



**Enhancing Literacy and Numeracy Training:  
A Case Study of the Initial Teacher Education Programme  
at Galway-Mayo Institute of Technology**

**By G00238648**

*A thesis submitted in fulfilment of the requirements for  
the Master of Science under Approved Programmes in Education  
in the Galway-Mayo Institute of Technology*

Research Advisory Panel

Dr. Pauline Logue

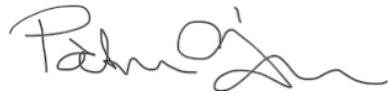
Dr. Susan Rogers

Dr. Cornelia Connolly

Mr. Michael Lynch

## DECLARATION OF ORIGINALITY

I declare that the content of this thesis is my own work. This thesis has not been submitted for any degree or other purposes. I certify that the intellectual content of this thesis is the product of my own work and that all the assistance received in preparing this thesis and sources have been acknowledged.



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Patricia O'Regan

30<sup>th</sup> August 2021

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Date

## ABSTRACT

Ireland has always prided itself on having a 'world class' education system. However, this was called into question when The Organisation for Economic Co-operation and Development (OECD) published the results from its Programme for International Student Assessment (PISA) in 2009, which indicated that Ireland's scholarly standards of literacy and numeracy had fallen significantly. These findings urged education stakeholders to evaluate how the development of literacy and numeracy competencies was being addressed. The Department of Education and Skills (DES) emphasised the development of literacy and numeracy as being the remit of all teachers. Initial teacher education (ITE) programmes had a responsibility to ensure that its graduates had the knowledge to enable the consolidation of developing literacy and numeracy competencies in all classrooms. This thesis aims to explore the provisions made for literacy and numeracy training within one Irish ITE programme at Galway-Mayo Institute of Technology (GMIT), to enhance training for its pre-service technical subject teachers. A mixed method case study was conducted, collecting data from pre-service teachers, school-placement tutors, educational staff and experts in the fields of literacy and numeracy. The methods included questionnaires, dialogical reflection groups, focus-groups and qualitative interviews. A key finding was the challenge in defining 'literacy' and 'numeracy'. This ambiguity left pre-service teachers and teacher-educators unclear of expectations in the context of ITE and resulted in a misalignment between the theory being taught and pre-service teacher perceptions of their abilities and their practices. It was also found that the technical subjects are a catalyst for promoting and developing a student's problem solving and critical thinking skills, which provide many opportunities for the development of literacy and numeracy competencies. A recommendation from this study is further training to enhance the development of pre-service teachers' comprehension of literacy and numeracy in the classroom and to create an awareness of their own abilities, through self-reflection. An output of this research is a series of ITE literacy and numeracy training workshops which address the challenges highlighted in this thesis.

**KEYWORDS:** *Literacy Development, Numeracy Development, Initial Teacher Education, Technical Subjects.*

## **DEDICATION**

To Ripley, Penny and Paddy, for all your support throughout this journey.

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## ABBREVIATIONS

BSc in Ed.	Batchelor of Science in Education
CS	Construction Studies
CPD	Continued Professional Development
DCG	Design and Communication Graphics
DES	Department of Education and Skills
GMIT	Galway-Mayo Institute of Technology
IEA	International Association for the Evaluation of Educational Achievement
ITE	Initial Teacher Education
NAERM	National Assessment of English Reading and Mathematics
NCCA	National Council for Curriculum and Assessment
OECD	The Organisation for Economic Co-operation and Development
PIACC	The Programme for the International Assessment of Adult Competencies
PIRLS	Progress in International Reading Literacy Study
PISA	The Programme for International Student Assessment
PL	Pedagogic Literacy
TIMMS	Trends in International Mathematics and Science Study
WT	Wood Technology

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# 1 Introduction

## 1.1 Context and Background

Ireland has always prided itself on having a ‘world class’ education system (Conway & Murphy, 2013; Printer, 2020). This was called into question when The Organisation for Economic Co-operation and Development (OECD) published the results from its Programme for International Student Assessment (PISA) in 2009. These results indicated that Ireland’s scholarly standards of literacy and numeracy had fallen significantly, urging education stakeholders to assess how literacy and numeracy development was being addressed. PISA tests literacy and numeracy by assessing them in the following three categories: reading, mathematics and science. This assessment is considered by many to be the yardstick by which each participating country measures its performance (OECD, 2019; Krautz & Graupe, 2014). In response to Ireland’s unexpected low ranking in PISA 2009 (Cosgrove & Cartwright, 2014), the Department of Education and Skills (DES) published *Literacy and Numeracy for Learning and Life; The National Strategy to Improve Literacy and Numeracy among Children and Young People 2011-2020* (DES, 2011). The DES sought to bring about reform in this area and as a result, raise the literacy and numeracy standards in Ireland to align with the top performing countries (refer to section 2.4.1). As our world is becoming increasingly interconnected and interdependent, many countries are reforming their education systems based on the OECD’s findings and a need for change, including Ireland.

The DES is encouraging reform for improvements in literacy and numeracy across all of Ireland’s education system, from early childhood education, infant classes, primary years, and post-primary years (DES, 2011). In the context of this study, the most relevant education reform that came about as a result of the OECD’s PISA findings was the junior cycle reform. Ireland currently has two state exams at post-primary level: The Junior Certificate, an examination taken at the end of the three-year junior cycle (age 12 – 15) and The Leaving

Certificate, an examination taken at the end of the two-year senior cycle (age 15 – 18) (NCCA, 2020). The reformed junior cycle suggests a shift in focus to the key skills, which include literacy and numeracy, and a new approach to assessment. *The Framework for Junior Cycle* (DES, 2015) provides a basis for Irish post-primary schools to plan quality, inclusive and relevant education programmes (NCCA, 2021). This framework highlights the importance of literacy and numeracy within each subject, stating that these key skills are fundamental to a student’s development.

It is now well established by a variety of policy makers, including the Department of Education and Skills (DES), the Teaching Council (TC) and the National Council for Curriculum and Assessment (NCCA), that initial teacher education (ITE) is a key component in improving Ireland’s literacy and numeracy standards. Traditionally, literacy and numeracy were considered the remit of the primary teacher (MacMahon, 2014). The idea that a post-primary teacher has a shared responsibility to develop these skills has only recently received similar attention (Murphy, Conway, Murphy, & Hall, 2014) with the DES stating that “all teachers should be teachers of literacy and numeracy” (DES, 2011, p. 47). It follows suit that literacy and numeracy teaching skills embedded in ITE programmes will differ depending on the level of education for which each person is training. Murphy *et al.* (2014) suggest that historically, when catering to the literacy needs of post-primary age students, the strategies were associated more closely with early education. These practices, although necessary and useful, reflect an approach that is too simplified to adequately cater for the 21<sup>st</sup> century literacy and numeracy demands of an adolescent (Rosowsky, 2006, p. 82). As suggested by MacMahon (2014) and Burke & Welch (2018), the emphasis that literacy and numeracy are to be embedded across all subjects means a significant culture shift for teachers of subjects other than the core English, Irish and Mathematics. There is evidence of change since the DES produced the national strategy to improve literacy and numeracy. The TC has highlighted personal literacy and numeracy development to be prioritised, as well as the ability to demonstrate appropriate levels of teaching and assessing of these skills as part of ITE (The Teaching Council, 2020). The Professional Development Service for Teachers (PDST) website

now contains many resources to aid teachers in the embedding of literacy and numeracy development in the classroom (PDST, 2021).

This study focuses on the ITE programme at The Galway-Mayo Institute of Technology (GMIT). In 1987, GMIT began offering furniture-making courses in its Letterfrack campus, Co. Galway, with the addition of teacher education programmes since 2006. The Letterfrack campus of GMIT has more recently (2018) been designated as a National Centre for Excellence in Furniture Design and Technology (GMIT, 2018). Graduates of the ITE programme, Bachelor of Science (Honours) in Education (Design Graphics and Construction), will be qualified to teach the following technical subjects; Graphics (G) & Wood Technology (WT) at junior cycle and Construction Studies (CS) and Design Communication Graphics (DCG) at senior cycle at post-primary level. When considering literacy and numeracy, technical subjects do not tend to be the ones that come to mind because they are more practical and hands-on subjects. However, the literature shows (See section 2.7) that technical subjects promote literacy, numeracy, problem solving, critical thinking and higher order learning: all vital skills needed for society to thrive (DES, 2011).

Garbe (2017) suggests that an emphasis on the importance of teaching literacy and numeracy skills will mould a pre-service (PS) teacher's education philosophy. Although this emphasis is of significant importance, it is equally important to focus on the personal literacy and numeracy skills of PS teachers. The TC suggested that the standards of literacy and numeracy among new PS teachers should be given adequate consideration (The Teaching Council, 2011, p. 12), indicating that this is not currently the situation. There was no requirement for applicants of ITE programmes to undertake an assessment of literacy and numeracy skills as part of minimum entry requirements for applicants of ITE modules. However, the TC had proposed that by 2017, applicants would be required to demonstrate literacy and numeracy competence by means of an ITE admissions test if more than five years had lapsed since the applicant completed the Leaving Certificate examination (The Teaching Council, 2011, p. 19). It was suggested by education stakeholders that a standard literacy and numeracy test be put

in place for ITE entry. However, it was decided that the suitability of such a test should be decided at an institute level (Darmody & Smyth, 2016, p. 126).

Literacy and numeracy are complex concepts, but this study seeks to bring to the fore definitions relevant to this research and one which more closely reflects the times in which we now live. As our understanding of the terms 'literacy' and 'numeracy' has altered over time, current definitions of these terms now embody the literacy and numeracy demands of today's society (Kangan, 2019). In response to the focus on literacy and numeracy development, this study seeks to address the questions of how to enhance literacy and numeracy training for PS teachers of the ITE programme at GMIT, and better understand the ways in which technical subjects can be a vehicle for improving literacy and numeracy standards for young people

## **1.2 Research Aim and Objectives**

The aim of this research is to undertake a case study analyses of the ITE programme at GMIT, in order to enhance literacy and numeracy training of PS teachers. In order to enhance training within the case programme, it is first necessary to investigate the extent of what is being provided in terms of literacy and numeracy development within the ITE programme, and to establish the efficacy of those provisions with regard to PS teachers' competence with both personal literacy and numeracy development, and their competence to develop literacy and numeracy teaching strategies.

The justification for undertaking this research study is to investigate and enable the ITE programme at GMIT to engage in the further development and enhancement of the programme, regarding literacy and numeracy competencies. This is a response to the national endeavour to enhance the development of these skills across all levels of education (DES, 2011). The engagement of third level institutes in research investigation of literacy and numeracy development within teacher education programmes might impact greatly on the implementation of the national literacy and numeracy strategy plan. Research investigation

into literacy and numeracy development within teacher education programmes is pertinent to successfully implementing the reforms made to the junior cycle (DES, 2015), as literacy and numeracy are highlighted as important key skills within the reform and ITE programmes are required to align themselves with these changes. Within the realm of post-primary education, literacy and numeracy development within technical-subject education has had limited focus and this research study seeks to highlight literacy and numeracy development possibilities within the teaching of these subjects. Since its commencement in 2006, the ITE programme for technical education at GMIT has not had the means to investigate the development of these skills within the programme, until now. The Department of Creative Education at GMIT identified a need to investigate literacy and numeracy standards within the programme and subsequently secured funding to undertake this research, in a bid to enhance training for their students and to become more closely aligned with the national literacy and numeracy standards.

The objectives of this research are:

1. To outline and develop definitions of literacy and numeracy, informed by relevant literature
2. To critically analyse literature, both nationally and internationally, pertaining to improving literacy and numeracy development in post-primary education and ITE programmes
3. To analyse the GMIT ITE programme documents, in order to identify what provisions are made for the inclusion of both the development of pre-service teachers' personal literacy and numeracy and their ability to teach literacy and numeracy
4. To design and conduct a primary research case study of the ITE programme at GMIT, with respect to literacy and numeracy competencies and training
5. To develop a series of training workshops for teacher-educators and pre-service teachers, in order to create awareness of the complexity of literacy and numeracy skills and to aid the embedding of both skills into the teaching of technical subjects

The following section explores the methods and methodologies chosen to achieve the aim and objectives of this research project.

### **1.3 Research Methods & Methodologies.**

This section introduces the research methods and methodologies to be used in this study, including the research philosophy, the research strategy, and the data collection tools chosen to achieve the aim and objectives set out in the previous section (See section 1.2). Prior to choosing a methodology a researcher must clarify what that means and how it relates to methods. Harris, Birks, Franklin and Mills (2017) made the distinction between methodology and methods, stating that a methodology is the lens through which a researcher views and makes decisions about a study, whereas methods are the procedures and techniques employed in the study. In any research study, research methodologies and methods must align with the predominant paradigm. A paradigm is an organising framework, which enables a researcher to express their orientation, positioning them in a certain community or belief system (McGregor, 2019). There are a number of prominent paradigms used in educational research, including positivism, constructivism, interpretivism and critical theory (Pham, 2018), which are explored further in section 3.2.1. However, this research is grounded in an interpretivist/constructivist paradigm. These philosophies seeks to interpret meaning from the experiences and perspectives of its participants (Adom, Yeboah, & Ankrah, 2016). The justification for choosing the interpretivist and constructivist paradigms as the underpinning philosophies for this study is because they align directly with research objective 4 of this study, which seeks to design and conduct a primary research case study of the ITE programme at GMIT, with respect to literacy and numeracy competencies and training, which this case study will include, exploring the perspectives of PS teachers, staff and management personnel in the ITE programme at GMIT. Having chosen an underpinning philosophy, a researcher must identify the most appropriate methods by which to conduct their study.

A research project can use methodologies which can be either qualitative, quantitative or mixed (Querios, Faria, & Almeida, 2017). Qualitative research is concerned with a deeper understanding of a given problem, whereas quantitative research deals with quantifiable information (Maxwell, 2013, p. 30; Bassias & Pollalis, 2018). A methodology which utilises both qualitative and quantitative is known as a mixed methods study (Shorten & Smith, 2017). By utilising a mixed methods approach a researcher can explore diverse perspectives and recognise patterns among the findings, drawing on potential strengths of both qualitative and quantitative methodologies (Punch & Oancea, 2014, p. 339). The chosen methodology for this study is mixed methods. The justification for this choice is because this methodology allows a researcher to achieve a balanced result by combining the strengths and weaknesses of both qualitative and quantitative methods. The advantages and disadvantages of both qualitative and quantitative methodologies are explored further in section 3.2.3. Having considered the appropriate methodology for this research project, an appropriate research approach was required to best address its aim and objectives.

The chosen framework for this study was a case study approach. Heale and Twycross describe a case study as an “intensive, systematic investigation of a single individual, group, community or some unit in which the researcher examines in-depth data relating to several variables” (2018, p. 7). This research focuses on one selected ITE programme and therefore, a case study approach would appropriately fulfil the objectives of this research. As one of the objectives of this study seeks to enhance training for programme staff, school-placement (SP) tutors and PS teachers, an advantage of the case study approach is that the study’s results will be available and accessible for its participants. One justification for choosing a case study approach is that this approach can offer something that other research approaches do not: a wealth and depth of information about a particular case (Astalin, 2013, p. 122). Denscombe suggests that a case study approach allows the researcher to “deal with the subtleties and intricacies” of the case (2010, p. 60). Denscombe highlights the importance of utilising multiple methods of data collecting, which facilitates the validation of the data collected through triangulation. To successfully achieve the aim of this research the data collection



methods include questionnaires (n=84), dialogical reflection groups (n=10), focus groups (n=2) and qualitative interviews (n=4). The details and justification for the chosen methodology and methods are explored further in Section 3.3.

#### **1.4 Scope and Limitations**

This study focuses on the ITE programme at GMIT; The Bachelor of Science (Honours) in Education (Design, Graphics and Construction). This research will make recommendations to assist programme staff in developing literacy and numeracy skills and for PS teachers' personal and pedagogical development purposes. Therefore, those who stand to benefit from this research project are the future PS teachers, programme staff and consequently, the post-primary students of the programme's graduates. There is potential to develop this research further, as similar programmes could adapt and build on this study. There is also opportunity for a comparative analysis study to be conducted in the future.

A case study methodology was employed in this study (See section 3.2.2) and this approach does not produce generalisable findings, nor does it intend or attempt to. This inability to produce generalisable findings is not a limitation, although the case study methodology is often criticised for this (Willis, 2014). However, Polit and Beck suggest that generalisations is a limitation in itself (2010), when the intention is to generate specific results, which are unique to a case, deeming the case study approach appropriate for this research study. While the research findings may not be generalisable to other studies, the models and processes employ in this research have been outlined explicitly and may potentially be replicated in other contexts.

Due to the predominantly qualitative nature of this study, limitations include the reliance on the participants' honesty, their ability to communicate their opinions clearly and decisively, and the researcher's ability to interpret those responses accurately, hence the need to develop robust processes to ensure maximum validity (See section 3.3.8). Another limitation of this study is that data will be gathered at a conference with three key speakers addressing

numeracy development only. The absence of key speakers addressing literacy development may impact the findings and create an imbalance between participants' interpretations of these skills (See section 4.3). However, on balance, conducting a case study will produce deeper insights into the relevant programme specifically. With time constraints the series of training workshops (which will be fully designed and informed by the primary research findings and conclusions) will not be seen in action or tested, but suggestions for future research will be recommended in section 7.5.

## **1.5 Thesis Structure**

This thesis report consists of 7 chapters. Following this introductory chapter, chapter 2 provides a review of pertinent literature, which shaped and informed this study. Definitions of 'literacy' and 'numeracy' are explored, providing a context for this research, exploring international and national testing of these skills and the impact these have had on influencing policy reform within education. The chapter continues by exploring ways in which these reforms affect ITE programmes and the embedding and treatment of literacy and numeracy within those. Practical frameworks and models will be explored and highlighted. The chapter continues by exploring ways in which literacy and numeracy feature in the teaching of the technical subjects.

Chapter 3 details and justifies the rationale behind the choices made regarding methodology and methods used in this study. Chapter 3 also outlines how data was collected, including information regarding the selection process, response rates, the data collection tools and the validity and reliability of these tools. Chapter 3 finishes by outlining the ethical considerations of this research study.

Chapter 4 presents, firstly, the methods and process involved in analysing the research data and, secondly, presents the results and the research findings under thematic headings, which emerged during the data analysis of this study. These themes included: defining the terms literacy and numeracy, literacy and numeracy in ITE, participants' confidence in literacy and

numeracy, literacy and numeracy theory and practice, and literacy and numeracy in technical subjects.

Chapter 5 progresses by discussing the results and findings of this study, in dialogue with relevant literature explored. Similar to chapter 4, the discussion in chapter 5 is also framed by the research themes which emerged through this study.

Chapter 6 explores the output of this project, a series of training workshops designed to assist staff and PS teachers to become confident and competent in knowledge relating to literacy and numeracy development practice. This chapter provides details regarding the rationale for designing a series of workshops, the workshop design and the pedagogical theories that underpin those design choices. Chapter 6 provides possible plans for rolling out the three literacy and numeracy training workshops, including a plan and suggested resources for each workshop.

This paper concludes with Chapter 7, which focuses on the key findings of this research study, and presents conclusions in relation to the research objectives outlined in section 1.2. This chapter continues by providing the contributions that this research study makes to the field of literacy and numeracy, the scope and limitations of this study, and recommendations for further research to enhance the ITE programme in GMIT. This chapter finishes by presenting the researcher's final reflections on the research and the research process.

## 2 Literature Analysis

### 2.1 Introduction

Many researchers use the term 'literature review' as a title for a chapter which explores literature pertaining to their chosen field or topic. However, the word 'review', meaning to 're-look' at a topic (Cambridge Dictionary, n.d.), does not accurately describe the process involved in analysing literature, for the purpose of a research thesis. The process involves thoughtful planning and organisation from the beginning (Ridley, 2012), giving "a picture of the state of knowledge and of major questions in your topic area" (Bell J. , 2010, p. 112). The (online) *Cambridge Dictionary* (Cambridge Dictionary, n.d.) defines the word 'analysis' as "the process of studying or examining something in an organised way to learn more about it, or a particular study of something". The purpose of a literature analysis section (See section 2.2) is to demonstrate to the readers that the researcher has an in-depth grasp of the topic being explored and to demonstrate that the researcher understands where their research fits into and adds to an existing body of knowledge. For that reason, the author has chosen to name this chapter 'literature analysis'.

This chapter aims to analyse relevant literature to provide a context and background which will guide the research questions and therefore underpin this study. This chapter addresses three of this study's objectives, namely, 1) to outline and develop definitions of literacy and numeracy, informed by relevant literature, 2) to critically analyse literature, both nationally and internationally, pertaining to improving literacy and numeracy development in post-primary education and ITE programmes and 3) to analyse the GMIT ITE programme documents, in order to identify what provisions are made for the inclusion of both the development of pre-service teachers' personal literacy and numeracy and their ability to teach literacy and numeracy.

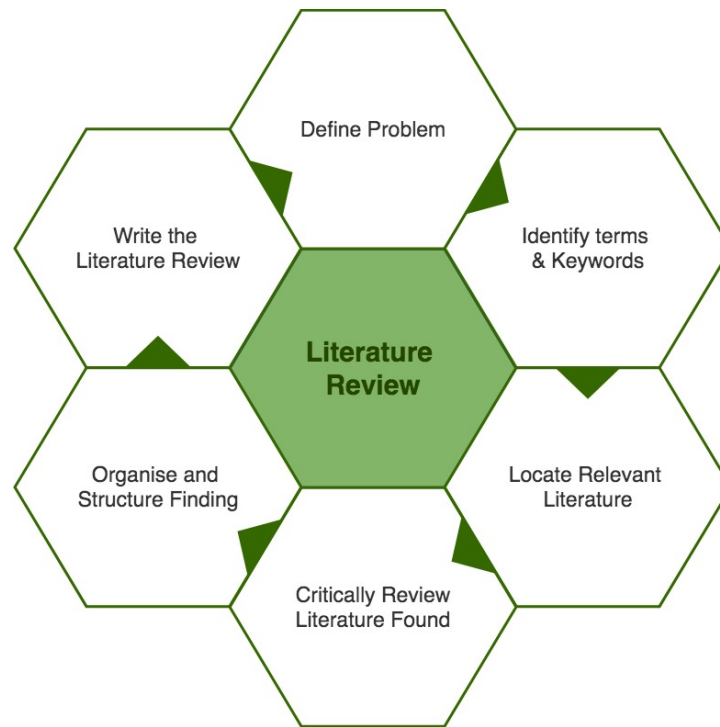
This chapter begins by describing the methodology used to conduct this literature analysis (section 2.2). Research has been conducted on the different approaches to completing a literature analysis and the rationale for the choice of the chosen approach is provided. Section 2.3 explores definitions of both literacy and numeracy and addresses research objective 1 (See section 1.2). The rationale for including this discussion early in this chapter was to develop a relevant definition for both literacy and numeracy, and to clarify what is being referred to when using these terms in the remainder of the thesis. Section 2.4 provides a context for this study, exploring the assessments of literacy and numeracy skills and how these results impacted educational reform worldwide. Section 2.5 addresses research objective 2 (See section 1.2) and explores the expectations and responsibilities of ITE programmes in general, regarding literacy and numeracy development. Section 2.5 also highlights the importance of reinforcing the idea that literacy and numeracy are the responsibility of all teachers, in all disciplines. Section 2.6 explores ways by which literacy and numeracy may be embedded within an ITE programme, focusing on a literacy framework and numeracy model, highlighting these practical tools to assist teachers and teacher educators in the inclusion of developing literacy and numeracy skills. Section 2.7 explores the place of technical subjects, among those subjects that would usually be considered rich in developing these skills. Section 2.7 also explores the links between design-based content and developing problem solving and critically thinking, both heavily present in the teaching of technical subjects and contributing to the development of literacy and numeracy. The closing section in this chapter (section 2.8) examines programme documentation specific to the case ITE programme, addressing research objective 3 (See section 1.2). This section presents evidence of the provision for developing these skills within the programme and within the programme modules.

## **2.2 Literature Analysis Methodology**

Webster and Watson (2002) describe a literature analysis as a firm foundation from which to advance your research, demonstrating a familiarity with the topic being researched and

positioning a research project in relation to the research topic (McCombes, 2019). For the purpose of this study the literature analysis was conducted as a preliminary analysis, serving as a background to the larger study, as opposed to a standalone project (Aveyard, 2014; Xiao & Watson, 2019). A quality literature analysis has certain steps which a researcher must take, which quite closely resemble the steps to conduct primary research: problem formulation, data collection, data evaluation, analysis and interpretation, and public presentation (Randolph, 2009). With many ways to approach a literature analysis chapter, it is important to choose a strategy that meets the requirements of the study and to use that strategy methodically and consistently (Cronin, Ryan, & Coughlan, 2008).

Using a number of various sources, a five-step process guided the analysis of literature for the purpose of this research study (Creswell, 2002; Fink, 2020). These steps included the following: 1) Identifying terms to use in the literature search, 2) Locating literature, 3) Reading and checking the relevance of the literature, 4) Organising the literature you have selected, and finally 5) Writing a literature review. Using the above five-step process, figure 2-1 below was developed and utilised to achieve objectives 1,2 and 3 (See section 1.2).



*Figure 2-1 Conducting a Literature Analysis*

*Source: Adapted from Creswell (2002) and Fink (2020)*

To solve a problem, a researcher must first define the research problem. Initially, literature was analysed to ascertain the current position of educational stakeholders worldwide, in terms of literacy and numeracy development. Then more specifically in Ireland, of ITE providers and where technical subject teacher training fits into this topic, and more importantly, if it does. The literature found in this regard gave insight into the problem that needed to be solved. This study's primary research question is: what training is being provided in one Irish ITE programme in terms of the development of PS teachers' personal and pedagogical literacy and numeracy skills, specifically in the teaching of technical subjects? This research seeks to enhance training within the case ITE programme, based on the findings of this study. The eight questions which guided this literature analysis are as follows: 1) Have similar studies already been conducted in Ireland or internationally? 2) What are 'literacy' and 'numeracy'? 3) Where does education in Ireland currently stand on the topic of literacy and numeracy and how did they arrive at that standing? 4) What reforms have come to fruition

as a result of these findings? 5) How is literacy and numeracy dealt with in ITE? 6) What frameworks or models are currently being used by teacher-educators to address literacy and numeracy development within ITE programmes? 7) Where do literacy and numeracy fit within the technical subjects? 8) What is included in the programme documentation to cater for the development of literacy and numeracy within the ITE programme at GMIT?. These questions provided a basis from where to start and indicated from an early stage gaps in the literature. By outlining the research problem, a focused literature search could begin.

Based on the research problem and the aim of the project, a list of keywords can be created. The literature search begins by identifying the main keywords mentioned in the research title. These keywords, terms and phrases evolve throughout the literature search, as some keyword searches produce few results, whereas others lead to many others. An example of this was the keywords related to technical subjects, which limited search results significantly. However, the keyword 'literacy' produced such a vast number of search results, which needed to be reduced and more focused. A researcher can create very precise searches by using Boolean operators. Table 2-1 demonstrates how these operators can be used to search more efficiently.



Table 2-1 Boolean Operators

Operator	Example	What it does
<b>And</b>	Literacy <b>AND</b> numeracy	Searches for results containing <b>both</b> 'literacy' and 'numeracy'. (Narrows the search)
<b>Or</b>	Numeracy <b>OR</b> mathematical literacy	Searches for results containing <b>either</b> 'numeracy' or 'mathematical literacy'. Broadens the search)
<b>Not</b>	Literacy <b>NOT</b> primary	Searches for results containing 'literacy' but <b>excludes</b> results containing 'primary'.
<b>"phrase"</b>	"Initial teacher education"	Searches for results containing the <b>exact phrase</b> "initial teacher education".
<b>Near/number</b>	Literacy <b>Near/5</b> education	Searches for results where education is <b>within 5 words</b> of literacy.
<b>*</b>	Teach*	Searches for results containing the <b>root word</b> 'teach', including teacher, teaching etc.
<b>()</b>	("literacy" OR "numeracy) AND "teacher education"	<b>Groups</b> similar concepts together. Searches for results containing either 'literacy' or 'numeracy', and 'teacher education'.

Source: Adapted from Bell (2010); Cohen et al. (2018); Singapore Management University (2021)

Search engines do not understand natural language and utilising Boolean operators will enable the searcher to portray exactly how they want to search, which will produce optimal results (Empire State College). Alternative keywords emerged through searching other authors discussing similar topics. Other relevant sources were identified through the bibliographies of relevant articles and authors. Table 2-2 below shows the evolution of search terms and keywords, including the initial keywords identified and searched for, and in the second column, the list of alternative keywords which emerged from other sources as the literature analysis progressed.

Table 2-2 Illustrative Examples of Initial Keywords Identified for the Purpose of this Study

Initial keywords	Alternative keywords	
Literacy	Literacy development Reading literacy Disciplinary literacy	Strategy Literacy framework/model Digital literacy
Numeracy	Mathematical literacy Disciplinary numeracy	Strategy Numeracy model /framework
Initial Teacher Education /ITE	Teacher education /educator /training Student teacher Pre-service teacher Trainee teacher Teacher instruction	Teacher tool kit Pedagogy Personal skills Transversal skills Disciplinary skills Key skills
Technology Education	Technical-subjects /technical subjects Design & Technology STEM education Embedding skills	Design Technology Graphics Construction Practical
Post-Primary Education	Secondary education Higher education 3 <sup>rd</sup> level Higher education	Junior cycle Senior cycle Curriculum Teaching council
Education Policy	Curriculum planning Literacy & numeracy strategy Educational reform Irish /Ireland	DES NCCA JCT PDST
Literacy & Numeracy Assessment	Test /testing Assessment	PISA OECD

Source: Author's Original

Once the initial key words are identified, it is important to identify where to access the most relevant literature. The initial focus was on the GMIT library catalogue, which enables access to the physical material available in the library (GMIT Library). The library website also gives access to online sources available through the library. From this “search & find” search box, a researcher can locate online material relevant to their research topic. The library catalogue contains a high percentage of scholarly content, which is more relevant to a research project

at this level. By using the library catalogue, the researcher can specify where to search within the documents, e.g., title, abstract, full text etc. This gives the researcher more control over the extent or bounds of the search. Once the library catalogue has produced search results, a researcher can begin searching specific databases. Databases are collections of resources such as journal articles and conference papers, and sometimes book chapters and reports. There are a number of different databases, but not all databases are relevant to the discipline of the study. Searches can be conducted in relevant databases initially, but this may expand as the search continues. By limiting the searches to relevant databases in the initial stages, a researcher will have more control over the direction in which the search will go. Table 2-3 below demonstrates the initial results yielded from five academic databases searched using multiple combinations of keywords.

Table 2-3 Initial Database Literature Search

Database - Keyword Focussed Literature Searches (Number of Most Relevant Academic Journals)						
Database	Literacy + Numeracy Initial Teacher Education	No.	Literacy + Numeracy /Teacher Education	No.	Literacy + Numeracy Teacher Education +Technology	No.
Academic Search Complete	Irish Educational Studies	13	Australian Journal of Teacher Education	142	Australian Journal of Teacher Education	17
ERIC	Australian Journal of Teacher Education	20	Australian Journal of Teacher Education	110	Australian Journal of Teacher Education	22
Science Direct	Teaching and Teacher Education	62	Teaching and Teacher Education	433	Teaching and Teacher Education	231
Omnifile Fulltext	Australian Journal of Language and Literacy	5	Teaching & Teacher Education	27	Issues in Education Research	6
Web of Science	Australian Journal of Teacher Education	20	Australian Journal of Teacher Education	44	British Journal of Education Technology	3

Source: Author's Original

However, no one database proved to be more productive than others as the research topic for this study is quite specific and a varied list of databases were used. The initial databases recommended by GMIT library in the discipline of Education/Teaching and Learning are *Academic Search Complete*, *Science direct*, *Omnifile Fulltext Mega*, *ERIC*, *Directory of Open Access Journals*, *Irish Times Digital Access Journals*, *OECD iLibray*, *Web of Science* and *Google Scholar*, with varying degrees of successful searches.

Having explored the most relevant databases, the next step was to identify and search journals relevant to the subject area. The top ranked journals relating to education are demonstrated in table 2-4 below.

Table 2-4 Ranked Journals Relating to Education

Top 10 Ranking Education/Teacher Education Journals		
	Google Scholar	Scimago Journal Ranking
1.	Teaching & Teacher Education	Review of Educational Research
2.	Studies in Higher Education	Journal of Engineering Education
3.	Review of Educational Research	American Educational Research Journal
4.	British Journal of Educational Technology	Educational evaluation and Policy Analysis
5.	Higher Education	Journal of Research in Science Teaching
6.	Educational Psychology Review	Child Development
7.	Educational Research Review	Journal of Educational Psychology
8.	Educational Researcher	Reading Research Quarterly
9.	Learning and Instruction	Learning and Instruction
10.	Assessment & Evaluation in Higher Education	Educational Researcher

Source: Adapted from Google Scholar (2021); Scimago institution Rankings (2019)

Although there are many journals ranked based on their H-index in both searches, many of these journals did not satisfy the requirements of this research project, as this study focused on a specific area of ITE for the technical subjects in the field of literacy and numeracy. The journals that proved most relevant and yielded the most results for the purpose of this project were *Irish Educational Studies* (n=6), *Australian Journal of Teacher Education* (n=4), *European Journal of Education* (n=2) and *European Journal of Education* (n=2). Having identified databases and journals relevant to the study through the methods mentioned above, a focused search was conducted on relevant grey papers, conferences proceedings, and theses in a bid to identify and locate further relevant sources.

Once an extensive search has been conducted and relevant sources have been identified, it is necessary to recognise what is not relevant to the topic and many articles and resources may

be discounted at this point. Considering the scope of the project, some aspects and subtopics originally considered may no longer satisfy the aim of the research. It was necessary to put limits on the search to ensure that the results were manageable. The limitations which enabled this were as follows: date (initially within 5 years, extended to 15 years), peer reviewed, full text, exclude health literacy and digital literacy (as these both produced many documents that were not directly relevant to this study).

This research deals with literacy and numeracy within ITE and more specifically, teacher education for technical subjects. Therefore, to clarify what is meant when using the terms 'literacy' and 'numeracy' within this thesis, the following section explores definitions of these two terms, and develops a relevant definition for each.

## **2.3 Defining Literacy and Numeracy**

With a newfound emphasis on literacy and numeracy in Irish education in recent years, various definitions for both have been identified and explored. However, there is still no universally accepted definition for either literacy or numeracy (Cambridge Assessment, 2013). Our understanding of these words has altered over time and current definitions of these words now embody the literacy and numeracy demands of the society we live in (Kangan, 2019). To appreciate the relevance and importance of literacy and numeracy in this research, we must clarify the meaning of the words 'literacy' and 'numeracy' in the context of this research. The terms 'literacy' and 'numeracy' no longer just refer to the ability to read, write and manipulate numbers, but refer to a deeper understanding and a relevance to the world around us (O'Donoghue, 2002).

### **2.3.1 Literacy**

Although literacy was traditionally understood to mean 'reading' and 'writing', which are essential components of literacy, the general understanding of the term now encompasses much more. There is a large volume of literature defining literacy, with definitions varying significantly depending on the context. Ní Chinnéide (2013) adds that not only are there

various definitions of literacy, definitions are also evolving with societal needs. Considering the context on this research, and to give an overview of variations in definitions, both Irish stakeholders (DES and NAERM) and international assessments programme's (PISA and PIACC) understandings of the term will be explored.

The DES defines literacy as: "the capacity to read, understand and critically appreciate various forms of communication including spoken language, printed text, broadcast media, and digital media" (DES, 2011, p. 8). When explored, in the context of this research this definition may be considered too broad. This is expected as the national strategy plan initiative addresses literacy from early childhood through to and including post-primary education. The above DES definition relates quite closely to that of the National Assessment of Reading and Mathematics (NAERM) which assesses Ireland's primary-school students at 2<sup>nd</sup> class and 6<sup>th</sup> class. NAERM defines what they perceive to be 'reading' as the following:

the process of constructing meaning through the dynamic interaction among the reader's existing knowledge, the information suggested by the written language, and the context of the reading situation. Young readers read to learn, to participate in communities of readers, and for enjoyment (*Shiel, Kavanagh, & Millar, 2014, p. 14*).

The above definition refers to the construction of meaning, the building on existing knowledge, the 'reading to learn' and the participation in a community and reading for enjoyment. There is a progression from the above definition to the next definition presented, which is expected as the PISA study is relevant to older children. Literacy is defined by the OECD in the context of the assessment of reading literacy in PISA. In 2009 the OECD amended their definition to include the word 'engaging' as an integral part of reading literacy. The extended definition is as follows: "understanding, using, reflecting on and engaging with written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society" (OECD, 2009, p. 23). This amendment in the definition shows a progression and reflects changes in society. Later, in 2013, the OECD reiterates this addition to the definition, stating that they are not only assessing proficiency but also the student's engagement in what they are reading (OECD, 2013, p. 9).

PISA assesses students in three areas: reading, maths and science. When the OECD refers to the three aspects as reading literacy, mathematical literacy and science literacy, there is an implication that they are not just testing reading, mathematical and science skills, but the understanding and the meanings behind the principles. By using these terms, they are focusing on the application of the knowledge in “the context of life situations” (OECD, 2009, p. 128). They refer to the “(k)nowledge and use of that knowledge to identify questions, to acquire new knowledge, to explain scientific phenomena and to draw evidence-based conclusions”.

Differing from PISA, the PIACC assesses the literacy skills of an adult population, which addresses the challenges that come with an ever-changing society and economy. PIACC defines literacy as:

The ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society (OECD, 2019).

This definition refers to a “continuum of learning”, achieving goals and participation in community and wider society. This concentrates more on the individual and what literacy will potentially lead to for those individuals.

Table 2-5 below enables the reader to quickly see the differences and similarities between the definitions of literacy, chosen for this section.



Table 2-5 Comparison Between the Definitions of Literacy Referred to in this Section.

Where:	Name:	For Whom	How:	Why:
Ireland	DES	3 - 18 years old	Read Understand Critically appreciate	N/A
	NAERM (ERC)	2nd class & 6th class	Construct meaning Communicate through written language Interact with existing knowledge	Participate in communities Read to learn enjoyment
International	PISA (OECD)	15-year-old	Understand Use Reflect Engage with	Achieve goals Develop knowledge and potential Participate in society
	PIACC (OECD)	Adult	Identify Understand Interpret Create Communicate Compute	Continuum of learning Achieve goals Develop knowledge and potential Participate in community and wider society

Source: Author's Original

One aspect implied among all definitions is the ability to “construct meaning”. Kennedy *et al.* suggest this idea of a “constructivist interactive process”, stating that through reading, the reader will actively construct meaning and that is part of being literate (Kennedy, et al., 2012, p. 10). This view is supported and developed further by PISA, who writes that “the reader generates meaning in response to text by using previous knowledge ... and situational cues that are often socially and culturally derived” (OECD, 2009, p. 23). With many different definitions for the term ‘literacy’, a consensus is that in using this skill, one will construct meaning and that it should relate to everyday and to real life of the learner.

Through analysis of the literature and data gathered in this research, the author has adapted the above definitions, and developed a definition to reflect what literacy may mean to the participants of this research. The author has defined literacy as:

The ability to engage with, identify, interpret and use both existing knowledge and new learning from printed text, spoken language, broadcast and digital media to construct and communicate meaning, and develop knowledge and potential, to enable the achievement of goals and the participation in community and society.

It is worth noting that although the above definition has been considered and developed, in a bid to capture elements of the skill that more closely reflect the 21<sup>st</sup> century learner, it does not speak to the complexity of the definition. This is discussed further in section 4.3.3. The purpose of presenting the definition above is solely to provide a tentative definition which is accessible and relevant to the participants of this study. Pilgrim and Martinez suggest that quite often, the words used to define literacy for the 21<sup>st</sup> century may be unfamiliar to some teachers (Pilgrim & Martinez, 2013). An example of this is the misalignment between a definition of literacy for the 21<sup>st</sup> century and that of Ireland's DES (DES, 2011). The 21<sup>st</sup> century definition of literacy reflects a continuously evolving concept, with increasing reference to emerging technologies and skills relating to that. Similar to literacy, the definition of 'numeracy' is an equally complex one, and one that varies depending on the context in which it is being used. This is explored in the following section.

### **2.3.2 Numeracy**

To reflect and to maintain a similar sequence as the previous section on defining literacy, the definitions for numeracy will be selected from the same bodies (DES, NAERM, PISA & PIACC). Similar to the DES's definition for literacy, their definition for numeracy may also be considered vague for the purpose of this research: "Numeracy encompasses the ability to use mathematical understanding and skills to solve problems and meet the demands of day-to-day living in complex social settings" (DES, 2011, p. 8). The above definition includes words and phrases that also appear in many definitions of 'literacy' such as understanding and problem solving, also referring to "day-to-day living", demonstrating an overlap between the

literacy and numeracy. In contrast to the broad nature of the DES definition of numeracy, the 2014 NAERM (which assess 2<sup>nd</sup> and 6<sup>th</sup> class Irish students) define numeracy in the context of primary school. They define numeracy as follows:

the science of magnitude, number, shape, space, and their relationships and also as a universal language based on symbols and diagrams. It involves the handling (arrangement, analysis, manipulation and communication) of information, the making of predictions and the solving of problems through the use of language that is both concise and accurate (*Shiel, Kavanagh, & Millar, 2014, p. 16*).

Although this definition refers to a specific age group, the common theme that is evident through all of the definitions is the skill of using maths to problem solve. To gain an understanding of the term “numeracy” in an international context, a comparison can be made between the above definition and the way in which numeracy is defined by the Evaluation of Educational Achievement (IEA) for the purpose of the Trends in International Mathematics and Science Study (TIMMS) which assesses the mathematics and science achievements of 4<sup>th</sup> class (Ireland) children. IEA break the term ‘numeracy’ into three domains to describe the framework for maths assessment: knowing, applying, and reasoning (Lindquist, Philpot, Cotter, & Mullis, 2017). Lindquist *et al.* stress the importance of mathematics in developing strong skills in problem solving (*TIMMS 2019 Mathematics Framework*), stating that it is essential in daily life (2017, p. 13). Considering the difference in the age groups of these two assessing bodies, TIMMS definition for numeracy relates quite closely to the following definition of numeracy by the OECD for the purpose of the PISA study.

PISA defines numeracy using words such as: formulate, employ, interpret in order to describe, predict and explain. In an assessment such as PISA, students are expected to be able to recognise the key role that maths plays in their lives in order to “make well-founded judgements and decisions”. They believe that these are the skills required to become “constructive, engaged and reflective citizens”. The OECD defines numeracy as: “The ability to formulate, employ and interpret mathematics in a variety of contexts to describe, predict and explain phenomena, recognising the role that mathematics plays in the world” (OECD, 2018). When defining numeracy in the context of assessing adults’ abilities PIAAC

(Programme for the International Assessment of Adult Competencies) (PIAAC), the OECD defines it as being able to: “access, use, interpret and communicate mathematical information and ideas” (OECD, 2012, p. 34). The OECD relate this to the wider context of “adult life”, stating that by doing this one will “engage in and manage” the mathematical demands of life. The different definitions referred to in this section are compared in the table 2-6 below.

*Table 2-6 Comparison Between the Definitions of Numeracy Referred to in this Section*

<b>Where:</b>	<b>Name:</b>	<b>For Whom</b>	<b>How:</b>	<b>Why:</b>
<b>Ireland</b>	DES	3 - 18 years old	Use mathematical understanding and skills Solve problems	To meet demands of day-to-day living Complex social settings
	NAERM	2nd class & 6th class	Magnitude, Numbers, Shape, Space Arrangement, analysis, manipulation, communication	Make predictions Solve problems Using language Concise and accurate
<b>International</b>	PISA (OECD)	15-year-old	Formulate Employ interpret	Describe Predict Explain in real world
	PIACC (OECD)	Adult	Access Use Interpret communicate	N/A

*Source: Author's Original*

In comparing the above definitions of numeracy, the aspects of the skill that appears to be common is the ability to apply mathematical understanding to think critically and solve problems in everyday life. Similar to ‘literacy’, through analysing the literature identified, the author has adapted the above definitions of numeracy, to reflect what numeracy may mean

to the participants of this research. The author has defined numeracy as: “The ability to access, interpret, manipulate and use mathematical information, to problem-solve, analyse, predict and communicate this information in a concise and accurate way, to relate to the real world and today’s society”. Similar to defining ‘literacy’ (See section 2.3.1), the above definition does not speak to the complexity of ‘numeracy’, but rather provides an accessible definition relevant to the participants of this study. Having explored these two terms separately to get a deeper understanding of their meaning in the context of this study, the focus now moves onto the relationship between the two skills, if there is one. The following section will explore the aspects that connect and separate the two skills.

### **2.3.3 The Relationship Between ‘Literacy’ & ‘Numeracy’**

There are differing opinions on the relationship between literacy and numeracy, with some arguing that they are two sides of the same coin and others arguing that they are not connected and should not be confused. However, the two terms are often referred to simultaneously. It is evident that there is a significant crossover between how the two terms, ‘literacy’ and ‘numeracy’ are used.

When considering these two terms in the context of teaching the curriculum, Chapman & Lee (1990, p. 281) suggest that identifying the two skills separately can be challenging as, although not always obvious, literacy skills (reading understanding) is evident in solving mathematics-based problems and equally, mathematical thinking may be required in non-mathematical and language-based contexts. However, when the term ‘literacy’ is considered in the context of social practice, when compared to its use in an education setting, it can have a significantly different meaning. Chapman offers an explanatory theory for this reappropriation of the term ‘literacy’, suggesting that when it is used in such a way, that it refers to ‘competency’ in a specific area (1993). In an earlier article, Chapman & Lee (1990, p. 277) refer to the term ‘literacy’ in the broader sense, as “a repertoire of meaning-making skills” of which numeracy is one.

O'Donoghue (2002) suggests that 'literacy' is the overarching culture and that numeracy falls under the literacy umbrella. This view is supported by Stoessiger (2002), who writes that it is common to link the two terms and goes on to say that the term 'literacy' came about as concerns were raised about students leaving school that could not read, write, or complete arithmetic problems adequately. He states that the term 'numeracy' was brought to the fore as the arithmetic aspect of literacy was being absorbed into the wider mathematical curriculum (Stoessiger, 2002, p. 47). O' Donoghue (2002, p. 47) suggests that one supports the other. He makes a connection between the two terms, with reference to the Crowther Report (1959) where numeracy was defined as 'the mirror image of literacy' and highlights the importance of a communication between the two domains. He describes them as "overlapping complementary attributes", equally important for a person to succeed in life. Barwell (2004, p. 21) agrees, suggesting that numeracy is a subset of literacy, stating that literacy is the process of making meaning with text, and similarly, numeracy is the process of making meaning with numbers.

There is an identifiable link between the two terms and the distinction between the two blurs (Chapman & Lee, 1990, p. 281), as the word 'literacy' is used to describe 'numeracy' in many countries (Graff, 1987, p. 32). Some such alternative terms for numeracy are 'quantitative literacy' (Hippe, 2012), 'mathematical literacy' (Frejd & Geiger, 2017) and 'statistical literacy' (Goos, et al., 2020). One example evident earlier in this chapter, is of the means in which the OECD uses the term 'mathematical literacy' instead of 'numeracy' when they refer to assessing students for the purpose of PISA. Hoogland (2003) discusses this further, referring to a chapter written by Eva Jablonka titled "*Mathematical Literacy*". Hoogland discusses the significance of naming the chapter as she did, stating that she believed that the term 'numeracy' refers to a narrower numerical aspect. However, by using the term 'mathematical literacy', she is deliberately referring to a wider approach (Hoogland, 2003, p. 2).

There is an overlap between the two skills. However, this may be as a result of the way in which we use the terminology to describe them. It can be concluded that both are concerned with developing a person's ability to better their lives outside education. Having defined

literacy and numeracy in terms of this research and their relationship to each other, the following section explores the assessment and therefore, reform of literacy and numeracy development within ITE.

## **2.4 Assessment and Educational Reform**

The assessment of literacy and numeracy has played a significant role in how educational systems have amended policies and practices, to impact and allow for improved development of these skills. The means by which these skills are assessed provides a backdrop and a rationale for such reforms.

### **2.4.1 Literacy and Numeracy Assessment**

With the establishment of international testing of literacy and numeracy skills at primary, post-primary and adult levels, participating countries have the opportunity to monitor the effectiveness of their education systems (Meeks, Kemp, & Stephenson, 2014). Ireland has participated in four such international assessments in recent years, including two programmes organised by the International Association for the Evaluation of Educational Achievement (IEA); the Progress in International Reading Literacy Study (PIRLS), through which literacy performance of 9 year olds (4th grade) is assessed every five years and the Trends in International Mathematics and Science Study (TIMSS) assessing the skills of children aged 9 (4th grade) and 13 years (8th grade) on a four year cycle, and two programmes organised by the Organisation for Economic Co-operation and Development (OECD); the Programme for International Student Assessment (PISA) which assesses 15- year olds every three years and the Programme for the International Assessment of Adult Competencies (PIAAC) (Shiel & Gilleece, 2015).

Since PISA's launch, it has become the world's yardstick, from which all participating countries can measure. PISA assesses 15-year-olds ability to use the skills of reading, mathematics and science knowledge to address real life challenges (OECD, 2021). Unlike traditional assessments, PISA aims to assess not only what students know, but what they can do with

that information (Schleicher, 2019). This programme assesses the extent to which its participants have acquired what is considered to be “the key knowledge and skills that are essential for full participation in modern society” (OECD, 2019). The number of countries/regions participating in PISA has increased from 32 when it began in 2000, to a projected 88 for PISA 2021 (Educational Research Centre, 2021). In 2015, PISA moved to a computer-based assessment, with a mix of computer-based and print based assessments incorporated in 2012. With advancements in each cycle the most recent results (PISA 2018) may be considered more accurate than previous years (Educational Research Centre, 2021). However, it is difficult to directly compare the different cycles of PISA, as not only are the assessments methods changing but the major domains on which they focus alter with each cycle also. The Education Research Centre (ERC) has demonstrated how the major domains have changed with each cycle in table 2-7 below.

*Table 2-7 Major Domains- Different Cycles of PISA*

Cycle	Major Domain	Minor Domains
PISA 2000	Reading literacy	Mathematics, Science
PISA 2003	Mathematics	Reading literacy, Science, Cross-curricular problem solving
PISA 2006	Science	Reading literacy, Mathematics
PISA 2009	Reading literacy	Mathematics, Science
PISA 2012	Mathematics	Reading literacy, Science, Creative problem solving
PISA 2015	Science	Mathematics, Reading literacy, Collaborative problem solving
PISA 2018	Reading literacy	Mathematics, Science, Global Competence
PISA 2021	Mathematics	Reading literacy, Science, Creative thinking

*Source: Adapted from Educational Research Centre (2021)*

It is evident from the above table, 2-7 that although literacy and numeracy were assessed in each cycle of PISA, more emphasis is placed on different domains depending on the cycle.



There are many criticisms of the PISA study, its view of education, the way in which the study is implemented, and the power and impact that it has on educational policy worldwide (Zhao, 2020). Sjøberg suggests that PISA directly aligns its view of education with economy, aiming to create a competitive global economy (2016), creating panic and discomfort among all countries (Alexander, 2012). It has been suggested that the PISA study does not reflect considerations regarding cause and effect (Murphy B. , 2018), not taking into account for example, social backgrounds (Schleicher, 2019) and therefore, provides a skewed view of participating countries' achievements in literacy and numeracy. It has also been suggested that the PISA results negatively impact the way in which curriculum is being taught and that 'teaching to the test' has become a part of standardised testing (Ó Breacháin & O'Toole, 2013), which PISA promotes. However, despite any shortcoming, the OECD and PISA significantly impact education at all levels (Sjøberg, 2016) and play an influential role in guiding policy making in Ireland.

Ireland has participated in all cycles of PISA with varying results. The most significant decline in reading and mathematics standards emerged from the results of PISA 2009 (highlighted in tables 2-8 and 2-9 below), showing the largest fall in average points across 38 countries for which results could be compared (Cosgrove & Cartwright, 2014). The tables 2-8 and 2-9 below show Ireland's scores in reading literacy and mathematical literacy (based on average OECD scores) in each cycle of PISA and Ireland's ranking amongst OECD countries (Shiel, Cosgrove, Sofroniou, & Kelly, 2001; Cosgrove, Shiel, Sofroniou, Zastrutzki, & Shortt, 2005; Eivers, Shiel, & Cunningham, 2008; Perkins, Moran, Cosgrove, & Shiel, 2010; Perkins, Shiel, Merriman, Cosgrove, & Moran, 2013; Shiel, Kelleher, McKeown, & Denner, 2016; McKeown, Denner, McAteer, Shiel, & O'Keefe, 2019; OECD, 2021).

Table 2-8 Reading Literacy Score for All PISA Cycles (Ireland)

Reading Literacy			
Year	Based on OECD Avg.	Ranking / OECD Countries	Top Ranking Country
2018	518 points (avg. 481)	4th / 36	Estonia (523)
2015	521 points (avg. 493)	3rd / 35	Canada (527)
2012	523.2 points (avg. 496.5)	4th / 34	Japan (538)
2009	495.6 points (avg. 493.4)	17th / 34	Korea (539) Finland (536)
2006	517.3 points (avg. 491.8)	5th / 29	Korea (556)
2003	515.5 points (avg. 494.2)	6th / 29	Finland (543)
2000	526.7 points (avg. 500)	5th / 27	Finland (546)

Source: Adapted from Shiel, Cosgrove, Sofroniou, Kelly (2001); Cosgrove, Shiel, Sofroniou, Zastrutzki, & Shortt (2005); Eivers, Shiel, & Cunningham (2008); Perkins, Moran, Cosgrove, & Shiel (2010); Perkins, Shiel, Merriman, Cosgrove, & Moran(2013); Shiel, Kelleher, McKeown, & Denner (2016); McKeown, Denner, McAteer, Shiel, & O’Keeffe (2019); OECD (2021)

Similar to table 2-8 above, table 2-9 below demonstrates the PISA scores in mathematics, for all cycles.

*Table 2-9 Mathematics Score for All PISA Cycles (Ireland)*

Mathematical Literacy			
Year	Based on OECD Avg.	Ranking / OECD Countries	Top Ranking Country
2018	500 points (avg. 489)	16th / 37	Estonia (523)
2015	504 points (avg. 490)	13rd / 35	Japan (532)
2012	501.5 point (avg. 494)	13 / 34	Korea (554)
2009	487.1 point (avg. 495.7)	26th / 34	Korea (546)
2006	501.5 point (avg. 497.7)	16th / 30	Finland (548)
2003	502.8 point (avg. 489)	17th / 29	Finland (544)
2000	502.9 point (avg. 500)	15th / 27	Japan 9557)

*Source: Adapted from Shiel, Cosgrove, Sofroniou, & Kelly (2001); Cosgrove, Shiel, Sofroniou, Zastrutzki, & Shortt (2005); Eivers, Shiel, & Cunningham, 2008; Perkins, Moran, Cosgrove, & Shiel (2010); Perkins, Shiel, Merriman, Cosgrove, & Moran (2013); Shiel, Kelleher, McKeown, & Denner, 2016; McKeown, Denner, McAteer, Shiel, & O’Keeffe (2019); OECD (2021)*

Cosgrove (2015) suggests that the Irish educational stakeholders were shocked by the 2009 findings, as there was no other indicator to suggest that literacy and numeracy standards had fallen so dramatically. In the first three cycles of PISA, Ireland was performing consistently above average OECD scores in reading literacy and consistently average in mathematical literacy. However, in 2009, Ireland demonstrated a significant drop to below average in mathematical literacy and to average in reading literacy (Perkins, 2015). This unexpected fall in reported standards urged the DES to further analyse the results and identify the factors that contributed to the lowering standards (Cosgrove & Cartwright, 2014). Cosgrove and Cartwright suggested the following four key issues to have impacted the PISA 2009 findings;

Demographic changes, major domains changing between cycles, response patterns on the PISA test over time and the methods used to estimate changes in achievement.

#### **2.4.2 Educational Reform**

The findings from this analysis of PISA 2009 results in particular have influenced and impacted some major reforms in Irish education systems. Ireland's education systems were not being reformed, based on PISA findings in isolation. Many countries around the world were doing something similar since the PISA project began in 2000 (Breakspear, 2012) (Pons, 2017). Breakspear (2012, p. 27) conducted a study on the impact PISA has on policy makers in different participating countries and the extent of that impact, concluding that PISA has been and is still very much influential in decision making and initiating a variety of policy reforms. He found that Germany and Denmark made major changes based on the early PISA cycles, but that almost all countries implemented varying measures of reform based on PISA findings. In Ireland, among other countries including Austria, Germany, Hungary, Japan, Luxembourg, Norway, Poland and the Slovak Republic, PISA was deemed to have played a significant role in highlighting the areas where improvements would be most beneficial, such as the assessment and evaluation of student learning outcomes (Breakspear, 2012, p. 19). One of the initiatives most relevant to this research was the national strategy plan (DES, 2011), which was developed by the DES in response to the PISA 2009 findings. However, it has been suggested that the development of the national literacy and numeracy strategy plan was a quick reaction to the 2009 PISA results (Murphy B. , 2018). Murphy contends that this kneejerk reaction to one set of results, which as mentioned earlier, may not accurately reflect the literacy and numeracy abilities of a nation (Schleicher, 2019), may result in focusing more on improving results in future assessments, rather than for the future of Ireland's young people. Whatever the motive, with an increasing demand for high levels of literacy and numeracy across all sectors of employment, improving standards would assist economic growth and ensure success for Ireland's young people in life and work (DES, 2011, p. 8). The national strategy plan suggests ways in which these improvements may come to fruition, including national targets for improving literacy and numeracy (p. 17), enabling parents and

communities to support development (p. 19), enabling better leadership within schools (p. 39), improving curriculum (p. 43), assisting students with additional needs to reach their potential (p. 61) and improving assessment and evaluation (p. 73), by prioritising literacy and numeracy across all disciplines.

Most relevant to this research, in the DES national strategy plan is chapter 4, *Improving the Curriculum and Improving Professional Practice for Teachers*. Regarding post-primary ITE, this chapter explores the idea that most ITE courses, which are completed over a nine-month period, allow insufficient time to adequately prepare to develop the skills required to teach literacy and numeracy to their students (DES, 2011, p. 32). The DES hoped to raise awareness of the importance of literacy and numeracy and to promote better attitudes towards these skills among children, young people, whole-schools, parents, and the wider community. The national strategy plan placed little focus on individual subjects or specific levels of education but provided general guidelines and targets for the curriculum as a whole. As this research focuses on literacy and numeracy within the technical subjects, the national strategy plan does not provide solutions on how to improve literacy and numeracy from the perspective of teachers of these subjects. To gain insight into how this translates into specific subjects, the framework for junior cycle reform will be explored.

*The Framework for Junior Cycle* (DES, 2015) highlights the importance of literacy and numeracy within each subject, stating that these key skills are fundamental to a student's development. *The Framework for Junior Cycle* relates quite closely to, and is in part, a direct result of DES' literacy and numeracy strategy plan. The reform of the junior cycle curriculum was signalled as a key action in the strategy document. The new subject specifications being developed place a greater emphasis on the teaching and consolidation of literacy and numeracy as key skills across all aspects of the junior cycle curriculum (DES, 2015, p. 14). *The Framework for Junior Cycle* reiterates the significance of teaching literacy and numeracy skills amongst others. The eight skills highlighted as part of this reform are: being literate, being numerate, being creative, managing information and thinking, working with others, communicating, managing myself and staying well (DES, 2015, p. 13). These eight skills are all

linked and compliment the teaching of literacy and numeracy skills. Table 2-10 below demonstrates how being literate and being numerate applies within the classroom.

*Table 2-10 Key Skills of Being Literate and Being Numerate*

Being Literate	Being Numerate
Developing my understanding and enjoyment of words and language	Expressing ideas mathematically
Reading for enjoyment and with critical understanding	Estimating, predicting and calculating
Writing for different purposes	Developing a positive disposition towards investigating, reasoning and problem solving
Expressing ideas clearly and accurately	Developing a positive disposition towards investigating, reasoning and problem solving
Developing my spoken language	Seeing patterns, trends and relationships
Exploring and creating a variety of texts, including multi-modal texts	Gathering, interpreting and representing data  Using digital technology to develop numeracy skills and understanding

*Source: Adapted from The National Council for Curriculum and Assessment (2015)*

It is evident from looking at this breakdown that these key skills, some more obvious than others, are embedded and developed within the technical-subjects, Wood Technology and Graphics at junior cycle level, which are two of the subjects specific to the ITE programme at GMIT.

### **2.4.3 Embedding Literacy and Numeracy Development within Technical Subjects**

The graduates from this case study ITE programme are qualified to teach four subjects at post-primary school. These four subjects include Graphics and Wood Technology at Junior Cycle (12-15 year olds) and Design and Communication Graphics and Construction Studies at Senior Cycle (15-18 year olds). Embedding literacy and numeracy within the technical subjects is

evident in the revised Junior Cycle framework in the form of the learning outcomes, which are clearly set out in each subject’s syllabus. These learning outcomes are divided into different strands specific to each subject.

An example of this segregation can be seen in Graphics, where the outcomes are broken down as follows: 2D graphics, 3D graphics and Applied graphics. These three strands have been broken down further into the following categories: spatial reasoning, design thinking, communicating, and geometric principles and constructions (NCCA, 2019), which can be seen in figure 2-2 below.

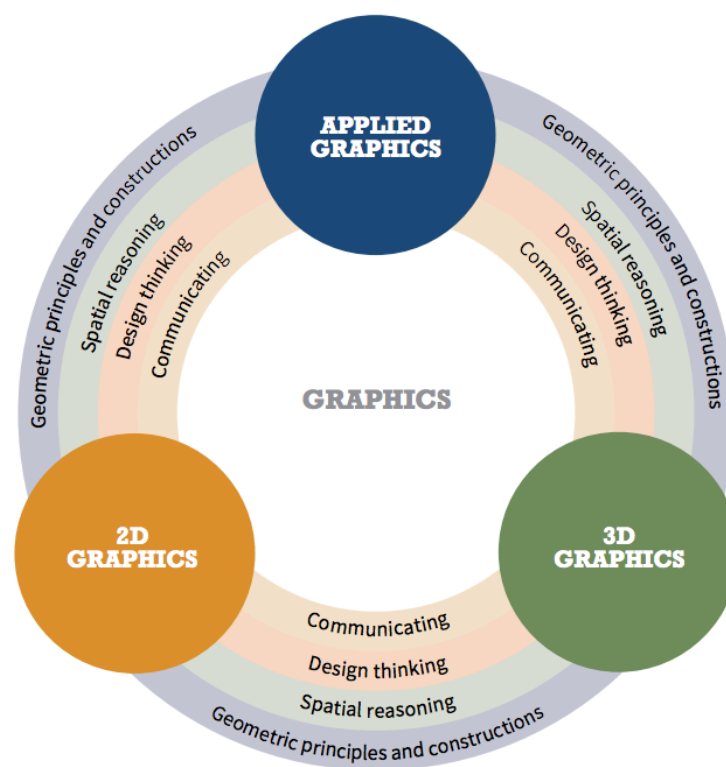


Figure 2-2 Junior Cycle Graphics (3 Strands)

Source: NCCA (2019)

By viewing the learning outcomes in this way, the students are enabled to develop their own understanding of these skills. In simplifying and clearly laying out the learning outcomes, this

framework places the student at the core of the educational experience, giving them the opportunity to take ownership of their learning, creating a deeper thinking student with stronger abilities in problem solving (DES, 2012, p. 29). O'Brien (2019) emphasises the importance of supporting for example, the development of creativity in the classroom. Junior Cycle Teachers (JCT) suggest that the development of these skills in students, makes an important link to both the learning at primary level and the further development of these skills at senior level (Flood, 2014) and beyond. The development of these skills is considered to be part of and to support lifelong learning.

In a bid to get a deeper insight into what this looked like within Irish technical-subject classrooms, a documentary analysis of the DES subject inspection reports was conducted. However, it was found that there was a limited amount of information relating to the technical subjects. A search was conducted on the DES website and the findings indicated that the DES conducted 6,185 subject inspections across all Irish post-primary schools, spanning the period between 2016 to 2020, which included 20 subjects. The researcher limited the search results according to geographical location by choosing one county (Galway) as a sample. By selecting one county the results were limited to 360 subject inspection reports. The results from this limited search indicated that 41 subject inspections were conducted for technical subjects.

The subject inspection reports indicated that efforts were being made in the classroom to improve literacy and numeracy. The recurring comments among the analysed reports, in relation to literacy was concerned with the 'identification' and 'interpretation' of subject specific keywords and terminology used in the lessons. Suggestions were made in Material Technology Wood (MTW) and Construction Studies (CS) reports, for students to record the terminology used in lessons to improve literacy. The most recent DES inspection report for MTW and CS (dated 05.11.2018) suggested that "students be required to record this [subject specific] terminology and to use those processes to reinforce learning". With regard to numeracy, emphasis was put on calculating, estimating, and measuring, with a suggestion that "(t)eachers made commendable efforts to incorporate numeracy when requiring



students to calculate measurements and estimate distance” (DES, 2018, p. 4). These skills do not encourage higher order thinking. In fact, the words used to describe what has been achieved, ‘identification’ and ‘highlighting’ along with those used by way of suggestion, such as ‘record’, all indicate a lower level of thinking (Qasrawi & BeniAndelrahman, 2020, p. 747). There is limited insight into what is happening in the classrooms from researching these reports, but suggestions made in these reports, by those inspecting these subjects, are not aligned with what we now understand to be literacy and numeracy.

In conclusion, the literature would suggest that there are ongoing efforts to improve literacy and numeracy for Ireland’s young people. The results from the OECD study have highlighted literacy and numeracy as a global issue and Ireland has responded by means of educational reforms. The junior cycle reform called for more emphasis on the development of key skills, of which literacy and numeracy are a part and with this newfound focus on these skills among others across the curriculum, the teaching practices of all teachers in all subjects are now being scrutinised. Having defined both literacy and numeracy earlier in this chapter and having explored the background and context of this study, the following section will identify how this effects ITE and more specifically teacher-education for technical-subjects.

## **2.5 Literacy and Numeracy Development within ITE**

With many governing bodies making significant efforts over the past decade, to improving literacy and numeracy across education systems worldwide, there are high expectations of ITE providers to promote literacy and numeracy among their PS teachers and to contribute to raising the standards of literacy and numeracy among Ireland’s young people (The Education and Training Inspectorate, 2011). ITE is a crucial stage for developing an awareness and an appreciation for a PS teacher’s own abilities as well as their students’ and it is at this stage that a professional mindset is born and developed (Caena, 2014). Garbe (2017), at the 20<sup>th</sup> European Conference on Literacy, argues that it is a strong emphasis on teaching literacy skills within ITE that moulds a PS teacher’s philosophy on teaching literacy (Garbe, 2017).

In Ireland, it is now well established by a variety of policy makers, that ITE is a key component of improving literacy and numeracy of our young people (DES, TC and NCCA). *In 2011*, the national strategy plan to improve literacy and numeracy (DES, 2011) emphasised the key role that teachers' professional development would play in improving literacy and numeracy, suggesting that ITE programmes be extended, and that programme content be reconceptualised to allow for this shift in emphasis. The TC has in 2020, included literacy and numeracy as a core element of all ITE programmes, suggesting that all programmes shall provide opportunities for PS teachers to develop, firstly, their own literacy and numeracy skills and, secondly, their competence in teaching and assessing literacy and numeracy.

The DES made suggestions on how to improve literacy and numeracy in ITE and professional development, highlighting the teacher education continuum, which was developed by the TC as a valuable policy (DES, 2011, p. 33). The *Policy on the Continuum of Teacher Education* makes suggestions on the topic of assessment of literacy and numeracy skills within ITE programmes, emphasising the importance of assessing the student's own literacy and numeracy skills, as well as evaluating their ability to teach and assess these skills (The Teaching Council, 2011, p. 14). The TC suggested that PS teachers should be required to demonstrate an acceptable proficiency in both areas (The Teaching Council, 2020, p. 14). Although the TC had proposed that by 2017, all applicants to ITE programmes would need to demonstrate a certain standard of literacy and numeracy skills by means of an admission test as part of the minimum requirement (The Teaching Council, 2011, p. 19), this is still not the case. It is only mature students that are required to demonstrate an acceptable proficiency in literacy and numeracy (The Teaching Council, 2011, p. 19).

Considering the responsibility placed on ITE to contribute to raising literacy and numeracy standards from early education to higher and adult education (DES, TC and NCCA), it is surprising to learn that a post-primary teacher had not always been considered to share the responsibility to develop these skills (Murphy, Conway, Murphy, & Hall, 2014). Murphy *et al.* explain that it is rare to find post-primary teachers explicitly developing these skills in their classrooms "due to the enduring subject discipline focus of schools at that level" (Murphy,

Conway, Murphy, & Hall, 2014, p. 332). Referring to the varying definitions of both literacy and numeracy, depending on the age group being taught, it follows suit that literacy and numeracy teaching skills embedded in ITE programmes will differ depending on whether it is for primary or post-primary education. Murphy *et al.* suggest that, historically, when catering to the literacy needs of post-primary age students, the strategies were associated more closely with early education. These practices, although necessary and useful, reflect an approach that is too simplified to adequately cater for the 21<sup>st</sup> century literacy and numeracy demands of an adolescent (Rosowsky, 2006, p. 82). Murphy *et al.* believe that teacher should understand the specific needs of their adolescent students and use a collection of methods to develop “specialised subject-specific” skills. In doing this, the learning would become more meaningful and would result in a deeper understanding of the content. However, Murphy *et al.* indicated that many PS teachers that were surveyed, had a relatively traditional understanding of literacy (Murphy, Conway, Murphy, & Hall, 2014, p. 338). One may wonder how students of ITE programmes can be expected to grasp the significance of teaching these core skills, literacy and numeracy, when their own skills in this area may not be of a required standard.

The focus of this section will now shift from the learner to the educator. ‘Pedagogic literacy’ (PL) is a term that has emerged regarding ITE and it is apparent that developing a PS teacher’s PL is not only vital, but is a complex task. It is this skill that enables a teacher to be able to respond and make decisions that will support learning based on what is happening in the classroom (Cajkler & Wood, 2016, p. 515). Cajkler *et al.* go on to say that it is crucial for a teacher to be able to “interpret what is happening in lessons through a heightened awareness of how learners respond to teaching”. Hall, Murphy, Rutherford and Ní Áingléis (2018, p. 38) agree that this skills of being able to ‘read a classroom’ is at the core of PL. Hall *et al.* recommend that by utilising certain professional skills such as lesson planning, use of questions and by understanding and using a variety of teaching approaches, a teacher will develop their PL skills but that these must coincide with a commitment to professional development and growth, and engagement in reflective practices. When considering the skills

of literacy and numeracy in ITE in Ireland, this idea of PL is echoed by DES, TC and NCCA, stating that it is at the core of implementing change and bringing about improvement; future proofing Ireland's education standards to reflect the needs of the learners of the ever-changing 21<sup>st</sup> century. In a bid to identify how teacher-educators might embed the development of literacy and skills within the different modules of an ITE programme, usable and accessible models, for both were explored.

## **2.6 Literacy and Numeracy in Theory and Practice**

This section will explore a literacy framework and a numeracy model, which were developed to assist PS teachers to embed the teaching and learning of these skills within their classrooms. Considering the new understanding of what literacy and numeracy mean in the context of this study, these two models were chosen, as they are practical guides to assist teachers of all subjects and they both allow and cater for the needs of people in 21<sup>st</sup> century.

### **2.6.1 Literacy in Practice**

Peter Freebody and Alan Luke's four resources model for literacy teaching was developed to assist teachers in clarifying what their students need to achieve in order to become what they call 'successful readers' (Freebody & Luke, *Literacies Programs: Debates and Demands in Cultural Context.*, 1990, p. 14). This model contains four roles; Code breaker (how do I crack this?), text participant (what does this mean?), text user (what do I do with this, here and now?) and text analyst (what does all this do to me?). Table 2-11 below (Freebody & Luke, 2003) gives more detail of what each role entails.

Table 2-11 The Four Resources Model

<b>The Four Resources Model (Freebody and Luke 1990)</b>	
<b>Breaking the code of texts:</b>	Recognising and using the fundamental features and architecture of written texts including: alphabet, sounds in words, spelling, punctuation, conventions and patterns of sentence structure, page layout, directionality and text formatting.
<b>Participating in the meanings of text:</b>	Understanding and composing meaningful written, visual and spoken texts in ways that connect texts' meaning systems to peoples' available knowledges and experiences of other cultural discourses, texts and meaning systems, and the relevant and purposeful inferences that can be drawn from these connections.
<b>Using texts functionally:</b>	Traversing and negotiating the social relations around texts; knowing about and acting on the different cultural and social functions that various texts perform both inside and outside school and knowing that these functions shape the way texts are structured, their tone, their degree of formality and their sequence of components, and the courses of social action they can accomplish with particular texts.
<b>Critically analysing and transforming texts:</b>	Understanding and acting on the knowledge that texts are not transparent windows on the world, that they are not ideologically natural or neutral, that they represent particular views and silence others, influence people's ideas; and that their designs and discourses can be critiqued and redesigned in novel and hybrid ways.

Source: Freebody and Luke (1990)

Freebody and Luke emphasise the need for these four roles to be addressed simultaneously, to become effectively literate (p. 7). Firkins (2015) describes this model as an 'enabling tool' for teachers and points out that because of its non-prescriptiveness, it is a flexible pedagogical tool, which can be used and adapted by and for all teachers. Freebody and Luke describe this model as 'a systematic way of interrogating practice', indicating that it is not literacy instruction. Similarly, the numeracy model explored below enables a teacher to reflect on their practice in order to improve pedagogic numeracy.

### **2.6.2 Numeracy in Practice**

Professor Goos (2007) recognised that for a description of numeracy to be useful for the teachers of today, it needed to reflect the multifaceted nature of numeracy in the 21<sup>st</sup> century. Goos developed a numeracy model to allow for this. Similar to the literacy framework above, this numeracy model was developed as a tool to assist teachers in planning and reflecting on their practice of implementing numeracy strategies (Goos & Geiger, 2010). The numeracy model encompasses five dimensions. Because the purpose of this model is to enable students to use mathematics in the 'real world', Steen (1999) stresses the importance of developing the skill of numeracy in multiple contexts, which Goos has placed at the centre of the numeracy model. Mathematical knowledge (skills, concepts and problem-solving ability), positive disposition (willingness and confidence to engage) and tools (the means by which mathematics is presented in the classroom and the wider context) all need to be catered for and considered in order to enhance the teaching and learning of numeracy (Geiger, Goos, Forgasz, & Bennison, 2014). To be numerate, when considering all of the elements mentioned above, a person must be able to view them critically (critical orientation). Table 2-12 below (Goos, Geiger, & Dole, 2012) explores the 5 elements of the numeracy model describing what each will look like within a classroom setting.

Table 2-12 Description of Elements of the Numeracy Model

Element of Model	Description of Element
<b>Mathematical knowledge</b>	Mathematical concepts and skills; problem solving strategies; estimation capacities.
<b>Contexts</b>	Capacity to use mathematical knowledge in a range of contexts, both within schools and beyond school settings.
<b>Dispositions</b>	Confidence and willingness to use mathematical approaches to engage with life-related tasks; preparedness to make flexible and adaptive use of mathematical knowledge.
<b>Tools</b>	Use of material (models, measuring instruments), representational (symbol systems, graphs, maps, diagrams, drawings, tables, ready reckoners) and digital (computers, software, calculators, internet) tools to mediate and shape thinking.
<b>Critical Orientation</b>	Use of mathematical information to make decisions and judgements; add support to arguments; challenge an argument or position.

Source: Adapted from Goos and Geiger (2010)

Figure 2-3 below (Goos & Geiger, 2010) demonstrates the relationship between all elements of the model, suggesting that no one element stands alone, but interacts with each other.

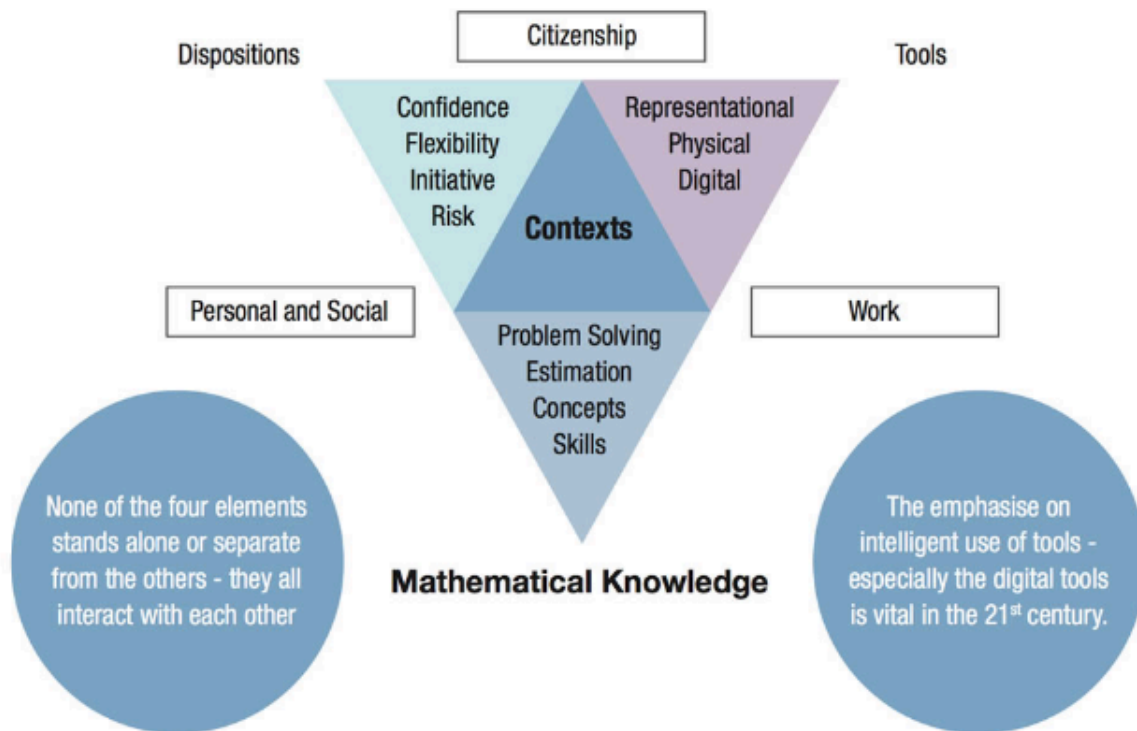


Figure 2-3 A Model for Numeracy in the 21st Century

Source: Goos (2007)

The literacy framework and numeracy model discussed above, both engage in meaning-making, critical thinking and making connections between different concepts, disciplines and tasks, which when viewed in the context of education, gives teachers a heightened awareness of the complexities of literacy and numeracy, while also providing a practical aid to developing these two skills from within, across the curriculum. By developing models which are more flexible and usable by all teachers, teachers are enabled to develop and reflect on their practices. Having established a means by which the development of literacy and numeracy skills can be embedded within all subjects, the following section focuses on literacy and numeracy within the technical subjects specifically.



## **2.7 Literacy & Numeracy Promotion within Technical Subjects**

As previously stated, (See section 1.1), technical subjects do not tend to be obviously rich in literacy and numeracy development because they are the more practical and hands-on subjects. However, the literature shows that technical subjects promote literacy, numeracy, problem solving, critical thinking and higher order learning (DES, 2011). Having highlighted problem solving and critical thinking as two aspects of developing literacy and numeracy skills, it is worth noting that problem solving and critical thinking are a significant part of technical subjects at post-primary level. These subjects now require their students to become active in the process of design and are therefore, a catalyst for promoting and developing a student's skills in this area of problem solving and critical thinking.

With a significant amount of design-based content and the utilisation of problem-solving skills required within the revised junior cycle subjects Wood Technology and Graphics and the senior cycle's Design and Communication Graphics and Construction Studies (NCCA, 2020), the technical subjects should be considered rich in the development of literacy and numeracy within their students. Schooner *et al.* identify problem solving and critical thinking as key skills in design, stating that these skills are addressed in technology and design education, as part of the subject matter and have been for centuries (Schooner, Nordlöf, Klasander, & Hallström, 2017). It has been suggested that technical subjects are so rich in developing problem-solving skills, critical thinking, creativity, that programmes should be developed for primary school also (Firman, Rustaman, & Suwarma, 2015). It has also been suggested that an engagement in these subjects would allow students to explore, inquire, solve problems, and think critically (Asghar, Ellington, Rice, Johnson, & Prime, 2012), but for these skills to be most beneficial for life outside education, students are required to be able to think across disciplinary boundaries (Berry, et al., 2005).

As the technical subjects fall into the remit of STEM education (Science, Technology, Engineering and Mathematics), teachers of these subjects are expected to be mathematically confident and also to have relatively strong pedagogical knowledge of developing numeracy

within their students (Ferme, 2018). The teaching of technical subjects is therefore, inherently promoting and developing numeracy, through problem solving, critical thinking, creativity (Murphy, Murphy, Danaia, & Wang, 2019) and also, their relevance to the outside world (Ferme, 2018). However, many teachers of technical subjects consider crossing disciplinary boundaries challenging. A challenge such as this arises when the terminology and tools used in these subjects are so vastly different to other subjects (Nikitina & Mansilla, 2003). Asghar *et al.* (2012) suggest that STEM subjects, such as these are so rich in disciplinary literacy and numeracy that it becomes a barrier when efforts are made to make the connections and relationships between these subjects and those in other disciplines.

Having outlined the context and background of the topic being explored in this study, the following section will highlight the inclusion of literacy and numeracy within the documentation relevant to the ITE programme at GMIT.

## **2.8 Documentary Analysis - ITE Programme at GMIT**

This section addresses objective 3 - to analyse the GMIT ITE programme documents, in order to identify what provisions are made for the inclusion of both the development of pre-service teachers' personal literacy and numeracy and their ability to teach literacy and numeracy. The analysis of these documents will give insight into the planning for and the inclusion of these skills within the programme and will inform the case study. The methodology for analysing the Approved Programme Schedule (APS) documentation for this programme, was to examine them in three stages, 1) the programme as a whole and its relevant learning outcomes, 2) an overview of each module separately and their specific learning outcomes and 3) documentation specific to each module.

### **2.8.1 ITE Programme – Provision for Literacy and Numeracy Development**

The eight learning outcomes for this programme are listed in the programme documentation and are broken down further into the expected detailed knowledge and understanding of the learner (See table 2-14 and 2-16). To give structure to the analysis of these documents, and

considering the lack of universally accepted definitions for both literacy and numeracy, the definitions developed for the purpose of this research were used to map the provisions made for the development of these skills within this document. Literacy and numeracy are presented separately below, as the two skills are not presented equally. Literacy appears to be more prominent in the programme’s learning outcomes.

The keywords within the definition of literacy below, are demonstrated in table 2-13 which follows.

The ability to engage with, identify, interpret and use both existing knowledge and new learning from printed text, spoken language, broadcast and digital media to construct and communicate meaning, and develop knowledge and potential, to enable the achievement of goals and the participation in community and society.

*Table 2-13 Literacy Keywords and Frequency*

Action	Through medium	For the purpose of
Engage (1)	Printed text/paper	Construct (1) meaning
Identify (1)	/literature/terminology (4)	Communicate (1)
Interpret (3)	Spoken Language (0)	Develop (5)
Use/apply/employ (4)	Broadcast media (0)	Participate (1)
		Society (4)

*Source: Author’s Original*

The selected literacy key words have been highlighted in table 2-14 below to demonstrate that although literacy is not named explicitly within these programme outcomes, elements of literacy are considered and included.

Table 2-14 Inclusion of Literacy Keywords within Programme Outcomes

Programme Outcome	On successful completion of this programme, the learner will/should be able to:	The learner will be able to:
1. Knowledge Breadth	[Demonstrate an understanding of] the theory, concepts and methods pertaining to a field (or fields) of learning.	None directly applicable to literacy development
2. Knowledge Kind	[Demonstrate] detailed knowledge and understanding in one or more specialised areas, some of it at the current boundaries of the field(s).	<ul style="list-style-type: none"> <li>• Advanced methods for acquiring, <b>interpreting</b> and analysing subject-specific information, with a critical understanding of the appropriate contexts for their use through the study of <b>texts</b> and original <b>papers</b></li> <li>• The <b>terminology</b>, nomenclature, and/or classification systems appropriate to the subject area</li> <li>• Current issues of concern to <b>society</b> and an understanding of the philosophical and ethical issues involved</li> </ul>
3. Knowhow and Skill Range	Demonstrate mastery of a complex and specialised area of skills and tools; use and modify advanced skills and tools to conduct closely guided research, professional or advanced technical activity.	<ul style="list-style-type: none"> <li>• Source, <b>interpret</b> and <b>apply</b> appropriate and referenced <b>literature</b> and other information sources</li> <li>• <b>Employ</b> advanced data analysing, synthesising and summarising skills in a scientific work setting</li> <li>• <b>Communicate</b> scientific information in a variety of forms to specialist and non-specialist audiences</li> </ul>
4. Knowhow and Skill Selectivity	Exercise appropriate judgement in a number of complex planning, design, technical and/or management functions related to products, services, operations or processes, including resourcing.	None directly applicable to literacy development

5. Competence Context	Use advanced skills to conduct research, or advanced technical or professional activity, accepting accountability for all related decision making; transfer and apply diagnostics and creative skills in a range of contexts.	<ul style="list-style-type: none"> <li>• Present and <b>engage</b> in debate relating to general scientific issues</li> <li>• <b>Use</b> advanced scientific skills to critically <b>interpret</b> existing knowledge and <b>apply</b> in new situations</li> </ul>
6. Competence Role	Act effectively under guidance in a peer relationship with qualified practitioners; lead multiple, complex heterogeneous groups.	<ul style="list-style-type: none"> <li>• <b>Participate constructively</b> in a complex team environment within a scientific field</li> <li>• <b>Develop</b> and train staff to meet changing technical needs</li> </ul>
7. Competence Learning to Learn	Learn to act in variable and unfamiliar learning contexts; learn to manage learning tasks independently, professionally and ethically.	<ul style="list-style-type: none"> <li>• <b>Identify</b> knowledge gaps and source and undertake self-learning to fill the gaps</li> </ul>
8. Competence Insight	Express a comprehensive, internalised, personal world view, manifesting solidarity with others.	<ul style="list-style-type: none"> <li>• <b>Develop</b> a capacity for <b>social</b> responsibility</li> <li>• Contribute to the <b>development</b> of the role of the scientist in <b>society</b></li> <li>• Demonstrate the capacity to acknowledge the current issues of concern to <b>society</b> and an understanding of the philosophical and ethical issues involved</li> </ul>

*Source: Author's Original - Adapted from APS Documents*

The rationale for the inclusion or exclusion of these learning outcomes, in table 2-14 above depended on the context. An example of this is the exclusion of the learning outcome 'Apply advanced numerical and statistical analysis skills'. Although this learning outcome includes the word 'apply', it relates specifically to numbers and statistics, which would have a strong relationship with numeracy. As discussed earlier in this chapter, some may argue that numeracy is an element of literacy and should therefore, be included in both tables 2-14 and 2-16. However, for the purpose of this analysis and the decision to use the newly formulated

definition to identify their inclusion of literacy and numeracy within these programme outcomes, they have been categorised into either literacy or numeracy.

Through analysis of the same programme documentation, the treatment of numeracy has been highlighted using the same approach as above. The keywords, within the below definition of numeracy are demonstrated in table 2-15 which follows:

The ability to access, interpret, manipulate and use mathematical information, to problem-solve, analyse, predict and communicate this information in a concise and accurate way, to relate to the real world and today's society.

*Table 2-15 Numeracy Keywords and Frequency*

Action	Through the medium of	For the purpose of
Access (0)	Mathematical information	Communicate (1)
Interpret (1)	/Numerical	Participate (1)
Manipulate (0)	/Statistical (2)	Society (4)
Use/apply/employ (3)	Concise & accurate (0)	

*Source: Author's Original*

Similar to literacy, numeracy is not mentioned explicitly, but again elements of this skill are also evident in these learning outcomes. The selected numeracy key words have been highlighted in table 2-16 below. However, these keywords are less frequently found, and this may relate to the fact that the previously explored definitions for numeracy are specific to numbers and unlike literacy, are not closely related to general competencies.

Table 2-16 Inclusion of Numeracy Keywords within Programme Outcomes

Programme Outcome	On successful completion of this programme, the learner will/should be able to:	The learner will be able to:
1. Knowledge Breadth	[Demonstrate an understanding of] the theory, concepts and methods pertaining to a field (or fields) of learning.	None directly applicable to numeracy development
2. Knowledge Kind	[Demonstrate] detailed knowledge and understanding in one or more specialised areas, some of it at the current boundaries of the field(s).	<ul style="list-style-type: none"> <li>• Current issues of concern to <b>society</b> and an understanding of the philosophical and ethical issues involved</li> </ul>
3. Knowhow and Skill Range	Demonstrate mastery of a complex and specialised area of skills and tools; use and modify advanced skills and tools to conduct closely guided research, professional or advanced technical activity.	<ul style="list-style-type: none"> <li>• <b>Employ</b> advanced data analysing, synthesising and summarising skills in a scientific work setting</li> <li>• <b>Apply</b> advanced <b>numerical</b> and <b>statistical</b> analysis skills</li> <li>• <b>Communicate</b> scientific information in a variety of forms to specialist and non-specialist audiences</li> </ul>
4. Knowhow and Skill Selectivity	Exercise appropriate judgement in a number of complex planning, design, technical and/or management functions related to products, services, operations or processes, including resourcing.	None directly applicable to literacy development
5. Competence Context	Use advanced skills to conduct research, or advanced technical or professional activity, accepting accountability for all related decision making; transfer and apply diagnostics and creative skills in a range of contexts.	<ul style="list-style-type: none"> <li>• <b>Use</b> advanced scientific skills to critically <b>interpret</b> existing knowledge and <b>apply</b> in new situations</li> </ul>

6. Competence Role	Act effectively under guidance in a peer relationship with qualified practitioners; lead multiple, complex heterogeneous groups.	<ul style="list-style-type: none"> <li>• <b>Participate</b> constructively in a complex team environment within a scientific field</li> </ul>
7. Competence Learning to Learn	Learn to act in variable and unfamiliar learning contexts; learn to manage learning tasks independently, professionally, and ethically.	None directly applicable to literacy development
8. Competence Insight	Express a comprehensive, internalised, personal world view, manifesting solidarity with others.	<ul style="list-style-type: none"> <li>• Develop a capacity for <b>social</b> responsibility</li> <li>• Contribute to the development of the role of the scientist in <b>society</b></li> <li>• Demonstrate the capacity to acknowledge the current issues of concern to <b>society</b> and an understanding of the philosophical and ethical issues involved</li> </ul>

*Source: Author's Original - Adapted from APS Documents*

The above tables, 2-14 and 2-16 show that the literacy keywords are evident in 14 learning outcomes, compared to the numeracy keywords, which are evident in 9 learning outcomes. The programme outcomes explored above encompass 29 modules, which are explored in more depth below.

### **2.8.2 Programme Modules - Provision for Literacy and Numeracy Development**

The ITE programme at GMIT, consists of 29 separate modules across four years. The configuration of modules at each stage is shown in table 2-17 below.



Table 2-17 Modules on the ITE Programme

Year 1: (9 modules)	Year 2: (9 modules)	Year 3: (6 modules)	Year 4: (5 modules)
School Placement 1	School Placement 2	School Placement 3	School Placement 4
Learning and Innovation Skills	School Placement Preparation	Educational Studies	Professional Studies
Technical Graphics	Theory of Teaching and Learning	Curriculum and Assessment	Advanced Graphics
Design Process 1	Graphics and Computer Applications	Applied Graphics	Building Services and Technology
Projects 1	Design Process 2	Architectural Design	Dissertation
Manufacturing Technology 1	Educational Projects 2	Educational Projects 3	
Furniture and Design History	Manufacturing Technology 2		
Mathematics	Materials and Sustainability		
Furniture Materials and Construction	Applied Science		

Source: Author's Original - Adapted from APS Documents

The programme documentation includes a specification document for each module, which includes elements, such as module description, learning outcomes, teaching and learning strategies, assessment strategies, module dependencies, indicative syllabus, coursework and assessment breakdown, ACCS mode workload, module resources, ISBN booklist, approval information and programme membership. These module specification documents were initially examined to establish if literacy and numeracy development was mentioned explicitly. It was found that literacy and numeracy were indicated in varying degrees, from 1<sup>st</sup> year to 4<sup>th</sup> year within the module specification documentation. The terms 'literacy' and

'numeracy' were mentioned explicitly in the education related modules only, and were found in the learning outcomes, indicative syllabus, module book resources, other resources, and additional information. This information is tabulated in table 2-18 below.

Table 2-18 Literacy and Numeracy Explicitly Named within the Programme

Year	Module	Evidence of Literacy & Numeracy Within the Modules
1	School Placement 1	<b>Learning Outcome: 6.</b> Demonstrate awareness of the need for Numeracy and Literacy and differentiation strategies in teaching and learning.
		<b>Indicative Syllabus:</b> Integration of Numeracy, Literacy, Oracy and Graphicacy into Teaching and Learning.
		<b>Additional Information:</b> Department of Education & Skills, Literacy & Numeracy for Learning & Life, 2012
2	Theory of Teaching and Learning:	<b>Learning Outcome: 4.</b> Apply foundational Numeracy, Literacy, Oracy and Graphicacy strategies to teaching
		<b>Indicative Syllabus:</b> DES Numeracy and Literacy Strategy: its application in teaching
		<b>Module Book Resources:</b> Department of Education & Skills, Literacy & Numeracy for Learning & Life, 2012.
	School placement 2:	<b>Indicative Syllabus:</b> Integration of Numeracy, literacy, oracy and graphicacy into teaching and learning.
		<b>Module Other Resources:</b> Department of Education & Skills, Literacy & Numeracy for Learning & Life, 2012
		<b>Module Book Resources:</b> Department of Education & Skills, Literacy & Numeracy for Learning & Life, 2012.
3	School Placement 3:	<b>Module Book Resources:</b> Department of Education & Skills, Literacy & Numeracy for Learning & Life, 2012.
	Education Studies:	<b>Learning Outcome: 6.</b> Outline effective Numeracy, Literacy, Graphicacy, and Oracy strategies
		<b>Indicative Syllabus:</b> Numeracy, Literacy, Graphicacy and Oracy Strategies

4	School Placement 4.	<b>Learning Outcome: 8.</b> Apply numeracy, literacy, graphicacy and oracy strategies to classroom teaching.
		<b>Indicative Syllabus:</b> Strategies in relation to differentiation, numeracy, literacy, graphicacy and oracy.
		<b>Module Book Resource:</b> Department of Education & Skills, Literacy & Numeracy for Learning & Life, 2012.

*Source: Author's Original - Adapted from APS Documents*

Not only was there evidence of the provision of literacy and numeracy development, explicitly named within these module specification documents, there appeared to be an incremental approach to this provision. Table 2-19 below shows the learning outcomes relevant to their place within the timeline of the programme, growing in their ambition, from awareness in 1<sup>st</sup> year to application in 4<sup>th</sup> year.

*Table 2-19 Literacy and Numeracy Related Learning Outcomes*

Year	Learning Outcome:
1	Demonstrate an <b>awareness</b> of the need for L & N strategies in teaching and learning
2	<b>Apply foundational</b> L & N strategies to teach
3	<b>Outline</b> effective L & N strategies
4	<b>Apply</b> L & N strategies in the classroom

*Source: Author's Original - Adapted from APS Documents*

Having found that the terms 'literacy' or 'numeracy' were not included in the specification for modules outside the education related modules, a deeper exploration of module descriptions and learning outcomes relevant to each module was undertaken. These two aspects of the specifications were chosen as, together these give insight into both the overall expectation

from each module, and the more specific outcomes for the learners. These findings are demonstrated in the four tables below. Table 2-20 presents the inclusion of literacy and numeracy in the module descriptors and module learning outcomes in year 1 modules.

*Table 2-20 Inclusion of Literacy and Numeracy within Year 1 Modules*

Year 1: (9 modules)	Literacy		Numeracy	
	Module description	Learning Outcome	Module description	Learning Outcome
School placement 1	✓	✓		✓
Learning and Innovation Skills	✓	✓		
Technical Graphics		✓	✓	✓
Design Process 1	✓	✓	✓	✓
Projects 1	✓	✓	✓	✓
Manufacturing Technology 1				✓
Furniture and Design History				
Mathematics		✓	✓	✓
Furniture Materials and Construction				✓

*Source: Author's Original - Adapted from APS Documents*

The following table, 2.21 demonstrates the findings with regard to module descriptors and learning outcomes for year 2 modules.

*Table 2-21 Inclusion of Literacy and Numeracy within Year 2 Modules*

Year 2: (9 modules)	Literacy		Numeracy	
	Module description	Learning Outcome	Module description	Learning Outcome
School placement 2	✓	✓		
School Placement Preparation	✓	✓		
Theory of Teaching & Learning	✓	✓		✓
Graphics and Computer Applications	✓	✓		✓
Design Process 2	✓		✓	
Educational Projects 2		✓		✓
Manufacturing Technology 2	✓		✓	
Applied Science		✓	✓	✓
Materials & Sustainability		✓		

*Source: Author's Original - Adapted from APS Documents*

Table 2.22 below demonstrates the presence of literacy and numeracy within the module descriptors and learning outcomes for year 3 modules.

*Table 2-22 Inclusion of Literacy and Numeracy within Year 3 & 4 Module*

Year 3: (6 modules)	Literacy		Numeracy	
	Module description	Learning Outcome	Module description	Learning Outcome
School Placement 3	✓	✓		
Educational Studies	✓	✓		✓
Curriculum and Assessment	✓	✓	✓	✓
Applied Graphics	✓	✓	✓	✓
Architectural Design	✓	✓		
Educational Projects 3	✓	✓		✓

*Source: Author's Original - Adapted from APS Documents*

Table 2.23 below demonstrates the presence of literacy and numeracy within the module descriptors and learning outcomes for year 4 modules.

*Table 2-23 Inclusion of Literacy and Numeracy within Year 4 Modules*

Year 4: (5 modules)	Literacy		Numeracy	
	Module description	Learning Outcome	Module description	Learning Outcome
School Placement 4	✓	✓		✓
Professional Studies	✓	✓		
Advanced Graphics		✓	✓	✓
Building Services and Technology	✓	✓		
Dissertation	✓	✓		

*Source: Author's Original - Adapted from APS Documents*

It is important to note that aspects of both literacy and numeracy could be read into all learning outcomes for all modules. However, the author used the definitions, developed for the purpose of this research to interpret and therefore, include or exclude outcomes in the findings below. Another element to consider, regarding the module specification documentation, is the different authors and disciplines involved in creating the documentation. This difference in background and disciplines impacts the findings regarding the presence of literacy and numeracy development within these documents.

The third stage of this documentary analysis is the exploration of the documents outside of the approved programme schedule, such as Continuous Assessment (CA) Briefs, assessment rubrics and finally, the student or module handbooks.

### **2.8.3 Module Documentation – Provision for Literacy and Numeracy**

This stage of the documentary analysis will demonstrate the inclusion or planning for and assessment of literacy and numeracy development within the modules. The Continuous Assessment (CA) briefs and their respective assessment rubrics were examined and evidence of both literacy and numeracy development were found within these documents.

Prior to a discussion of the inclusion of these skills within these documents, it is worth highlighting that the act of responding to an assessment brief is a demonstration of literacy development. Returning to the definition of literacy developed for this study, and using the same keywords highlighted in the analysis above (Table 2-13), to respond to the assessment brief the student must engage with the text, identify and interpret what is being asked of them and then use that information to solve a problem. These assessment briefs are given in text form, either printed or through digital media. In responding to the brief, the students must construct meaning and, in many cases, communicate their responses in many different forms. Quite often, because of the practical elements of this programme the responses relate to the wider society and aid development of the students' literacy and numeracy for life after third level education.

Upon further examination of the individual CA briefs, elements of both literacy and numeracy can be found in the aims and objectives, outputs, marking schemes and assessment rubrics, though some modules are more conducive to developing either literacy or numeracy skills, over other modules. Examples of literacy development within the module assessments include, conducting research, application of research findings to solve a problem, reflective practice, analysis, and evaluation of module relevant literature, writing lesson plans and developing schemes of work, written procedure reports, and communicating solutions through posters or other forms of presentation.

Examples of numeracy development with module assessments include communicating a timeline, developing time management for the planning of schemes of work and lesson plans, planning projects, creating working drawings, developing cutting lists, time keeping, calculate and document mathematical solutions for dwelling design, dimensional accuracy, and conciseness, and manage work volume efficiently.

The examination of these CA briefs highlighted the relevance and relationship between the skills that were being developed within these modules and life outside the lecture halls. Both definitions developed for the purpose of this research highlight the purpose of developing literacy and numeracy is to “participate in society” and this aspect is reinforced within a considerable number of the module assessments. Examples of the relationship to participation in wider society include, engaging in a community parade, calculating heat loss for the student’s own home, costing for setting up and running a small business, assessments relating to the whole school and education in general.

To conclude, the findings of this documentary analysis show what is included in the programme documentation. However, these findings do not necessarily represent what provisions are being made for literacy and numeracy development within the lectures or tutorials of this programme. What these findings demonstrate is that both literacy and numeracy are planned for within the ITE programme being studied, and although not always



named explicitly, there is evidence of these skills being intrinsically included in the development of the programme.

## **2.9 Conclusion**

This chapter aimed to examine literature regarding literacy and numeracy development within ITE, focusing on addressing objectives 1, 2 and 3. Initial searches of literature around methodological approaches to conducting a literature analysis formed the basis for this chapter, highlighting key research questions that would guide the literature analysis. This analysis has highlighted that there have not been any studies conducted from which this one can be directly compared and also compounded the need for this study to be conducted.

Objective 1 was to outline and develop definitions of literacy and numeracy, informed by relevant literature. Literature showed that there is a lack of clarity around the meaning of the two terms 'literacy and 'numeracy' and what is evident from this analysis is that there is no agreed definition for either. However, it can be concluded that it no longer refers to reading and writing and mathematical manipulation. As the world is evolving along with societal needs, these terms are evolving to reflect this change. The author has developed definitions for both literacy and numeracy, drawing from other relevant educational stakeholders.

Objective 2, to critically analyse literature, both nationally and internationally, pertaining to improving literacy and numeracy development in post-primary education and ITE programmes, underpinned the exploration of literature relating to the context and background to why this study was being conducted. It was found that assessment of these skills played a significant role in bringing about educational reform, both internationally and nationally. The most significant steps made in Ireland, to impact literacy and numeracy standards in education include developing a national strategy plan to improve standards in 2011 and the junior cycle reform, which emphasises literacy and numeracy as key skills in 2015. The literature shows that this newfound emphasis on improving literacy and numeracy standards worldwide, impacts how ITE programmes are addressing the development of

literacy and numeracy. There is currently no literacy and numeracy assessment for PS teachers. However, some ITEs have developed modules specifically to address the embedding of these skills. Two models for developing literacy and numeracy within teacher education have been identified and highlighted for the purpose of this research. These were chosen because of their practicality and usability for all disciplines, and to demonstrate the need for such models for use within the technical subjects. The literature would suggest that technical subjects include elements that make them conducive to developing literacy and numeracy skills, such as problem solving, critical thinking and their relevance to real-life.

The final inclusion in this chapter was to address Objective 3 of this research: to analyse programme documents for the ITE programme at GMIT, in order to identify what provisions are made for the inclusion of both the development of PS teachers' personal literacy and numeracy and their ability to teach literacy and numeracy. This analysis has identified areas where the development of these skills is included within the programme and also within each module of the programme. Though it is not always named, the development of literacy and numeracy skills are intrinsic to the teaching of all modules on this programme.

Having provided a comprehensive analysis of the literature pertaining to literacy and numeracy development in the context of ITE, including programme documentation, initial research themes were deduced and were brought forward into the design of the primary research, informing qualitative questions and topics being put to the research participants in this study. These initial themes included 'literacy' and 'numeracy' terminology, literacy and numeracy in the context of ITE, the relationship between literacy and numeracy and PS teachers' personal and pedagogical literacy and numeracy skills (See table 4-3 sections 4.2.2). The following chapter explores the research methodology choices made to conduct this research study.

## **3 Research Methodology & Methods**

### **3.1 Introduction**

This chapter provides an account of the methodological choices made within this research study, giving a rationale for those choices in dialogue with literature pertaining to research methodology and methods. This chapter addresses objective 4 of the research, namely, to design and conduct a primary research case study of the ITE programme at GMIT, with respect to literacy and numeracy competencies and training (See section 1.2), providing details about how this research study was designed, including the data gathering tools that would be employed, and the process of gathering that data.

Section 3.2 explores the meaning of a research methodology and how these methodological choices guide the project, indicating the philosophies commonly used in educational research, and the paradigm chosen to frame this study. Details are provided regarding the choice to utilise a case study approach and a rationale for using both qualitative and quantitative data gathering methods. Section 3.3 details data collection, including choices made regarding the selection of site and participants and the response rate of the participants. This section continues by describing the chronology of the data collection process, going into further detail about the different data collection tools used. Section 3.3 finished by exploring the question of validity and reliability of this research study. The last section in this chapter, section 3.4 addresses and provides insight into the ethical considerations underpinning this study. These include the ethical values and principles that were central to this research and the practices involved in achieving a well-considered and ethically conducted research project.

### **3.2 Research Methodology**

A research methodology is a systematic way by which a researcher can solve a problem, demonstrating a framework of 'how' evidence can be obtained in order to answer the

research question (Kallet, 2004). This section explores the multiple aspects of a research methodology including the underpinning philosophy, paradigms, strategies, and methods. A research methodology has precise and specific terminology associated with it, which are outlined in each section, as the term arises.

### **3.2.1 Research Philosophy**

The methodology and methods used in a research project are derived from the philosophies and theories which underpin the study (Punch & Oancea, 2014, p. 17). A research philosophy deals with a system of beliefs and assumptions made by the researcher around the reality being investigated (Saunders, Lewis, & Thornhill, 2019). By exploring different research philosophies, a researcher gets a better understanding of the assumptions and beliefs underpinning their study. A researcher's philosophy involves "the choice of research strategy, formulation of the problem, data collection processing and analysis". However, part of a research philosophy is the research paradigm, which consists of ontology, epistemology, methodology and methods (Zukauskas, Vveinhardt, & Andriukaitiene, 2018).

A research paradigm shapes the way that a researcher views their research. The word has Greek origins meaning 'to show', and Latin origins meaning 'example' or 'pattern' (etymonline). In the context of educational research, the term paradigm is used to describe a researcher's 'worldview' (Kivunja & Kuyini, 2017; Khatri, 2020). It was Thomas Kuhn, a highly influential philosopher of science, who introduced the idea of multiple paradigms (*The Structure of Scientific Revolutions* (1962)), changing the way researchers think about how they view and understand the world and therefore, how they approach their research. To put it simply, a paradigm is an organising framework, which enables a researcher to express their orientation and positions them in a certain community or belief system (McGregor, 2019). To understand and arrive at a suitable paradigm, certain assumptions are made, and these are referred to as 'ontology' and 'epistemology' (Rehman & Alharthi, 2016). Before exploring how these terms relate to this particular research project, it would be beneficial to clarify and consider the meaning of the terms 'ontology' and 'epistemology'.

Kivunja *et al.* define ontology as “the assumptions we make in order to believe that something makes sense or is real, or the very nature or essence of the social phenomenon we are investigating” (2017, p. 27). Separate to the ontology is epistemology, defined as that which can “describe how we come to know something; how we know the truth or reality; or... what counts as knowledge within the world” (Kivunja & Kuyini, 2017, p. 27). Perry, Riege and Brown sum this up in a simple way by saying that “ontology is ‘reality’, epistemology is the relationship between that reality and the researcher and methodology is the technique used by the researcher to discover that reality” (1999, p. 18). Arriving at a suitable research paradigm can be a daunting task for a researcher, as there are many differing views and opinions on the topic, but by making clear one’s beliefs and assumptions, a researcher demonstrates the relevance of their research study within the context of a certain belief system (Patel, 2015; Rehman & Alharthi, 2016). It is these assumptions that inform the methodology and methods which will follow. To identify the paradigm within which a certain research study belongs, a researcher must consider the questions shown in table 3-1 below.

*Table 3-1 Choosing a Research Paradigm*

Term	Description	Question
Ontology	The assumptions we make in order to believe that something makes sense or is real, or the very nature or essence of the social phenomenon we are investigating	What is reality?
Epistemology	Describes how we come to know something; how we know the truth or reality; or what counts as knowledge within the world	What and how can I know reality?
Methodology	The study and critical analysis of data production techniques. It is the “strategy, plan of action, process or design” that informs one’s choice of research methods	What procedures can we use to acquire knowledge?
Methods	Specific means of collecting and analysing data	What tools can we use to Acquire knowledge?

*Source: Adapted from Patel (2015); Rehman & Alharthi (2016)*

Many paradigms have been proposed and recognised in research today (Kelly, Dowling, & Millar, 2018; Kivunja & Kuyini, 2017) namely, positivism, post-positivism, constructivism, interpretivism, critical theory and pragmatism. However, each research paradigm has its specific purpose and means by which it produces research results (Taylor & Medina, 2013). Different authors will produce alternative list of paradigms best suited to specific fields of research. However, for the purpose of this research, the following dominant research paradigms were explored: positivist, constructivist, critical theory, and pragmatist (Kivunja & Kuyini, 2017), in a bid to identify the paradigm which aligns most closely with this research project. Table 3-2 below demonstrates the dominant paradigms in educational research and how they compare to each other.

*Table 3-2 Dominant Paradigms in Educational Research*

<b>Paradigm</b>	<b>Positivist</b>	<b>Constructivist</b>	<b>Critical Theory</b>	<b>Pragmatist</b>
<b>Ontology</b>	Objective There is a single reality or truth	Subjective objectivity There is no single reality or truth	Material subjectivity Realities are socially constructed	Objective and subjective Reality constantly renegotiated
<b>Epistemology</b>	Reality can be measured	Reality needs to be interpreted	Socially constructed and influenced by power relations from within community	Problem solving. Finding out is the means, change is the aim
<b>Methodology</b>	Primarily quantitative Experimental research or Survey	Primarily qualitative	Usually qualitative Critical discourse analysis Critical ethnography ideology	Mixed methods Design based research Action based research

*Source: Adapted from Guba & Lincoln (1994); Kivunja & Kuyini (2017); Patel (2015); Rehman & Alharthi (2016)*

The positivist paradigm is a very well-established research philosophy worldwide and would be considered suitable for a research project that aimed to test a theory or hypothesis. Positivists believe that “there is a single reality” (Patel, 2015) and that that reality can be

proved through experiment. This paradigm often involves only quantitative methodology (Taylor & Medina, 2013), making this paradigm objective. Positivists believe in a single reality and one that is separate and external to the researcher (Alwadi, 2013). A research project underpinned by a positivist paradigm seeks to measure facts, using quantitative and scientific methods (Kivunja & Kuyini, 2017). The positivist paradigm seeks to test a theory using experimental methods (Taylor & Medina, 2013). However, this research study relies on the researcher to interpret meaning from participants and to interact with the participants through qualitative discussions as part of the research process (See section 3.3), making the data collection subjective in nature. This research does not seek to test a theory, as suggested by positivist theorists. Therefore, the positivist paradigm does not align with the aims and objectives of this research study.

In contrast to the positivist theory, constructivists, believe that “there is no single reality or truth, and therefore, reality needs to be interpreted”, making this paradigm subjective rather than objective (Patel, 2015). It is important for a researcher undertaking a research project underpinned by the constructivist paradigm to be aware of this subjectivity in the process of interpretation (Cohen, Manion, & Morrison, 2018) and to cater for that when considering the ethics of conducting research that relies so heavily on interpretation, both the researcher’s and the participants’ (See section 3.4), as the researcher interacts with the research data and participants, seeking to gain insight into the culture which is being researched (Taylor & Medina, 2013). The constructivist paradigm has also been referred to as ‘interpretivist’ and ‘humanist’ paradigms (Taylor & Medina, 2013).

The third paradigm explored was the critical paradigm, which involves identifying and transforming socially unjust beliefs and practices, seeking to construct a moral version of a better society (Taylor & Medina, 2013). This theory assumes that reality has been shaped by multiple factors which interact with each other, including cultural, political, ethnic, gender and religious factors (Rehman & Alharthi, 2016). Critical theory also assumes that the research is affected by the researcher, making it subjective. This theory requires the researcher to engage in dialogue with its participants. However, unlike constructivism, critical theory seeks

to bring about change within social systems (Guba & Lincoln, 1994). Regarding critical theory, there are aspects of this paradigm that align with this research assumptions, in that the researcher is subjective and that this study seeks to bring about change within the community that it is studying. However, this research study does not relate to wider society or power relationships within that society, but seeks to discover a reality relevant to its participants, as opposed to construct a reality based on political, moral, and ethical issues (Kivunja & Kuyini, 2017). Thus, making the critical paradigm insufficiently aligned with what this research seeks to achieve.

Comparisons and crossovers can be drawn from the previous three paradigms, namely positivism, constructivism, and critical theory. However, the final paradigm being explored for the purpose of this research study is the pragmatic paradigm. By including this paradigm, the researcher is developing a well-rounded understanding of the different world views from which a researcher can approach their study, as the pragmatic paradigm challenges the two opposing positions of the positivists and the interpretivists (Kivunja & Kuyini, 2017). A pragmatist paradigm promotes the use of multiple research methods, and ones that are practical and most suitable to the task (Kaushik & Walsh, 2019). When the paradigms explored above are viewed with the aim and objectives of this study in mind (See section 1.2), it becomes evident that certain characteristics of a number of the paradigms do not align. A research study underpinned by a pragmatic paradigm is driven by the research question or problem. This paradigm seeks to address this problem using the most appropriate methods (Ormston, Spencer, Barnard, & Snape, 2013) and is most associated with the utilisation of a mixed methods approach (Kaushik & Walsh, 2019). This research project was not driven by a research question or problem. In contrast, the research problem emerged and evolved throughout the research process. Also, this research study focuses predominantly on qualitative data, even though the findings present both qualitative and quantitative data, they both refer to the interpretations of both the participants and the researcher and cannot be measurable with scientific methods. Hence, although a small number of aspects of this



paradigm relate to this research study, it does not sufficiently align with its beliefs, making it an unsuitable paradigm for this study.

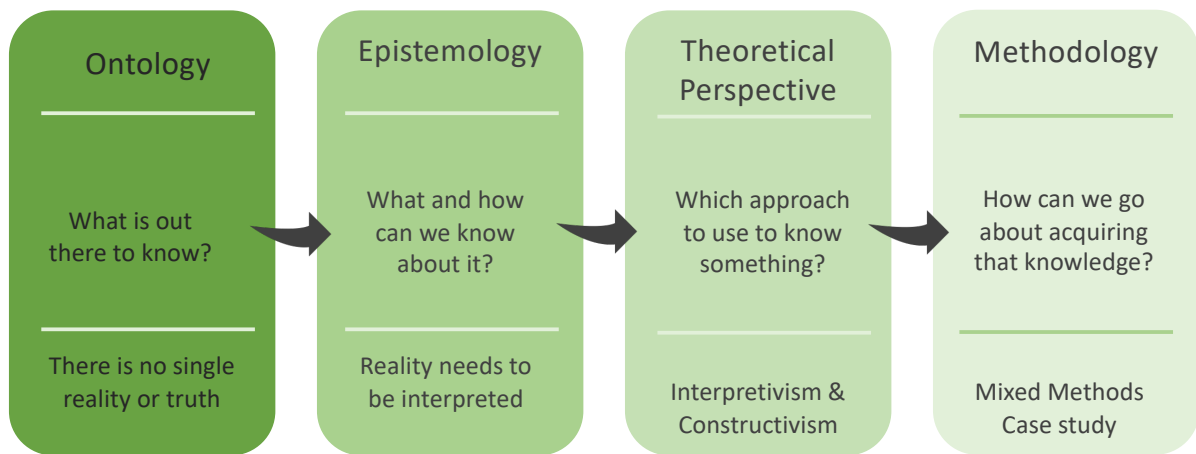
Having explored multiple paradigms above and mapped those against what this research sought to achieve and solve, the constructivist paradigm emerged as the one that would address the aim and objectives most effectively. Prior to exploring the interpretivist and constructivist paradigm in the context of this particular study and why they have been identified as the paradigms that this research most closely aligns with, it is important to explore what they mean. In order to provide a context for choosing this framework, the ontological and epistemological assumptions of the constructivist and interpretivist paradigms are listed in table 3-3 below.

Table 3-3 Constructivist and Interpretivist Positions and Their Underlying Assumptions

Ontological Assumptions	Epistemological Assumptions
<ul style="list-style-type: none"> <li>• External reality exists but is only known through human mind and socially constructed meanings</li> <li>• There is no shared social reality, only a series of different individual constructions of it</li> <li>• Reality is subjective</li> <li>• There exist only estimate or approximate observations or views of reality</li> <li>• Social phenomena and their meanings are continually being accomplished by social actors</li> <li>• Social phenomena and their meanings are produced through social interaction and are in a constant state of revision</li> <li>• Life is defined in 'estimate' terms based on inner experiences of humans where choice, freedom and individual responsibility are appreciated</li> </ul>	<ul style="list-style-type: none"> <li>• The researcher and the social world impact on each other</li> <li>• Facts and values are not distinct</li> <li>• Objective and value-free inquiry is not possible since findings are inevitably influenced by the researchers' perspectives and values</li> <li>• Methods of natural science are not appropriate for the study of social phenomena for the social world is not governed by law-like regularities but mediated through meaning and human agency</li> <li>• Knowledge is produced by exploring and understanding the social world of the people being studied</li> <li>• Knowledge is seen as personal, subjective, and unique</li> <li>• The researcher understands the social world using both his/hers, as well as the participants' understanding</li> <li>• Social world is approached through the understanding of human behaviour</li> </ul>

Source: Adapted from Al-Saadi (2014)

When the interpretivist and constructivist paradigms are considered in the context of this research study, characteristics such as seeking insight, interpretation, interactivity, and subjectivity, all describe how the researcher envisaged this research study to be conducted, influenced by the training and the research philosophy developed by the researcher in her own third level education (See section 7.6). Returning to table 3-1, which explored the questions that require consideration in order to choose a research paradigm, figure 3-1 below answers those questions in the context of this research study.



*Figure 3-1 Interpretivist and Constructivist Paradigm*

*Source: Adapted from Brown & Duenas (2019); Patel (2015)*

The answers to the questions in figure 3-1 above, justify the choice to ground this study in the interpretivist and constructivist paradigms, as this research aligns with the assumptions made by the those philosophies. The justification for choosing this paradigm was also informed by the research aim, which was to conduct a study of a particular case (a case study of one ITE programme), regarding the provision of literacy and numeracy training, with a view to enhancing that training (See section 1.2). This aim was to be achieved by conducting an analysis of, firstly, pertinent literature and the ITE programme documents (objectives 1, 2 and 3) and, secondly, by exploring and interpreting participants’ perspectives of training and competences (objective 4), aligning with the subjective nature of the paradigms and further justifying the appropriateness of interpretive and constructive philosophies, in which to ground this research.

A common research strategy suited to this paradigm is a case study, which was the approach taken in this research project.

### **3.2.2 Research Strategy: Case Study**

This research sought to identify what provisions were being made in terms of literacy and numeracy, in a particular case, namely, the ITE programme at GMIT. The strategy chosen to

achieve this was a case study, which, it has been suggested is the most frequently used qualitative research strategy (Yazan, 2015). A case study has been defined as “the study of a particularity and complexity of a particular case, coming to understand its activity within important circumstances” with the intention of capturing details within its context (Stake, 1995, p. xi). There are strengths and weaknesses to using a case study approach and it is a researcher’s responsibility to become aware of these and to then base their choice of research strategy on this knowledge. One of the advantages of utilising the case study approach is that insight will be gained by interpreting and contextualising what the participants of the study describe and what the researcher observes, offering something that other research approaches do not: a wealth and depth of information (Astalin, 2013, p. 122). Denscombe agrees with this, stating that using a case study approach allows the researcher to “deal with the subtleties and intricacies” of the case (2010, p. 60). He goes on to point out that this approach allows the utilisation of multiple methods of data collecting (focus groups, interviews, observation), facilitating the validation of the data collected through triangulation. The results of a case study can be more easily accessible than that of an alternative methodology because of the way in which they are frequently written, which is in an everyday language (Cohen, Manion, & Morrison, 2018, p. 379).

However, there are certain drawbacks associated with utilising the case study approach. It has been argued that a case study approach lacks structure and does not utilise fully defined protocols (Rashid, Rashid, Warrich, Sabir, & Waseem, 2019). It has been suggested that because of its interpretive nature, when compared to other research strategies, the case study approach allows the researcher less control over the direction in which the research may go, resulting in a less rigorous and reliable methodology (Bell J. , 2010; Tripathy, 2009). Bell goes on to suggest that this lack of structure, paired with the interpretive nature of the approach, may lead to “the possibility of selective reporting and the resulting dangers of distortion” (Bell J. , 2010, p. 9). A researcher must be aware of how their participation and perceptions might unintentionally influence the outcomes of the research (See section 3.3.8).

In practical terms, a case study can quite quickly accumulate a significant amount of raw data (Crowe, et al., 2011), data which requires analysis and interpretation within a certain period.

Although this approach has shortcomings, a case study was deemed most effective to address the aim of this research study (see section 1.2). It has been suggested that a case study, in the field of educational research is an appropriate choice to identify and explain specific issues or problems of practice (Merriam, 1998; Yazan, 2015), which satisfies what this research seeks to achieve. This study seeks to identify what provisions are made within the case programme regarding literacy and numeracy training, and a case study approach will enable the researcher to identify “issues or problems of practice” within this programme. This approach will allow the researcher to interact with the research participants using multiple methods (See section 3.3.3) and will provide a richness and depth to the findings (Flick, Kardoff, & Ed., 2004).

### **3.2.3 Mixed Methods**

The mixed methods approach is explored in this section, identifying just how this approach was adopted within this research. ‘Mixed methods’ is the third methodological approach used to conduct research, alongside qualitative and quantitative (Molina-Azorin, 2016). Creswell defines a mixed methods research as “a procedure for collecting, analysing and mixing both quantitative and qualitative research and methods in a single study to understand a research problem” (2012, p. 535). This suggests that in order to use this research methodology effectively, the researcher must gain a good understanding of both qualitative and quantitative research because there are strengths and weaknesses to both approaches. Among the many arguments for approaching a research project using mixed methods, a fundamental one is that utilising this approach has the potential to produce more balanced research results, through combining the strengths of both qualitative and quantitative, while also compensating for both methodologies’ weaknesses (Punch & Oancea, 2014, p. 339).

Qualitative analysis does not produce absolute meanings, in contrast to quantitative data. Instead, it explores opinions, attitudes, and values of its participants. It has been argued that

qualitative research covers such a vast range of 'kinds of research', that using this term 'qualitative research', becomes useless (Hammersley M. , 2013, p. 99). When analysing qualitative data, analysis begins from the first read of the responses (See section 4.2.2). The researcher begins making connections and links among the responses and this starts as early as when the data is being collected (Denscombe, 2010, p. 239). The advantage of using a qualitative research method is that it will offer a complete description of the participants' views on the topic without limiting the scope of the research (Bell J. , 2010). However, Chew-Graham *et al.* argues that by utilising a qualitative methodology, there is a risk of the researcher interpreting the findings based on their own personal experience or judgments (Chew-graham, May, & Perry, 2002). He goes on to say that this type of study is not measurable or quantifiable. In contrast, analysing quantitative data produces absolute and definitive findings and these findings are often presented using descriptive statistics, otherwise known as numerical data (Maxwell, 2010). An example of this can be seen in the findings of this research (See section 4.3.1) through presenting percentages, frequencies, and range (Bhatia, 2018). When findings are presented in a numerical way the findings do not always represent the rationale behind those statistics. Rahman suggests that, although numerical or measurable data are often considered more credible than qualitative data, quantitative findings can frequently bypass important influential elements behind the numbers (2017), omitting an important part of the research story. Considering the position of the constructivist and interpretivist paradigms which underpin this study, one epistemological assumption (outlined in table 3-3) is grounded in the belief that "findings are inevitably influenced by the researcher's perspectives and values" (Al-Saadi, 2014, p. 7). This assumption highlights the importance of generating and collecting both qualitative and quantitative data, to strengthen findings and present a more complete research picture. Hence, this research study uses predominantly qualitative data, supported by quantitative data. Quantitative methods alone in this study would not capture participants' opinions and understandings, which are an important part of this study. Choy suggests that what some might consider to be a weakness of a research method, may be its strength and the very reason they were chosen (2014, p. 102).

This thesis presents findings which are both narrative and numerical (See chapter 4). However, does that make this study a mixed methods research? It would be simple to suggest that the division between qualitative and quantitative research was merely the difference between generating descriptions and generating statistics (Hammersley M. , 2013). Maxwell suggests that qualitative research projects can include quantitative data to strengthen or emphasis a finding (2010), giving the project an enhanced credibility or validity. In terms of research paradigms and making the distinction between choosing qualitative, quantitative or a mixed methods approach to your research, at this stage a researcher is focusing on research methods rather than research data (Hesser-Biber, 2010). As mentioned previously, this research is underpinned by the philosophy and beliefs of the constructivist and interpretivist paradigms (See section, 3.2.1), which, because of the subjective nature of the research project mainly utilises qualitative research methods. This project does include qualitative research methods such as dialogical reflection groups, focus groups and qualitative interviews (discussed further in section 3.3). However, it also included a questionnaire, which produced predominantly qualitative data, but also numerical data. The numerical data did not represent quantitative findings in the way that a quantitative research methodology might, but instead reflected frequencies and proportions which supported and complimented the qualitative findings. For this reason, the imbalance between the qualitative and quantitative findings presented in chapters 4 and 5 is evident, because this research deals with the participants' perspectives on the topic of literacy and numeracy development within the case programme and the researcher's interpretations of those perspectives, and although present, the quantitative findings represent the researcher's interpretations rather than a definitive measurement of those perceptions (Sandelowski, Voils, & Knafel, 2009). This mixed methods approach was taken to facilitate the recognition of patterns within the qualitative data and to verify and support assumptions. Having explored the research methodology and approach taken in this study, the following section explores how research data was collected and the choices made regarding the data gathering methods.

### **3.3 Data Collection**

This section details the core elements of the data gathering process, namely, the research site, the participant sample and selection processes, data gathering tools and processes, and questions of validity and reliability.

#### **3.3.1 Research Site and Participant Selection**

Participants were drawn from one Irish ITE programme involved in technical teacher training, at GMIT. This study aimed to explore the provision of literacy and numeracy development within this ITE, and the participants in this study gave insights into the efficacy of that provision. The process of participant selection is an important part of research design. The rationale for selecting certain cohorts of participants must reflect and satisfy the research aim (Collins, 2017). The selected participants must embody characteristics which will allow the researcher to investigate the chosen topic efficiently (Arcury & Quandt, 1999). With a variety of factors to consider, including the goals, the topic, and the context, it is important that a researcher identifies a sampling method that is appropriate to their specific study (Kimmons, 2021). Sampling methods can be divided into two categories: probability sampling and non-probability sampling. Creswell associates probability sampling to 'quantitative sampling', suggesting that this sampling technique generalises from the sample to the population. Whereas he suggests that non-probability sampling relates to 'qualitative sampling', seeking to develop a deep understanding of a particular site (Creswell, 2012, p. 206). Figure 3-2 below demonstrates the various sampling strategies within both categories: probability and non-probability sampling techniques.



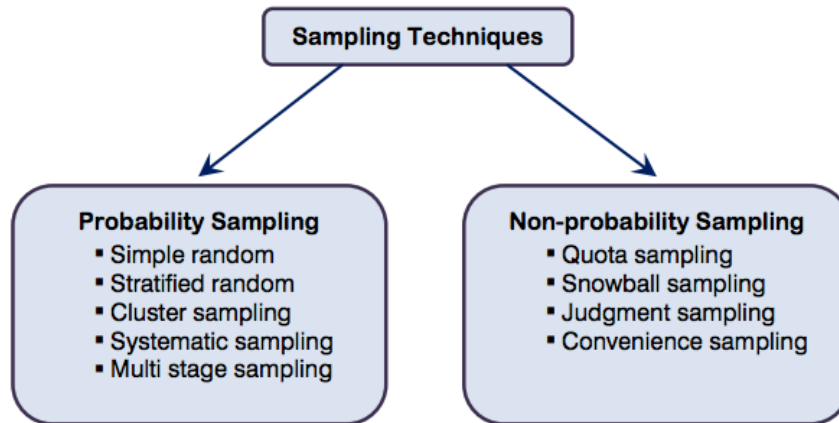


Figure 3-2 Sampling Techniques (Probability & Non-Probability)

Source: Taherdoost (2016, p. 20)

As this study deals with a specific case and seeks to gain insights into its participants' perspectives, non-probability sampling was selected as the most appropriate sampling method. This sampling method is often associated with case study research and is deemed appropriate for this study, as the population is precisely defined and does not intend to make claims in relation to the wider population (Alvi, 2016; Taherdoost, 2016). From the above list of non-probability sampling strategies (See figure 3-2), two strategies closely align with the purposes of this study: Judgement sampling and convenience sampling.

Convenience sampling is a type of non-probability sampling, where participants are included in a study because of certain criteria including "easy accessibility, geographical proximity, availability at a given time and their willingness to participate" (Etikan, Musa, & Alkassim, 2016, p. 2). This technique has been suggested as a favoured sampling strategy when dealing with students, as it may be considered inexpensive and accessible when compared to other sampling techniques (Taherdoost, 2016). For this research case in particular, the selected participants were accessible to the researcher, making this sampling method appropriate. The second sampling method employed in this research study is purposive sampling, which can also be referred to as judgemental sampling (Etikan, Musa, & Alkassim, 2016). Taherdoost

describes this type of sampling strategy as a particular cohort of participants deliberately selected to provide valuable information that cannot be obtained from other samples (2016, p. 23). Passmore & Baker suggest that both sampling strategies can be a source of bias, allowing an unethical researcher to choose a particular group with the sole purpose of making a certain point (2005, p. 51). However, in some scenarios, these sampling strategies may be the only ones suitable for a researcher in achieving the study's goals.

This study included participants from five different cohorts: PS teachers, SP tutors, other educational staff, management staff and experts in the field of literacy and numeracy. Firstly, the participants in this study included 69 PS teachers enrolled on the programme for the year 2019-2020, of which 20 were 1<sup>st</sup> year students, 16 were 2<sup>nd</sup> year students, 18 were 3<sup>rd</sup> year students and 15 were 4<sup>th</sup> year students. 69 PS teachers completed questionnaires (See appendix 1). The PS teachers were selected to gain a clear indication of not only their literacy and numeracy abilities, but their perceptions of their abilities. PS teachers' responses would provide a perspective of how the case ITE programme was catering for literacy and numeracy development, a perspective that had the potential to be quite different to that of SP tutors and other staff on the ITE programme. An additional 15 questionnaires were completed, of which 5 were SP tutors involved in the ITE programme at GMIT (See appendix 2) and 10 were other educational professionals, from both internal to GMIT and other institutes (See appendix 3). The 84 participants which completed the questionnaires (PS teachers, SP tutors and other educational professionals), also participated in dialogical reflection groups.

After participation in the questionnaires and dialogical reflection groups, SP tutors were invited to participate in a focus group. This cohort was selected for a focus group to provide the researcher with insight into the perceptions of SP tutors regarding PS teachers literacy and numeracy development practices on school placement. By analysing and comparing the perspectives of both PS teachers and SP tutors, the researcher will potentially be able to recognise areas where improvements would be beneficial. Another focus group was arranged for management staff (n=3), with the purpose of obtaining information regarding the perspectives of individuals experienced in coordinating whole schools and campuses. This

cohort was selected to establish what might be achievable in terms of a research output and to ascertain what this cohort might perceive to be the most effective and beneficial methods of improving literacy and numeracy standards within the ITE programme. The final cohort of participants selected for this research study were experts in the fields of literacy (n=2) and numeracy (n=2). Qualitative interviews were conducted with literacy and numeracy experts in a bid to gain insights from experienced individuals, as these experts could potentially give valuable insights and make valuable suggestions regarding literature pertinent to this research. One such literacy expert was approached due to their specific expertise in the development of a module to address literacy and numeracy in the context of ITE. That participant then suggested a second expert in the field of literacy development, who had conducted research on a topic similar to this project. An expert in the field of numeracy was approached, following a conference (See section 3.3.3), at which she had been a key speaker addressing numeracy in the classroom. The second numeracy expert was contacted following an analysis of their literature on the topic of numeracy in the context of ITE. Having considered the various cohorts of participants and the rationale for choosing these, it was important to explore what might be considered sufficient and adequate sample sizes. The following section explores sample sizes and response rates.

### **3.3.2 Response Rates**

A good response rate is required in order to collect reliable and satisfactory results (Saleh & Bista, 2017). Response rates can be defined in a number of ways. An example of this is when a response rate is defined as the number of participants who took part (sample) as a percentage of those who were eligible to take part (population), as opposed to a percentage of those that were invited to participate in the study (Morton, Bandara, Robinson, & Carr, 2012). For the purpose of this study, response rates refer to the latter. Research data was collected using different tools which incorporated both face-to-face and online collection, which brought about differing response rates.

Firstly, face-to-face data collection was conducted at the *2020 Creativity and Innovation in the Classroom: Initial Teacher Education Conference* (19<sup>th</sup> February), through questionnaires and dialogical reflection groups. PS teachers were required to be present at this conference as part of their training and as a result, a high percentage of that cohort were in attendance (92%). Of the total population (n=75) of PS teachers enrolled on the programme for the year 2019/2020, 69 attended the conference. The conference was open to staff involved in the ITE programme at GMIT, including SP tutors, teacher-educators, management staff and other educational professional with an interest in ITE. Of all of those that attended the conference (n=84), which included PS teachers (n=69), SP tutors (n=5) and other educational professionals (n=10), there was a 100% response rate to the questionnaires and dialogical reflection group participation.

Moving now to the collection of research data online, which included focus groups and expert interviews. 11 SP tutors were invited to take part in a focus group, of which 5 participated (45%). The suggested ideal size for a focus group for research such as this is between five to seven participants (Lazer, Feng, & Hochheiser, 2017). However, it has been suggested that a focus group can be successful with as few as three participants (Mishra, 2016). Kreuger and Casey suggest that a small group provides an appropriate setting for an in-depth discussion (2015). When conducting a focus group with relatively small numbers, it is important to consider that the group must be small enough to allow all participants an opportunity to get their point across, but at the same time large enough to allow a diversity of opinions (Freitas, Oliviera, Jenkins, & Popjoy, 1998). For the purpose of the management staff focus group three participants were invited to take part, to which all three responded. This focus group includes individuals with high levels of expertise regarding the management of the ITE programme and are in a position to discuss what this research project may contribute to literacy and numeracy development within the programme. Regarding expert interviews, which were also to be conducted online, 5 were invited to participate. However, 4 experts agreed to be interviewed as part of this research project (80%).

### 3.3.3 Data Collection Chronology

As mentioned in the previous section (sections 3.3.1 and 3.3.2), 84 participants manually completed a questionnaire at a conference on 19<sup>th</sup> February 2020, organised by GMIT. The conference, titled *Creativity and Innovation in the Classroom: Initial Teacher Education Conference*, presented keynotes addressing *Numeracy in Irish Post-Primary Context* and *Numeracy within Graphics* (See Appendix 4: Conference Flyer). Research data was gathered at this conference through the aforementioned questionnaires along with the dialogical reflection groups. The dialogical reflection groups were arranged across 10 tables, with each table including participants from every cohort present, for which a seating plan was designed (See appendix 5).

After data was gathered at the *Creativity and Innovation in the Classroom: Initial Teacher Education Conference*, and analysed, the SP tutors were invited to participate in a focus group online. The SP tutors' focus group built on the questionnaire responses. Following that, the management staff were invited to take part in an online focus group to discuss the research findings and possible outcomes of this research project. Once focus groups were completed, and the qualitative discussions analysed, four interviews were conducted online with experts in both literacy (n=2) and numeracy (n=2). The four data gathering tools are demonstrated in table 3-4 below presenting the chronology and sites for data collection.

Table 3-4 Data Collection Methods

Method	No.	Participants	Description
<b>Questionnaires</b> <i>Creativity and Innovation in the Classroom: Initial Teacher Education Conference</i>	84	Pre-service teachers, school-placement tutors educational professionals.	These were individually filled out, manually on that day and collected immediately after completion
<b>Dialogical reflection groups</b> <i>Creativity and Innovation in the Classroom: Initial Teacher Education Conference</i>	10	Pre-service teachers, school-placement tutors educational professionals. (10 participants per table)	A seating chart was designed to ensure each group was represented at each table.  Each table included a dedicated facilitator and a dedicated manual recorder, to capture the discussion and responses to the prompt questions.
<b>Focus groups</b> Conducted online	2	School-placement tutors (5)	Prompt questions were sent to the participants beforehand.  2 parts. The first followed on and responds to the finding from questionnaires the second explored recommendations for improvement.
		Management staff (3)	Discussion on the feasibility and practicality of making recommendations for improvement.
<b>Expert interviews</b> Conducted online	4	Literacy experts (2)	30 mins. Semi structured interviews
		Numeracy experts (2)	

Source: Author's Original

The following sections explore the above-mentioned data collection tools, questionnaires, focus groups, and qualitative interviews, in more detail, providing a rationale for choosing these tools.

### 3.3.4 Questionnaires

The first data collection tool used in this study was a questionnaire. A questionnaire consists of a series of questions, which are designed for the purpose of gathering information from

the participants (McLeod, Questionnaire: Definition, Examples, Design and Types, 2018). As with all data collection methods, questionnaires have both advantages and disadvantages. One disadvantage of using questionnaires, is that it may only provide a snapshot of the whole story, when compared to interviews as a method of data collection (Patten, 2017). An important aspect of questionnaire design needs to consider the clarity of questions. If the questions are unclear and cause confusion for the participants, there is little opportunity to clarify these and then modify for all participants (Marshall, 2005). Questionnaires would be considered an efficient and economic method of gathering data. However, quite often, the response rate for participation in this type of data collection method can be low. It was found that in this study, because of the setting in which the questionnaires were distributed to participants, and conducting questionnaires in person, all cohorts completed the questionnaire.

There are several different types of questions that can be included in a questionnaire depending on the information the researcher is seeking (Bloomer, 2010; Cohen, Manion, & Morrison, 2018), including open questions, closed questions, quantity questions, list questions, category questions and ranking questions (Marshall, 2005). Marshall also highlights the importance of correctly structuring the questions, as this makes the researcher's task of interpreting responses, a much simpler one. The types of questions included in the questionnaire designed for this study consisted of open-ended questions, closed questions, multiple choice questions and questions utilising a Likert scale. By including a variety of question types, both qualitative and quantitative data was collected from the questionnaire responses in this study.

The advantage of conducting the questionnaire during the *Creativity and Innovation in the Classroom: Initial Teacher Education Conference* was that all cohorts were present, allowing full participation when compared to the possibility of completing the questionnaire through an online platform. However, analysing the data was time consuming and labour intensive, as the responses were collected in hard copy only. Following the questionnaire completion, the participants were asked to engage in a dialogical reflection, which is discussed next.

### 3.3.5 Dialogical Reflection Groups

A dialogical reflection can be described as a 'collaborative reflection' (Dzay-Chulim & Mann, 2017) or 'learn by talking', whereby participants reflect on a topic, and explore concepts through discussion (Dragas, 2019, p. 147). Stefani suggests that this method of data collection promotes higher order thinking skills (2019). Dialogical reflection groups can be an effective method of collecting qualitative research data, as it engages participants in re-evaluating their experiences, through making connections between prior and new knowledge, and through participants own views when compared to other participants views (Ivala, 2015). Ivala suggests that participants in a dialogical reflection group can re-conceptualise and explore their prior beliefs and possibly create alternative ones through this experience, allowing for a deeper level of reflection and learning (2015, p. 40).

Once again, the dialogical reflection groups took place at GMIT's *Creativity and Innovation in the Classroom: Initial Teacher Education Conference*, and a seating plan was created to ensure that all ten tables included participants from each cohort. As registration was required for this event, the researcher was able to develop a seating plan which allowed each table to include a minimum of two PS teachers from each of the four year-groups and a minimum of one other educational professional, either a SP tutor or an educational staff member (See Appendix 5: Conference Seating Plan). Before the dialogical reflection groups commenced their discussions, the researcher informed the participants that a facilitator and a record keeper should be appointed by each table/group and that a list of prompt questions (See Appendix 6: Breakout Circle Group - Facilitators Questions) and a record sheet (See Appendix 7: Breakout Circle Group – Record of Responses) was included in the information pack on each table. The prompt questions were a follow-on from the questions on the questionnaire. The purpose of the dialogical reflections was to give participants an opportunity to share perspectives and to consider literacy and numeracy in more depth than what was required in the questionnaire. This data gathering process was unique in that it not only collected research data but was educational also. This process required participants to engage in discussions and to think critically about how they, as individuals were dealing with literacy



and numeracy in their classrooms, highlighting literacy and numeracy as a priority in their teaching and as an important part of the ITE programme.



*Figure 3-3 Image of Questionnaire and Dialogical Reflection Group Participants, at the Creativity and Innovation in the Classroom: Initial Teacher Education Conference, February 2020.*

*Source: Michael O'Shaughnessy Photography*

Once the questionnaires and the dialogical reflection group responses were gathered, they were documented and analysed, which is explored further in section 4.2. Shortly after this data collection, due to the COVID-19 pandemic, it was necessary to move all research data collection to online platforms from the 16th of March 2020. This amended route to collecting research data allowed for new opportunities and potential to gather data more efficiently and economically (Archibald, Ambagtsheer, Casey, & Lawless, 2019). Archibald *et al.* suggest that online methods of data collection can not only replicate, but compliment and improve traditional face-to-face focus groups and interviews. Bertrand and Bourdeau (2010) agree, suggesting that with online platforms now recording both voice and video, these forms of online data collection replicate traditional in-person experiences. Focus groups and expert

interviews were conducted online and are discussed in the following two sections (sections 3.3.6 and 3.3.7 respectively).

### **3.3.6 Focus Groups**

Two focus groups were conducted as part of this research study. A focus group is a meeting of carefully selected people, from a specific cohort, and is used to collect information from its participants, through group interaction (Smithson, 2007). Focus groups may uncover participants' perceptions and values (Nyumba, Wilson, Derrick, & Mukherjee, 2018). The group are given a topic or guiding questions. Focus groups identify and explore how its participants interpret that topic or situation and gives participants an opportunity to debate and explore that topic. Breen suggests that the qualitative data collected in a focus group requires recording, transcribing and then analysing to identify common themes, and this aspect of focus groups can be time consuming (2006). One advantage of utilising focus groups as a method of data collection is that it provides a social environment where participants can articulate their opinions and interact with others in the same discipline. This form of data collection relies heavily on participants perceptions being unbiased and the reliability of the researcher to interpret and recognise emerging themes from the focus group data (Breen, 2006).

A SP tutor focus group (n=5 participants) and a management staff focus group (n=3 participants) were conducted, with the researcher facilitating both focus groups. The purpose of both the SP tutor focus group and the management staff focus group was to further explore the findings from the questionnaires and to gain further insight into literacy and numeracy development from the perspectives of the focus group participants. Another aim of the management staff focus group was to establish what may be a suitable and feasible output from this research study. The process for both research focus groups included a welcome to the participants, an overview of the topic being researched, information regarding consent to participate (See appendices 8, 9, 10 and 11) and the expected outcome of the focus group. The facilitator then proceeded with prepared questions or topics to discuss. Following the

focus groups, experts in the fields of literacy and numeracy were interviewed using an online video conferencing platform, which is discussed further below.

### **3.3.7 Qualitative Interviews**

As a research data collection tool, qualitative interviews provide an opportunity for a more personal method of gathering information from an expert in a particular area (Taylor R. , 2019). When compared to a questionnaire as a research data collection method, Taylor suggests that an interview enables the researcher to probe deeper and allows the opportunity to ask further questions depending on the responses given. Interviewing is one of the most common methods of collecting qualitative research data as it allows for a deeper and more meaningful discussion to develop between the researcher and the interviewee (Jamshed, 2014).

Four expert interviews were conducted as part of the data collection for this research study, of which two were experts in the field of literacy and two were experts in the field of numeracy. The rationale for choosing to interview experts in the fields of literacy and numeracy at the exploratory phase of the research study, as opposed to using an alternative data gathering tool, was that it was a more efficient and concentrated data gathering tool. Expert interviewing provides the researcher with the opportunity to get expert topical knowledge, which can be probed further within the period of the interview (Bogner, Littig, & Menz, 2009). McGrath *et al.* suggest best practice tips for conducting qualitative interviews as a research gathering tool (McGrath, Palmgren, & Liljedahl, 2019), in conjunction with knowledge gained through conducting interviews for the purpose of this study, which is demonstrated in table 3-5 below.

Table 3-5 Best Practice in Conducting Qualitative Interviews

Best Practice:	Description:
Prepare yourself as an interviewer	Consider the focus and scope of the research question. Read literature pertaining to the topic but also specific to the expert being interviewed.
Construct an <b>interview guide</b> and test your questions	Consider the questions that require answers. Keep the questions simple and relevant. Discuss and test questions prior to the expert interview.
Build <b>rapport</b> with the interviewee	Establish comfortable interactions with the participant prior to and during an interview, to developing a sense of trust between the researcher and the interviewee.
Be aware that the researcher is <b>co-creator</b> of the data	The researcher is a prime instrument in the collection of data through qualitative interviews, which consequently requires the researcher to be reflexive, conscious and aware of how they may impact the discussion.
Talk less and <b>listen</b> more	The researcher should avoid feeling the need to fill silences. Actively listen to the interviewee and give them the space to reflect on their responses.
Allow <b>adjustment</b> of the interview guide	Be flexible with the prepared questions guide. Some may turn out to be irrelevant or the interviewee may steer the interview in another direction. Be attentive and confident in deciding if the alternative route is still within and relevant to your research topic.
Transcribe and analyse <b>early</b> .	Transcribing of research data is time consuming and requires scrutinising and analysing to make sense of it. Complete this while the interviews are still relatively recent. Analysing the data at the earliest convenience, enables the researcher to become aware of emerging themes and begin to make sense of the data.

Source: Author's Original-Adapted from McGrath, Palmgren & Liljedahl (2019)

There are a number of disadvantages to conducting qualitative interviews, as stated by Adams (2015), they are time-consuming, labour intensive and require the interviewer to be sensitive, poised, and nimble, as well as knowledgeable about the topic being discussed. As this research included expert interviews, being knowledgeable in the field of literacy and numeracy development in the context of ITE was a vital part of conducting the interviews, as this would not only have been evident in the questions being asked by the researcher, but in responding to the answers being given by the experts. However, qualitative interviews allow participants the opportunity to elaborate on their points in their own world and from their

own perspectives, in a way that is not possible in other data collection methods (Sheppard, 2020). Similar to the focus groups, the four interviews were conducted online. The researcher prepared some guiding questions and topics to be explored in the interviews (See appendices 12, 13, 14 and 15), each reflecting the interviewee's field of expertise. Consent was given by all interviewees to partake in the study (See appendix 8). Once the interviews were completed, the recorded meetings needed to be transcribed and later analysed. These transcripts were analysed in conjunction with the focus group transcripts, the dialogical reflection group responses, and the questionnaire responses, to identify themes that emerged from this data.

### **3.3.8 Validity & Reliability**

Validity and reliability are an important part of any research project, however, distinguishing between the two is not a simple task, as each can have several meanings and the two may overlap (Oppenheim, 1992). To put it simply and to distinguish between validity and reliability for the purpose of this research study, validity suggests that the research questions and findings measure what they are supposed to and refer to the accuracy of an instrument, whereas reliability refers to the purity and consistency of a measure (Creswell, 2014; Oppenheim, 1992; Heale & Twycross, 2015). A research project can become invalid at every stage of the research process, and it is therefore, imperative for a researcher to be aware of the ways that this can come about and to minimise threats to research validity (Cohen, Manion, & Morrison, 2018). Cohen *et al.* suggest the following to ensure validity of the research: choosing an appropriate timescale, ensuring adequate resources to undertake the project, selecting an appropriate methodology to satisfy the research question, selecting appropriate instruments to collect data, using an appropriate sample, ensuring reliability in terms of stability, and avoiding bias of the researcher (2018).

In mixed methods research both qualitative and quantitative reliability needs to be considered, as reliability has differing meanings for each approach (Cohen, Manion, & Morrison, 2018). Golafshani defines reliability in quantitative research as the extent to which

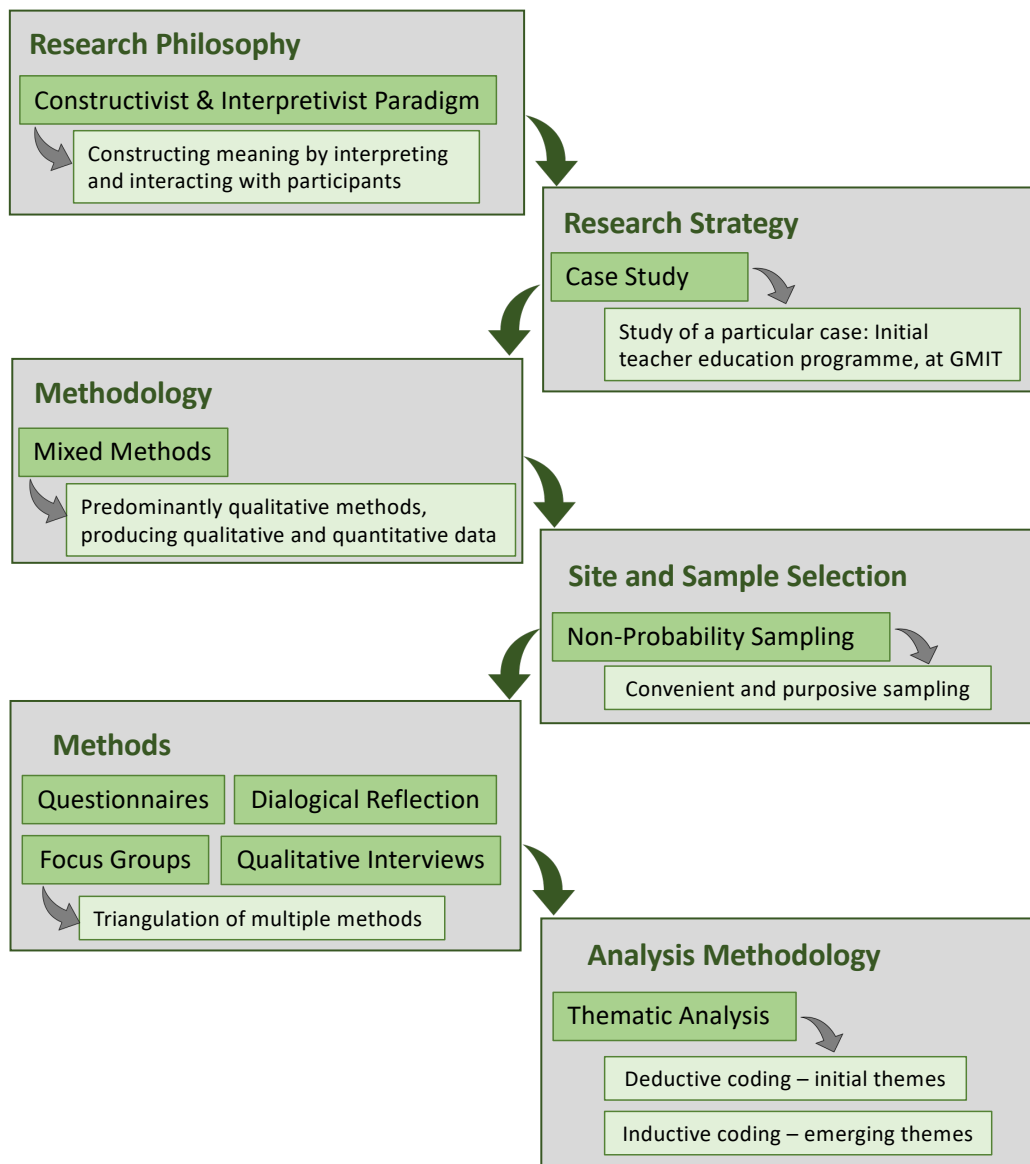
results are consistent over time and an accurate representation of a total population. Reliability also refers to whether a study can be reproduced using similar methodology (2003). However, Bogdan and Biklen contest the suitability of the word 'reliability' for use within qualitative research (1998). They suggest that qualitative researchers see 'reliability' as a fitting compromise between what is recorded as data and what actually occurred, rather than seeking consistency across different observations of the same information. They put emphasis on the research results, rather than the process of getting to those results. Allowing for and acknowledging bias will ensure the trustworthiness of the qualitative research findings (Noble & Smith, 2015). A strategy used by researchers to evaluate and ensure reliability in qualitative data is triangulation, which will reduce the possibility of bias in interpretations made by the researcher (Daniel & Onuegbuzie, 2002).

Triangulation is a research strategy which uses multiple data sources or research methods to ensure that the data, analysis, and conclusions of a research study are as comprehensive and accurate as possible (Moon, 2019). Cohen *et al.* suggest that using triangulation allows a researcher to view and study the research data from more than one standpoint (2018), making use of both qualitative and quantitative data. This research study has taken advantage of the strengths of multiple methods of collecting research data, through questionnaires, dialogical reflection groups, focus groups and qualitative interviews, presenting both qualitative and quantitative results together (See section 3.2.3), to produce a more credible and comprehensive set of findings (Noble & Smith, 2015). Before data collection commences, piloting the chosen tools must occur, to ensure reliability and validity of those instruments (Marshall, 2005). The purpose of piloting data collection tools is to increase and enhance the quality of research data, by identifying questions that lack clarity and recognising areas that do not elicit appropriate responses, in order to modify and improve the tools (Malmqvist, Hellberg, Mollas, Rose, & Shelvin, 2019; Guðmundsdóttir & Brock-Utne, 2010). Busetto, Wick and Gumbinger suggest piloting research collection tools with a small cohort of people before commencing data gathering (2020). For the purpose of this research study, the questionnaires and the guiding questions for the dialogical reflection groups, the focus groups, and the expert

interviews, were checked by two colleagues with experience of conducting similar data collection and were discussed with research supervisors to evaluate and revise the questions.

The methodological choices which have been explored in section 3.2 and 3.3 are demonstrated in figure 3.4 below including research philosophy (See section 3.2.1), research strategy (See section 3.2.2), research methodology (See section 3.2.3), selection of site and sample (See section 3.3.1), data collection methods (See section 3.3.3), and the data analysis approach, which is explored in the following chapter (See section 4.2).

Figure 3-4 Research Design



Source: Author's Original

Having considered the data collection methods and how a researcher ensures validity and reliability to the best of their ability, the following section focuses on how to ensure a research project is conducted ethically.



### 3.4 Research Ethics

Research ethics has been described as doing what is morally and legally right in research dealing with human behaviour (Ramrathan, Grange, Shawa, & Higgs, 2017). Researchers have a responsibility to observe and promote certain practices to ensure research integrity (All European Academies, 2017). A researcher must be aware of and consider ethical values. Values represent what is important in a person's life, whereas principles represent the rules which a researcher must follow in order to achieve our values (Chippendale, 2011). It is these ethical values that will act as the foundation for ethical principles (Hasa, 2016). The *Singapore Statement on Research Integrity (2010)* provide a framework for considering a researcher's responsibility in this regard, suggesting four basic principles for responsible research which include: honesty in all respects of research, accountability in the conduct of research, professional courtesy, and fairness in working with others, and good stewardship of research on behalf of others (2nd World Conference of Research Integrity, 2010). This statement was produced in a bid to develop global standards in the promotion of research integrity (Resnik & Shamoo, 2011) and includes 14 responsibilities a researcher should reflect on to enable ethically conducted research. Table 3-6 below list the research integrity responsibilities which a researcher must consider, giving a brief description of each responsibility.

Table 3-6 Responsibilities for Research Integrity

Responsibility	Description
<b>Integrity:</b>	Researchers should take responsibility for the trustworthiness of their research.
<b>Adherence to Regulations:</b>	Researchers should be aware of and adhere to regulations and policies related to research.
<b>Research Methods:</b>	Researchers should employ appropriate research methods, base conclusions on critical analysis of the evidence, and report findings and interpretations fully and objectively.
<b>Research Records:</b>	Researchers should keep clear, accurate records of all research in ways that will allow verification and replication of their work by others.
<b>Research Findings:</b>	Researchers should share data and findings openly and promptly as soon as they have had an opportunity to establish priority and ownership claims.
<b>Authorship:</b>	Researchers should take responsibility for their contributions to all publications, funding applications, reports, and other representations of their research. Lists of authors should include all those and only those who meet applicable authorship criteria.
<b>Publication Acknowledgment:</b>	Researchers should acknowledge in publications the names and roles of those who made significant contributions to the research, including writers, funders, sponsors, and others, but do not meet authorship criteria.
<b>Peer Review:</b>	Researchers should provide fair, prompt, and rigorous evaluations and respect confidentiality when reviewing others' work.
<b>Conflict of Interest:</b>	Researchers should disclose financial and other conflicts of interest that could compromise the trustworthiness of their work in research proposals, publications, and public communications as well as in all review activities.
<b>Public Communication:</b>	Researchers should limit professional comments to their recognized expertise when engaged in public discussions about the application and importance of research findings and clearly distinguish professional comments from opinions based on personal views.
<b>Reporting Irresponsible Research Practices:</b>	Researchers should report to the appropriate authorities any suspected research misconduct, including fabrication, falsification, or plagiarism, and other irresponsible research practices that undermine the trustworthiness of research, such as carelessness, improperly listing authors, failing to report conflicting data, or the use of misleading analytical methods.
<b>Responding to Irresponsible Research Practices:</b>	Research institutions, as well as journals, professional organizations, and agencies that have commitments to research, should have procedures for responding to allegations of misconduct and other irresponsible research practices and for protecting those who report such behaviour in good faith. When misconduct or other

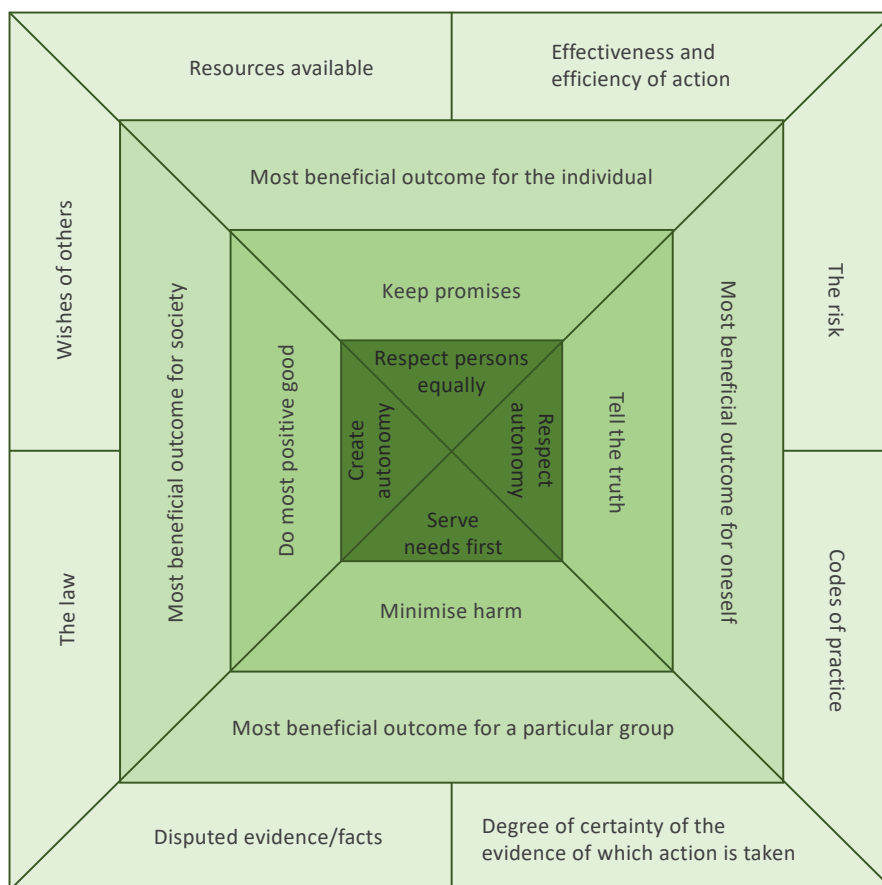
	irresponsible research practice is confirmed, appropriate actions should be taken promptly, including correcting the research record.
<b>Research Environments:</b>	Research institutions should create and sustain environments that encourage integrity through education, clear policies, and reasonable standards for advancement, while fostering work environments that support research integrity.
<b>Societal Considerations:</b>	Researchers and research institutions should recognize that they have an ethical obligation to weigh societal benefits against risks inherent in their work.

*Source: 2nd World Conference of Research Integrity (2010); Resnik & Shamoo (2011)*

The above principles provide a solid foundation and overview of what is expected of researchers when conducting a research study. However, it is important to consider the context of this research study, as guidelines and policies for responsible research may differ between institutes. The institute has a legal and moral responsibility to ensure that research conducted within its domain is done ethically (Sieber & Tolich, 2013). It is therefore, vital that a researcher is aware of and becomes familiar with the ethical principles specific to their institute. Before embarking on a discussion regarding those principles specific to this study (See table 3-7), the following section will begin by exploring the meaning of the terms, ethical values, and principles.

### **3.4.1 Ethical Values and Principles**

The ethical values which underpin any research project should include: autonomy, free and informed consent, veracity, respect, privacy and confidentiality, justice and inclusiveness and, finally, minimising harm and maximising benefit (Hickey, 2018). Through consideration and an awareness of these values, a researcher can make informed decisions and ensure the integrity of the research project (Stutchbury & Fox, 2009). Seedhouse developed a grid for the purpose of aiding and enhancing a researcher in ethical dilemmas, demonstrating a complexity, and organising the values, through 4 different layers (Seedhouse, 2009, p. 174). This ethical grid was initially designed for use within healthcare but has since been adopted for other disciplines. Figure 3-5 below demonstrates the Seedhouse ethical grid.



*Figure 3-5 Ethical Grid*

*Source: Adapted from Seedhouse (2009)*

Figure 3-5 above shows four distinct layers of ethical considerations. The outer layer includes external issues. Through consideration of these aspects of research ethics, the researcher is enabled to reflect on the context in which they are researching. The next layer encourages the researcher to consider the consequences of their research, regarding individuals, groups and societies that may be affected. The third layer considers issues regarding duty and the ways in which the research is approached. The final and central layer in this grid includes consideration for respect and autonomy of the individuals involved.

When these four layers are considered in relation to the principles which guided this research project, there is evidence of all layers throughout. The four layers demonstrated on the Seedhouse grid are:

Outer layer (1st) – consideration for external issues, context

2nd layer – consequences regarding individuals, groups, and societies

3rd layer – duty regarding the way by which a researcher approaches the research

Inner layer (4th) – respect and autonomy for individuals

Having considered the ethical values in Seedhouse’s grid above, table 3-7 below shows the ethical principles which guided this research study in relation to that grid. The ten ethical principles were provided by the GMIT research ethics policy (GMIT, 2010, p. 4).

*Table 3-7 Ethical Principles as They Relate to Seedhouse’s Ethical Grid*

Ethical Principles		Layer
1	The promotion of honesty, openness and fairness in the conduct of research for the benefit of all stakeholders and in the dissemination of research outcomes.	1 3 4
2	The promotion of professionalism, transparency and accountability of researchers.	3 4
3	Respect for confidentiality of data on human subjects.	2 4
4	Respect for the appropriate confidentiality of commercial information supplied to researchers.	1 2
5	Identification of possible conflicts of interest whether financial, legal or personal between the researchers, the Institute and any external person or bodies.	1
6	Promotion of best practice in research.	3
7	Proper acknowledgement of the role of all involved in the research.	2 3

8	Respect and consideration of the broader social and cultural implications of research.	1
9	Recognition that questions of equity and morality arise, as regards who should receive the benefits of research and who should accept its burdens.	3 4
10	Acceptance of the principle that the benefits of research should be maximised, and the possible harms should be minimised.	3 4

*Source: Author's Original - Adapted from GMIT (2010, p. 4)*

Having considered what ethical values and principles are and how they relate to each other, the following section explores what these looks like in the context of this research project.

### **3.4.2 Ethical Practices**

The above ethical principles need to be considered from when a research project begins, for both primary and secondary research. The practices involved in conducting primary research as part of this study are separated into three stages below: before, during and after. Table 3-8 below demonstrates the different ethical considerations in this research project, at the three distinct stages, followed by a more detailed discussion of each stage.

Table 3-8 Ethical Considerations at 3 Stages

Stages of Research	Ethical Considerations	Specific to this research study
Before	Information & Consent	Printed or digital information given to participants. Tick the box/ signature obtained by all that agreed to participate.
	Recruitment of participants	Conference - In person Focus groups - Online Interviews - Online
	Confidentiality	Questionnaires - no signature required. Participants anonymous. Focus groups and interviews – signatures required but names coded when represented in the findings.
	Ethical Approval	Approval sought from GMIT
During	Debriefing participants	Opportunity to ask questions. Contact details of researcher, should a participant wish to withdraw or acquired further information.
	Managing Data	Confidentiality during questionnaire and dialogical reflection group data collection. Coding of participants of focus groups and interviews.
	Data storage and Security	Hard copies – locked cabinet Digital data – password protected computer and digital storage device.
After	Write-up	Unbiased reporting of findings Coding of participants
	Ownership of data	Primary means of giving credit Responsibility for study and results.
	Publication	Fulfilling responsibility to funding agency

Source: Adapted from Hickey (2018)

Before data collection was to commence, certain ethical aspects required consideration. Firstly, when a researcher carries the dual role of researcher-lecturer/tutor, they have a

responsibility to consider their relationship to the research participants, by making themselves aware of, firstly, the potential conflicts or tensions that may arise between the two roles and, secondly, how to address any potential issues, to minimise or eliminate any impact on the outcome of the research study (Healey, et al., 2013; Bell K. , 2019). For the duration of this research study (Sept. 2019- Sept. 2021) the researcher has been tutoring/lecturing 1<sup>st</sup> year (n=20) and 2<sup>nd</sup> year(n=16) PS teacher participants, in the case ITE programme. The researcher has also been assigned as a SP tutor for a small number of PS teacher participants across all year groups enrolled on the ITE programme (n=11). Literature suggests that a significant concern regarding this dual role is the power imbalance between the student and the research (Bell K. , 2019; McGinn, 2018; Pool & Reitsma, 2017). However, step can be taken to ensure that this power imbalance is managed and if at all possible, avoided. These include ensuring that all participants are given adequate information before they consent to participating in the research study, that participants take part solely on a voluntary basis, and that confidentiality and anonymity for participants is protected (Nolen & Putten, 2007; McGinn, 2018).

To recruit potential participants, sufficient information needs to be provided about the project and the procedures involved, for participants to be able to give fully informed consent. Information was provided in writing and explained orally also. The participants in this study were given the option to withdraw at any time. The participants were asked to tick a box for the questionnaires and sign for interviews and focus groups, which indicated that they understood the information about the research study and that they gave consent to participate in the study (See appendices 16, 17 and 18). Participants were recruited and data was collected at a conference through questionnaires and dialogical reflection groups, which included all PS teachers, several staff members, and several SP tutors from the ITE programme at GMIT, and through focus groups conducted online with SP tutors and management staff and finally through qualitative interviews conducted online with a small number of experts in the field of literacy and numeracy. Information was provided about the research project and the process involved in being a participant of this study. Participants were free to take part or



withdraw from the study. Regarding confidentiality and anonymity, those who participated in the questionnaires and the dialogical reflections were not required to give a signature, which ensured that their responses would be anonymous. In addition to this, participants' identities were also protected during collection, storage, analysis and reporting of the findings of this study. Those who participated in focus groups and interviews were not anonymous to the researcher, but when presenting the findings, names were coded to protect identity of participants. Ethical approval was sought from GMIT Research Sub Committee of Academic Council. Included in that documentation:

- Participant Information Leaflet (Appendix 16)
- Informed Consent Forms 1 & 2 (Appendices 17 and 18)
- Questionnaire - Student Teachers (Appendix 1)
- Questionnaire - School - Placement Tutors (Appendix 2)
- Questionnaire - Other Educational Professionals (Appendix 3)
- Breakout Circle Group - Guidelines and Questions (Appendix 6)
- Breakout Circle Group – Record of Responses (Appendix 7)

Having recruited the participants for this study ethically and provided them with the appropriate information to enable the participants to make an informed decision regarding their involvement in the study, the following paragraph focuses on the aspects that needed to be addressed during the process of the data collection.

During the collection of research data, the researcher needed to be aware of how to manage the process ethically. The participants in this study were given the opportunity to ask questions about the project and where given details for contacting the researcher should they wish to withdraw from the study or required further information. Consideration was given to how to ensure that questionnaire and dialogical reflection group responses would remain anonymous. The collection of the questionnaires was conducted in a way that no participant could be identified. When conducting focus groups and interviews, transcripts were written using coded names, to ensure a level of confidentiality for the participants. Consideration was

given to how the data was going to be stored and who might have access to this research data. The storage and security of the data collected must align with the terms of consent, confidentiality, and anonymity which the participants were promised. All questionnaires and dialogical reflection group responses, which were manually completed, were stored in a locked cabinet and all digital data gathered online, through focus groups and online interviews was stored on a password protected computer and digital storage device.

Research ethics is the responsibility of all researchers at all stages of research process, from producing the initial and overall research question, researching the context of the project, conducting the literature analysis, developing the research design, collecting primary research data, analysing that data, and writing and disseminating the research findings (Kara, 2017). Although there is a vast amount of literature on ethics when collecting data, there are ethical dimensions to be considered when conducting secondary research, in the form of an analysis of relevant literature. With a growing body of literature available to a researcher, and more academic documents being accepted as 'literature', a researcher must be aware of and reflect on how they are analysing these documents ethically (Salmons, 2015). With online searches yielding vast results, a researcher must choose what to focus on in an ethical manner, aiming to avoid bias and present a variety of views and opinions. When writing what has been found as part of the literature analysis and documentary analysis, a researcher has a responsibility to be aware of and avoid plagiarism (Comstock, 2013). The last section in this chapter, provides a conclusion to the methodology and methods used in this research study.

### **3.5 Conclusion**

The aim of this chapter was to explore the methodology and methods employed in this study, addressing part of research objective 4 of this study, to design and conduct a primary research case study of the ITE programme at GMIT, with respect to literacy and numeracy competencies and training (See section 1.2). To conclude this chapter, this study utilised a case study approach, underpinned by interpretivist and constructivist philosophies to gather

data on the ITE programme regarding the provision for literacy and numeracy development within the programme. The information presented in this chapter demonstrated a rationale for the suitability of these choices, suggesting that interpretivist and constructivist philosophies allowed the researcher to interact with the participants and construct meaning from participants' interpretation of their reality, satisfying the beliefs of interpretivist and constructivist worldviews. A mixed methods case study approach was chosen, as this research is concerned with and specific to one ITE programme, allowing an in-depth analysis of the people and the practices regarding literacy and numeracy development within that specific case. The data collection tools used in this project were questionnaires, dialogical reflection groups, focus groups and qualitative interviews, ensuring validity and reliability through triangulation of data collecting tools. The last section in this chapter explored the ethical values and principles that needed to be considered, heightening awareness of the researcher, and ensuring the integrity of the research project. The following chapter explores how the data was analysed and provides the results and findings of that analysis.

## **4 Research Results, Findings & Analysis**

### **4.1 Introduction**

Objective 4 of this study was to design and conduct a case study of the ITE programme at GMIT, with respect to literacy and numeracy competencies and training, which was outlined in chapter 3. This chapter presents the analysis process and the results of that case study. The qualitative findings, which are supported by quantitative findings are presented together in this chapter, under five research themes. These five themes are introduced in section 4.2.2 and presented in table 4-3. This chapter begins by exploring and explaining the processes involved in analysing the research data gathered in this study. Section 4.2 provides the analytical methodology and the analysis process, outlining how the research themes were generated and how the research findings are to be presented. Section 4.3 presents the findings in relation to theme 1: defining literacy and numeracy. This section explores the participants' interpretations of the terms, the challenges involved in defining the terms, and the relationship between the two skills. Section 4.4 explores theme 2: the importance of literacy and numeracy within ITE. This theme presents PS teachers' and SP tutors' awareness of their responsibility to develop literacy and numeracy, in the context of training within the ITE programme. Section 4.5 explores theme 3: PS teachers' perceptions of their own abilities. This theme includes the distinction between PS teachers' literacy and numeracy skills and knowledge relating to the teaching of these skills, referring to participants' confidence in both. This theme also examines SP tutors' perspectives on PS teachers' confidence. Section 4.6 examines theme 4: the relationship between theory and practice. This theme examines PS teachers' perceptions of the provisions of training within the programme for the development of personal literacy and numeracy skills, their pedagogical knowledge of developing these skills, and the relationship between the two. Section 4.7 explores the final theme, 5: literacy and numeracy in technical subjects. This section explores the relationship between technical subjects and the development of literacy and numeracy skills, focusing on

the perceptions and beliefs of the participants of the focus groups and expert interview. Section 4.8 presents the results regarding SP tutors' and educational professionals' suggestions to enhance literacy and numeracy training within the programme. Prior to exploring the results and findings of this study, the following section explores the process of analysing the research data.

## **4.2 Data Analysis Methodology**

The aim of this section is to give an overview of the process of data analysis and the rationale for the choices made. This section explores how the data for this research project will be analysed, discussing the thematic approach to be taken, the process involved in analysing the research data and how the information was going to be presented.

### **4.2.1 Analytical Methodology: Thematic Approach**

Research data analysis is the process used by researchers to interpret a story to extract insights and therefore, answer their research questions. Le Crompte describes research data analysis as 'creating patterns' and 'assembling structures' (2000). Raw data generated in a research project does not always show an obvious relevance to the study. However, the research data becomes more meaningful when it is analysed, through finding patterns, connections, and relationships (White, 2011). There are a number of different methods to analyse both qualitative and quantitative research data, including qualitative analysis methods such as content analysis, narrative analysis, discourse analysis, thematic analysis, grounded theory and phenomenology analysis, and quantitative analysis methods such as descriptive statistics and inferential statistics (Creswell, 2002; Denscombe, 2010; Cohen, Manion, & Morrison, 2018). There are crossovers and overlaps between the various approaches to analysing research data. However, two methods align more closely with this research study's aims and objectives. As this research study includes data detailing participants perceptions and opinions, which were collected using predominantly qualitative research collection methods, a thematic approach to qualitative data analysis was deemed

the most appropriate, while incorporating descriptive statistics to analyse the quantitative research data. A thematic approach incorporates aspects of other analysis models, enabling a researcher to highlight similarities and differences among the participants' perspectives, allowing the generation of unanticipated insights (Nowell, Norris, White, & Moules, 2017).

Braun and Clarke define the use of thematic analysis in research, as a method for identifying, analysing, organising, describing, and reporting themes found within a data set (2006). By separating the research data into numerous themes, researchers using different research methods are enabled to communicate their findings with each other (Nowell, Norris, White, & Moules, 2017). An advantage of this approach is the flexibility for the researcher to adapt the approach to their individual needs, offering more freedom to the researcher and more accessibility to the participants (Braun & Clarke, 2006). The disadvantage of this flexibility is that it can lead to inconsistencies and a lack of coherence (Nowell, Norris, White, & Moules, 2017). Nowell *et al.* go on to say that by making your epistemological position clear, coherence and consistency can be promoted.

The steps involved in undertaking a thematic approach to analysing your research are as follows: familiarisation, coding, identify patterns, reviewing and defining themes (Caulfield, 2019). These steps are explained in more detail in table 4-1 below.

Table 4-1 Six Phases of Thematic Analysis of Research Data

Phases of Thematic Analysis	
<b>Familiarisation with the data</b>	This phase involves reading and re-reading the data, to become immersed and intimately familiar with its content.
<b>Coding</b>	This phase involves generating succinct labels (codes) that identify important features of the data that might be relevant to answering the research question. It involves coding the entire dataset, and after that, collating all the codes and all relevant data extracts, together for later stages of analysis.
<b>Generating initial themes</b>	This phase involves examining the codes and collated data to identify significant broader patterns of meaning (potential themes). It then involves collating data relevant to each candidate theme, so that you can work with the data and review the viability of each candidate theme.
<b>Reviewing themes</b>	This phase involves checking the candidate themes against the dataset, to determine that they tell a convincing story of the data, and one that answers the research question. In this phase, themes are typically refined, which sometimes involves them being split, combined, or discarded. In our TA approach, themes are defined as patterns of shared meaning underpinned by a central concept or idea.
<b>Defining and naming themes</b>	This phase involves developing a detailed analysis of each theme, working out the scope and focus of each theme, determining the 'story' of each. It also involves deciding on an informative name for each theme.
<b>Writing up</b>	This final phase involves weaving together the analytic narrative and data extracts and contextualising the analysis in relation to existing literature.

Source: Adapted from Braun and Clarke (2018)

One of the most important steps in analysing the research data is data coding. Coding is the process of organising and labelling qualitative data, which enables the researcher to identify different themes and the relationship between them (Medelyan, 2021). Yi has suggested that the coding of qualitative data quantifies the information gathered, making the otherwise inaccessible information presentable and credible, in the same way that quantitative data speaks for itself (2018). This simplifies the information, breaking it down into manageable and presentable data. Table 4-2 below explores the aspects to consider when choosing a suitable coding method.

Table 4-2 Manual or Electronic Coding

Manual or Electronic Coding		
	Manual Coding	Electronic Coding
<b>Tools</b>	Paper, pencil, pen, note cards, hard copy of the transcripts or documents, artifact to be coded  Word document, Excel spreadsheet	Computer-Aided Qualitative Data Analysis Software (CAQDAS) such as Nvivo, Atlas ti and Transana
<b>Usability</b>	Easy to use especially when data is not a lot	Need to familiarise with the functions of the software before starting to analyse the data  Recommendation: Watching YouTube instructional videos and practicing
<b>When to use</b>	Small data recommendation: At the initial stage of data analysis – when familiarising yourself with the data	Large Data  Including videos and audio that have not been transcribed
<b>Organisation</b>	Time consuming	Easy to organise codes, run code frequency, explore the relationship between codes and do 'memoing'

Source: Adu (2013)

It was decided that manual coding, as opposed to electronic coding of the data was a suitable method for this research. Although manual coding can be time consuming, given the small size of the cohort, and the ease of access and suitability for the researcher, this method was deemed most suitable.

The process of developing themes can be derived from predetermined codes or themes, known as a deductive coding method (Stuckey, 2015). In this research study, there were a small number of themes which guided the design of questionnaire, focus groups and interview questions. These themes included: 1) 'literacy' and 'numeracy' terminology, 2) literacy and numeracy in the context of ITE, 3) the relationship between literacy and numeracy and 4) PS teachers' personal and pedagogical literacy and numeracy skills, and were deduced from investigating literature pertinent to literacy and numeracy development in the context of this research (See chapter 2). While using deductively inclined coding, it is



important that the researcher engages with the data continuously to be open to new themes emerging (Linneberg & Korsgaard, 2019). In this particular research study, the data analysis process combined both deductive coding (initial themes) and inductive coding (emerging themes). This combined approach required an iterative analysis process to ensure that the researcher was going to recognise new themes emerging (Xu & Zammit, 2020). Although coding was part of both qualitative and quantitative data analysis, it was present at various stages and in varying quantities for each (Denscombe, 2010, p. 245). A significant part of the analysis for this research project was the analysis of the qualitative data. However, by utilising a thematic approach, the researcher was enabled to organise and structure the data and therefore, to methodically analyse it in a way that was manageable.

As mentioned in chapter 3, this research study utilised qualitative research methods and generated both qualitative and quantitative data (See section 3.2.3). This distinction is made to highlight that the quantitative data presented in this chapter was not what was driving this research. Instead, the quantitative data emerged later in the process and was used to compliment and support the qualitative findings. This type of quantitative analysis is known as descriptive analysis which, as the name suggests describes the data using simple calculations such as averages, percentages, or frequencies (Bhatia, 2018). Based on the above framework, the process of analysing the data gathered began and details of that process are demonstrated in the following section.

#### **4.2.2 Analysis Process**

Having generated and collected research data through the methods previously mentioned, questionnaires, dialogical reflection groups, focus groups and interviews, and having decided that the data would be coded manually, the questionnaires and dialogical reflection responses needed to be copied to maintain the original responses and the focus group and interviews needed to be transcribed and printed. Transcribing data collected online gave the researcher some insights into the emerging themes and enabled the researcher to familiarise

themselves with the data. Figure 4-1 below was created to show an overview of the process of analysing the data gathered.

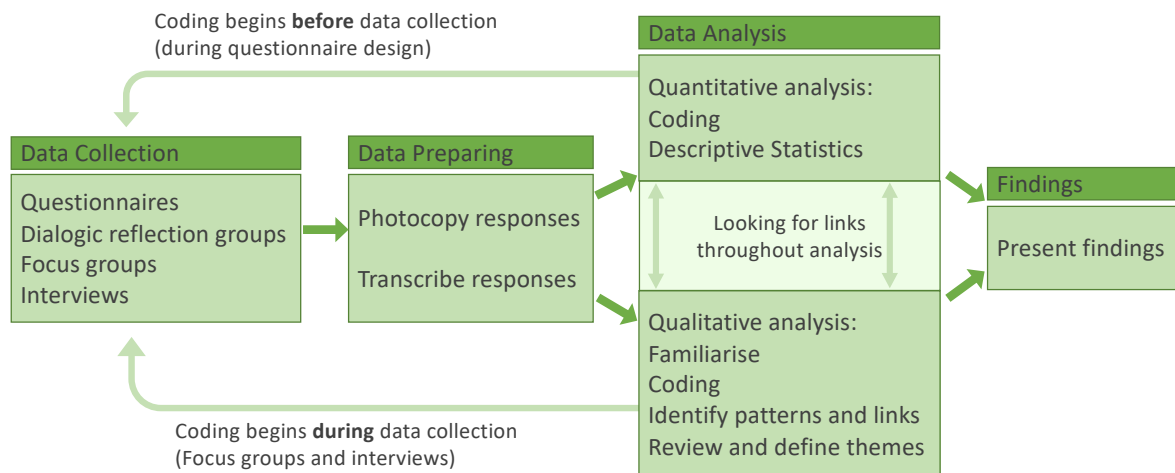


Figure 4-1 Analysis Process

Source: Author's Original

Norwell *et al.* (2017) highlight the importance of finding the correct balance between too many predefined themes, which may impact the researcher's ability to consider themes that contradict their original assumptions, and too few predefined themes, which in contrast may leave the analysis with little direction. As mentioned previously (See sections 2.9), a small number of predetermined themes were generated in response to the literature analysis (chapter 2) and the documentary analysis (See section 2.8), which included: 1) 'literacy' and 'numeracy' terminology, 2) literacy and numeracy in the context of ITE, 3) the relationship between literacy and numeracy and 4) PS teachers' personal and pedagogical literacy and numeracy skills. These predetermined themes informed the design of data collection. Once the data analysis stage began the participant responses were examined, with these predetermined themes in mind. The purpose at this stage of the analysis, was to recognise patterns and frequency of themes, for example a significant number of the responses revolved around 'The meaning of the terms' and this remained a dominant theme from the

first read to the last. Once patterns were highlighted, links between the different interviews and links within a single conversation were made. This second read presented more themes, some of which were closely related to original themes and others had organically emerged and began to steer the research in a different direction than had initially been anticipated. It can be argued that engaging with too much literature can narrow your field of vision and make it difficult to see other potentially important themes that might emerge (Braun & Clarke, 2006) but Braun and Clarke also argue that it can enhance your ability to recognise new themes. Nowell *et al.* find this method of analysis especially useful for the very reason that it may generate unanticipated insights (2017). With many different themes emerging, colour coding was used to distinguish between themes, as shown in the images below.

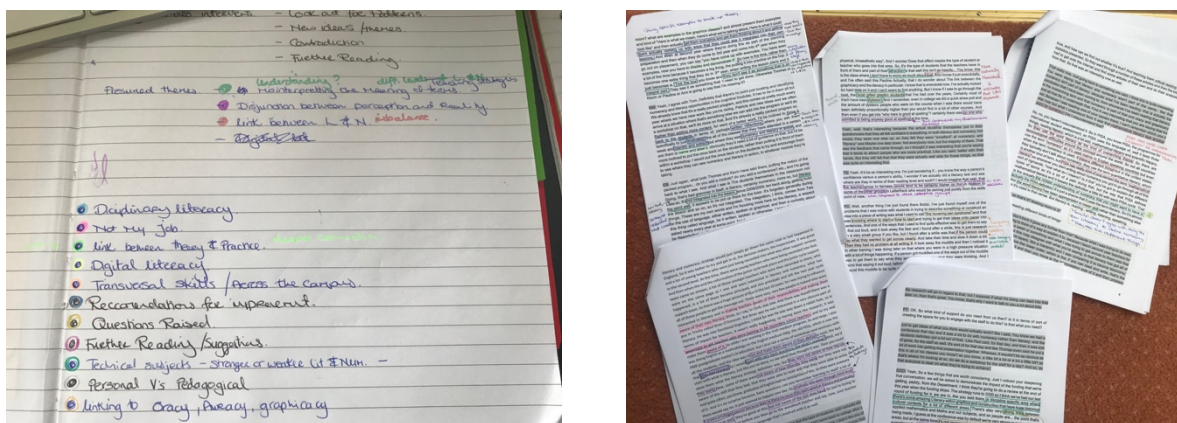


Figure 4-2 Images of Manual Coding, Using Colour

Source: Author's Original

Once the data had been read several times and colour coded, the links between themes became more obvious and the dominant themes began to emerge. Some of the sub-themes could have fit under a number of the dominant themes, for example ‘the meaning of the terms’ can be linked to ‘disciplinary literacy and numeracy’, but is also connected to ‘making the link between theory and the practice’. Figure 4-3 below shows the many themes and the many links between them.

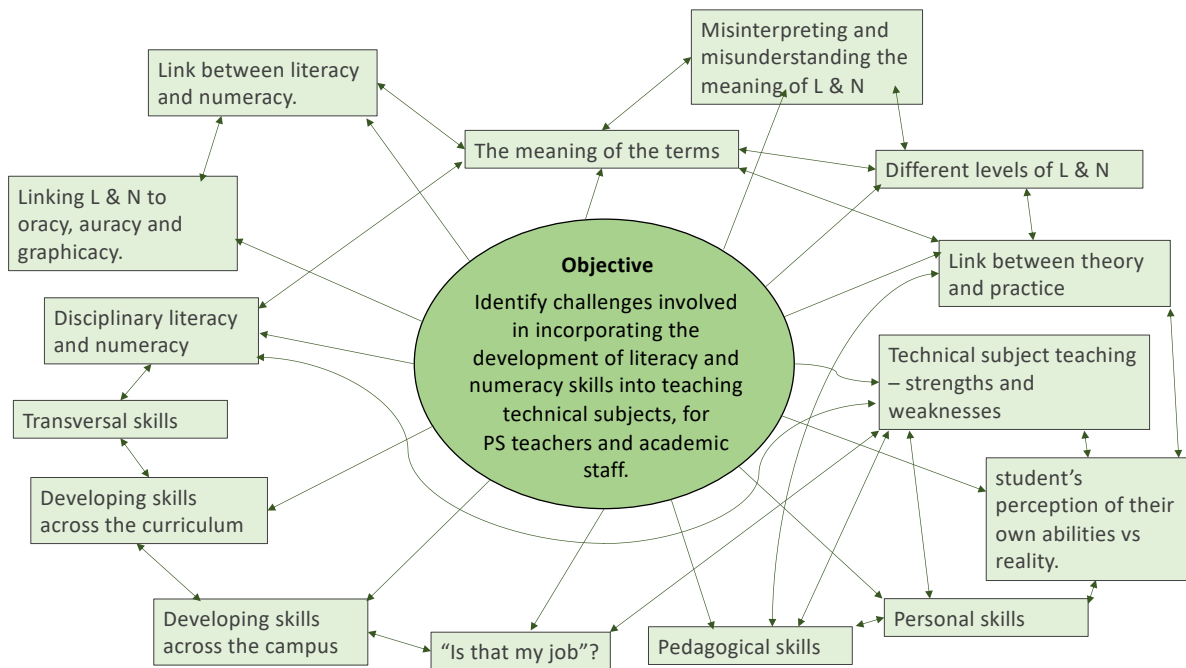


Figure 4-3 Themes Emerging from Literature & Data Analysis

Source: Author's Original

As previously mentioned (page 109), the final research themes were arrived at through the employment of both deductive coding and inductive coding. Initial themes emerged through the literature analysis stage of the research. Focus groups and interview transcripts were then manually colour coded, using the initial themes as a framework (figure 4-2). New themes and patterns began to emerge through this inductive process. The final themes included: theme 1) Defining literacy and numeracy, theme 2) Literacy and numeracy within ITE, theme 3) PS teachers' perception of their own abilities, theme 4) The relationship between theory and practice and theme 5) Literacy and numeracy in technical subjects. The justification for reducing the many themes seen in figure 4-3 above, to the final five themes (see table 4-3), was the context and the links made by the participants in the interviews and focus groups. The process involved in arriving at the final themes was an iterative exercise, using the context

in which these sub-themes were mentioned by the participants as the rationale for these categorising choices. It was important to allow the participants' perspectives to guide the final theme choices as it is those perspectives that are at the heart of this research study. The final themes of this research are demonstrated in table 4-3 below.

*Table 4-3 Final Dominant Research Themes*

Theme no.	Theme Name:
Theme 1	Defining literacy and numeracy
Theme 2	Literacy and numeracy within initial teacher education
Theme 3	Pre-service teachers' perceptions of their own abilities
Theme 4	The relationship between theory and practice
Theme 5	Literacy and numeracy in technical subjects

*Source: Author's Original*

These five themes are explored in sections 4.3, 4.4, 4.5, 4.6 and 4.7. Prior to the exploration of the five dominant themes, the following section provides an approach for presenting the findings and a rationale for the chosen approach.

### **4.2.3 Presenting the Findings**

There was a strong link between the analysis of the qualitative data and the analysis of the quantitative data. It was decided during writing up stage of this project that both qualitative and quantitative findings would be presented together. Quantitative findings are usually presented in figures, diagrams, graphs, and tables and then commented on. However, qualitative findings are usually presented using words and discussed under themes. The rationale for presenting qualitative and quantitative findings together was that this would enhance the validity and confidence of the findings and provides a sense of "confirmation" and "completeness" of the research data (Halcomb & Davidson, 2006, p. 40). Both the

qualitative and the quantitative data are discussed under each theme, complementing each other, and therefore, effectively present the full research story.

The participants' voices are an important aspect of this study and to maintain the confidentiality and anonymity which was promised to the participants, the identity of participants has been coded. The pre-service (PS) teachers are presented as "PS teachers". The school-placement (SP) tutors are referred to as "SP tutors" followed by a number to differentiate between them, e.g., SP tutor 1 or SP tutor 2. The management staff are distinguished by number coding, e.g., Management Staff 1 (MS1) and Management Staff 2 (MS2). The literacy and numeracy experts who were interviewed as part of this research project are referred to as Literacy Expert 1 and Literacy Expert 2, and Numeracy Expert 1 and Numeracy Expert 2. Having discussed the chosen approach to analysing the research data, including the processes involved in generating the research themes, the following five sections take each theme in turn, exploring the original contributions that this research makes to the field of literacy and numeracy in the context of ITE. Chapter 5 will discuss these findings in relation to literature.

### **4.3 Theme 1: Defining Literacy and Numeracy**

The meaning of the terms 'literacy' and 'numeracy' has been discussed with various participants throughout this research. A questionnaire was designed to capture participants' interpretations of the terms 'literacy' and 'numeracy'. Q2 of the questionnaires (See appendices 1,2 and 3) asked the participants to define the terms 'literacy' and 'numeracy' in their own words. Defining the terms was discussed in the dialogical reflection groups, the focus groups and in the expert interviews also. The responses regarding the defining of the terms 'literacy' and 'numeracy' are explored separately below.

#### **4.3.1 Literacy Interpretations**

The definition formulated in section 2.3.1, for the purpose of this project included keywords relevant to this discussion. The author defined literacy as:

The ability to engage with, identify, interpret and use both existing knowledge and new learning from printed text, spoken language, broadcast and digital media to construct and communicate meaning, and develop knowledge and potential, to enable the achievement of goals and the participation in community and society.

The keywords included in the above definition can be separated into three distinct areas, actions, medium and purpose to, firstly, simplify the term and secondly, to appreciate the complexity of its meaning. The questionnaire responses were examined with these keywords in mind. However, many questionnaire responses included words outside this table and therefore, a list of keywords was compiled to reflect the PS teachers' responses. The most frequently used keywords are collated and represented in the following table, 4-4 indicating the frequency that a keyword was mentioned within each year group and the total number of times those keywords were used, as a percentage of the total.

*Table 4-4 Literacy Keywords and Frequency % - Pre-Service Teachers*

<b>Keywords:</b>	<b>1<sup>st</sup> Year</b>	<b>2<sup>nd</sup> Year</b>	<b>3<sup>rd</sup> Year</b>	<b>4<sup>th</sup> Year</b>	<b>Total</b>
Write	9	6	7	9	31 (18%)
Read	11	4	6	8	29 (16%)
Understand	13	9	2	3	27 (15%)
Words	4	7	7	4	22 (13%)
Communicate /Convey/express	3	6	6	6	21 (12%)
Language	2	3	4	6	15 (9%)
Discussions /Talking	2	1		5	8 (5%)
Skill	1	1	1	3	6 (3.4%)
Develop		1	1	2	4 (2.3%)
Spelling /Grammar	2			1	3 (1.7%)
Critical Thinking			1	1	2 (1.1%)

Vocabulary	2				2 (1.1%)
Analyse				1	1 (.5%)
Strive in Community				1	1 (.5%)
21 <sup>st</sup> century				1	1 (.5%)

*Source: Author's Original*

The grey boxes indicate that no one from that year-group used the corresponding keyword in their definitions. What is evident from table 4-4 above is that across all year groups, the most common keywords used to define literacy were 'read' (18%), 'write' (16%), 'understand' (15%), 'words' (13%) and 'communicate' (12%). Taking these most frequently used terms, when compared to the keywords from the definition developed by the author for the purpose of this project, the PS teachers' responses indicate a basic or more traditional understanding of the term.

When year groups are analysed separately, there is evidence of an incremental approach to delivering literacy and numeracy development across the four year programme, which is explored in more detail in section 2.8. Out of the 20 1<sup>st</sup> year participants, the most frequently used word that emerged from the responses was 'understanding'(n=13), with 'reading' (n=11) and 'writing' (n=9) the next most frequently used word. Some examples of these responses are presented below:

Understanding of how to read and write

The ability for someone to be able to read and write  
(1st year participants)



Other words such as 'grammar', 'spelling', 'words' and 'vocabulary' were mentioned also, but with less frequency (n=8 in total).

words, vocabulary

Literacy is reading, writing, spelling and grammar. It is language skills  
(1st year participants)

A quarter of this group of participants used one of the words 'language', 'convey' or 'communicate' (n=5) and 4 participants made the connection to 'talking', 'discussing', 'hearing' and 'seeing'. Only 1 participant from this year group used the word 'skills' to define literacy, saying that literacy refers to "The understanding of words, language and how to convey it by yourself. Literacy is reading, writing, spelling and grammar. It is language skills" (1st year participant). When compared to the 4th year group responses (n=15) the vocabulary being used to define literacy, changed. The most frequently used words were 'writing' (n=9) and 'reading' (n=8), but with 'communicate/express' (n=6) and 'language' (n=6) being used by a significantly larger percentage of this group of participants. Interestingly, only three participants in this group referred to 'understanding':

To express oneself through a language

The use of words and letters in a way to communicate effectively

Literacy is the use of the written language. Being able to understand and communicate through written language  
(4th year participants)

A small number of responses from the 3<sup>rd</sup> and 4<sup>th</sup> year groups (n=2) used the words 'critical thinking' and 'higher order'.

Literacy is the ability to ask higher - lower order questions and having the ability to logically answer the question. (3<sup>rd</sup> year participant)

Literacy is the use of words & phrases to describe a person, place, or thing. The larger your knowledge base the better using of the world & critical thinking. (4<sup>th</sup> year participant)

Educational staff and SP tutors' (n=15) literacy definitions demonstrated a deeper knowledge of what we now understand to be literacy, "the capacity to effectively use and interpret text and symbols, including reading and writing" (SP tutor), with 7 referring to 'communication', 6 referring to 'using/applying', 4 referring to 'interpreting' and 3 indicating a connection to 'society/life'. One 4<sup>th</sup> year PS teacher referred to the wider society:

Being able to use the skill of reading and writing to strive in the wider community.  
Being able to use the skill to develop as a human capable to strive in the 21<sup>st</sup> century.  
(4<sup>th</sup> year PS teacher)

From an examination of the responses given in the SP tutors' questionnaires (n=5), with regards to defining literacy, it was evident that that their responses demonstrated a deeper knowledge:

Literacy: The ability to interpret information provided by a variety of sources/ methods and evaluate concepts, reach sound conclusions and present outcomes in a way that is capable of being accurately understood. (SP tutor – Less than 1 year)

Similar to defining literacy, the questionnaire responses were examined in a comparable way for defining numeracy.

### **4.3.2 Numeracy Interpretations**

When compared to defining literacy, and considering the context in which the questionnaires were answered, which was at the *Creativity and Innovation in the Classroom: Initial Teacher Education Conference* where three key speakers focused on numeracy, the responses for numeracy were more closely aligned with the definitions explored in section 2.3.2. Table 4-5 demonstrates the findings regarding the keywords PS teachers were using to define numeracy, including percentages of those most frequently used.

Table 4-5 Numeracy Keywords and Frequency % - Pre-Service Teachers

Keywords:	1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	4 <sup>th</sup> Year	Total
Real world /Everyday /Society	12	5	6	7	30 (36%)
Problem solve	7	5	4	4	16 (19%)
Maths/numbers	6	3	3	1	13 (15%)
Understanding	4	1	3	1	9 (11%)
Relate other subjects	1	3	2		6 (7%)
Spatial awareness	1	1	2		4 (5%)
interpret			2	1	3 (4%)
apply	1				1 (1.2%)
express			1		1 (1.2%)
Think critically			1		1 (1.2%)

Source: Author's Original

Out of the 69 participating PS teachers, the most significant finding was that 'everyday life/real world' (36% of keywords used) and 'problem solving' (19%) featured prominently in the responses. The word 'understanding' or the implication of it (apply, interpret, spatial awareness) was evident across the year groups (15%), demonstrated in the responses below:

The ability to think about a problem by relating it back to everyday principals and estimating. (1<sup>st</sup> year PS teacher)

Ability to use/solve/see problems in everyday situations both in and out of the classroom setting. (2<sup>nd</sup> year PS teacher)

Numeracy is the ability to understand and problem solve using different methods. Numeracy involves you to think critically and use logic to answer questions. (3<sup>rd</sup> year PS teacher)

Numeracy is the use of numbers, measurement, problem solving, graphs in a lesson & how that applies to the real world. (*4<sup>th</sup> year PS teacher*)

Many of the participants are using the correct terminology to define 'numeracy' and as mentioned earlier in this section, this may be because of the key speakers at the *Creativity and Innovation in the Classroom: Initial Teacher Education Conference*, relating their content to numeracy and giving practical and real-life examples relevant to the technical subjects. This is being suggested as a reason for numeracy definitions more closely aligned with those explored in chapter 2, because although the definitions provided gave the impression that the participants had a deeper understanding of what numeracy was, the strategies they had suggested that they were using to promote numeracy in the classroom, did not align with their definitions. This is discussed in more detail later in this chapter (4.4).

Once again, the SP tutors' (n=5) questionnaire responses, with regards to defining numeracy, indicated a comprehension of what we now understand to be numeracy:

Numeracy: The ability to interpret, analyse and use data provided in a numerical or graphical form to understand a situation or problem and arrive at an outcome.  
(*SP tutor – less than 1 year*)

The other keywords and phrases present in SP tutors' responses were 'application', 'comprehension', 'critical thinking', 'the real world' and 'communication', indicating balanced and well thought out responses.

### **4.3.3 Challenges in Defining Literacy and Numeracy**

In contrast to the above finding, when asked to define literacy and numeracy at a focus group for SP tutors involved in the ITE programme at GMIT (n=5), there was hesitation from all participants, indicating a lack of confidence in their ability to define these terms. Both terms proved difficult to define and this task required more debate and consideration than the focus group facilitator had expected. Another difficulty with defining these terms is that they mean different things within different disciplines, and to different generations, which was

suggested by two SP tutors taking part in this focus group. SP tutor 4 suggested that the meaning of these terms has changed over time, saying:

it's all relative to the era we're living in. I'm thinking of my own parents... for somebody to be able to sign their name might have been quite good at literacy at one point in time, whereas now that would be considered a very low level [of literacy].  
(*SP Tutor 4*)

Literacy Expert 1 spoke about the 'traditional understanding' of the terms, referring to the basic skills of reading, writing and mathematical skills, suggesting that 'traditionally', when assessing their students' literacy skills, teachers were not looking for understanding or application to the wider world. However, Literacy Expert 1 states that "it's infinitely more complex than that" and suggests that it is important to instil this understanding in PS teachers from the beginning of teacher training, as "the school system doesn't really do anything to knock this out of them", suggesting that this needs to be part of the students' ITE. In relation to understanding what the terms mean, Literacy Expert 2 spoke about the challenge that he had found in school settings where literacy was discussed "only in the context of literacy difficulties". Through this linking of literacy to 'problems' or 'SEN [Special Educational Needs]', teachers were not catering "for all student literacy, whether they're weak... or high achievers". The above opinions of both Literacy Expert 1 and Literacy Expert 2 highlight the importance of developing a context appropriate understanding of these terms at the ITE stage of a teacher's career. This is discussed further in section 4.4. Another aspect to consider when developing an understanding of the terms 'literacy' and 'numeracy', is their relationship to each other, which is discussed in the following section.

#### **4.3.4 The Relationship Between Literacy and Numeracy**

In an exploration of numerous definitions of both 'literacy' and 'numeracy' (See section 2.3.3), two fields of thought were presented. Firstly, that literacy is the overarching skill, under which numeracy fits. Another field of thought is that literacy and numeracy are not related and are two, of many skills which run alongside each other independently, which are developed throughout education, with little connection. The relationship between these two skills was

discussed with literacy and numeracy experts and with SP tutors and this is discussed in dialogue with relevant literature in the following chapter.

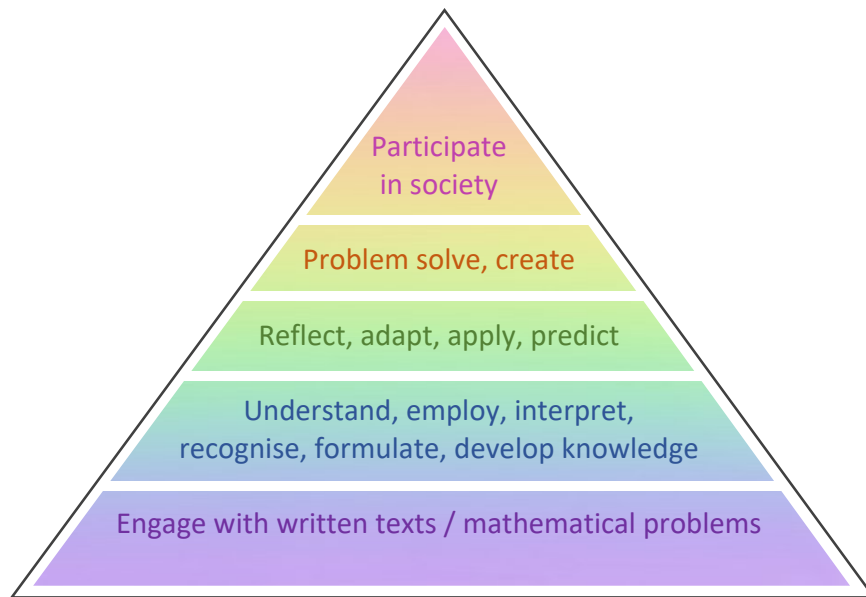
The view that literacy was considered the overarching skill was echoed by Literacy Expert 1, who was interviewed as part of this project. He suggests that because of this hierarchy, there is an imbalance between how the two skills are treated, within one specific teacher training programme. He reported that within the programme that he is involved in, with 24 hours dedicated to literacy and numeracy skills, “it’s 16 hours of literacy and 8 hours of numeracy”. Numeracy Expert 1 commented on just how separate she felt the two skills were. She suggested that “numeracy is considered the poor relation” of literacy and from conversations with parents of children that she taught, she had concluded that they felt that being literate held more value in people's lives, than being numerate. Numeracy Expert 2 echoes these thoughts saying that “a lot more interest and money and funding and programmes have gone into literacy, rather than numeracy” (Numeracy Expert 2). This imbalance is not reflected in PS teachers’ confidence in their own abilities. Contrary to this, PS teachers participating in this study are more comfortable with their numeracy skills than their literacy skills. This is explored further in section 4.5.1.

When asked about numeracy in subjects where it may not be obvious or explicit, Numeracy Expert 1 made suggestions as to where she feels it may be present:

when you are trying to analyse a text and draw conclusions from a text to show that you are not being persuaded in a certain way, so that is where I would kind of look at the English. So, numeracy in English is that you can step back and critically analyse what is being presented to you and draw conclusions yourself. *(Numeracy Expert 1)*

When questioned about whether this was literacy or numeracy, she suggested that it could be considered either or both, suggesting that there are many crossovers between the two skills. This relationship or crossover between the two skills was also explored with the SP tutors. When asked to discuss the link between literacy and numeracy in the SP focus group, there were differing opinions on the matter. For the purpose of the debate and to begin a

conversation on the topic, a taxonomy with keywords for both skills combined was presented to the group, which is shown in figure 4-4 below.



*Figure 4-4 Hierarchy - Literacy and Numeracy Keywords Combined*

*Source: Author's Original*

Out of the five SP tutors participating in the focus group, two initially agreed that the combination of the two skills worked on the taxonomy, while another suggested that literacy and numeracy should be presented separately. For example, one participant (SP Tutor 3) felt that separate taxonomies would more accurately reflect the distinct aspects of each skill, saying that “problem solving and reflection is more of a literacy thing, whereas the prediction would be more of a numeracy thing” (SP Tutor 3). Another participant (SP Tutor 4) argued that the amalgamation of the two skills made sense to her, suggesting that “It works because I do see them as two sides of the same coin”. After a deeper discussion about this topic, SP Tutor 3 concluded that he initially recognised the ‘numeracy’ related words, but at a second glance could see “the same words as they apply to literacy”. The DES refers to these two skills, literacy and numeracy in many documents and they are very often mentioned together,

which would indicate that they consider them as two skills that run alongside each other, albeit separately. Numeracy Expert 2 agreed that numeracy was commonly seen as a subset of literacy, but she did not agree with this view and saw them as separate skills which are rooted in different disciplines.

When questioned on the use of the term 'mathematical literacy' and its connection to the word 'numeracy', Numeracy Expert 2 suggested that the term 'mathematical literacy' was popularised by PISA and the OECD. She went on to explain that in some countries "they use the word 'literacy' as the kind of overarching theme", suggesting that "the word 'literacy' has been appropriated to mean skill". As a numeracy expert and someone who also previously explored literacy, she felt there were terminological difficulties around using the word literacy to define numeracy, and this was not unique to her. She suggested that this view was echoed among many others in the same field, around the world. To further the argument that these two skills are not interconnected, Numeracy Expert 2 explained that Luke and Freebody, experts in the field of literacy had developed a framework for literacy known as 'The Four Resources Model of Literacy' (Freebody & Luke, 1990), explored in chapter 2, which experts in the field of mathematics had tried to adapt for numeracy, concluding that it was not successful. Numeracy Expert 2 explained that this model did not translate to numeracy because "numeracy is grounded in mathematics, and mathematics is a completely different discipline from literacy, which is more grounded in language" (Numeracy Expert 2). Although Numeracy Expert 2 does not agree with using the term 'literacy' being used by PISA to define numeracy, she suggests that the most accurate definition of numeracy is that of PISA.

Having analysed the interpreted definitions of literacy and numeracy of the participants of this study, the challenges involved in defining these terms and the opinions on the relationships between them, it can be concluded that the PS teachers on the case programme have a basic understanding of what literacy is. Numeracy was defined with more alignment with definitions previously explored in this paper. The following section will explore the value of literacy and numeracy development with ITE, from the perspective of the participants.

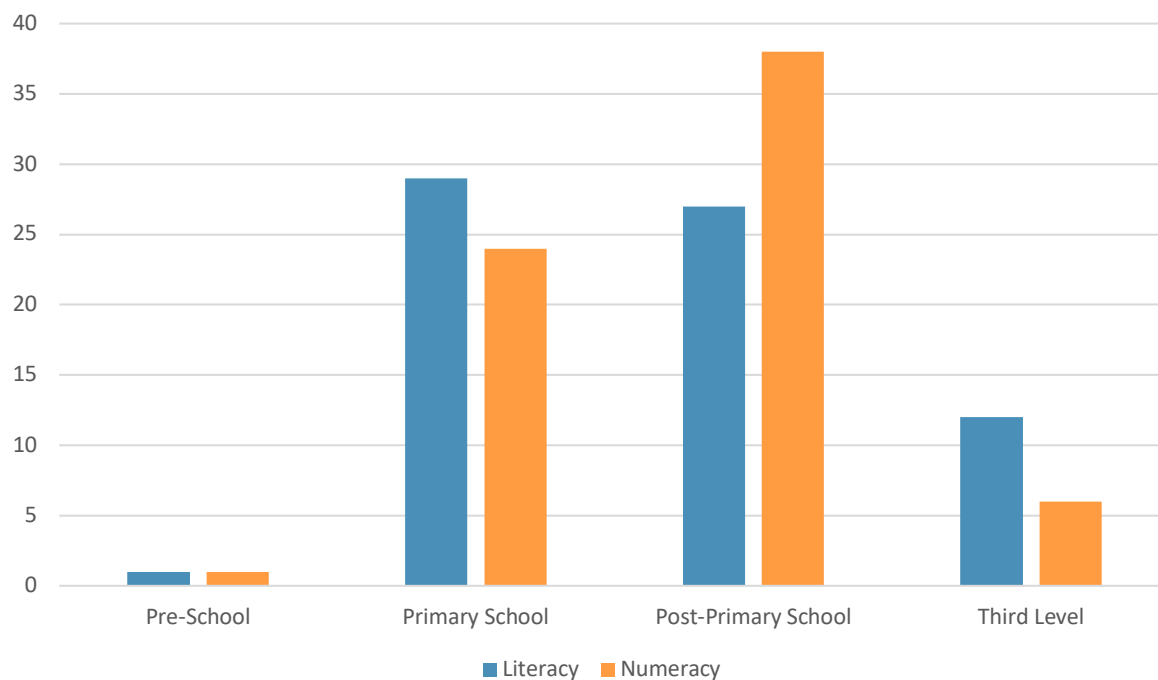


## **4.4 Theme 2: Importance of Literacy & Numeracy within ITE**

The second theme that emerged from this research is the place of literacy and numeracy within the wider context and a PS teacher's awareness of what this might mean for them.

### **4.4.1 Responsibility at all Levels of Education**

It has been well established that the development of literacy and numeracy skills is the responsibility of all teachers, of all disciplines and at all stages of education. This was explored in section 2.5 and highlighted the importance of teachers at all education level to actively develop literacy and numeracy within their classes, with some authors suggesting a belief that these skills were the consideration of primary school teachers. When the PS teachers at GMIT were asked "(a)t what stage of your education did you most develop your literacy and numeracy skills?", the responses did not align with this sentiment (Q4. in questionnaire). Although the question did not ask whose responsibility it was to teach literacy and numeracy skills, the responses to this question indicate the participants' expectation of when, in one's education, these skills are most developed. The questionnaire responses were culminated and presented in figure 4-5, below.

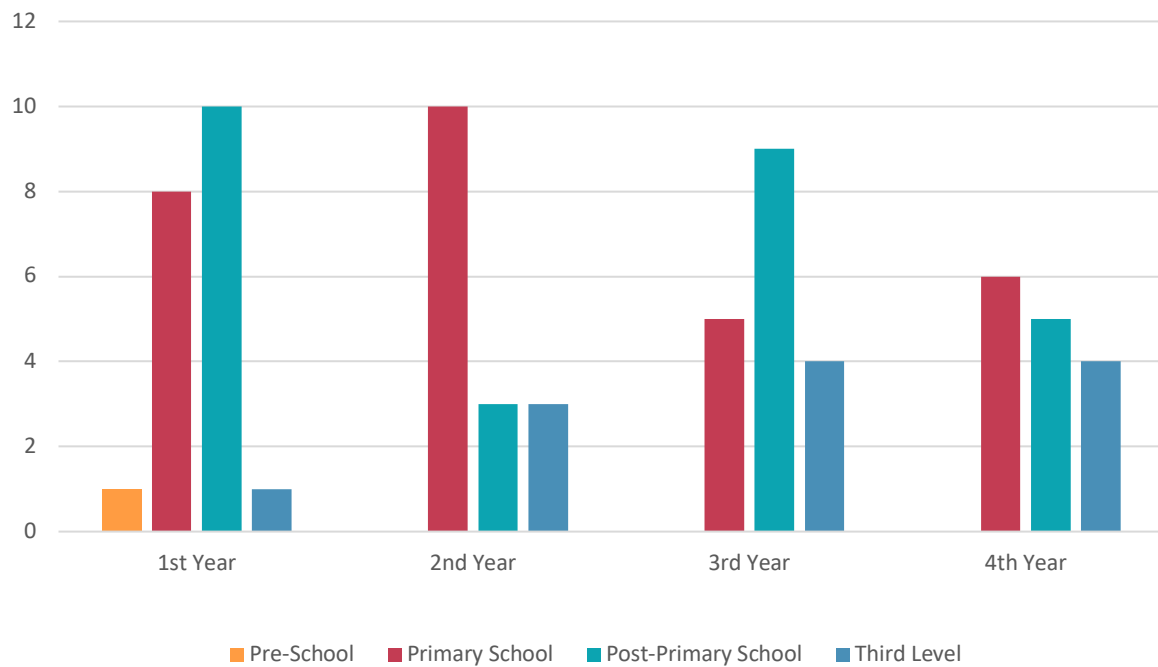


*Figure 4-5 Literacy and Numeracy - All Year Groups*

*Source: Author's Original*

Figure 4-5 demonstrates that, of the 69 PS teachers that took part in this study, 38% believed that they developed literacy and numeracy skills most at primary school and 47% believed that they developed these skills at post-primary school. A significantly smaller percentage believed that they developed these skills at pre-school (2%) and third level (13%) (See Appendix 19). What the above figure, 4-5 also demonstrates is the difference between literacy and numeracy development, indicating that numeracy development was perceived to be more dominant than literacy at post-primary level. These findings indicate that PS teachers on the case ITE programme do not consider literacy and numeracy development the sole responsibility of the primary school teacher but are aware of their responsibility as future post-primary teachers to develop literacy and numeracy within their classes. When these findings are presented, with each year group separate, a significantly larger number of the 3<sup>rd</sup>

years (72%) and 4<sup>th</sup> years (73%), felt that they developed their numeracy skills most at post-primary level. Whereas a significantly smaller percentage of the same groups believed that their literacy skills were most developed at post-primary (50% of 3<sup>rd</sup> years, 33% of 4<sup>th</sup> years), as shown in the two figures below. Figure 4-6 demonstrates PS teachers' perceptions of where they feel their literacy skills were developed most.



*Figure 4-6 Education Level - Literacy Development*

*Source: Author's Original*

The following figure, 4-7 demonstrates PS teachers' perceptions of where they feel their numeracy skills were developed most.

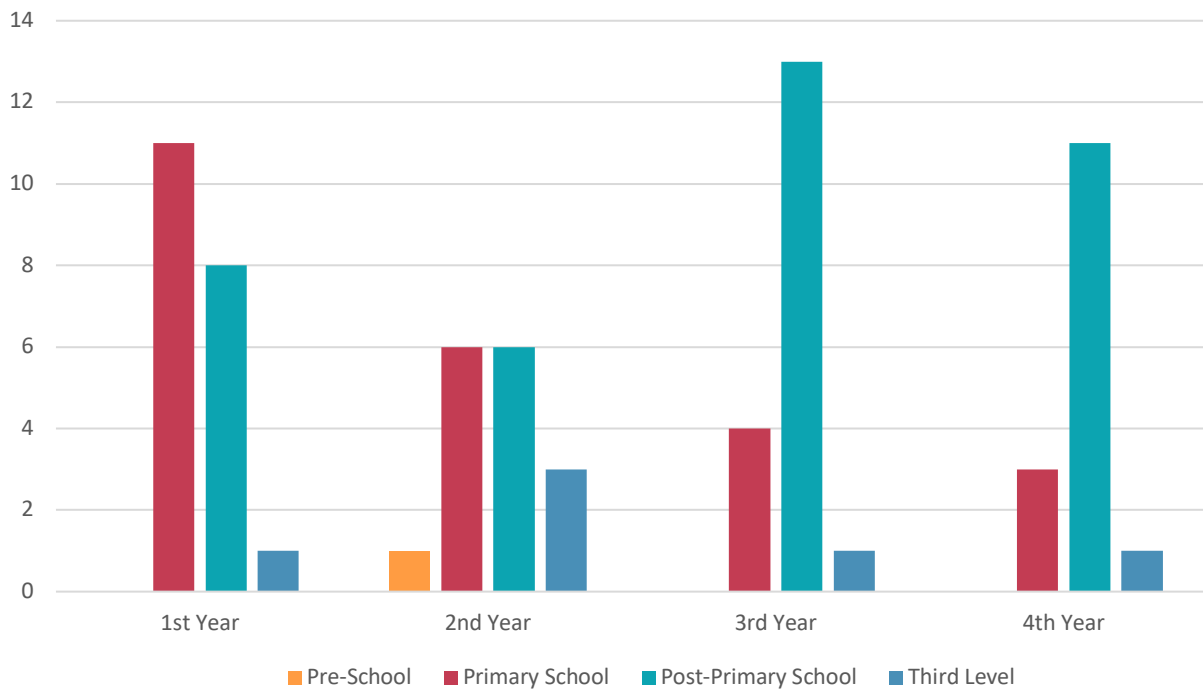


Figure 4-7 Education Level - Numeracy Development

Source: Author's Original

With the findings above in mind, it is worth considering the PS teachers' understanding of the terms literacy and numeracy, and how this may have impacted their responses to Q.4 of the questionnaire. The following section distinguishes between the treatment of developing literacy and numeracy skills as a cross curricular task, and as a discipline specific development of these skills.

#### 4.4.2 Transversal Skills Vs Disciplinary Skills

The previous section had explored the importance of all teachers taking the responsibility to develop literacy and numeracy within their classes. It is now necessary to explore what this looks like within ITE. The development of the skills of literacy and numeracy can be separated into two distinct areas: transversal and disciplinary skills.

Transversal skills are those that may be applied to all subjects and disciplines. Literacy Expert 1 emphasised the importance of 'getting the basics', referring to what is understood to be transversal skills, in place first and then later, making the distinction that you are switching over to disciplinary skills:

A general understanding first and then through your understanding you look at it in a more subject specific or discipline specific way. (*Literacy Expert 1*)

Numeracy Expert 1 spoke about her surprise that many teachers outside of Maths and science subjects, felt that developing numeracy was not their responsibility. She added:

the pre-service teachers that I surveyed, they were from all different disciplines, from languages to science, computer science, CSP, everything and the majority just thought of it [numeracy] as numbers, and while some of them recognise it was important, they didn't recognise it was important for their subject. (*Numeracy Expert 1*)

What emerged from the focus group with the SP tutors was that some were viewing these skills through a discipline specific lens i.e., Applied Technical Graphics at third level, whereas others who come from a managerial background in education i.e., post-primary principal and teacher were viewing these skills in a more general way. The distinction between the two was not made when the facilitator put questions forward in the focus group. However, one SP tutor referred to the distinction between transversal and disciplinary development of literacy and numeracy, suggesting that any training that may be designed for staff, should include all staff on the campus and not just on this programme, highlighting the importance of transversal skills, spanning all programmes. When this subject was broached with management staff focus group, MS3 suggested that training such as this was currently being considered by means of a whole-school approach.

Disciplinary literacy and numeracy are the skills developed through subject and discipline specifics. Numeracy Expert 2 spoke about how literacy and numeracy will look in a particular subject, suggesting that it will appear differently in each. As an example, she referred to a "numeracy footprint" suggesting that the 'Model for Numeracy', which is explored in section

2.6.2 can be applied to all subjects and it is more about developing an awareness of numeracy within your specific subjects and therefore, recognising what might be missing:

It's about recognising what is already there and sort of putting on a new set of eyes. So, you can say "oh, actually, it's there". It's in the curriculum, and there are different aspects of numeracy that will come to the fore, more or less across the different subjects so they'll all look different.... It's about an awareness. (*Numeracy Expert 2*)

The distinction between the development of transversal literacy and numeracy and disciplinary literacy and numeracy, within ITE highlighted the importance of creating an awareness among PS teachers and staff, of not only developing discipline specific skills, but also addressing the cross curricular needs of PS teachers and other programmes on the campus. The following section explores the training opportunities that were available to staff on the programme regarding developing literacy and numeracy skills.

#### **4.4.3 School-Placement Tutor Training**

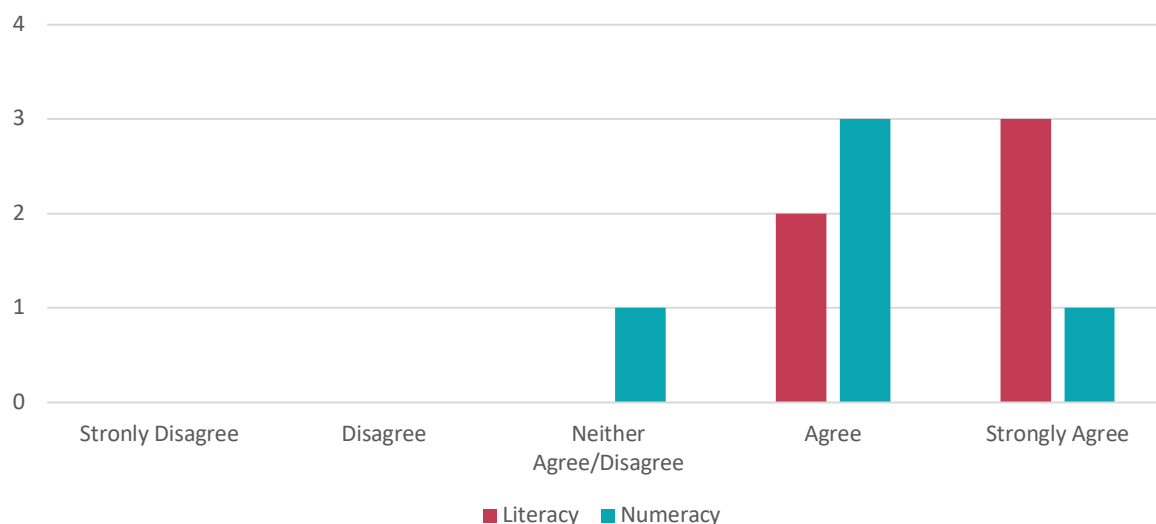
The SP tutors were asked what training, if any they had received to prepare them for literacy and numeracy pedagogy and assessment (questionnaire - Q7). Out of the 8 responses received, one SP tutor answered "none". Through an analysis of the seven remaining responses, it was evident that there were three distinct areas 1) where SP tutors were receiving training to develop pedagogical literacy and numeracy skills, 2) through national bodies such as the education department and 3) through the institute GMIT and through individual education and experience. The training received in each area are demonstrated in table 4-8 below.

*Table 4-8 School-Placement Tutor Training for Literacy and Numeracy Development*

<b>National Training</b>	
	Continuous professional development course, organised by DES
	Junior cycle reform training, 2-day course
<b>Local Training, GMIT</b>	
	Workshop in GMIT, teaching-practice preparation
	Today's conference – Creativity and Innovation in the Classroom (GMIT).
<b>Individual Training</b>	
	Lifelong learning
	Previous experience as a teacher
	Individual development through reading relevant documents

*Source: Author's Original*

These findings suggest that there is no obligation for SP tutors to receive training in this regard. When these findings were compared to responses to question 4 in the SP tutor questionnaires, which asked SP tutors to indicate, on a Likert scale their confidence to teach literacy and numeracy skills to their students, 9 responses (90%) indicated that they agreed/strongly agreed with the statement (See Appendix 20). These responses are presented in figure 4-9 below.



*Figure 4-9 School-Placement Tutor Confidence in Pedagogical Literacy and Numeracy*

*Source: Author's Original*

These findings, demonstrated in figure 4-9 above suggest that, although there is no formal training requirements for SP tutors on this programme, confidence levels in their ability to teach literacy and numeracy skills, are relatively high. In contrast to this finding, when this topic was discussed at the SP tutor focus group, SP Tutor 4 suggested that further training was required for SP tutors to impact literacy and numeracy levels of PS teachers, saying that “lecturers really need to reflect on their own practice and we [SP tutors] probably need more training ourselves”. She went further suggesting that she believed that any training designed to improve the way in which lecturers are developing literacy and numeracy within their modules, should be extended to all staff, not exclusively for the staff teaching on the ITE programme. This outlook indicated the first instance that someone was making the connection between literacy and numeracy training and transversal skills as opposed to disciplinary skills. The following section explores theme 3, which addresses PS teachers’ perception of both their own literacy and numeracy abilities and their ability to teach these skills in the classroom.

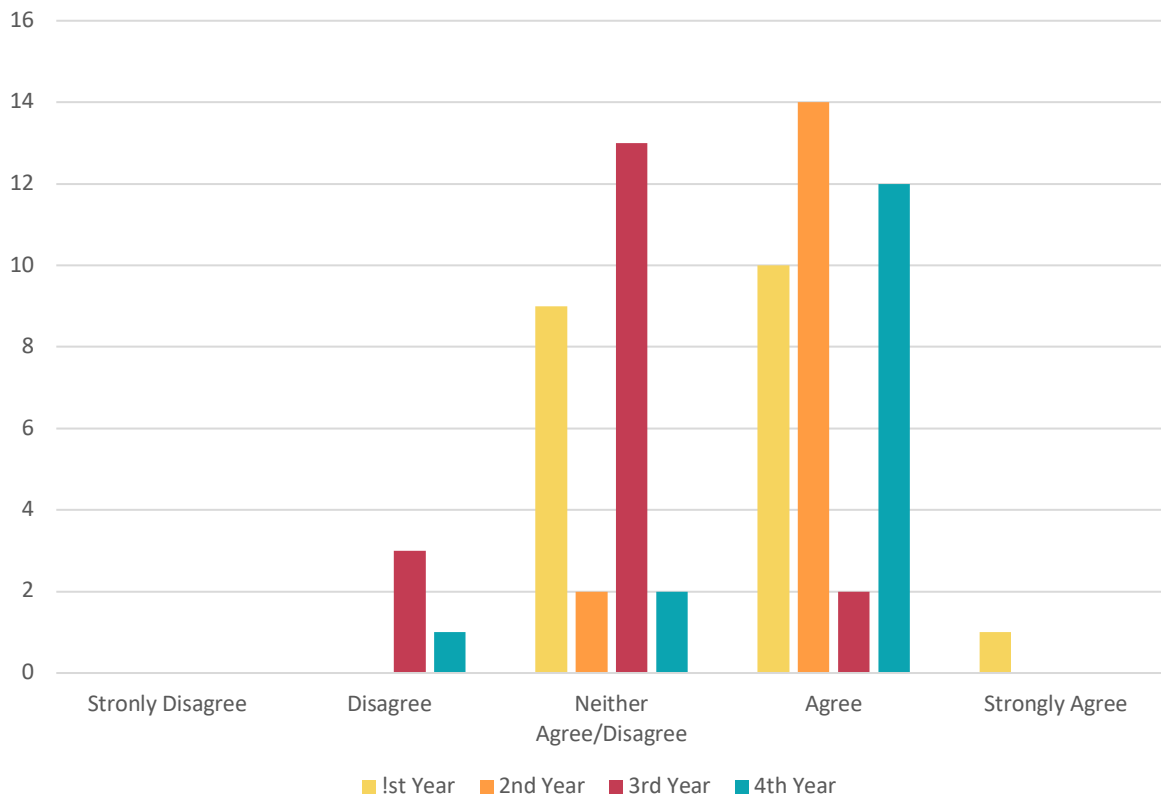


## **4.5 Theme 3: Pre-Service Teachers' Perception of Their Own Abilities**

Another important thing that came to light in the discussion between the SP tutors, was the fact that when speaking about literacy and numeracy as transversal skills to be developed in all programmes across the campus, they were referring to the development of personal skills as opposed to pedagogical skills. The distinction between personal and pedagogical, in terms of developing literacy and numeracy skills is explored in this section. The PS teachers were asked specifically about their personal literacy and numeracy skills, separate to their pedagogical skills. This distinction was made between the two aspects of developing these skills, firstly, to highlight the difference for the PS teachers participating in the study and secondly, to determine the area where this study could be most beneficial.

### **4.5.1 Confidence in Personal Literacy and Numeracy Skills**

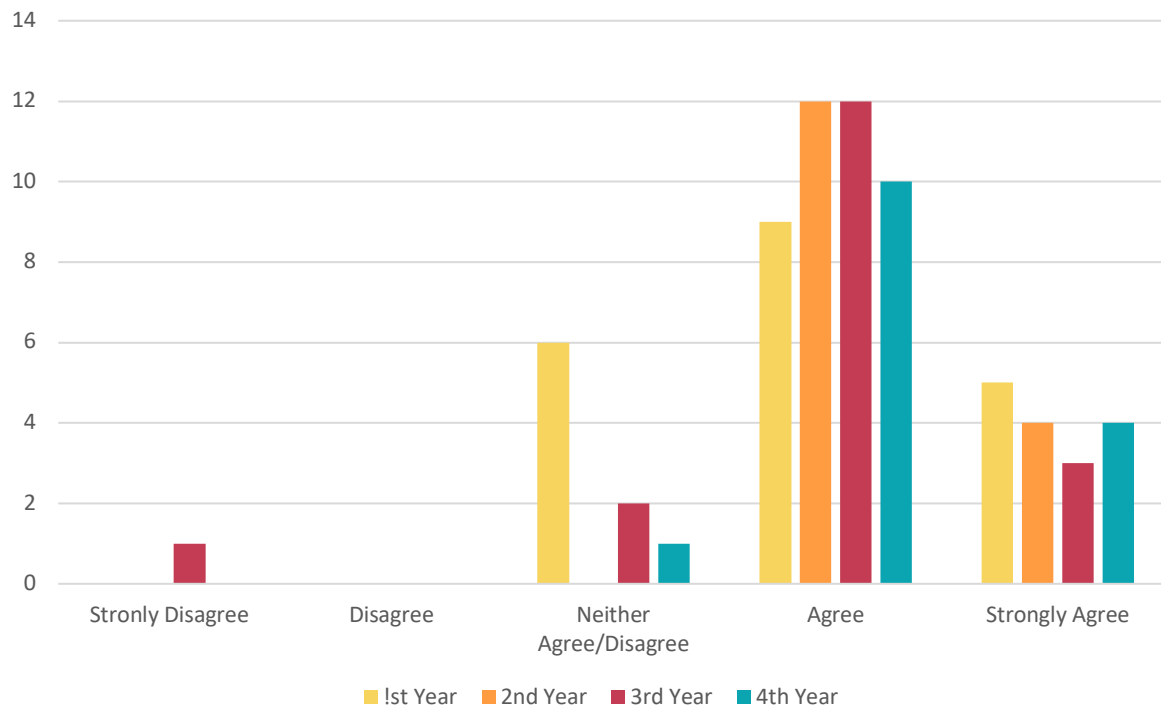
Question 3 in the PS teacher questionnaires asked participants to indicate, on a Likert scale to what extent they agreed or disagreed with the statement "I am confident in my own personal literacy and numeracy skills". The responses for literacy and numeracy were separated to show the differences between the PS teachers' confidences in these two skills (See Appendix 21). Figure 4-10 below presents the findings for confidence in literacy skills.



*Figure 4-10 Confidence in Personal Literacy Skills – All Year Groups*

*Source: Author's Original*

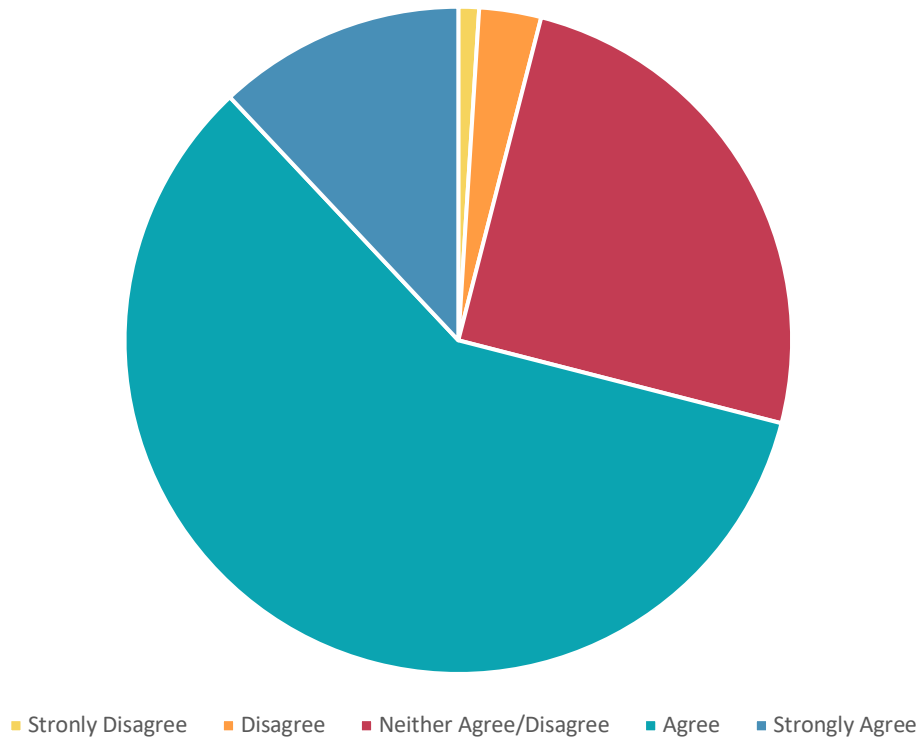
What is evident from the above figure is that a substantial proportion of the 4<sup>th</sup> year group (80%) agree that they are confident in their own literacy skills. When these findings are compared to figure 4-11 below, showing confidence in numeracy skills, the largest proportion of the same group (66%) agreed with the statement. However, a further 27% of this cohort strongly agreed to being confident in personal numeracy skills, when none of this group strongly agreed to being confident in personal literacy skills.



*Figure 4-11 Confidence in Personal Numeracy Skills*

*Source: Author's Original*

Another finding that emerged when comparing the two above figures, 4-10 and 4-11 for PS teachers' confidence in their personal literacy and numeracy skills, was that 66% of all PS teacher participants agreed/strongly agreed to being confident in literacy, whereas 85% of PS teachers agreed/strongly agreed to being confident in their numeracy skills. This finding shows that the PS teacher cohort on the case ITE programme feel, in general more confidence in their numeracy skills than in their literacy skills. The pie-chart below figure 4-12 demonstrates the PS teachers' confidence in both literacy and numeracy skills combined.



*Figure 4-12 Confidence in Personal Literacy and Numeracy Abilities*

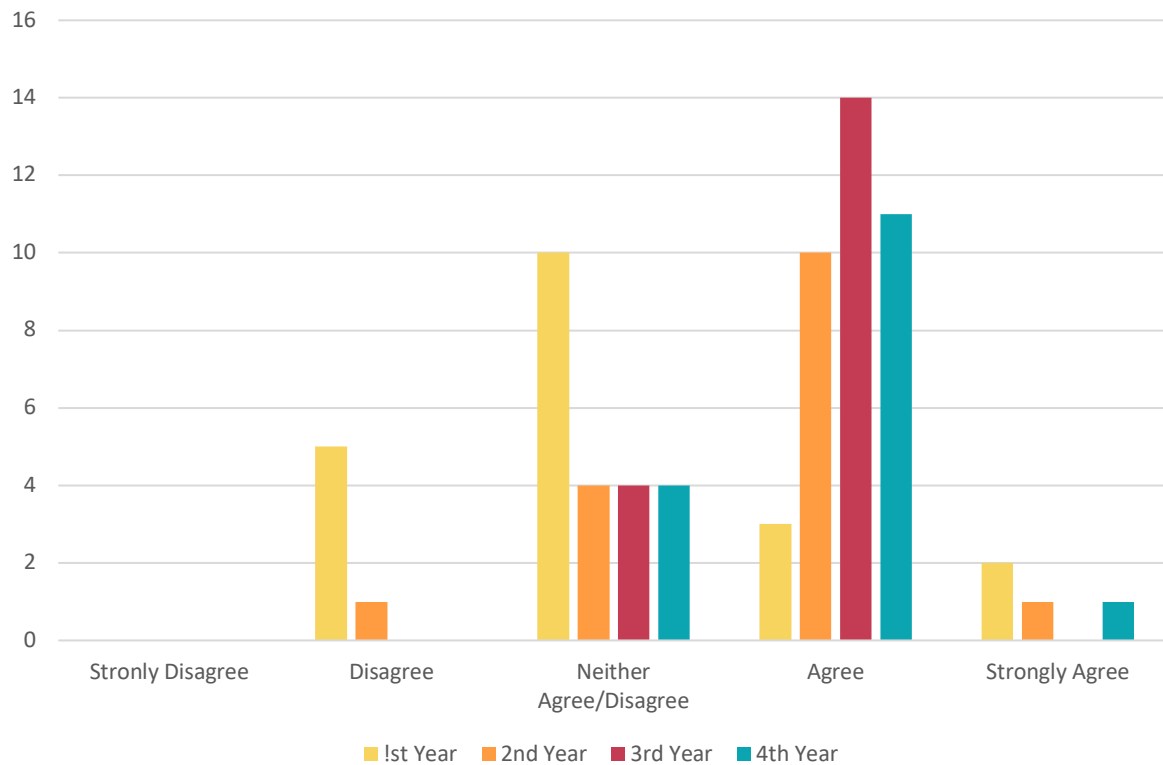
*Source: Author's Original*

The chart above shows 59% of PS teachers in this study agree that they are confident in both skills and 12% strongly agree with this statement, making up a significant 71% of the cohort. 25% of the PS teachers neither agreed nor disagreed with being confident in their skills and only 4% disagreed or strongly disagreed. Having presented the PS teachers' perceptions of their personal abilities with regards to literacy and numeracy, the following section addresses PS teacher confidence in the ability to develop these skills in the classroom, pedagogical literacy and numeracy skills.

#### **4.5.2 Confidence in Pedagogical Literacy and Numeracy Skills**

Similar to the discussion above, the PS teachers showed confidence in their pedagogical knowledge to develop literacy and numeracy within their classrooms. Question 6 in the PS teachers' questionnaires asked that they indicate on a Likert scale their level of agreement

with the statement “I am confident in teaching literacy and numeracy skills to my students”. The responses to this question are demonstrated in figures 4-13 and 4-14 below (See Appendix 22). Once again confidence in teaching literacy is shown separate to confidence in teaching numeracy, to highlight the difference between PS teachers' confidence in developing these two skills within the classroom. Figure 4-13 below shows PS teachers’ confidence in pedagogical literacy development.

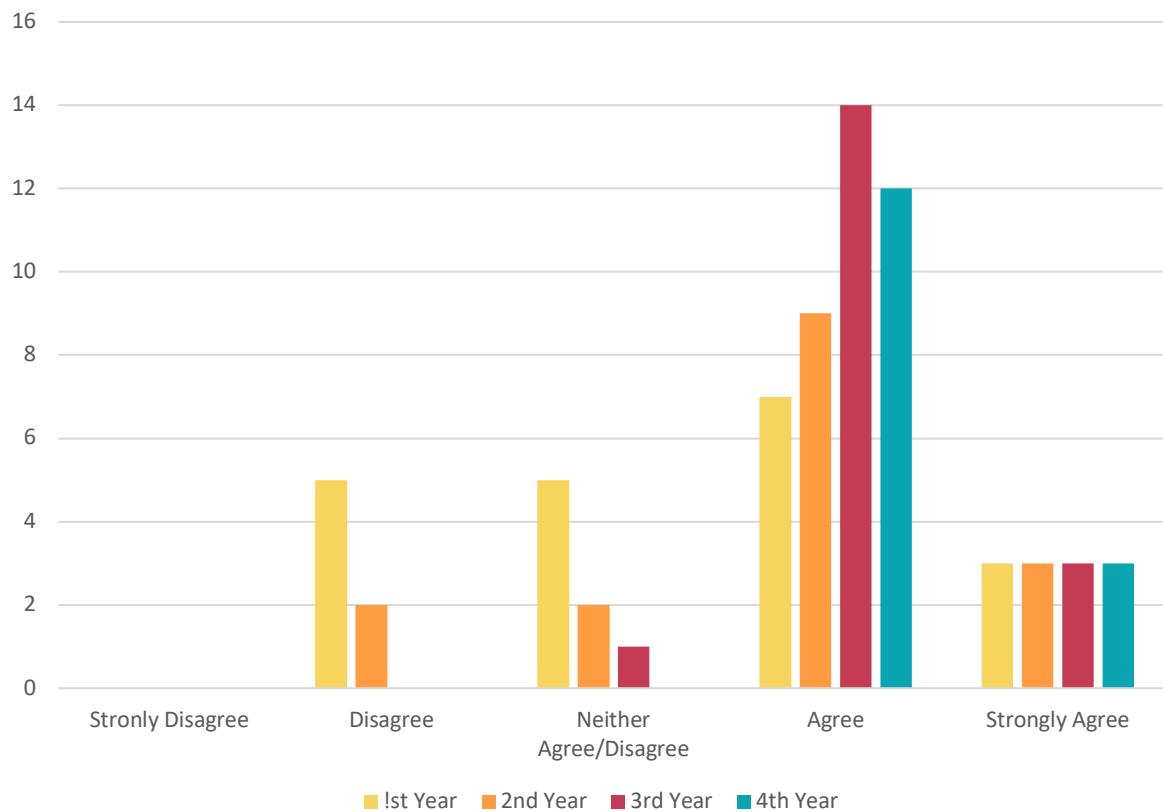


*Figure 4-13 Confidence in Pedagogical Literacy Development*

*Source: Author's Original*

What is initially evident from figure 4-13 is that the largest proportion (55%) of the PS teacher participants agree that they are confident in teaching literacy within the classroom. When compared to their confidence in their personal literacy skills (Figure 4-10), they were less confident in teaching literacy skills to their students, with a larger percentage of PS teachers indicating neither agree nor disagree (32%). Figure 4-14 below demonstrates PS teachers’

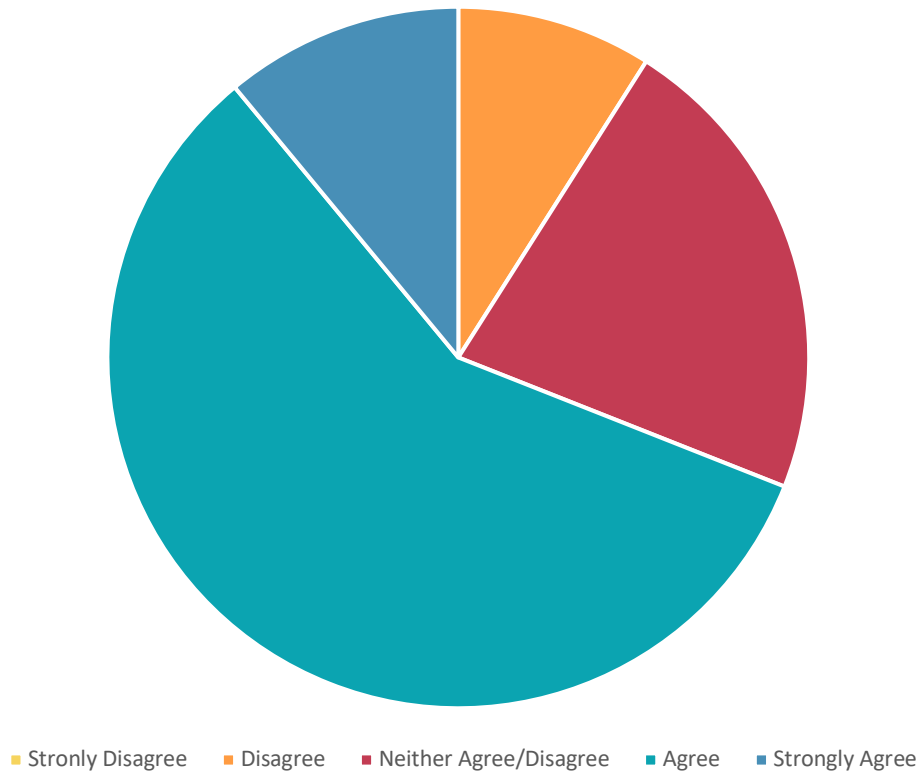
confidence to develop numeracy within the classroom, with 78% of the cohort agreeing (61% /strongly agreeing (17%) with the statement in the question.



*Figure 4-14 Confidence in Pedagogical Numeracy Development*

*Source: Author's Original*

Another significant finding from figure 4-14 above is that, out of the 16 4<sup>th</sup> year PS teacher participants, all responses were 'agree' or 'strongly agree' regarding confidence in pedagogical numeracy development. This was not the case with literacy development, with 25% of the 4<sup>th</sup> year cohort indicating that they 'neither agreed nor disagreed with the statement in the question. The pie-chart below figure 4-15 gives an overview of the PS teachers' confidence in literacy and numeracy combined.



*Figure 4-15 Confidence in Pedagogical Literacy and Numeracy*

*Source: Author's Original*

The most significant finding from presenting confidence in the two skills together in the above pie-chart, is the proportion that represents a lack of confidence to teach these skills in the classroom (9%), which compares to only 4% of the cohort indicating a lack of confidence in their personal abilities with literacy and numeracy (See appendix 23). However, it can be seen from figures 4-10 and 4-11 that, of these 13 responses, 10 were 1<sup>st</sup> years and 3 were 2<sup>nd</sup> years. None of these responses were from the 3<sup>rd</sup> and 4<sup>th</sup> year groups. This finding is expected as the analysis of the APS documents (Section 2.8.2) indicated an incremental approach to the delivery of strategies to develop literacy and numeracy in the classroom. The following section explores this comparison between personal confidence and pedagogical confidence further and analysing this topic in light of focus group discussions with SP tutors and management staff.

### 4.5.3 Comparing Confidences in Literacy and Numeracy

When literacy and numeracy confidences were compared directly, encompassing both personal confidence and pedagogical confidence, it emerged that the PS teachers felt more confident in numeracy development than literacy, with 82% agree/strongly agreeing to being confident in numeracy development, whereas 59% agree/strongly agree to being confident in literacy development (See appendices 23 and 24). Figure 4-16 below shows confidence in both skills, compared directly.

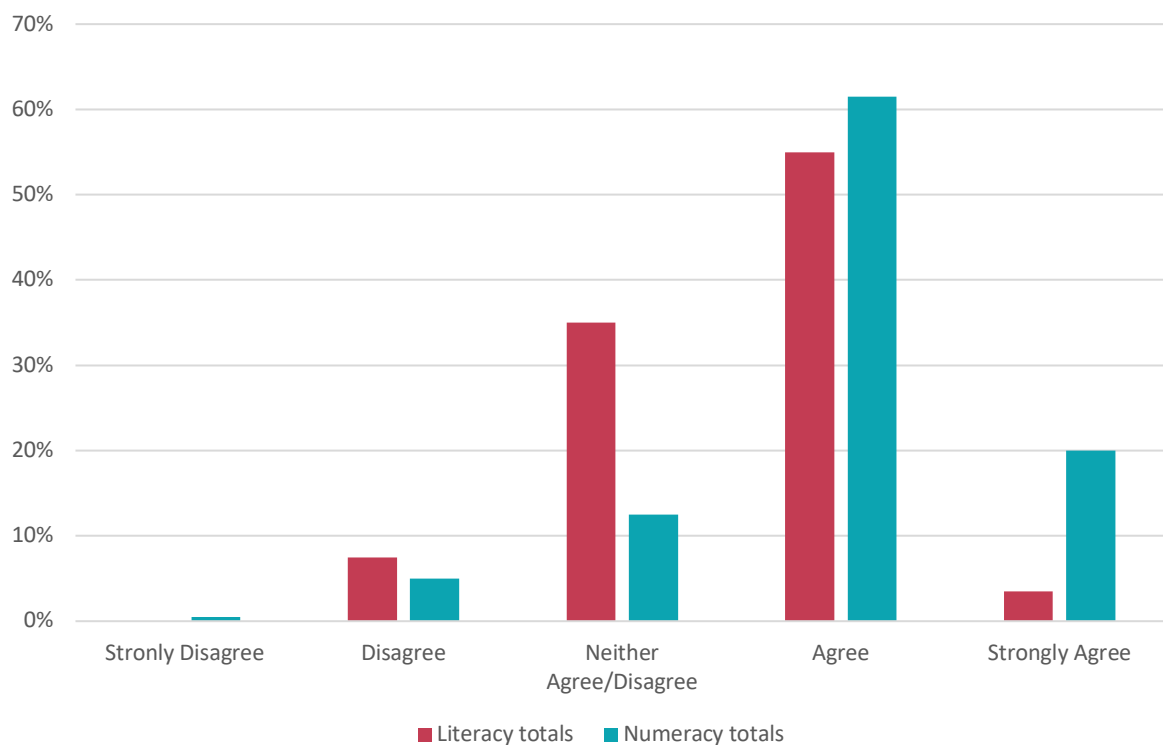


Figure 4-16 Comparison of Literacy and Numeracy Confidence

Source: Author's Original

The above figure shows the percentage of PS teachers that neither agreed nor disagreed with being confident in these skills. However, more chose this option for literacy (35%) than for numeracy (13%), indicating more uncertainty regarding developing literacy skills.



This finding was not surprising for SP tutors, with SP Tutor 3 stating that his students felt that “this [technical subject] is a class where I don’t have to worry about that [literacy]”. He adds that he found that students of technical subjects would not consider themselves “good at spelling” for example. However, the questionnaire responses indicate that this group felt ‘confident’ in their personal abilities. SP Tutor 2 suggested that from his many years of experience as a SP tutor, he found that there was:

no curiosity about literacy. Either in their own case or in being if you like a literacy tutor, integrating literacy in their classrooms. Certainly, curiosity on the mathematical numeracy line, because, again going back to the “I can see where that is more useful to me”. (*SP Tutor 2*)

To add to the argument that the PS teachers did not value personal literacy skills over numeracy skills, SP Tutor 4 described an instance when she witnessed a PS teacher misspelling a simple word on a board, on a SP visit. She said, “I’m sure I’m not the only person... where you’ve gone to a classroom and the teacher has put something on the board and it’s been spelled incorrectly” (SP Tutor 4). This conversation indicated a misalignment between the PS teachers’ confidence in their abilities in literacy and numeracy development, both personal and pedagogical, and that which the SP tutors were witnessing in both regards. This is explored further in the following section.

#### **4.5.4 Alignment of Pre-Service Teacher Confidence and Practice**

This misalignment between the PS teachers’ perception of their literacy and numeracy abilities and those of the SP tutor was discussed with SP tutors, management staff at GMIT and experts in the fields of literacy and numeracy. Numeracy Expert 1 spoke about a misalignment between student perception and reality which she had witnessed in her own research. She explained that she had given an assessment to test their numeracy skills. Once completed she had asked them to tell her if they believed that they had got the correct answer, which 78% of the students had said yes to, when in fact only 50% had got the question right. She added that many of the students did not understand the concept, and this explained the misalignment between the two percentages.

Literacy Expert 1 spoke about his students having an extremely basic understanding of the terms 'literacy' and 'numeracy'. Examples of numeracy in practice, given by his students were "sharing the date, page number of assignments or the task, or rather than it being really about... the broader skills of analysis and... noticing patterns" (Literacy Expert 1). He suggests that this was a lack of awareness on the PS teachers' part, of the various levels of literacy and numeracy. An example often given of low-level-literacy development can be the word wall, which featured prominently as an example of a teaching strategy to develop literacy given by the PS teacher participants completing the questionnaire. This relates back to this idea of a "traditional understanding" of literacy, such as recalling and spelling words. SP Tutor 2 commented on the fact that he was not witnessing any higher level integration of literacy within the lessons observed on school placement. He suggests that:

it seems to stop at a lower level, ... of the measurement. "Oh yeah, numeracies are important because we use a ruler, we measure" and not moving it into problem solving. I don't see a lot of it. (*SP Tutor 2*)

Adding that the word wall "appears to be put up there for the tutor". SP Tutor 5 agreed and suggested that there was not enough of an emphasis being put on recognising and highlighting good practice of developing literacy and numeracy when observing lessons. A participant in the management focus group, MS2 added the following to this observation:

Sometimes the student-teacher's own literacy, in particular, may be a barrier to engaging with this. So, students may think that they've actually very good English and they're not able to write the difference between 'there' and 'their', and very simple things because their language skills may not be developed well, or they may have a different perception of how good or bad they are. (*MS2*)

Murphy *et al.* (Murphy, Conway, Murphy, & Hall, 2014) explored the perceived poor personal literacy competences of PS teachers, suggesting that the concern was primarily an issue with their spelling ability. Interestingly, many of the questionnaire responses from the PS teachers in this study had spelling mistakes and grammatical errors, which indicate an incompetence in the most basic levels of literacy. However, this was not reflected in the findings relating to their perceived competence. In contrast to this, Literacy Expert 2 had experienced a different

perspective of this. When interviewed Literacy Expert 2 suggested that he was finding from his research in the area, that teachers were not aware of their own literacy level, suggesting that many felt that they were not particularly skilled when it came to literacy. However, he found that they were, in fact much more literate than they believed. He added that in contrast to this, some others were more illiterate than they believed. He was making the point that they were not aware of their own literacy. This view was echoed by some SP tutors, where there appeared to be evidence of good practice from several PS teachers assessed on school placement. However, these strategies that the SP tutor had witnessed did not appear in the PS teacher's lesson plans. This indicates that the PS teacher was unaware of it or did not recognise these activities to be developing literacy and numeracy.

Does this misalignment come from a lack of understanding of the terms "literacy" and "numeracy", a lack of cohesion between PS teachers and SP tutors understanding and expectation, or is it the PS teachers' lack of the ability to communicate the process via the lesson plans? There are two arguments to be made regarding this. The first being, if the students believe the definition of literacy, for example is as simple as reading and writing, which the questionnaire responses indicate that some do, and they can read and write, they will have confidence in their abilities. The second part of the same argument considers the following question, if the PS teachers and the SP tutors have different understandings of these term, will the expectations or requirements of the SP tutors ever be met? The following theme explores the strategies being implemented to develop literacy and numeracy in the classroom and the alignment between PS teachers' interpretations of these terms and the strategies being used.

#### **4.6 Theme 4: The Relationship Between Theory and Practice**

Objective 3 of this research sought to analyse the GMIT ITE programme documents, in order to identify what provisions are made for the inclusion of both the development of pre-service teachers' personal literacy and numeracy skills and their ability to teach literacy and

numeracy skills. The programme documents relevant to the case ITE programme were analysed and are discussed in section 2.8. This fourth theme explores the perceptions of the PS teachers regarding theory on literacy and numeracy development and their awareness of the presence of such training within the programme. Following that, is an exploration of the strategies being implemented by the PS teachers within their teaching practice.

#### 4.6.1 Literacy and Numeracy Theory, within the Programme

As previously mentioned, it was evident in the APS documents (See section 2.8.2) relevant to the case ITE programme, there was an incremental delivery of an awareness of teaching strategies to develop literacy and numeracy. This is reflected in the PS teacher questionnaire responses. Question 5 asked if the participant was aware of literacy and numeracy within the programme (See Appendix 25). The responses are presented in the following figure (4-17).

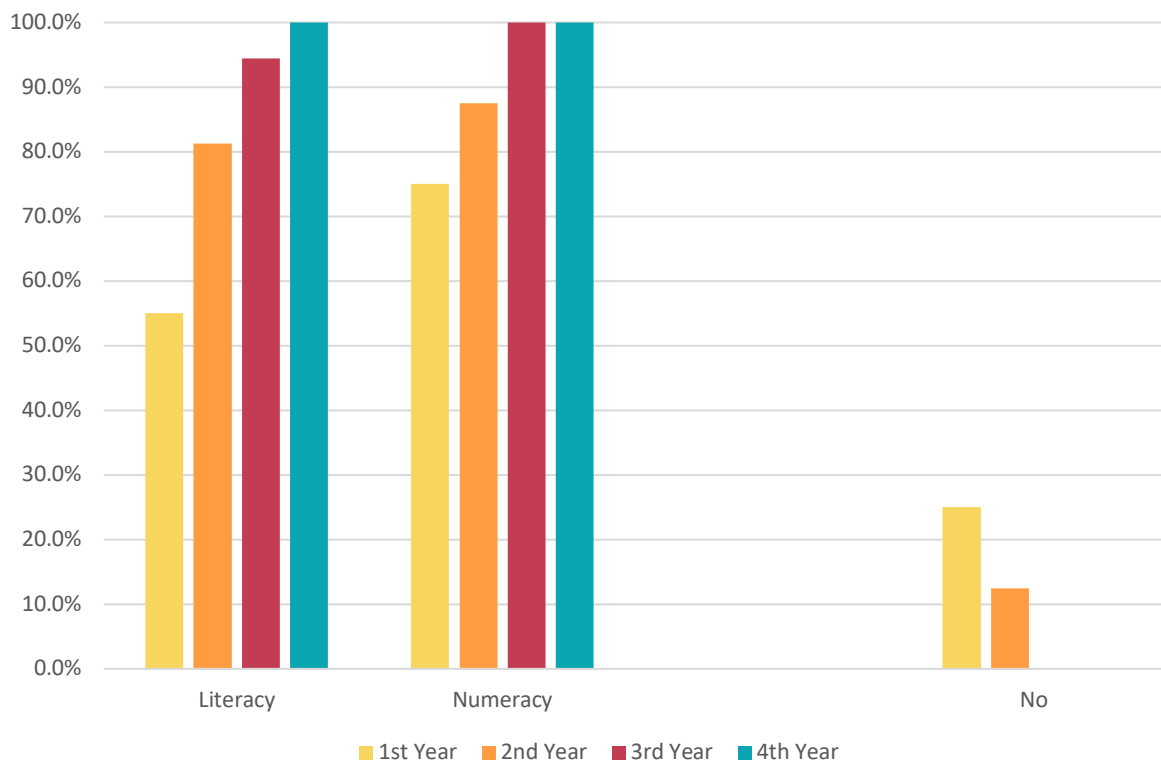


Figure 4-17 Pre-Service Teacher Perspectives of Literacy and Numeracy Development within the Programme

Source: Author's Original

The responses to question 5 indicated that many of the PS teachers who took part in the study, were aware of literacy and numeracy being explored within the different modules in the programme. Only 7 PS teachers answered 'no' to having learned how to promote and develop these skills within the programme, 5 of which were 1<sup>st</sup> years and 2 of which were 2<sup>nd</sup> years. Also evident from figure 4-17 above, is the higher percentage of PS teachers' awareness of numeracy development, when compared to literacy development across all year groups. However, this was not the case for 4<sup>th</sup> year PS teachers, where 100% of this cohort indicated an awareness of both literacy and numeracy development within the programme.

When asked to 'give examples', there was a mix between giving examples of teaching strategies they were using and some participants mentioning the modules within which they recognised developing personal and pedagogical literacy and numeracy skills. The PS teachers suggested modules such as "Applied Graphics", "Professional Studies", "Projects", "School-placement" and "Computers". The responses for this question would have presented a more detailed finding with regards to the modules in which PS teachers were recognising literacy and numeracy skills being developed, had it asked for specific modules within the programme

Considering the aim of the research was to explore how, and to what extent literacy and numeracy were being catered for within the programme, it has been established that it is present, but what was not clear was to what extent the PS teachers were making the link between the theory being taught on the programme and the application of the theory within their teaching practice. The following two sections explore the strategies being implemented by the PS teachers on school-placement.

#### **4.6.2 Literacy Development Strategies**

This section examines the responses from question 7 in the PS teacher questionnaires, which asked what strategies they were using in their school-placement to promote literacy within their lessons (See Appendix 26). The responses are presented in the following figure (4-18).

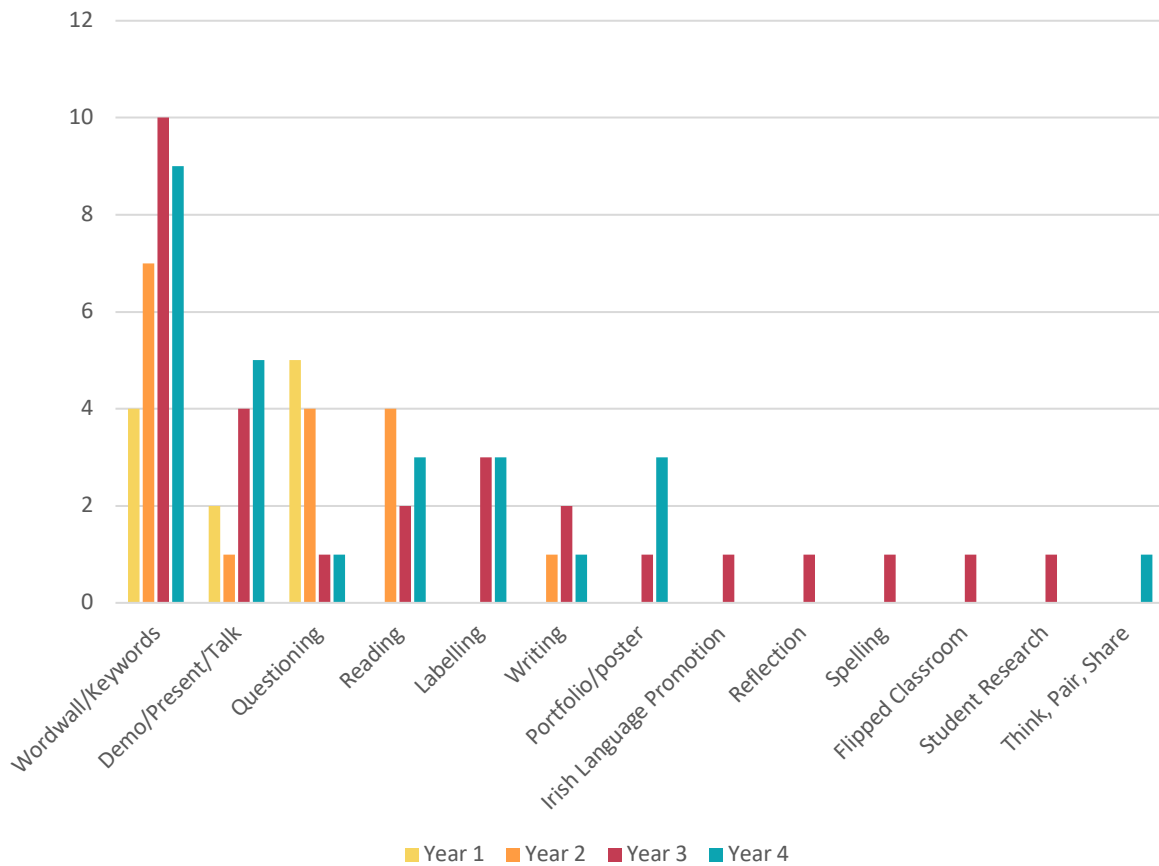


Figure 4-18 Pre-Service Teacher Strategies to Promote Literacy

Source: Author's Original

The above figure highlights the most frequent response to Q7, regarding the promotion of literacy skills in the classroom, to be the use of a 'word wall' or 'keywords (37% of responses). Figure 4-18 also presents a progression from the lower order strategies (word wall and keywords) to the strategies that engage the students in more critical thinking (reflection and research). Another finding to emerge from the above figure, 4-18, is that the strategies that evoke higher order thinking are more evident in 3<sup>rd</sup> and 4<sup>th</sup> year participants. The 3<sup>rd</sup> year participants suggested some other higher order thinking strategies to promote literacy in the classroom, which were Irish language promotion, creating portfolios, reflective practice, flipped classroom and student research, demonstrating a further developed understanding

of the term 'literacy development' and indicating a step-up in the literacy theory being taught in 3<sup>rd</sup> year. This was evident in the programme documents also, which is explored in section 2.8. The following section examines numeracy development with the classrooms, from the perspective of PS teachers on the programme.

### 4.6.3 Numeracy Development Strategies

Question 7 in the PS teacher questionnaires also sought to establish the strategies PS teachers were implementing in their teaching practice to develop numeracy amongst their students (See Appendix 26). Figure 4-19 demonstrates the responses to this question.

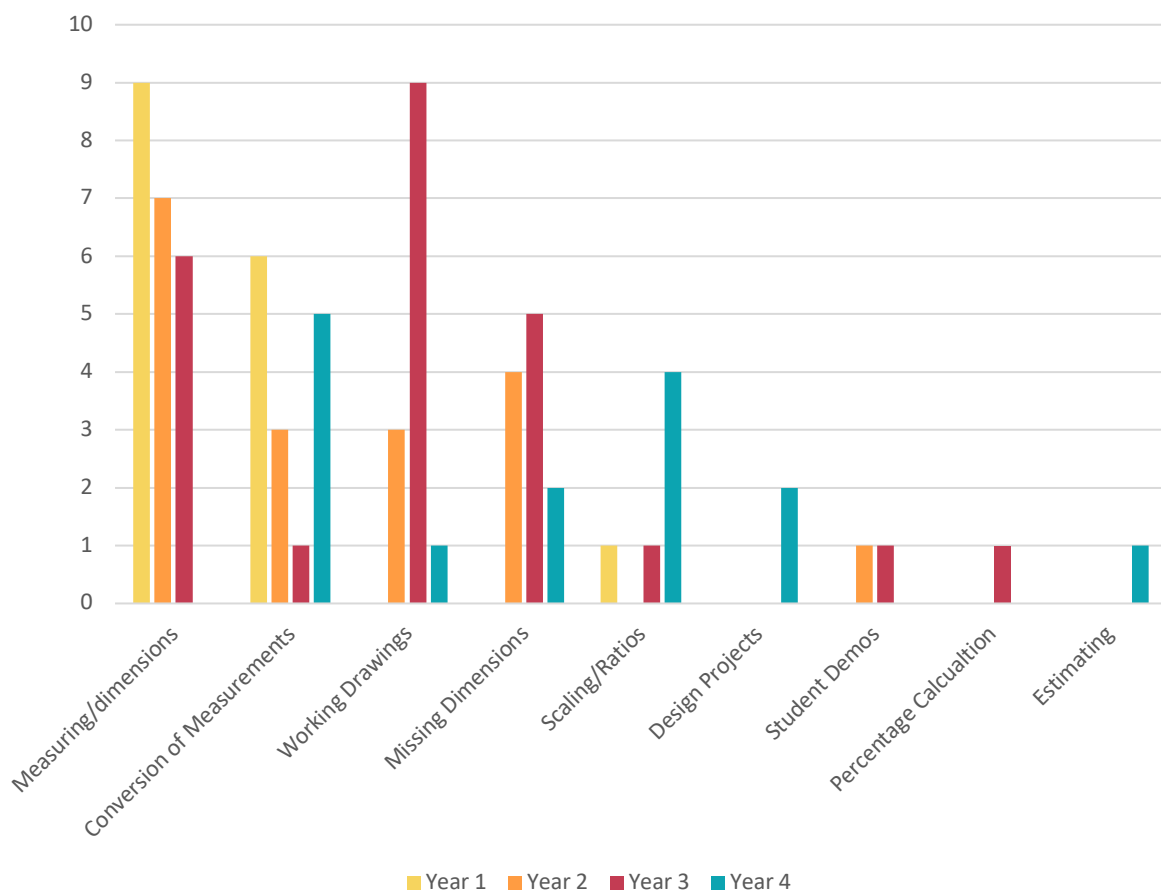


Figure 4-19 Pre-Service Teacher Strategies to Promote Numeracy

Source: Author's Original

‘Measuring’ and ‘reading dimensions’ was the most prominent response (30% of all responses), which is a considerable percentage considering only three of the year groups referred to this. The 4<sup>th</sup> year group did not include it in their responses. The only numeracy strategy that was mentioned by all year groups was the ‘conversion of measurements’, which made up 21% of all responses. Another finding from the above figure, 4-19 is that the 3<sup>rd</sup> year group suggested the largest number (32% of the total) of strategies to develop numeracy.

#### 4.6.4 Aligning Strategies with Definitions

When comparing the PS teacher interpretations of definitions of literacy and numeracy (Q2), with their strategies to promote the skills (Q7), there was a misalignment between the two. One example of this is shown in table 4-6 below.

Table 4-6 Aligning Responses - 4th Year Example

Define terms	Suggested teaching strategies
<b>Literacy</b>	
“Is the use of words & phrases to describe a person, place or think. The larger your knowledge base the better using of the world & critical thinking”	<ul style="list-style-type: none"> <li>• Word walls</li> <li>• Think, pair, share</li> </ul>
<b>Numeracy</b>	
“Is the use of numbers, measurement, problem solving, graph etc in a lesson & how that applies to the real world”	<ul style="list-style-type: none"> <li>• Measurement conversion (inches, mm, cm, m, Feet)</li> <li>• Parabolas</li> <li>• Scale (ratios)</li> </ul>

Source: Author’s Original

The definitions in the above sample, like many others do not align with their suggested literacy and numeracy strategies. This would indicate that the PS teachers are exposed to theory of literacy and numeracy development, but the challenge arises when PS teachers are expected to put that theory into practice. It appears, from some of the questionnaire responses that the PS teachers are not making this link between their interpretation of



literacy and numeracy, and their suggested strategies to teach these skills in the classroom. It was suggested by SP Tutor 3 that PS teachers will only make the link between theory and practice once literacy and numeracy are explicitly named within the lessons. This is echoed by several SP tutors in the focus group.

Although PS teachers are explicitly highlighting literacy and numeracy strategies in their lesson plans, SP tutors suggested that the PS teachers were not demonstrating the use of strategies, other than the lower level ones, such as the 'word wall'. SP Tutor 2 suggested that there was evidence of literacy and numeracy strategies being used on school-placement, it very rarely evolved into the area of problem solving. SP Tutor 3 suggested that the PS teachers that have "a poor understanding of the definition of literacy and numeracy" will copy what they see their lecturers doing and without a deep-rooted understanding of the meaning of literacy and numeracy, it would prove challenging for the PS teachers to recognise opportunities to develop these skills in practice.

From an analysis of the questionnaire responses regarding the PS teachers' suggested literacy and numeracy teaching strategies, and their respective definitions, it became evident that there was a misalignment between the two. The 3<sup>rd</sup> and 4<sup>th</sup> year groups had been exposed to more theory on ways to develop these skills within the classroom, which was evident from the suggested PS teacher strategies (See figures 4-18 and 4-19). However, without a deep understanding of what these terms mean as a teacher and not having the ability to recognise opportunities to develop these skills within their classrooms, PS teachers will not have the ability to adapt and develop their own strategies to suit the technical subject classrooms. The following section explores what literacy and numeracy might look like in the technical subjects.

#### **4.7 Theme 5: Literacy & Numeracy in Technical Subjects**

The technical subjects provide many opportunities to develop both literacy and numeracy, which is discussed in section 2.7 and this theme analyses the opinions of educational

professionals involved in this study, which includes SP tutors, management staff and experts in the fields of literacy and numeracy development.

Many associate the technical subjects with numeracy, and the findings from the questionnaire corroborated this, in that the PS teachers themselves indicated that they felt more confident in this area, as opposed to literacy development. This was confirmed in the focus group with SP tutors giving examples of where numeracy development was more evident within PS teachers' practices, although sometimes at a lower level. SP Tutor 1 suggested that there was "more respect for numeracy" within these subjects as the PS teachers were able to see its use. Whereas literacy appeared as something abstract and for 'practical teachers', this concept appeared to be outside of their requirements.

Within the SP tutor focus group there was reference made to the term "better with his hands", indicating that there is an inherited belief, from previous generations that a practical-subject teacher or student does not need to concern themselves with literacy. SP Tutor 3 suggested that it is this very idea that might attract a student to the subject or even a PS teacher to the profession. SP Tutor 3 also commented on the fact that a post-primary student, that might be less competent in their literacy skills might be encouraged to choose a practical-subject, such as the ones the GMIT ITE programme is training PS teachers to teach, adding that these have traditionally been perceived to be "low literacy subjects". SP Tutor 3 went on to question whether this belief influenced the "type of student or teacher who go into this area [technical-subject teaching]", suggesting that PS teachers of these subjects believe that they "don't need to worry so much about that [literacy]". However, the DES are trying to emphasis and instil a belief that every teacher is a literacy and numeracy teacher. SP Tutor 3 suggests that "by default, we are very strong in some of these areas [numeracy]". However, one requirement of being a teacher of any subject, is that you need to be strong in literacy development also. Literacy Expert 1 echoed this by adding that "just because you're hands-on, doesn't mean that you don't have to be literate to function in the world".

In contrast to the view that technical-subjects tend to be considered 'numeracy subjects', Literacy Expert 2 had an alternative view of woodwork and technical-graphics teachers specifically. He had studied post-primary teachers from different disciplines and found these subjects specifically to be rich in literacy. Literacy Expert 2 suggested that teachers of the technical subjects had "so much of their own language", adding that he felt that "it was much richer than some of the other subjects" that he had studied. To add to this view, in a focus group with a small management team (n=3), MS2 suggested a belief that technical subjects are more numeracy based than literacy based, while at the same time providing many opportunities to develop a vast range of skills. MS2 stated that, although not in obvious ways these subjects also provide opportunities to develop literacy.

The following section explores suggestions made by SP tutors and other education staff who participated in this study, on how to impact change to further facilitate literacy and numeracy development within the case ITE programme.

#### **4.8 Suggestions for Improvement**

This section explores suggestions made to assist the further development of both PS teachers' personal literacy and numeracy skills and staff practices in this regard.

Question 5, of the educational professionals' questionnaires (n=10) asked, "based on your professional experience, can you suggest ways to enhance the development of student-teachers' personal literacy and numeracy skills on the GMIT ITE programme?" (See Appendix 27). The responses are shown in figure 4-20 below.

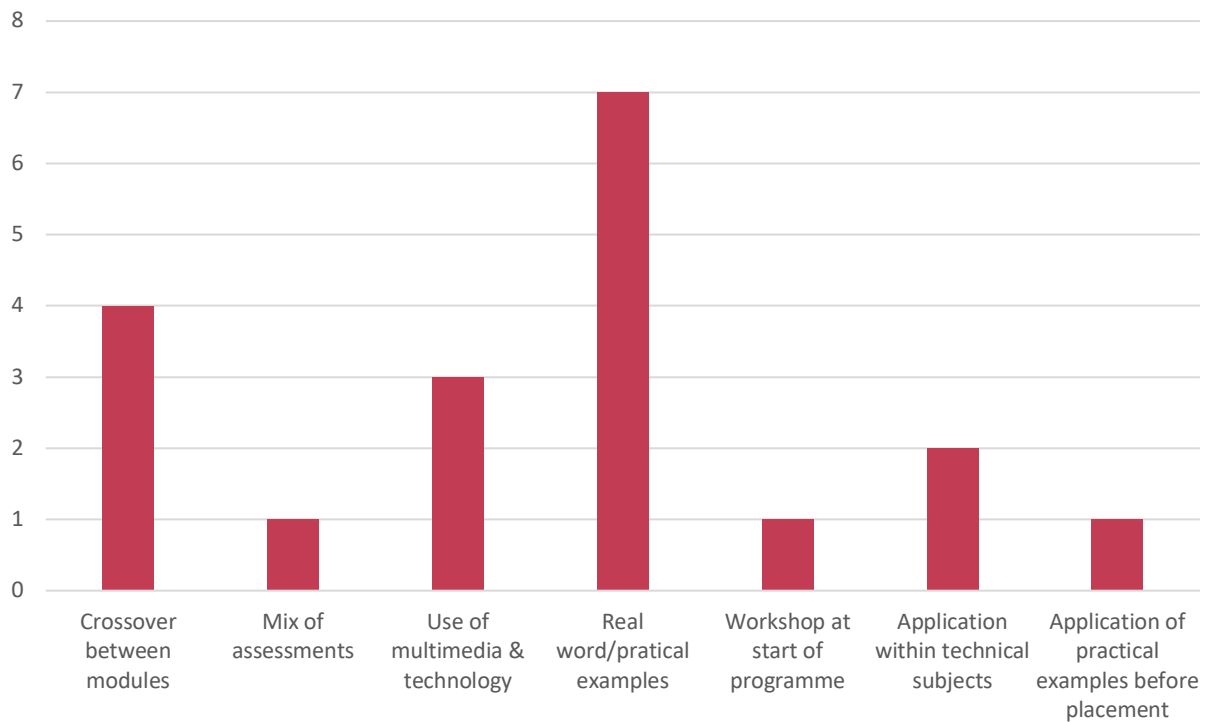


Figure 4-20 Educational Professionals' Responses

Source: Author's Original

Figure 4-20 above demonstrates that the educational professional participants' most popular response related learning to the real world, using practical examples. 'Making links to real life' was a common theme at the *Creativity and Innovation in the Classroom: Initial Teacher Education Conference* where this data was collected and may go some way to explain why this was the most common response to question 5. When these responses were separated into the four categories, personal literacy and numeracy development, pedagogical literacy and numeracy development, transversal literacy and numeracy and disciplinary literacy and numeracy, the two suggestions which fell into all four categories were using real world examples and a workshop at the commencement of the programme. This is demonstrated in table 4-7 below.

Table 4-7 Educational Professionals' Suggestions

Suggested Strategies	Personal	Pedagogical	Transversal	Discipline
Cross over modules	●		●	
Mix of assessment types	●			
Use of multimedia & technology	●		●	
Real world examples	●	●	●	●
Workshop at start of programme	●	●	●	●
Application models examples pre- practice	●	●		●
Application in technical subjects		●		●

Source: Author's Original

When these findings are compared to the responses from SP tutors' questionnaires, when asked "what changes should be considered to further facilitate literacy and numeracy development on the ITE programme at GMIT?" (Question 8), there is a distinct division between training for staff and strategies to assist the PS teachers in table 4-8 below.

Table 4-8 School-Placement Tutor Suggestions to Facilitate Improvement in the Programme

Suggested Strategies	Programme Staff	Pre-service Teachers
Guest experts, Annually	●	●
Whole team approach, programme board level		●
Staff training – School Placement Tutors and lecturers – expand to whole campus (staff and pre-service teachers)	●	●
Starter experience – practice specific examples		●
Explore creative methods of best practice strategies		●
Observation and reflection focusing on literacy and numeracy		●
Assist pre-service teachers in academic writing – peer assessment		●
Cooperative learning model		●
Staff modelling best practices	●	

Source: Author's Original

When the responses are separated into the two categories, assisting staff and assisting PS teachers, table 4-8 above shows that many responses indicated a belief that more could be put in place to assist PS teachers to further improve literacy and numeracy development within the programme. In the SP tutor focus group, SP Tutor 5 suggests, by way of assisting PS teachers to recognise and implement literacy and numeracy strategies in practice, that the PS teachers are given a task of evaluating and reflecting on their own classes and “identify and extract where they see numeracy and literacy in action”. It was suggested that a task such as this would engage the PS teachers and give them ownership of this learning. In an ITE programme in a University of Cork, there is currently a PS teacher assignment similar to what was suggested by SP Tutor 5 above, the PS teachers create a portfolio which includes four different reflections on the elements of literacy. The course coordinator for that programme suggested that completing that task and engaging in tutor feedback on practice, enabled the PS teachers to make that important link between theory and practice.

Although table 4-8 above indicates that the SP tutors who participated in this study suggested more strategies to assist PS teachers than Staff, staff training, and staff modeling were discussed as part of the SP tutor focus group also. SP Tutor 2 suggests that improving literacy and numeracy standards is the responsibility of the lecturers and tutors within the programme, adding that teaching by modelling good practices would impact this. SP Tutor 1 adds to this, saying “what we’re talking about is communication. The integration of good techniques and good standards into communication is what we are trying to imbue. Modelling is a huge part of this. Frequency of high standards and intolerance of low standards”. SP Tutor 2 suggested that the PS teachers are not seeing their own lecturers on the ITE programme implementing strategies to develop literacy and numeracy within their lessons. On the occasions when lecturers on the programme are implementing strategies to develop literacy and numeracy, they may not be named as such and therefore, PS teachers are unaware of the lecturers doing so. SP Tutor 2 went on to suggest that “as teachers across all disciplines, we should demonstrate ... in a lecture hall with them [the PS teachers], the integration of literacy and numeracy in our own teaching”.

The findings from this section indicate that there are many ways to assist further improvement in literacy and numeracy development for both the PS teachers and for the staff training them. The last section in this chapter concludes the findings and analysis of this study.

## **4.9 Conclusion**

The objective of this chapter was to present the research results and findings, partly addressing objective 4: to design and conduct a primary research case study of the ITE programme at GMIT, with respect to literacy and numeracy competencies and training. This objective sought to explore participants’ interpretation and understanding of the terms ‘literacy’ and ‘numeracy’, PS teachers’ literacy and numeracy abilities, and the inclusion of these skills in the ITE programme. Regarding interpreting the terms ‘literacy’ and ‘numeracy’, it can be concluded that there is a certain degree of uncertainty, among the PS teachers

around what these terms mean for both today's society and within the context of an ITE. The findings demonstrated an incremental approach to the delivery and intensity of literacy and numeracy training within the programme, which corroborated the findings of the documentary analysis (See section 2.7).

Theme 2 related to literacy and numeracy within ITE and the findings indicated that the participants were aware of these skills being developed within the programme, but also indicated an awareness of their responsibility as future post-primary teachers to develop literacy and numeracy skills. Theme 3 related to PS teachers' confidence in both their personal literacy and numeracy skills, and their ability to develop these skills in their classrooms. The findings from the questionnaires suggested confidence in both. However, this confidence did not align with SP tutors' perception of PS teachers' abilities in practice. Although some PS teachers have a good understanding of what literacy and numeracy are, their suggested strategies to develop these skills do not align with their definitions, demonstrating a misalignment between the theory being taught and the practical side of developing strategies. The SP tutors indicated that developing numeracy was intrinsic to technical subjects. However, there were mixed opinions on the place of literacy development within these subjects. An inherited belief that technical subjects may be considered low level literacy subjects explained the findings regarding SP tutors' perceptions regarding PS teachers' competence. However, literature suggests that there is potential in these subjects to engage students in higher order thinking and problem solving, through design but also through the language specific to these subjects.

Suggestions were made by SP tutors and other educational professionals to improve PS teachers' personal skills along with their skills to develop students' literacy and numeracy in the classroom, but also more training for both teacher educators and PS teachers on the programme. These suggestions have been considered and form the basis for the choice to develop a series of training workshops, which will to address the above mentioned. The following chapter discusses the findings in this section in relation to literature in the field of literacy and numeracy development.



## **5 Discussion**

### **5.1 Introduction**

This research project sought to undertake a mixed method case study to analyse the provision of developing literacy and numeracy skills for PS teachers enrolled on the case ITE programme at GMIT. This chapter continues to address objective 4), to design and conduct a primary research case study of the ITE programme at GMIT, with respect to literacy and numeracy competencies and training. Chapter 4 presented an analysis of the research results and findings of this research study, and this chapter will explore the significance and implication of those findings, addressing each theme in turn. Each section will begin with a concise summary position of the results, findings, and analysis from the previous chapter (4), progressing to discussing the themes in dialogue with literature. Each section will finish with a discussion on how these themes will be incorporated in the research output, a series of literacy and numeracy training workshops (chapter 6), with a view to objective 5), to develop a series of training workshops for teacher-educators and pre-service teachers, in order to create awareness of the complexity of literacy and numeracy skills and to aid the embedding of both skills into the teaching of technical subjects.

### **5.2 Theme 1: Defining Literacy and Numeracy**

Theme 1 sought to establish the participants' understanding of literacy and numeracy development, through defining the terms literacy and numeracy. The research findings revealed a degree of uncertainty around defining literacy, with the PS teachers using the words 'read', 'write' and 'understand', indicating a more traditional understanding of what literacy means in the context of ITE. However, PS teachers were more aware of numeracy development within the programme and the value of this, as opposed to their understanding and awareness of literacy development.

As literature suggested that there was no universally accepted definition for either (Cambridge Assessment, 2013; Kangan, 2019), coupled with literacy and numeracy development being addressed explicitly in only a small number of modules on the case ITE programme (See section 2.8.1), these results were as expected. Although literacy and numeracy development is intrinsically included in the teaching of all modules in theory (See section 2.8.1), the development of literacy and numeracy skills and pedagogical knowledge of these skills is not being emphasised enough to impact the standards of literacy and numeracy development within the programme. The findings suggest that there are differing opinions, among the participants in this case study on the relationship between the two skills, which aligns with what was found in the literature on the topic. Several sources suggest that these two skills are two sides of the same coin and reflect each other, through different forms, mathematical and textual, while others suggest that literacy refers to competencies, of which numeracy is one (Hippe, 2012; Frejd & Geiger, 2017; Goos, et al., 2020; Hoogland, 2003).

The significance of these findings is not the lack of understanding or awareness regarding the development of literacy and numeracy, but the importance of clarity around what these terms should mean in the context of teaching these skills within the technical subjects. Without this clarification, neither the staff, nor the PS teachers will be enabled to progress to a deeper contextual understanding of these terms and this confusion will filter through to the expectations of PS teachers involved in the ITE programme. The implications of these findings are that they highlight the importance of developing a foundation of knowledge around the development of both literacy and numeracy skills and pedagogical knowledge of developing these skills, among the PS teachers enrolled in the case ITE programme, having the potential to impact achieving the goals of the DES (DES, 2011) to improve literacy and numeracy standards among Ireland's young people.

These findings contribute to the output of this research study, the series of three literacy and numeracy training workshops, as this theme, defining literacy and numeracy, has been incorporated into workshop 1 and provides the foundational knowledge, on which the remaining workshops build (See table 6-1). Two activities have been designed to allow

participants to firstly, research the topic, receive input from the workshop facilitator, and finally, develop definitions for both literacy and numeracy working in groups, which will be shared with the all workshop participants, using presentations and reflective discussions (See section 6.5.1).

### **5.3 Theme 2: Literacy & Numeracy within Initial Teacher Education**

Theme 2 addresses literacy and numeracy development within the context of ITE and explores the PS teachers' perspectives on the responsibility of a post-primary teacher regarding the development of these skills. The findings in this theme indicated an awareness among the PS teachers of their responsibility to develop literacy and numeracy in their teaching, with 85% of them suggesting that their own literacy and numeracy skills were developed at either primary or post-primary. It was found that many of the PS teachers were aware of when their literacy and numeracy skills were most developed, namely through both primary and post-primary education.

This finding was unexpected as a previous study conducted with post-primary teachers indicated that there was a belief that literacy development, in particular was the remit of primary-school teachers (Murphy, Conway, Murphy, & Hall, 2014; MacMahon, 2014). The DES also emphasised the need to make literacy and numeracy development a priority within all classrooms, from early education to adult education (DES, 2011).

The second aspect that was explored under the theme of literacy and numeracy development within ITE, was the distinction between developing transversal literacy and numeracy skills and developing these skills specific to the discipline. What emerged from the conversation regarding literacy and numeracy development within ITE was that many participants were not making the distinction between transversal skills (universal literacy and numeracy skills) and disciplinary literacy and numeracy (those skills that are specific to each discipline). As explored earlier in the literature, Caena and Garbe suggest that making this distinction at the development stage of teacher training will mould and influence how a PS teacher develops

their teaching philosophy (Caena, 2014; Garbe, 2017), emphasising this as crucial to becoming an effective teacher of these skills. Once again, creating clarity around these two different aspects of developing these skills stands to benefit both the PS teachers and the staff on the case ITE programme. The implication of creating an awareness of the development of transversal literacy and numeracy skills, as distinct from disciplinary skills is that a PS teacher can then begin to recognise where they are already doing this and equally, where they may not be. By developing this aspect of a teacher's philosophy, they will be enabled to critically reflect on their own practices and adapt in order to improve their practices. However, it was indicated that plans are currently being developed to address literacy and numeracy development on a whole campus level. It was not indicated whether that strategy to address these skills across disciplines included training for staff and SP tutors as well as students.

It was found that SP tutors were not obliged to complete any training regarding tutoring PS teachers on school-placement. However, some SP tutors had taken advantage of training opportunities to develop their knowledge in the field of literacy and numeracy development. Although there was little training made available to SP tutors, the findings indicated a high level of confidence among all SP tutors in their ability to tutor and assess PS teachers' literacy and numeracy development. The significance of this finding, along with the earlier finding of a lack of clarity and ease for PS teachers to identify examples of literacy and numeracy development within their own teaching and within the programme, is that there is a misalignment between the expectations of SP tutors and PS teachers, on what is considered to be sufficient practice regarding the development of literacy and numeracy skills in teaching practice. This finding will potentially highlight the misalignment between the two cohorts of participants, SP tutors and PS teachers, and could give more responsibility to the SP tutors to actively mentor PS teachers in their development of literacy and numeracy skills in practice.

The findings relating to theme 2 of this research, literacy and numeracy in ITE, highlight a number of important aspects which informs the design of training workshop 2, namely the distinction between transversal and disciplinary literacy and numeracy, and the distinction between the development of personal literacy and numeracy, and pedagogical literacy and

numeracy. Reflection on these four aspects of literacy and numeracy development within the context of ITE, will develop an awareness among participants of these elements in their practices. The activities which incorporate this theme will include a multiple-choice questions, to be completed using an online polling application. These activities are not designed to assess participants, but to develop an awareness of what the terms, 'transversal', 'disciplinary', 'personal' and 'pedagogical' mean and also see evidence of these different aspects of literacy development in the ITE programme (See table 6-1 and section 6.5.2)).

#### **5.4 Theme 3: Pre-Service Teachers' Perception of Their Own Abilities**

Theme 3 explored the perceptions of PS teachers regarding their own literacy and numeracy skills, alongside their perceptions of their pedagogical knowledge of literacy and numeracy development. The findings showed that most PS teachers felt 'confident' or 'very confident' in their own literacy and numeracy skills, whereas a smaller percentage expressed such confidence in their pedagogical knowledge of literacy and numeracy development and their abilities to implement strategies to develop these skills in the classroom. When these two findings were viewed in conjunction with each other, only a small percentage (9%) indicated a lack of confidence in both personal skills and pedagogical development of these skills.

There was an expectation that the 3<sup>rd</sup> and 4<sup>th</sup> year PS teachers, as opposed to the 1<sup>st</sup> and 2<sup>nd</sup> year PS teachers would demonstrate more confidence in their pedagogical knowledge of literacy development and the implementation of strategies to develop these skills in the classroom. This was as expected because the literature relating to the case ITE programme (See section 2.8.2) indicated an incremental approach to pedagogy of literacy and numeracy development, increasing from 1<sup>st</sup> year to 4<sup>th</sup> year. However, it was not anticipated that such a significant percentage of the cohort of PS teachers would show such high levels of confidence in both their literacy and numeracy skills and their ability to teach these skills within the classroom.

As explored earlier, Murphy *et al.* (2014) also witnessed poor personal literacy skills among PS teachers, including that there were issues such as spelling and grammatical errors, but the same PS teachers had little awareness of this lacking. This misalignment between PS teachers' perceptions of their abilities, together with what was being witnessed by SP tutors echoed what the literature suggested (Sellings, Felstead, & Goriss-Hunter, 2018). A study conducted in Australia, on PS teachers' self-efficacy and competence in literacy development (Bostock & Boon, 2012), found a similar misalignment between the two, suggesting that, similar to research findings here there was a discrepancy between the PS teachers' beliefs regarding their abilities to teach literacy and numeracy, and the confidence that staff on the programme had about how prepared the PS teachers were in this regard. This finding was further compounded by the misalignment between the PS teachers' definitions of literacy and numeracy, and the teaching strategies they were suggesting to develop literacy and numeracy within the classroom. The relationship between the theory being taught in the modules about developing literacy and numeracy in the classroom, and the practical side of developing strategies did not align.

These findings suggest that PS teachers' confidence in their abilities does not correlate with their levels of competence to develop literacy and numeracy. These findings also suggest that this lack of self-awareness is based on inaccurate or incomplete information. Bostock & Boon suggest that a finding such as this may be because of generalised beliefs about literacy, and their own understanding of the term (2012). This finding clearly indicates the level of training that is needed to ensure a sufficient standard of competency among PS teachers on the case ITE programme. There is currently no literacy and numeracy assessment for PS teachers in Ireland (The Teaching Council, 2011, p. 19). However, the teaching council has suggested that the inclusion of such an assessment should be decided at an institution level (The Teaching Council, 2020). Several ITEs are developing modules specifically to address the development of literacy and numeracy skills among their PS teachers. Short of an assessment of literacy and numeracy skills as an entry requirement for ITE programmes, the development of

modules or training workshops may be the most appropriate way to ensure a minimum standard among PS teachers.

Like theme 2, theme 3 is also incorporated into workshop 2. The findings from theme 3, PS teachers' perception of their own abilities, indicated that many PS teachers lacked an awareness of their literacy and numeracy development abilities. This needed to be addressed in the series of training workshops as without this awareness, PS teachers reduce the possibility of improving in this area. Participants will engage in a sample ITE literacy and numeracy assessment, using an online surveying application. Once again, this activity seeks to develop an awareness of one's abilities, rather to test them. This theme brings the training workshop 2 from developing foundational knowledge, to developing a 'sense of self' among its participants (See table 6-1 and section 6.5.2).

### **5.5 Theme 4: The Relationship Between Theory and Practice**

This theme addresses the relationship between the theory being explored regarding pedagogical knowledge of developing literacy and numeracy skills in practice, and the practical strategies being implemented by PS teachers in the case ITE programme. The results of this study found that theory on the development of literacy and numeracy skills is present in the programme, varying in degrees between modules. However, although PS teachers can list several teaching strategies which will aid literacy and numeracy development, there appears to be no link between those teaching strategies and their understandings of the terms 'literacy' and 'numeracy'. PS teachers' awareness of the presence of literacy and numeracy pedagogy was more evident in 3rd and 4th year participants. However, this was expected as that was indicated in the programme documentation explored (See section 2.8), which indicated an incremental approach to the delivery of such instruction.

These findings indicate that PS teachers may benefit from, firstly, understanding and appreciating what literacy and numeracy development means in the context of both teaching, but also in their specific subjects. The significance of these findings is that a substantial

percentage of PS teachers in this research study, have not yet developed the ability to recognise opportunities to develop literacy and numeracy within their classrooms. They are still being trained how to develop and reflect on their own practices, which will enable them to take appropriate actions to ensure that their students can engage in the development of literacy and numeracy skills through higher order thinking and problem solving. PS teachers should be able to develop their own teaching strategies to suit the technical subject discipline in which they are teaching. A literacy model and a numeracy model are highlighted in section 2.6, as one method to address the challenge of ensuring that PS teachers can become aware of their abilities and their practices in developing literacy and numeracy (Freebody & Luke, 2003; Goos, et al., 2020). The findings in this section have important implications for the direction that this research project will go. The need for further training to assist PS teachers to make that connection between theory and practice formed the basis for the output for this study. The findings in this theme have influenced and impacted choices made regarding the design of the training workshops and the need to included activities which will enable participants to engage in the development of such a teaching aid.

The findings from theme 4, literacy and numeracy in theory and practice, highlighted the importance of, firstly, gaining knowledge regarding the pedagogy of literacy and numeracy development, but also to be able to know how to put that knowledge into practice. These findings contribute the design of training workshop 3 (See section 6.5.3), which includes problem-based learning activities which engage participants in the development of an aid to assist teachers in the embedding literacy and numeracy in their classrooms (See table 6-1). These will be based on the two models highlighted in this research (See section 2.6.1 and 2.6.2). The active participation in the creation of these teaching aids will give participants the opportunity to implement the new knowledge that they constructed in the workshops 1 and workshop 2.



## **5.6 Theme 5: Literacy & Numeracy in Technical Subjects**

Theme 5 explored how the participants of this study perceive the technical subjects regarding their strengths and weaknesses in developing literacy and numeracy. It was found that SP tutors and expert interviewees could easily recognise the place of numeracy within these subjects. However, opportunities to develop literacy within the teaching of the technical subjects was not as obvious. This was confirmed by the PS teachers' indication of a higher level of confidence in developing numeracy over literacy skills. SP tutors discussed a perceived inherited belief that technical subjects were considered low literacy subjects, and that this may have impacted the cohorts that enrol on a teacher education programme for technical subjects. However, literature suggests that there is potential in these subjects to engage students in higher order thinking and problem solving, through design but also through the rich language specific to this discipline (DES, 2011; NCCA, 2020; Schooner, Nordlöf, Klasander, & Hallström, 2017). Literature also suggests that technology subjects provide such rich opportunities to develop these skills that similar discipline subjects are being designed for primary schools (Firman, Rustaman, & Suwarma, 2015; Asghar, Ellington, Rice, Johnson, & Prime, 2012).

The significance of the findings in this section is that there are numerous opportunities within technical subjects to develop literacy and numeracy, though they are not always obvious. The practical elements of technical subjects make them reflect both workplace scenarios and society in general. Developing literacy and numeracy in the 21<sup>st</sup> century requires the close correlation between what is being taught in the classroom and participation in society, which engagement in technical subjects corroborates. The correlation between life outside the classroom and the language specific to technical subjects has the potential to engage students in seeing the relevance of what they are learning. The findings of this study indicated that PS teachers were not making this connection and were not fully aware of the potential within these subjects specifically to develop literacy and numeracy. However, through developing an awareness among the PS teachers of the opportunities to promote, literacy as well as numeracy skills, these subjects could take advantage of the elements already present

in these subjects, such as problem solving, critical thinking and design-based learning to foster an approach suited to the PS teachers on the case ITE programme.

The findings from theme 5, literacy and numeracy in the technical subjects, suggested that elements of teaching the technical subjects, such as their practicality and their relevance to real life, were not being recognised and therefore, not being utilised to their full potential. Training workshop 3, addresses theme 5 findings by engaging participants in reflecting on and identifying teaching strategies commonly used in technical subjects and more specifically in their classrooms. These activities will encourage participants to discuss and share their experiences and collaborate to highlight elements of their specific subjects, which develop literacy and numeracy (See table 6-1 and section 6.5.3).

## **5.7 Conclusion**

The aim of this chapter was to explore the results and original findings of this research project and discuss them in conjunction with relevant literature on the topic, addressing and concluding research objective 4 (See section 1.2).

Theme 1 addressed literacy and numeracy definitions and it emerged that the PS teachers do not have a clear understanding of what 'developing literacy and numeracy' means and to develop a good foundation for becoming competent in this area. This finding supports the need for clarity around the meaning and the significance of literacy and numeracy development, from the beginning of their training. This would enable the PS teachers to develop and deepen their understanding and their practice throughout the degree.

Theme 2 addressed literacy and numeracy in ITE, and it was found that there is evidence of the provision for literacy and numeracy training within the programme and the findings demonstrated that the PS teachers are aware of its inclusion in several modules. However, a significant portion of the training happens in the later years of the degree programme, allowing for insufficient time to develop an approach to becoming competent in developing

these skills in practice. This finding provides valuable insight into the importance of developing a clear foundation from early in the programme of knowledge on the topic of literacy and numeracy development, which would provide a solid basis from which PS teachers could develop self-awareness and self-efficacy in the promotion and development of literacy and numeracy teaching strategies.

Theme 3 addressed PS teachers' perceptions of their own abilities, which highlighted another important finding which was that PS teachers do not have a realistic perspective on their own abilities with both, personal and pedagogical literacy and numeracy skills. This impacts the task of developing a personal approach to teaching literacy and numeracy, making it challenging and unattainable. Self-reflection on practice should be prioritised, based on correct and appropriate information to enable PS teachers to become more self-aware and therefore, improve competence in this area.

Theme 4 addressed the relationship between literacy and numeracy theory and practice. It emerged that there was little alignment between PS teachers' definitions of literacy and numeracy and their teaching strategies to address literacy and numeracy development, demonstrating that PS teachers were recalling theory, but not necessarily understanding the significance of their meaning or their importance in practice. This finding provides insight into why SP tutors are not witnessing higher standard of literacy and numeracy development in practice. This finding has influenced the choices made regarding the inclusion in the training workshops of activities which will encourage the promotion of self-reflection in order to develop a realistic view of one's abilities and areas that might be developed further.

Theme 5 addressed literacy and numeracy in technical subjects. In this regard literature suggests that technical subjects are rich in opportunities to develop literacy and numeracy skills, though not always easily recognised. This research highlighted a belief that these subjects have not been considered so for many generations and that this may have impacted and influenced PS teachers to develop an unrealistic view of technical subjects regarding their strengths and weaknesses in promoting literacy and numeracy.

The above five themes highlight challenges within the case ITE programme, regarding literacy and numeracy development and training. As a result of these findings a series of workshops has been designed to address the aforementioned challenges, reflecting the research themes, and focussing on three aspects, developing new knowledge, developing a sense of self, and implementing the new knowledge. The following chapter provides details for one design for a series of training workshops which seeks to address the findings of this research study.

## **6 Research Output: Training Workshops**

### **6.1 Introduction**

The aim of this research was to undertake a case study analysis of the provision of literacy and numeracy training in the ITE programme at GMIT, in order to enhance training for PS teachers. Objective 5 of this research was to develop a series of three training workshops for teacher-educators and PS teachers, to create awareness of the complexity of literacy and numeracy skills and to aid the embedding of both skills into the teaching of technical subjects. This chapter addresses this objective and presents several different aspects that informed the workshop design. Section 6.2 provides a rationale for the development of a series of three training workshops. Following that section 6.3 explores how the workshops were designed, discussing the rationale for the decision to host the training online. This section also provides the learning outcomes of the workshops. Section 6.4 discusses the teaching approaches used within the workshops, explaining the rationale for choosing collaborative learning and problem-based learning. Section 6.5 provides an expected schedule of the three training workshops, along with a detailed plan for how they will be run.

### **6.2 Rationale**

The need for further literacy and numeracy training and enhancement of what was already being provided in the programme was emphasised at the management focus group (See section 4.4.2). The most appropriate method to present the research findings and to most impact the participants of this study was to develop a series of online training workshops to address the five themes which emerged through this research. Berkun describes a workshop as a brief, intensive educational programme in a particular field, for a relatively small group of people (2013), which would satisfy what this research seeks to achieve. However, it was important that this series of training workshops would not only address the five challenges highlighted in chapter 5, but that the workshops were conducted in an interactive way, to

allow for maximum engagement and therefore, maximum learning (Ternay, 2021). This series of workshops was designed to progress from the development of a basic understanding of what literacy and numeracy mean, to the development of a sense of self among participants and finally, to the more practical elements of embedding these skills into the teaching of technical subjects. These three developmental stages are included in table 6-1 below, showing the relationship between the themes that emerged from this research study and how the findings from each theme are addressed in the series of training workshops.

*Table 6-1 The Relationship Between the Research Themes and Training Workshops*

<b>Theme</b>	<b>Workshop Element</b>	<b>Development stage</b>
<b>Theme 1:</b> Defining literacy and numeracy	<b>Workshop 1:</b> Activity 1: Defining literacy Activity 2: Defining numeracy	<b>Foundational:</b> Developing foundational knowledge
<b>Theme 2:</b> Literacy and numeracy within ITE	<b>Workshop 2:</b> Activity 3: Transversal/Disciplinary literacy and numeracy Activity 3: Personal/Pedagogical literacy and numeracy	
<b>Theme 3:</b> PS teachers' perception of their own abilities	<b>Workshop 2:</b> Activity 4: Confidence and competence	<b>Personal:</b> Developing a sense of self
<b>Theme 4:</b> The relationship between theory and practice	<b>Workshop 3:</b> Activity 5: Literacy in practice Activity 6: Numeracy in practice	<b>Practical:</b> Implementing new knowledge
<b>Theme 5:</b> Literacy and numeracy within technical subjects.	<b>Workshop 3:</b> Activity 5: Literacy in practice Activity 6: Numeracy in practice	

*Source: Author's Original*

The challenges highlighted in chapter 5 included a lack of clarity, and therefore, understanding of what literacy and numeracy development means to PS teachers (section

5.2). It is important for the participants to achieve an understanding of these terms before progressing onto the other activities within the workshops, because this understanding forms the basis for the remaining activities, which build on this premise. Defining literacy and numeracy in activity 1 and activity 2 will impact participants' ability to develop personal skills and their pedagogical knowledge of developing literacy and numeracy skills in the classroom (section 5.3). The workshops will address this challenge by breaking down the terms and highlighting their importance within ITE. Caena (2014) and Garbe (2017) suggest that by emphasising the relevance of literacy and numeracy within the context of ITE and breaking it into the four elements personal, pedagogical, transversal, disciplinary, it will influence and impact the development of a personal teaching philosophy.

Having addressed the development of the foundational knowledge in activities 1, 2 and 3, the next phase of the training workshops addresses the development of participants' self-awareness, regarding literacy and numeracy. Theme 3 highlighted the misalignment between PS teachers' perception of their abilities, both personal and pedagogical skills, and SP tutors' perspective of PS teachers' abilities in both regards (section 5.4). Bostock and Boon suggest that PS teachers may have limited opportunities to reflect on their own practices, or may have an unrealistic perception of their abilities as a result of generation specific trends which encourage positive self-appraisal (2012, p. 30). The rationale for including activity 4 in these training workshops is to provide participants with an opportunity to view themselves and their practices in light of new knowledge obtained through earlier activities. Reflecting on personal and professional development will enable participants not only to recognise where progress has been made, but also to identify where improvements can be made.

The training workshops will then progress to the practical elements of implementing literacy and numeracy practices within the classroom. Theme 4 highlights the misalignment between the theory being taught on the case ITE programme, and what is being practiced on school placement (section 5.5). Activities 5 and 6 address these challenges through the aid of literacy and numeracy models designed specifically to assist PS teachers and teacher educators in recognising and developing strategies to teach literacy and numeracy. Theme 5 (discussed in

section 5.6) highlights the opportunities within technical subjects to develop both literacy and numeracy and challenges the beliefs that these subjects are lacking in literacy development. Activities 5 and 6 address this by exploring what is already included in the teaching of these subjects and engages participants in the examination of their practices in teaching the technical subjects, bringing the relevance and relationship between theory and practice to the fore.

The significance of developing this series of training workshops is that it brings the stakeholders of this research study together in an environment designed specifically to engage participants. To that end, participants will expand their knowledge and deepen their awareness of the topic of literacy and numeracy development, generally but also specifically within the case ITE programme. This series of workshops is designed to allow a relevant and meaningful learning experience for its participants.

### **6.3 Workshop Series Design**

This series of training workshops were designed to emulate and reflect the same level of engagement and communality that was achieved in the face-to-face experience of data collection at the *Creativity and Innovation in the Classroom: Initial Teacher Education Conference* (See sections 3.3.2 and 3.3.3), which enabled an authentic and meaningful collaborative learning experience for the participants. The COVID 19 pandemic and social distancing restrictions (Government of Ireland, 2021) would have made conducting face-to-face training workshops unachievable. Therefore, it was decided to design this series of workshops to be conducted using alternative online platforms. This move to the online space creates an opportunity to rethink how training and professional development could be conducted.

There are many factors to consider when designing a training workshop, which is to be conducted in an online space. One major factor associated with online education is the potential for participant disengagement (O'Shea, Stone, & Delahunty, 2015). The



responsibility of effective engagement lies with the instructor or facilitator of the online workshop. This can be achieved through effective communication, management of technology, and the delivery and assessment of content (Roddy, et al., 2017). Kennette and Reed suggest that effective online instruction significantly impacts the learning experience and creates a sense of presence (2015). It is this sense of presence of both the instructor and the participants which would influence the aspect of communality, which is sometimes missing from online education. Boettcher and Conrad suggest a number of best practices for teaching online which were relevant to designing a training workshop for the purpose of this study (2021) (See section 6.5). These best practices included to be present at the course site, to create a supportive community for the learners, to develop a set of explicit expectations for the learners, to use a variety of large, small, and individual work activities, to prepare discussion posts that invite responses, questions, discussions and reflections, and to plan a closing activity (Boettcher & Conrad, 2021). This list of best practice tips for an online workshop have been incorporated into the design of this series of workshops.

From a practical perspective of planning an online workshop, there are several elements to consider (Siniscarco, 2020). It has been suggested that a workshop last no longer than 120 minutes, as after this period productivity diminishes and participants experience video conference fatigue. The training workshops designed for the purpose of this research study will be broken into three 2-hour workshops, which will incorporate smaller tasks of between 30 minutes and 45 minutes. Participants will be encouraged to take short screen breaks between tasks. A 15-minute break will be scheduled in the middle of the workshop and participants will be encouraged to leave their computer for that break. It has also been suggested that a facilitator should know the number of participants in advance, which will assist planning of the workshop and the fluidity of the activities. This will be achieved by way of participants being required to register for the 'event', allowing to plan for group sizes and to consider facilitators for each group. Encouraging participants to turn on their videos will allow participants to build rapport and read facial expressions and body language, which can often be lost in the virtual space. As a facilitator of the workshop, it has also been suggested

that they use two monitors, which will allow a view of participants and the chat functions, while still having a screen to share slides and other resources (Kennie, 2020; Smart, 2020; Siniscarco, 2020).

There are a considerable number of videoconferencing systems, from which to conduct such a training workshop. However, the one that will be explored here as a possible platform to conduct the training workshop for this study is Microsoft Teams. This platform is supported by Windows, Mac OS, and Linux operating systems, which can all be installed on a desktop computer, allowing easy access to users (Correia, Liu, & Xu, 2020). This platform has many education-related features, including audio (and mute), video (and turn off camera), recording and playback, screen sharing, application sharing, remote control, file transfer, chat function, annotation tool, breakout rooms, polling/Q&A tools, virtual hand-raising and captioning. All platforms have strengths and weaknesses depending on the requirements and needs of those using it (Gesler, 2020). However, Ms Teams is the platform used by GMIT and the one most familiar to the researcher (O'Regan, 2021; Logue, Dunne, & Rogers, 2021).

This series of training workshops has been designed specifically for PS teachers, SP tutors and other staff involved in the case ITE programme, at GMIT. The goal of the series of workshops is to create an awareness among the participants of what literacy and numeracy mean in the context of ITE and to develop a tool to assist the enhancement of literacy and numeracy training for technical subject classrooms. The learning outcomes for the training workshops relate to the themes of this research study. They also relate to the learning outcomes specific to literacy and numeracy development within the case ITE programme (See tables 2-14 and 2-16, in section 2.8.1). The learning outcomes of the series of training workshops are as follows. At the end of this series of training workshops participants will be able to:

1. Clearly define the terms literacy and numeracy, relevant to the society of the 21<sup>st</sup> century.
2. Distinguish between the development of transversal and disciplinary literacy and numeracy skills, in the context of ITE and in the classroom.

3. Differentiate between the development of personal literacy and numeracy skills and the development of pedagogical knowledge of literacy and numeracy teaching, on the ITE programme.
4. Self-assess their personal literacy and numeracy abilities, based on an ITE literacy and numeracy test, and on their own definitions of these terms.
5. Participate in the development of a framework/model to assist PS teachers to develop literacy and numeracy, specifically in the technical subjects

Considering this literature investigation of best practice workshop delivery in online teaching, this series of three training workshops has been designed to run for 2 hours each, allowing for a 15-minute stretch break to give participants a chance to process the information and have a screen break before the next activity begins.

#### **6.4 Workshop Pedagogy**

The educational strategies chosen for the delivery of this study's training workshops are collaborative learning and problem-based learning, as these two approaches provide opportunities for engagement of both the facilitator and the participants. This will be achieved by incorporating a constructivist and social constructivist approach to learning, within this series of training workshops. These two learning theories promote active involvement in one's learning through the construction of knowledge (Amineh & Asl, 2015). However, the difference between the two theories is that in constructivism individuals construct knowledge through personal processes, whereas in social constructivism knowledge is constructed through interactions within a society (Powell & Kalina, 2009). The two developmental psychologists most associated with these theories are Jean Piaget (1896-1980) and Lev Vygotsky (1896-1934) (Lourenço, 2012). Both collaborative learning and problem-based learning have roots in the theories of Piaget and Vygotsky. These theorists suggest that through working together, deeper reasoning and learning is promoted among participants (Sawyer & Obeid, 2017).

Collaborative learning relies on five basic elements; Positive interdependence to achieve a goal, Interaction between the members of the group through encouragement and sharing of knowledge, individual accountability for all group members to do their share of work, social skills are developed through practising building trust, leadership, decision making, communication and conflict management, group self-evaluation through periodically assessing their progress and amending the process to achieve goals (Laal & Lall, 2012). By utilising a constructivist pedagogy in this series of training workshops, participants will be actively involved in their learning (McLeod, 2019), allowing for a more meaningful experience than that of a more traditional approach to delivery. A complimentary pedagogical approach to collaborative learning is problem-based learning, and for this reason they are quite often used together (Davidson & Major, 2014), enhancing positive attitudes among participants and retention of new information (Springer, Stanne, & Donovan, 1999).

Problem based learning is an approach which uses real life problems as a vehicle to promote skills in critical thinking, problem solving and communication (Allen, Donham, & Bernhardt, 2011). Hung, Jonassen and Liu suggest that problem-based learning incorporates the following characteristics: problem-focused, student-centred, self-directed, self-reflective and is supported by a tutor or facilitator (Hung, Jonassen, & Liu, Problem-Based Learning). Although problem-based learning has been praised for its emphasis on higher order thinking, concerns have been expressed regarding the possibility of sacrificing knowledge acquisition (Hung, 2003). Hung concludes by suggesting that higher-order thinking and knowledge acquisition can coexist and complement each other (p. 16).

Both approaches promote aspects of literacy and numeracy and reflect navigating the world outside the classroom, which will be highlighted in the workshop. These approaches have been chosen for several reasons. In a bid to replicate and reflect the collaborative learning experienced in the *Creativity and Innovation in the Classroom: Initial Teacher Education Conference* (Feb. 2020), with a similar approach to including a mix of abilities and levels of experienced professionals in each group, allowing the same communality and communication among the workshop participants. The final activity of this workshop will incorporate a

problem-based learning task and will relate directly to all the workshop participants and how they can promote literacy and numeracy among their students but also to assess and monitor how they are doing this.

## 6.5 Training Workshops Schedule & Sequence

This section provides details on how the researcher envisages the series of workshops' schedule. Table 6-2 below demonstrates this.

*Table 6-2 Workshop Series Schedule*

Workshop 1	Workshop 2	Workshop 3
9.00 Introduction 9.15 Defining literacy	9.00 Introduction Literacy & Numeracy in ITE 9.10 Transversal/Disciplinary Literacy and Numeracy 9.35 Personal/Pedagogical Literacy and Numeracy	9.00 Introduction 9.10 Literacy in Practice
10.00 Coffee/Tea Break	10.00 Coffee/Tea break	9.45 Coffee/Tea Break
10.15 Defining Numeracy 10.45 Wrap up	10.15 Confidence & Competence 10.15 Confidence & Competence	10.00 Numeracy in Practice 10.45 Wrap up
11.00 Workshop Close	11.00 Workshop close	11.00 Workshop close

*Source: Author's Original*

The schedule indicates each workshop commences at 9am and runs for two hours. The researcher envisages the workshops to run over three consecutive weeks. The following three sections, 6.5.1, 6.5.2 and 6.5.3, outline in detail the sequential order of each workshop, including sections on: participants expected previous knowledge, workshop rationale and approach, relevant learning outcomes, learning intentions and success criteria, teaching approaches, assessment, workshop timeline and relevant resources.

## 6.5.1 Literacy and Numeracy Training Workshop 1

### 1. Workshop Information

Subject: Defining Literacy & Numeracy	Length of Workshop: 2 hrs
Participants: Pre-service teachers, School-placement tutors & other ITE programme staff	Workshop no.: 1/3

### 2. Previous Knowledge

Programme staff will have had differing amounts of previous training on the topic of literacy and numeracy development within an ITE programme. There is currently no training for staff, specific to ITE for technical subjects. The pre-service teachers will have had varying levels of engagement in training to teach literacy and numeracy. School-placement tutors will have had experience in assessing pre-service teachers' ability to develop literacy and numeracy on school-placement visits. The research data gathered for the purpose of this thesis indicated varying degrees of understanding from the case study participants.

### 3. Workshop Rationale

This workshop will begin with basic terminology and defining literacy and numeracy skills, as some participants may have little awareness of how these skills fit into the programme. By developing a deeper understanding of these terms, participants will begin to recognise these skills in their training and in their teaching. This will allow participants to develop a heightened awareness of, not only what they are achieving in the classroom, but in their personal literacy and numeracy development also. What was evident from the research project was that a substantial number of PS teachers had little awareness of the significance or importance of literacy and numeracy development within their practices. This traditional understanding of literacy and numeracy may impact their practices and enable missed opportunities to develop these skills for themselves and in the classroom.

#### 4. Learning Outcomes and Corresponding Learning Intention and Assessments

(Learning Outcome 1) Clearly define the terms literacy and numeracy relevant to the society of the 21 <sup>st</sup> century.		
<b>Learning intention and success criteria:</b>  At the end of this workshop participants will be enabled to define literacy and numeracy, demonstrating an understanding of the “what, how and why” a teacher develops these skills in the 21 <sup>st</sup> century classroom.	<b>Teaching approaches:</b>  Facilitator input Independent research Collaboration Presentation & Communication	<b>Assessment:</b>  Presentation of definitions and group assessed.

#### 5. Workshop Sequence

Timeline	Activity	Through
9.00	Introduction	
	<p>Facilitator welcomes participants to the workshop.</p> <p>Outline the facilitator’s expectations of participants regarding cooperation and engagement, highlighting the different activities and platform to be used throughout the workshops. Remind participants to mute microphones and to turn on cameras.</p> <p>Set out the learning outcome of the series of workshops, showing the outcomes for each activity on PowerPoint slides.</p> <p>Facilitator introduces the research, highlighting the main findings of the study and how it informed the design of this series of workshops. Show a schedule for the workshops, highlighting the importance of the 15-minute stretch break in the middle of each workshop.</p>	
9.15	Defining literacy:	
	<p>Workshop facilitator input:</p> <p>Traditional understanding</p> <p>Importance of getting a clear understanding of what this means to inform your teaching of this skill in the classroom.</p>	PowerPoint

9.20	<p>What is literacy and how does it relate to you?</p> <p>Take 5 minutes to research the term and find 3 definitions which help you to understand its meaning better.</p>	Independent research
9.30	<p>Whole group collaboration:</p> <p>What keywords have you come up with? Use the hands-up function to add to the list.</p> <p>Break the keywords down into three aspects: what, how and why.</p>	<p>Hands-up function</p> <p>Collaborative tool?</p>
9.40	<p>Group work:</p> <p>Developing your group definitions</p> <p>Create break-out rooms to include members of each cohort of participant (approx. ten in each).</p> <p>Ask yourselves the following questions:</p> <ol style="list-style-type: none"> <li>1. What is the first word that springs to mind when you think of literacy?</li> <li>2. Reading and writing.... reading and writing what exactly?</li> <li>3. What verbs describe the actions that you are taking?</li> <li>4. Why are you taking those actions?</li> <li>5. Through what mediums?</li> </ol> <p>Provide guidelines for task:</p> <p>appointing a group facilitator</p> <p>Using your keywords and the worksheet create your group definition</p> <p>Take screen shot of your definition</p> <p>10-minute timer.</p>	<p>Break-out room names</p> <p>Group participants</p> <p>Task Instructions</p> <p>Facilitator</p> <p>Definition framework: What, how &amp; why?</p>
9.50	<p>Re-join the main meeting.</p> <p>Group appointed participant to upload your group's definition to the collaborative tool.</p> <p>Make note of differences between the groups if there are any.</p>	Padlet tool
	<p>Show of hands:</p> <ol style="list-style-type: none"> <li>1. if you came into this workshop with a clear understanding of what literacy meant.</li> <li>2. If you have learned something from this experience.</li> </ol>	<p>Hands-up function</p> <p>Chat function</p>



	<p>Time permitting: what is your biggest takeaway from taking part in this activity?</p> <p>Remind participants of 15-minute break. Step away from your screen, cup of tea/coffee. Resume workshop at 10.15</p>	
<p>10.00 15-minute Break</p>		
10.15	Defining Numeracy:	
	<p>Workshop facilitator input:</p> <p>Better understanding of numeracy than literacy. Numeracy is more obviously evident in these subjects. You might feel more confident and be more competent in this area.</p>	PowerPoint
10.20	<p>Activity:</p> <p>Facilitator will give keywords to the group</p> <p>Go into breakout rooms again and complete the same activity for numeracy. Encouraging discussion and debate.</p>	<p>Breakout rooms</p> <p>collaboration</p>
	<p>Return to main meeting to share definitions for numeracy. Using a collaborative tool, upload screen shots of your group definition.</p> <p>Discuss and comment on the most complete definition.</p>	<p>Chat function</p> <p>Hands-up function.</p>
10.45	Wrap up	
	<p>Reflection:</p> <p>Consider both activities and both terms. What is your biggest learning from completing these tasks? take 3 minutes to consider this and write three things that you have learned. Write your biggest takeaway using the chat function.</p> <p>Circle of learning: Ask 5 people to share their most important take-away from today's workshop.</p>	Chat function
10.55	<p>Facilitator to remind participants of what was explored in this workshop and point towards the next workshop.</p> <p>Thank participants.</p>	

11.00 Workshop close

## 6. List of Workshop Resources

PowerPoint presentation (See Appendix 28)  
Activity instructions  
Definition development Worksheet  
Collaboration tool  
Breakout room timer.

### 6.5.2 Literacy and Numeracy Training Workshop 2

#### 1. Workshop Information

Subject: Literacy & Numeracy in ITE	Length of Workshop: 2 hrs
Participants: Pre-service teachers, School-placement tutors & other ITE programme staff	Workshop no.: 2/3

#### 2. Previous knowledge

The participants will have had varying degrees of training regarding literacy and numeracy and what that means within initial teacher education. The terms transversal and disciplinary literacy and numeracy may be unfamiliar to many. However, participants will have had opportunity to considered how to develop literacy and numeracy in the classroom i.e., Pedagogic literacy and numeracy, but for the 1<sup>st</sup> and 2<sup>nd</sup> year PS teachers, this may be the first time. Many participants will not have had the opportunity to consider their own literacy and numeracy abilities, separate to their ability to teach these skills in the classroom. Regarding the development of an awareness of one's own abilities, participants will not have been assessed or received feedback on this as part of the ITE programme, as a lecturer, tutor or student.

### 3. Workshop Rationale

Literacy and numeracy development within ITE is a complex topic and by breaking it down into four separate elements, transversal, disciplinary, personal and pedagogical, participants will be better equipped to self-assess their own skills and practices. What was evident from the research project was that a substantial number of participants were not aware of their own abilities, personal or pedagogical. By drawing attention to this and giving participants the opportunity and the space to at least consider these elements in relation to their own practices, participants are more likely to develop and grow in this regard.

### 4. Learning Outcomes and Corresponding Learning Intentions and Assessments

(Learning Outcome 2) Distinguish between the development of transversal and disciplinary literacy and numeracy skills, in the context of ITE and in the classroom.		
<b>Learning intention and success criteria:</b> At the end of this workshop participants will be enabled to recognise examples of disciplinary literacy and numeracy, from a list of both transversal and disciplinary literacy and numeracy scenarios.	<b>Teaching approaches:</b> Independent research Facilitator input Collaboration (padlet) Mentimeter survey	<b>Assessment:</b> Visual inspection Discussion Online quiz
(Learning Outcome 3) Differentiate between the development of personal literacy and numeracy skills and the development of pedagogical knowledge of literacy and numeracy teaching, on the ITE programme.		
<b>Learning intention and success criteria:</b> At the end of this workshop participants will be enabled to develop a list of methods to develop personal literacy and numeracy skills	<b>Teaching approaches:</b> Facilitator input Mentimeter survey Collaboration/Groupwork	<b>Assessment:</b> Visual inspection Online questioning
(Learning Outcome 4) Self-assess their personal literacy and numeracy abilities, based on an ITE literacy and numeracy test, and on their previous definitions of the skills		
<b>Learning intention and success criteria:</b> At the end of this workshop participants will be enabled to appraise their own Literacy and	<b>Teaching approaches:</b> Facilitator input Self-assessment	<b>Assessment:</b> Class test Self-assess

numeracy abilities through engaging in a literacy and numeracy test.	Group sharing	
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## 5. Workshop Sequence

Timeline	Activity	Through
9.00	Introduction	
	<p>Welcome participants</p> <p>Recap of what was explored in the previous workshop: defining literacy and numeracy. Using the “what, how and why” guide, can you take a minute to define both literacy and numeracy? Race for the first five definitions in the chat.</p> <p>Use hands-up function to indicate if you feel you would be more comfortable being asked to define these two terms, compared to at the beginning of the previous workshop.</p> <p>The three learning outcomes for this workshop are:            (LO2) Distinguish between the development of transversal and disciplinary literacy and numeracy skills, in the context of ITE and in the classroom.            (LO3) Differentiate between the development of personal literacy and numeracy skills and the development of pedagogical knowledge of literacy and numeracy teaching, on the ITE programme.            (LO4) Self-assess their personal literacy and numeracy abilities, based on an ITE literacy and numeracy test, and on their previous definitions of the skills</p>	
9.10	<p>Literacy and Numeracy in ITE:</p> <p>Transversal/disciplinary literacy and numeracy skills (Learning outcome 2)</p>	
	<p>Workshop facilitator input:</p> <p>There are four aspects of literacy and numeracy development to consider in the context of ITE.</p> <p>Explain the difference between transversal skills and disciplinary skills. Explore why these are important.</p>	PowerPoint
	<p>Activity:</p> <p>Ask participants to engage in a task which asks them to pick from a list of learning intentions and assignments, distinguishing between the development of transversal and disciplinary skills, using an online survey tool.</p>	<p>Mentimeter-Survey tool</p> <p>Survey questions sheet</p>

	We will then discuss the results and explore any differences in opinions, highlighting the importance of considering both in the classroom.	
	The purpose of this task was not to test if you knew the difference but was to encourage you to consider these two aspects of these skills separately, which should change the way you think about how you develop both transversal and disciplinary skills in the classroom.	
9.35	Personal skills/ pedagogical knowledge: (Learning outcome 3)	
	Workshop facilitator input:  Consider the tasks that you engage in, in the programme (for teacher educators and pre-service teachers) that develop pre-service teachers' personal literacy and numeracy skills, separate to their ability to teach these skills in the classroom.	PowerPoint
	Take a moment to consider these two aspects of ITE.  use the hands-up function to indicate if you have considered these two separately in your training (for both teacher educators and pre-service teachers).  Activity: Can you come up with one example of where pre-service teachers can develop personal literacy or numeracy skills within the programme? (You can be as specific as you require, to make your point).  Facilitator will create a map of the responses	Hands-up function  Collaborative tool
10.00	15-minute Break	
10.15	Competence/Confidence in Skills: (Learning outcome 4)	
	Workshop facilitator input:  Misalignment? Discuss the findings of the research What do I mean by being competent? And how can we assess our competence?	PowerPoint

	Start with personal competence. As a teacher, you are expected to facilitate and promote literacy and numeracy skills among all your students, no matter what subjects you teach, and no matter what level of education you are teaching in.	
10.25	<p>Our ability to teach literacy and numeracy are tested on school-placement, but how do we test our personal literacy and numeracy abilities?</p> <p>Activity: Anonymous online test of personal literacy and numeracy abilities (based on an ITE admission test).</p> <p>Before answers are shown, ask yourself if you feel confident that you answered all questions correctly (by show of hands)</p> <p>Show questions with answers.</p> <p>Calculate percentage that you got correct</p> <p>Based on the definitions which you all created in the previous workshop and at the beginning of this workshop, you feel that you are achieving everything that the definitions are suggesting?</p> <p>Using a Likert scale... hands-up if you feel</p> <ol style="list-style-type: none"> <li>1. Completely satisfied that you are achieving all that the definitions suggest</li> <li>2. Satisfied</li> <li>3. Not satisfied.</li> </ol> <p>Facilitator will take note of the number of hands up and ask participants to work out percentages of the group who responded in each category.</p> <p>Responses in the chat.</p>	<p>Online testing tool</p> <p>Hands-up function</p> <p>Questions and correct answers sheet.</p> <p>Chat function</p>
10.50	Wrap up	
	<p>Recap of the four literacy and numeracy elements to consider in the context of ITE</p> <p>Circle of learning: Reflect on what we explored in this workshop. Take 2 minutes to choose what your biggest learning was from completing these tasks.</p>	Chat function

	<p>Write your reflections in the chat function.</p> <p>A small number of differing responses will be read out by the facilitator by way of a wrap up of the session.</p> <p>Remind participants of the learning outcome of the following workshop.</p>	
11.00 Workshop close		

## 6. List of Workshop Resources

<p>PowerPoint presentation (See Appendix 28)</p> <p>List of learning outcomes and assignments (transversal and disciplinary) (See Appendix 29)</p> <p>Literacy and numeracy ITE assessment (See Appendix 30)</p> <p>ITE Assessment answers</p>
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### 6.5.3 Literacy and Numeracy Training Workshop 3

#### 1. Workshop Information

<p>Subject:</p> <p>Literacy &amp; Numeracy- theory/practice</p>	<p>Length of Workshop:</p> <p>2 hrs</p>
<p>Participants:</p> <p>Pre-service teachers, School-placement tutors &amp; Other ITE programme staff</p>	<p>Workshop no.:</p> <p>3/3</p>

## 2. Previous Knowledge

Having taken part in the two previous workshops, participants will now understand what literacy and numeracy mean in general, but also in terms of initial teacher education. Participants will be more aware of their own abilities regarding personal literacy and numeracy and the development of these skills within the classroom. The third workshop in this series will explore how to implement this knowledge in practice. Participating PS teachers will have had training on how to develop these skills in the classroom but may not have had the opportunity to develop a framework to address all the different aspects of achieving this in technical subjects.

## 3. Workshop Rationale

This workshop provides an opportunity for participants to use what they learned in the previous two workshops, to develop an approach to literacy and numeracy development, which is specific to their discipline. The previous two workshops provide a foundation for a framework which participants can develop and use in their practices. By engaging in the development of this teaching aid, participants will potentially heighten their awareness of what is required to successfully develop literacy and numeracy in their teaching.

## 4. Learning Outcomes and Corresponding Learning Intention and Assessments

(Learning Outcome 5)

Participate in the development of a framework/model to assist pre-service teachers to develop literacy and numeracy specifically in the technical subjects

### Learning intention and success criteria:

At the end of this workshop participants will be enabled to create a teaching resource to aid the development of literacy and numeracy in the technical subjects, through a literacy/numeracy model designed to assist teachers.

### Teaching approaches:

Facilitator input  
Problem based learning  
Collaboration  
Group presentation

### Assessment:

Visual inspection  
presentations



## 5. Workshop Sequence

Timeline	Activity	Through
9.00	Introduction	
	<p>Welcome participants</p> <p>Remind participants of what areas were explored in the previous two workshops. Learning outcomes.</p> <p>Provide learning outcome for this workshop: (LO5) Participate in the development of a framework/model to assist pre-service teachers to develop literacy and numeracy specifically in the technical subjects</p>	PowerPoint
9.10	Theory/Practice: Literacy in Practice	
	<p>Workshop facilitator input:</p> <p>Discuss research findings in relation to theory and practice of literacy and numeracy development.</p> <p>Literacy framework (Based on Peter Freebody and Alan Luke framework)</p> <p>This framework was designed to assist all teachers of all disciplines.</p> <p>What should this look like in your subjects?</p>	<p>PowerPoint</p> <p>Freebody &amp; Luke framework</p>
9.20	<p>Activity: (15 minutes)</p> <p>Allocate participants to preorganised breakout rooms.</p> <p>Allocate a group facilitator. Using the questions provided, develop a diagram or graphic to represent how this framework might be used in the technical subjects.</p> <p>Discuss in your group the rationale for presenting the different aspects of literacy in your chosen way.</p> <p>Appoint someone from you team to present your model in the main workshop meeting.</p>	<p>Guiding literacy teaching questions</p> <p>Collaborative tool</p>
9.35	<p>Return to the main meeting</p> <p>Three groups will be chosen at random to present their model, sharing their image/file with the whole group (2 minutes each).</p>	<p>Presentation of models</p> <p>Hands-up function</p> <p>Verbal feedback.</p>

	Once complete, facilitator will ask all other groups to highlight strengths and weaknesses, using the hands-up function and giving verbal feedback.	
9.45	15-minute Break	
10.00	Theory/Practice: Numeracy in practice	
	<p>Workshop facilitator input:</p> <p>Show the numeracy framework (Based on Merrilyn Goos model) Similar to the literacy model explored earlier, this too was designed to assist teachers in developing numeracy in the classroom.</p> <p>Go through the meaning of the different elements of this model.</p>	<p>PowerPoint</p> <p>Padlet collaboration tool</p>
	<p>Activity:</p> <p>In allocated groups, using the five elements of the literacy model, develop a model which represents priority and chronology of the elements and their relationship to each other.</p> <p>Include a section for how these elements fit into technical subjects.</p> <p>Decide on a way to address getting this information into a diagram which will provide a self-assessment tool for initial teachers of technical subjects.</p>	List of five elements and their meanings.
	<p>What techniques and teaching methods have your group come up with which are specific to the teaching of numeracy within the technical subjects?</p> <p>Upload your suggestions to the collaboration tool.</p>	Padlet collaboration tool
10.45	Wrap up	
	<p>Reflection on workshop learning:</p> <p>What was important?</p> <p>Why is it important?</p> <p>How will this impact your teaching?</p>	<p>Chat function</p> <p>Verbal presentation of ideas.</p>
	Final recap:	PowerPoint

	Remind participants of learning outcomes for 3 workshops and how these were achieved. Present the most useful models for literacy and numeracy.	
1.30 Workshop close		

**6. List of Workshop Resources**

PowerPoint presentation (See Appendix 28) Literacy model - Freebody and Luke Template for developing your own model (See Appendix 31) Numeracy Model – Goos Explanations of the five elements of numeracy Numeracy model – to be completed by participants (See Appendix 32)
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**6.6 Conclusion**

This chapter sought to present a series of training workshops for teacher-educators and PS teachers, to address the most significant findings of this study, addressing objective 5, which was to develop a series of training workshops for teacher-educators and pre-service teachers, in order to create awareness of the complexity of literacy and numeracy skills and to aid the embedding of both skills into the teaching of technical subjects.

The workshop design considered how best to create a rich learning experience in an online format, in a bid to replicate the face-to-face experience achieved at the 2020 *Creativity and Innovation in the Classroom: Initial Teacher Education Conference* (See section 3.3.3). Literature suggests that the biggest challenge when conducting training online is the lack of engagement. There are steps that can be taken to reduce participants disengagement, including organising a variety of participant activities, utilising various functionalities of the

chosen online platform, and considering the period that participants are expected to engage in a certain task.

The series of training workshops presented in this chapter were designed to align with the five themes that emerged as part of this research and sought to improve understanding and awareness of literacy and numeracy development, both personal and pedagogical within the context of an ITE programme. These training workshops progress through three stages of participants' development, the development of new knowledge, the development of self-awareness and finally the implementation of the newly acquired knowledge, with each stage building on the previous one. This series of training workshops puts an emphasis on utilising problem based and collaborative learning approaches. This series of training workshops affords participants the opportunity to develop practical solutions to embedding literacy and numeracy into their teaching, through active learning. The following chapter concludes this thesis.

## **7 Conclusions & Recommendations**

### **7.1 Introduction**

The research study sought to undertake a case study analysis of the provision of literacy and numeracy training in the ITE programme at GMIT, in order to enhance training for PS teachers of post-primary technical subjects. This chapter aims to conclude this thesis in relation to the objectives set out in chapter 1 (See section 1.2 and 7.2), providing insights into the contributions that this study makes to the field of literacy and numeracy in ITE and more specifically to the case programme (See section 7.3). Section 7.4 outlines the scope and limitations of the study and section 7.5 provides recommendations for future research on this topic. The final inclusion in this chapter is the researcher's final reflection on undertaking this research study (See section 7.6).

### **7.2 Research Objectives & Conclusions**

This section addresses the research objectives separately, providing a conclusion for each.

#### **7.2.1 Objective 1: Literacy and Numeracy Definitions**

Objective 1 of this research sought to outline and develop definitions of literacy and numeracy, informed by relevant literature. To address objective 1 of this study, this research began by exploring literature pertaining to defining literacy and numeracy, to develop and enhance PS teacher understanding, but also their practices regarding the development of literacy and numeracy. It became evident that there was no agreed definition for either skill. However, it was clear that all recent definitions of literacy and numeracy were reflecting the evolving society, emphasising a complexity, and moving on from a traditional understanding of these terms. This confusion and lack of clarity impacts how these terms are perceived within ITE and within the case programme. This research developed definitions for literacy and numeracy and developed a framework which broke these terms down into three

elements, in a bid to make these terms more accessible, more relevant, and therefore, usable by the participants of this research study. This research concludes that participants' conceptual understanding of literacy and numeracy remain largely traditional, in that any discussions refer to reading and writing and mathematics, which although important aspects of these skills, reflect only a small part of the complexity of literacy and numeracy skills. By focusing solely on the reading, writing and mathematical aspects of these skills, participants are potentially omitting crucial elements of skills that are central to a child's educational development and limits the scope of how being literate and numerate may impact life after school.

### **7.2.2 Objective 2: Literature Analysis**

Objective 2 of this research sought to critically analyse literature, both nationally and internationally, pertaining to improving literacy and numeracy development in post-primary education and ITE programmes. In addition to gaining a deeper understanding of the terms 'literacy' and 'numeracy', literature pertaining to improving literacy and numeracy development in post-primary education and ITE programmes was analysed, both nationally and internationally. This analysis found a newfound emphasis on improving literacy and numeracy standards worldwide, impacting ITE programmes' approaches to the inclusion of the development of these skills. Two models for developing literacy and numeracy within teacher education have been identified, which could potentially aid teachers' ability to become more aware of their own inclusion of the development of these skills. In the context of ITE, literature suggests that it is as important to address personal literacy and numeracy competence, as it is to address pedagogic competence. Due to the practical nature of the technical subjects, they may not be considered catalysts for literacy and numeracy development. However, literature suggests that they are conducive to developing these skills through problem solving, critical thinking and their relevance to real life. What emerged from this literature analysis was the responsibility of ITE programmes to make significant efforts to ensure that they are doing their part to effect change in literacy and numeracy development, as outlined by DES in the national strategy plan. Efforts have been made across the Irish

education systems and improvements are evident. However, participants' conceptual understanding of literacy and numeracy does not align with definitions outlined in the national strategy plan, indicating a missing link between that and how literacy and numeracy development are being addressed at an institute level. This raises questions about the support and policy in place for institutes developing teacher education programmes.

### **7.2.3 Objective 3: Programme Documentation Analysis**

Objective 3 of this research sought to analyse programme documents for the ITE programme at GMIT, in order to identify what provisions are made for the inclusion of both the development of PS teachers' personal literacy and numeracy and their ability to teach literacy and numeracy. This analysis identified areas where the development of PS teachers' personal skills is present within the planning of this programme, indicating an intrinsic development of these skills. Also identified within the programme and various modules, was the development of PS teachers' pedagogic skills. The *Approved Programme Schedule* provided insight into how the case ITE programme was catering for the development of transversal literacy and numeracy skills. However, the documents pertaining to individual modules gave an insight into how personal and pedagogical literacy and numeracy might also be developed. The lack of consistency between the different modules and disciplines suggests a lack of unity or campus effort to address literacy and numeracy within the programme. Clarity and instruction in this area must come from the programme leaders, the campus, school and most crucially from the institute. As previously mentioned, there is currently no policy which details how literacy and numeracy development should be addressed within ITE and it is this lack of guidance from the DES that creates challenges for those trying to address this on the ground.

### **7.2.4 Objective 4: Case Study Design and Implementation**

Objective 4 of this research sought to design and conduct a primary research case study of the ITE programme at GMIT, with respect to literacy and numeracy competencies and training. This was to be achieved by exploring participants' interpretation and understanding

of the terms 'literacy' and 'numeracy', PS teachers' literacy and numeracy abilities, and the inclusion of these skills in the ITE programme.

The case study design allowed the researcher to gain valuable insights into the perspectives of the participants. The methodological choices enabled a meaningful interaction with participants, which impacted the intended outcomes of the case study. This case study found that there was a degree of uncertainty among the participants, regarding the meaning of literacy and numeracy and their inclusion in the programme, with a stronger ability and ease with defining and recognising numeracy within their training. This case study explored, at depth the participants' perceptions of literacy and numeracy in the context of ITE. However, a lot can be said, about what was not said. One significant omission that emerged from this case study was the relevance of digital and multimodal literacy and numeracy, which further compounds the idea that participants are lacking a contemporary understanding of these terms and what they mean in the context of the 21<sup>st</sup> century. This omission also signifies the missing link between PS teachers' training, regarding literacy and numeracy development and their lives outside of their education. The children sitting in today's classrooms, which reflects a 21<sup>st</sup> century society, are overtaking the way that ITE programmes are training their PS teachers in terms of technology and this needs to be addressed if ITE programmes are to become most effective in literacy and numeracy development.

This research found that PS teachers were only partially aware of any training that they had received to specifically address literacy and numeracy development within the classroom. It was also found that SP tutors were not obliged to participate in literacy and numeracy training, although a small number of participants had engaged in such training as part of their professional development. It became evident that participants required further training to easily define the terms 'literacy' and 'numeracy'. The significance of this finding is that the lack of clarity and ease that participants had in this regard, impacts all other aspects of literacy and numeracy development. PS teachers require training to assist them to become more self-aware, which will clarify for them the areas of this topic that they can improve. Another finding from the case study indicated a misalignment between PS teachers' perceptions of



their own abilities, both their personal abilities and their ability to teach literacy and numeracy, and SP tutors' perceptions of the same. The traditional understandings of literacy and numeracy also feeds into the misalignment between PS teachers' understanding of the terms 'literacy' and 'numeracy' and their corresponding teaching strategies. This finding suggests that PS teachers were recalling theory as opposed to demonstrating a deeper understanding of the concepts. This raises questions about whether there have been opportunities within training or tutoring, to discuss and examine one's own abilities regarding literacy and numeracy development. Literacy and numeracy are examined as part of school placement assessment. However, this does not allow significant opportunity for PS teachers to reflect deeply on their practices. This, paired with the lack of clarity or understanding of the meaning of the skills, creates challenges and reduces the potential to progress to self-efficacy and self-actualisation. This significantly impacts the literacy and numeracy standards of teachers graduating from the programme.

The opportunities within the technical subjects to develop literacy and numeracy skills, through problem solving and critical thinking is evident to the SP tutors on this programme. However, this study found that PS teachers are often not aware of and therefore, do not recognise these opportunities in practice, which impacts their ability to create opportunities to develop literacy and numeracy, through utilising what is already intrinsic to these subjects. However, if there is little reflection and therefore, awareness of how rich these subjects are through their relevance to the outside world and society, PS teachers will struggle to achieve self-efficacy in this area. It is these specifics and intricacies within each discipline that create the most worthwhile learning.

In conclusion, the participants of this research study still largely maintain a traditional understanding of the concepts of literacy and numeracy. This is understandable, as up until relatively recently, these skills were considered intrinsic to teaching and it was taken for granted that teachers were addressing the development of literacy and numeracy in a way that catered for today's society. However, people instinctively resist change and with no obligation to reflect on whether literacy and numeracy development is being addressed in

ITE, in a way that mirrors today's societal needs, PS teachers are left with little guidance or clarity in this regard. The researcher designed the research output, a series of training workshops to highlight the issues found by this study but also to enable participants to become self-aware and therefore, position them to make these critical changes and to allow their practices to evolve alongside society.

#### **7.2.5 Objective 5: ITE Literacy and Numeracy Training Workshops**

Objective 5 of this research sought to develop a series of training workshops for teacher-educators, tutors, and PS teachers, in order to create awareness of the complexity of literacy and numeracy skills and to aid the embedding of both skills into the teaching of technical subjects. This series of training workshops was designed to reflect and to address the themes and the challenges that emerged through this study. The aim of the workshops was to develop a solid foundation for literacy and numeracy development for all PS teachers, SP tutors and other staff, which will sufficiently assist participants to develop an approach to becoming competent in developing these skills in practice.

This series of literacy and numeracy training workshops has the potential to advance participants' ability to, not only embed these skills in their teaching, but also to reflect on their own skills in order to improve them. This research maintains that conducting these workshops using collaborative and problem-based learning and teaching approaches, will engage participants and give them ownership of their learning. The significance of developing these skills has never been so poignant as it is in the current climate. The world has spent the past eighteen months (since March 2020) attempting to navigate all of the information being provided through numerous media platforms on the COVID 19 pandemic. Becoming competent in literacy and numeracy skills would enable people to engage with this information, not only to understand and critique it, but also to be able to use this information to make informed decisions about their lives. The following section explores the contribution that this study makes to the field of literacy and numeracy development.

### **7.3 Contribution**

This study has raised a number of important questions about the nature of literacy and numeracy instruction in ITE programmes and the discipline specific requirements of addressing literacy and numeracy development within the technical subjects. These include:

- What training would be required to build PS teachers competence in developing literacy and numeracy skills for themselves and for their students?
- What measures could be put in place to assess personal and pedagogical literacy and numeracy skills within the programme, either on entry or throughout, and what guidelines would most effectively support institutes in this regard?
- Why are the technical subjects still not considered subjects that advocate literacy and numeracy development? One of the most significant aspects of literacy and numeracy development within the 21<sup>st</sup> century is the relevance to society, which is at the core of technical subjects.

It emerged that there is a deficit of literacy and numeracy studies in ITE programmes in the Irish contexts, specifically within technical subjects. Therefore, this thesis makes an original contribution to the body of knowledge on this topic, providing insights from the perspectives of those involved in developing these skills in practical subjects; an area that has had little, if any focus. This study contributes to the enhancement of literacy and numeracy practices in post-primary education through improved performance by PS teachers on school-placement. The study contributes to the CPD of SP tutors and other educational staff through the promotion and development of literacy and numeracy training within the case ITE programme.

### **7.4 Scope & Limitations of the Study**

This research sought to conduct a case study of the ITE programme at GMIT, to ascertain the provisions made for literacy and numeracy training. This was to be achieved through analysing

literature in this field, examining programme documentation, gaining insights from participants' perspectives on the topic (September 2019- June 2021), with the goal of addressing issues, through a series of literacy and numeracy training workshops. Within the scope of this study the researcher seeks to enhance literacy and numeracy development training for PS teachers, SP tutors and other educational staff involved in the ITE programme at GMIT.

Like all research studies, there are several limitations which affect the results of the research. These may include limitations regarding the research design, considering the methodological choices made to conduct the study. Another limitation which may impact a research study are those that result from the research data. Being limited to the ITE programme at GMIT, this study's findings are not generalisable beyond the chosen sample, making them extremely specific to the case ITE programme. The scope of this study was limited in terms of the number of SP tutors and other lecturing staff involved in qualitative data collection. This would have more accurately represented the target cohort's perspective of the treatment of literacy and numeracy development within the programme. Another limitation regarding the sample profile was that the PS teachers were not involved in data collection, as a follow up to the questionnaires, which relied heavily on the researcher's interpreting of several responses, due to a lack of clarity in the questions. Further probing questions would have provided responses that would have more accurately reflected the PS teachers' perspectives. This study did not include the implementation of the training workshop, which was informed by the findings of this research study, and there was therefore, no opportunity to assess the efficacy of its use within the case ITE programme. The following section explores the recommendations and opportunities for further research.

## **7.5 Recommendations and Future Research**

A natural progression of this work is to implement the training workshop designed as part of this study. There is scope for a post-masters research project to build on this research. The

findings of this study provide insights for future research around literacy and numeracy development in the context of ITE and more specifically, in practical subjects. A further study could be conducted at a whole-campus level, which could assess third-level students' personal numeracy and literacy skills alone, with a view to identifying areas where improvements could be made. Furthermore, a greater focus on PS teacher practice could provide deeper insights into their understanding and their application of the theory and instruction of literacy and numeracy development. Research into such a specific area would address the missing link between theory and practice, which was a significant finding from this research study. The last section in this paper provides insight into the researcher, through a final reflection.

## **7.6 Researcher's Final reflection**

My education has taught me to reflect on what I am doing and to learn from that reflexivity in order to develop and move forward. Throughout the process of this research I have engaged in a reflexive process and now wish to share some of the results of that practice.

I graduated from the case ITE programme at GMIT in 2012. I, like many involved in the research study was drawn to the practical and technical subjects in school and therefore, was encouraged to embark on a career which embodies many elements of these subjects, allowing me to remain in an area in which I felt comfortable and safe. I never felt confident in what I understood to be literacy and certainly never envisaged myself undertaking a research study such as this one. However, I returned GMIT to enrol in a Masters by research in 2019.

Because of my previous involvement in the programme, I had insights and empathy for the participants of this study. I have been very aware of this fact throughout the project and have paid particular attention to how participants reacted to my undertaking and engagement in a research project in this familiar setting. I was aware of instances where I had answers to questions I was asking, from my perspective as a PS teacher, but also as a SP tutor and a module lecturer. Tutoring and lecturing was expected of me, by the institute as part of my

Masters. Who I am, what training I have previously engaged in, and my personality traits have undoubtedly impacted how this research was conducted and how it is presented. However, I hope that my awareness of these influential elements has helped to reduce bias and instead, impacted positively on the process.

This experience has contributed to my heightened awareness of the complexities of literacy and numeracy in the context of ITE and for that, I am grateful, as this insight provides me with valuable tools going forward in life. However, it has not all been plain sailing. Attempting to continue this research project while a global pandemic threw the entire world into chaos, presented challenges that I needed to overcome. Engaging in this experience has undoubtedly been a challenging one. However, it has also been a journey of significant growth and development, both personally and professionally.

My hope as a researcher is that this research will assist the participants of the study but also that it will encourage a conversation among staff on how best to move forward. There is a wealth of knowledge and experience among the staff involved in the ITE programme at GMIT and with a little consideration and consolidation of ideas, these people have the means to effect change in the field of literacy and numeracy development within their ITE programme.

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## **Appendices**

## Appendix 3: Questionnaire - Professional Educators

# Literacy and Numeracy Training and Teaching

## Questionnaire – Professional

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A Case Study Analysis of the Provision and Efficacy  
of Literacy and Numeracy Training in the  
Initial Teacher Education Programme at GMIT, Letterfrack.

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Researcher:

Patricia O'Regan  
G00238648@gmit.ie  
0879870371

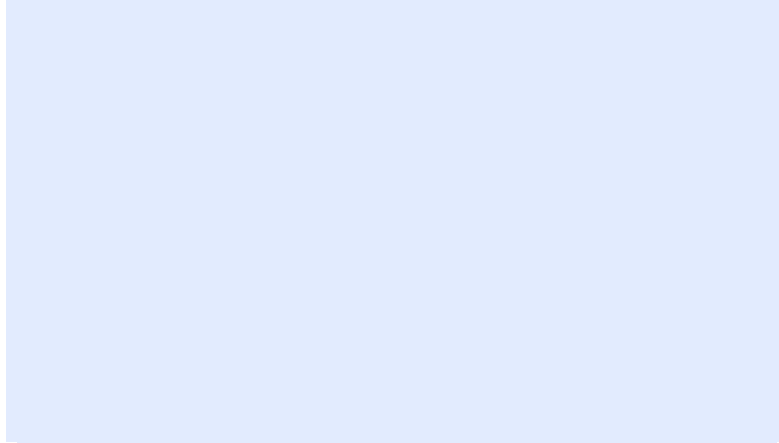




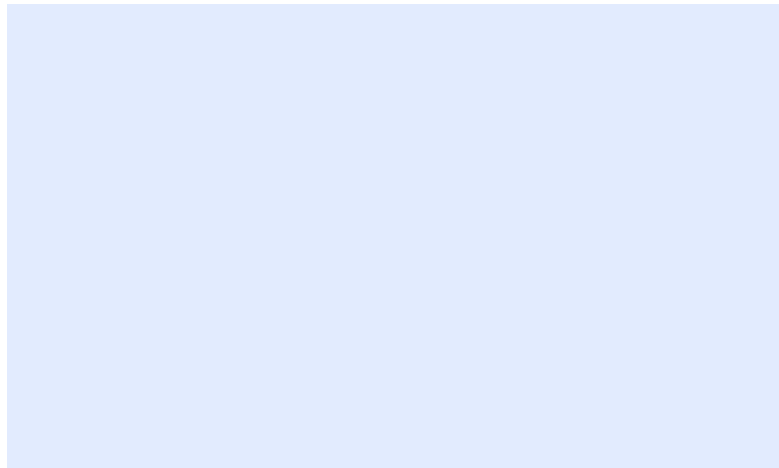
## Section B: Questionnaire

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1. What is your professional role and how does that relate to literacy and numeracy?



2. Do you think enough is being done to develop literacy and numeracy among student teachers?



3. Can you suggest ways to enhance the teaching of literacy and numeracy skills on school placement?

Numeracy

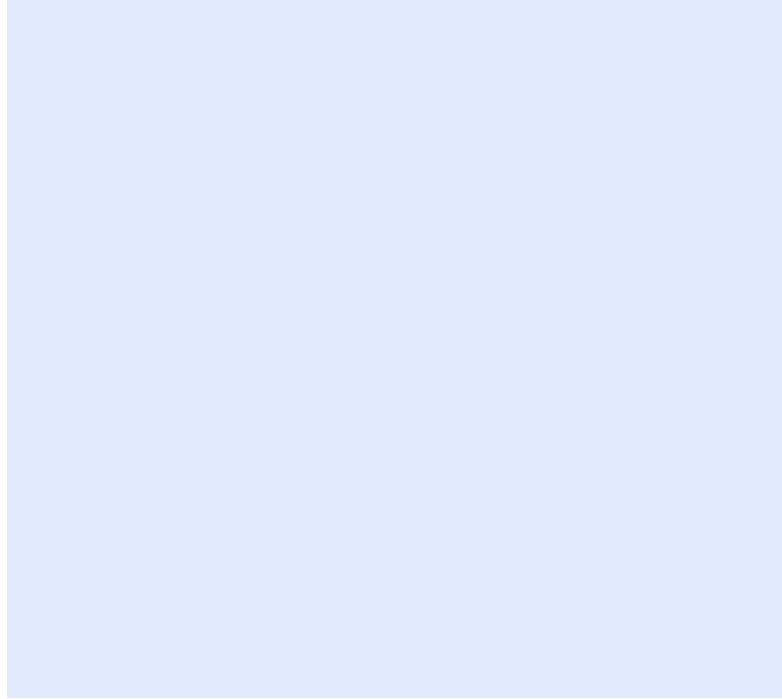
Literacy

4. Can you give any insight from your professional practice that may assist third level lecturers/tutors in developing literacy and numeracy skills amongst student-teachers on the GMIT Letterfrack teacher education programme?

Literacy

Numeracy

5. Any other comments



## Appendix 1: Questionnaire - Student Teacher

### Literacy and Numeracy Training and Teaching

#### Questionnaire – Student Teacher

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A Case Study Analysis of the Provision and Efficacy  
of Literacy and Numeracy Training in the  
Initial Teacher Education Programme at GMIT, Letterfrack.

---

Researcher:

Patricia O'Regan  
G00238648@gmit.ie  
0879870371



## Section B: Questionnaire

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1. Which year of the B. Sc. Ed. programme are you on?

Year 1

Year 2

Year 3

Year 4

2. Define the terms '**literacy**' and '**numeracy**' in your own words

Literacy

Numeracy

3. "I am confident in my own **personal** literacy and numeracy skills".

Indicate below, to what extent you agree/disagree with this statement.

**Literacy:**

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

**Numeracy:**

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

4. At what stage of your education did you most develop your literacy and numeracy skills?

**Literacy:**

- Pre-school
- Primary
- Post-primary
- Third level
- Other

**Numeracy:**

- Pre-school
- Primary
- Post-primary
- Third level
- Other

5. Have you learned, on the teacher education programme at GMIT Letterfrack, how to promote and develop literacy and numeracy skills within the classroom?

Yes  or No

*If 'yes', please give examples below*

Numeracy

Literacy

6. "I am confident in **teaching** literacy and numeracy skills to my students".

*Indicate below, to what extent you agree/disagree with this statement.*

**Literacy:**

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

**Numeracy:**

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

7. What strategies are you using in your School Placement to **promote** literacy and numeracy within your lessons?

Literacy

Numeracy

8. What methods are you using to **assess** the literacy and numeracy skills of your students?

1

2

3

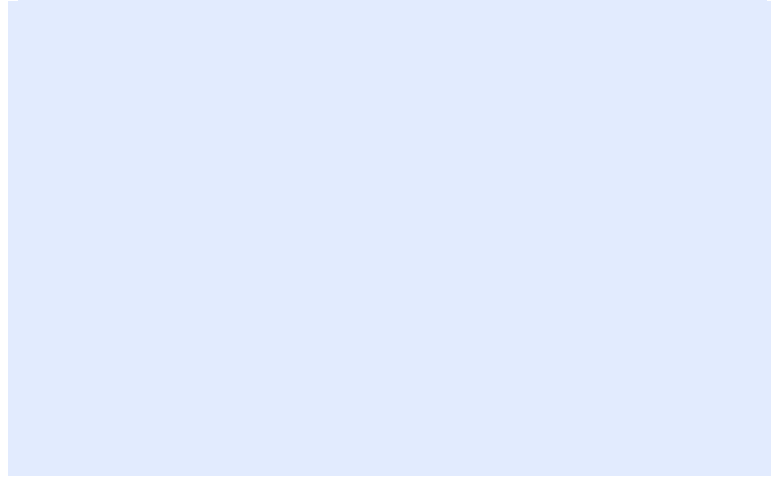
9. What are your 3 most **important learnings** from the keynote speeches?  
*List below in an order of priority*

1

2

3

10. Any other comments





## Appendix 2: Questionnaire - School Placement Tutor

### Literacy and Numeracy Training and Teaching

#### Questionnaire – School-Placement Tutor

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A Case Study Analysis of the Provision and Efficacy  
of Literacy and Numeracy Training in the  
Initial Teacher Education Programme at GMIT, Letterfrack.

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Researcher:

Patricia O'Regan  
G00238648@gmit.ie  
0879870371



## Section B: Questionnaire

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1. How many years have you been acting as a School Placement tutor on the B. Sc. Ed. Programme at GMIT Letterfrack?

- Less than 1
- 1-5 years
- 5-10 years
- 10+ years

2. Define the terms '**literacy**' and '**numeracy**' in your own words

Literacy

Numeracy

3. "I am confident in my own **personal** literacy and numeracy skills".

*Indicate below, to what extent you agree/disagree with this statement.*

**Literacy:**

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

**Numeracy:**

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

4. "I am confident in **teaching** literacy and numeracy skills to my students".

*Indicate below, to what extent you agree/disagree with this statement.*

**Literacy:**

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

**Numeracy:**

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

5. Which **examples of best practice** have you observed on school placement visits, regarding the promotion of literacy and numeracy skills?

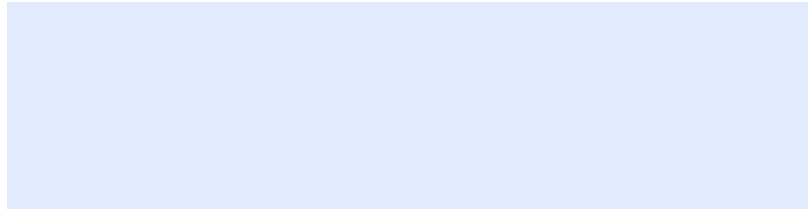
Literacy

Numeracy

6. Has your observation of literacy and numeracy skills become more prominent in your school placement assessments since the Junior Cycle reform?

- Not at all
- Only marginally
- Yes
- Very much so

7. What training, if any, have you received to prepare you for literacy and numeracy pedagogy and assessment?

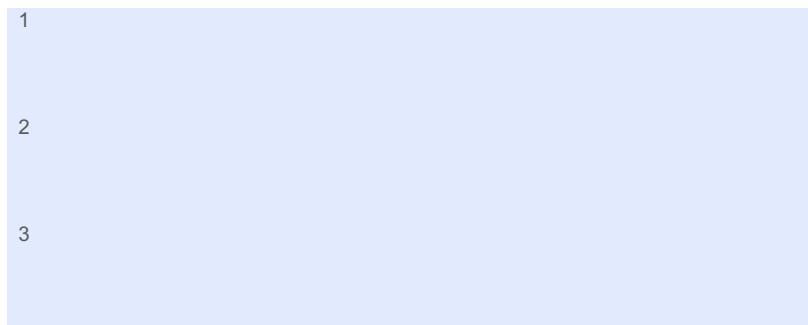


8. What changes should be considered to further facilitate literacy and numeracy development on the ITE programme at GMIT Letterfrack?

1

2

3



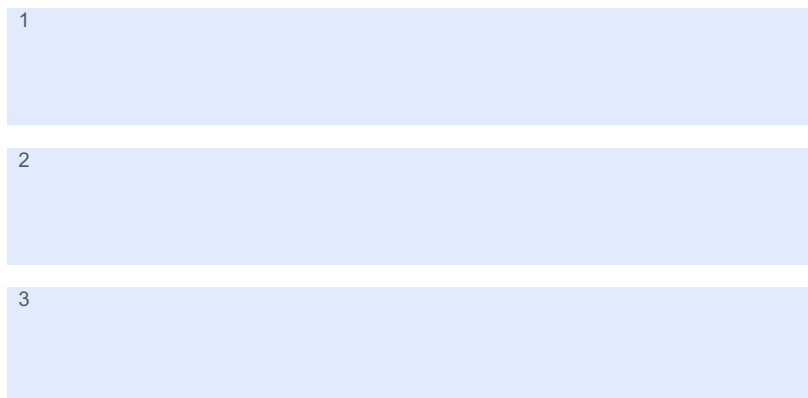
9. What are your **3 most important** learnings from the keynote speeches?

*List below in an order of priority*

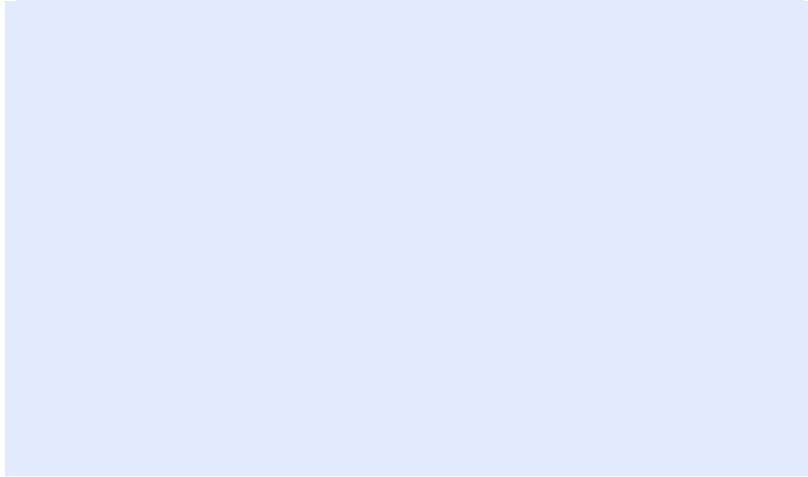
1

2

3



10. Any other comments



## **Appendix 3: Questionnaire – Other Educational Professionals**

# Literacy and Numeracy Training and Teaching

## Questionnaire – Professional

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A Case Study Analysis of the Provision and Efficacy  
of Literacy and Numeracy Training in the  
Initial Teacher Education Programme at GMIT, Letterfrack.

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Researcher:

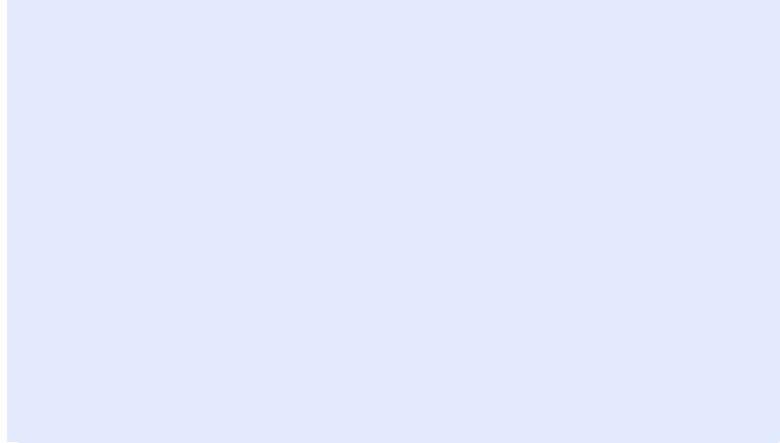
Patricia O'Regan  
G00238648@gmit.ie  
0879870371



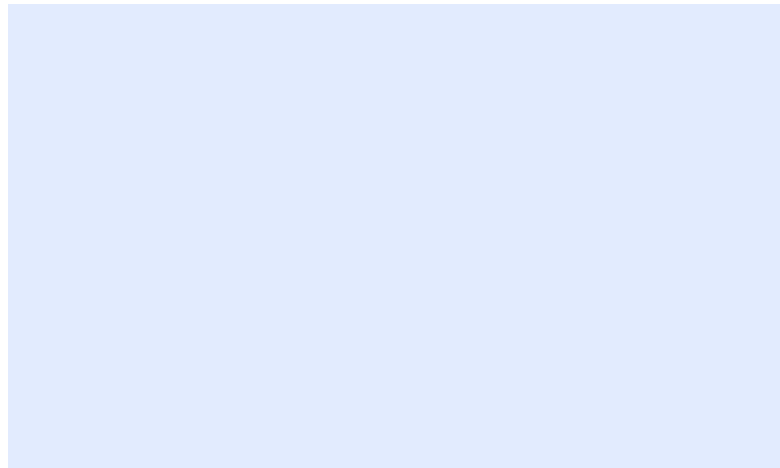
## Section B: Questionnaire

---

1. What is your professional role and how does that relate to literacy and numeracy?



2. Do you think enough is being done to develop literacy and numeracy among student teachers?





3. Can you suggest ways to enhance the teaching of literacy and numeracy skills on school placement?

Numeracy

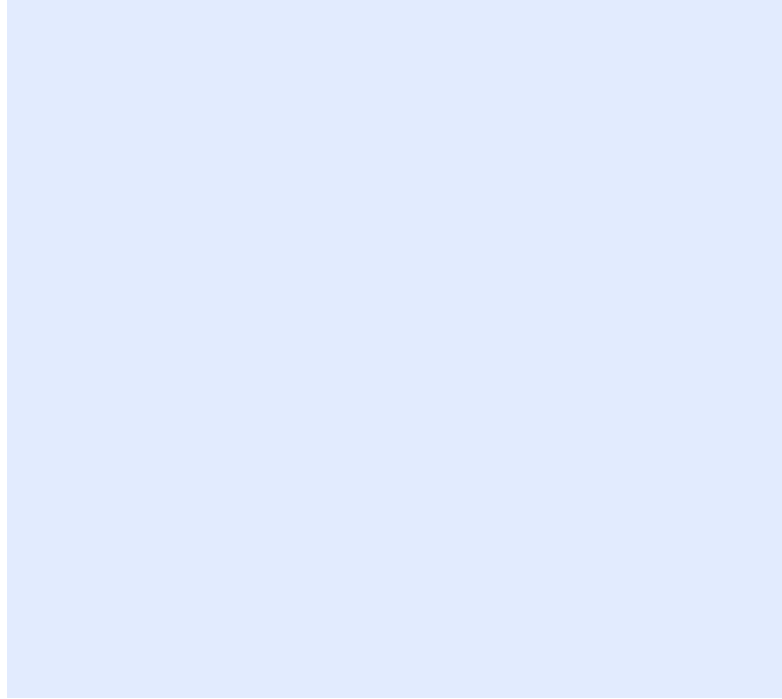
Literacy

4. Can you give any insight from your professional practice that may assist third level lecturers/tutors in developing literacy and numeracy skills amongst student-teachers on the GMIT Letterfrack teacher education programme?

Literacy

Numeracy

5. Any other comments



## Appendix 4: Conference Flyer

# CREATIVITY AND INNOVATION IN THE CLASSROOM **INITIAL** **TEACHER** **EDUCATION** **CONFERENCE**

**Wednesday**  
**February 19<sup>th</sup>**

**9.30 am - 3.30 pm**

**Venue – Galvia Suite, Connacht  
Hotel, Dublin Rd., Galway**

**Galway Mayo**  
**Institute of**  
**Technology**



## Event schedule

9.30 - Registration and Tea/Coffee

10.00 – Welcome Address Dr.  
Patrick Tobin, Head of School of  
Design and Creative Arts, GMIT

10.15 – Introductions, Kevin Maye,  
Programme Chair, GMIT

10.25 – Keynote Addresses on  
Literacy and Numeracy in Irish  
Post-Primary Context, Dr. Cornelia  
Connolly and Kathy O’ Sullivan,  
NUI Galway

11.00 – Thomas Sheppard, GMIT  
Numeracy within Graphics

11.20 – Q&A

11.30 – Break

12.00 – Literacy & Numeracy  
Questionnaire

12.15 – Breakout Discussion  
Groups and Feedback

1.00 – Lunch

2.00 – Final Year Students’ School  
Placement Presentations

3.15 – Closing Remarks, Paul  
Leamy, Head of Department, GMIT  
Letterfrack

## Appendix 5: Conference Seating Plan

### CREATIVITY AND INNOVATION IN THE CLASSROOM

Initial Teacher Education Conference Galway Mayo Institute of Technology

### SEATING PLAN

...Look for the corresponding coloured sign on each table

<p><b>1 PIAGET</b></p> <p>1 Name 1<sup>st</sup> year 1 Name 1<sup>st</sup> year 2 Name 2<sup>nd</sup> year 2 Name 2<sup>nd</sup> year 3 Name 3<sup>rd</sup> year</p> <p>3 Name 3<sup>rd</sup> year 4 Name 4<sup>th</sup> year Placement Tutor 1 Placement Tutor 2 Education Professional</p>	<p><b>2 VYGOTSKY</b></p> <p>1 Name 1<sup>st</sup> year 1 Name 1<sup>st</sup> year 2 Name 2<sup>nd</sup> year 2 Name 2<sup>nd</sup> year 3 Name 3<sup>rd</sup> year</p> <p>3 Name 3<sup>rd</sup> year 4 Name 4<sup>th</sup> year Placement Tutor 1 Placement Tutor 2 Education Professional</p>
<p><b>3 MASLOW</b></p> <p>1 Name 1<sup>st</sup> year 1 Name 1<sup>st</sup> year 2 Name 2<sup>nd</sup> year 2 Name 2<sup>nd</sup> year 3 Name 3<sup>rd</sup> year</p> <p>3 Name 3<sup>rd</sup> year 4 Name 4<sup>th</sup> year Placement Tutor 1 Placement Tutor 2 Education Professional</p>	<p><b>4 ROGERS</b></p> <p>1 Name 1<sup>st</sup> year 1 Name 1<sup>st</sup> year 2 Name 2<sup>nd</sup> year 2 Name 2<sup>nd</sup> year 3 Name 3<sup>rd</sup> year</p> <p>3 Name 3<sup>rd</sup> year 4 Name 4<sup>th</sup> year 4 Name 4<sup>th</sup> year Placement Tutor 1 Education Professional</p>
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## **Appendix 6: Breakout Circle Group – Facilitators Questions**

# Literacy and Numeracy Training and Teaching

## BREAK OUT CIRCLES QUESTION SCHEDULE

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A Case Study Analysis of the Provision and Efficacy  
of Literacy and Numeracy Training in the  
Initial Teacher Education Programme at GMIT, Letterfrack.

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Researcher:

Patricia O'Regan  
G00238648@gmit.ie  
0879870371



## Break-out Circle Group

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Tutor-Facilitator:

*Tutor facilitating break-out circle group*

Group No.:

*Tutors may be contacted at a later date to discuss or clarify some of the responses recorded below.*

### *Guidelines:*

*Please write your group number in the above box*

*Complete these questions within time frame - 30 mins.*

*Complete all sections/questions*

*One student-teacher in each group is to be assigned the role of record keeper. Responses to be completed on pages provided.*

### 1. Defining the terms literacy and numeracy.

*You have reflected on the terms- 'literacy' and 'numeracy':*

*How do you understand 'literacy', in light of today's explorations?*

*What have you learned that is new, in relation to literacy?*

*How do you understand numeracy, in light of today's explorations?*

*What have you learned that is new in relation to numeracy?*

*Can you agree with each other on the meaning of these terms?*

*Do you think anything has been left out?*

*Do you think literacy and numeracy are linked with oracy? If so, in what way?*

*Do you think literacy and numeracy are linked with graphicacy? If so, how?*

*What is the difference between numeracy and maths?*

*Has your understanding of these terms changed because of this conversation?*

## 2. Personal literacy and numeracy skills.

*Does being personally literate and numerate, make it easier to teach your specialised subjects?*

*Have you done anything to better your literacy and numeracy skills since commencing college?*

*Are you aware of supports that you can get in this area: GMIT Maths Centre and Academic Writing Centre?*

*Would you consider using these support services? Why/ why not?*

*Is anyone in the group comfortable sharing their personal confidence levels in literacy and numeracy? If so, are you aware of any contributing factors?*

## 3. Literacy and numeracy throughout education.

*At what stage of education are learning literacy and numeracy skills most developed? Was this the case for you? Why/why not?*

*Do you think it is your job to teach these skills at post-primary level?*

*Do you think it is the job of third level lecturers/tutors to teach you these skills?*

## 4. Training within the Teacher Education programme.

*Have you any recollection of exploring literacy and numeracy on the programme?*

*Was literacy and numeracy evident in all/any modules on the programme?*

*Can you provide examples of training in developing literacy and numeracy in specific modules?*

*In your School Placement Planning Grids and Lesson Plans, did you incorporate literacy and numeracy strategies?*

*Did you successfully implement these strategies while on School Placement?*

## 5. Strategies to promote and assess literacy and numeracy.

*Are you currently promoting literacy and numeracy in the classroom?*

*If so, please share what you are doing to promote literacy and numeracy in your teaching.*

*If not currently, how might you in the future?*



*Are you currently assessing literacy and numeracy in the classroom?*

*If so, please share what you are doing to assess literacy and numeracy in teaching.*

*If not currently, how might you in the future?*

6. Key learnings from conference.

*As a group, collectively agree the three dominant learnings from the key speakers today, in order of priority.*

7. Any other comments.

## **Appendix 7: Breakout Circle Group – Record of Response**

# Literacy and Numeracy Training and Teaching

## BREAK OUT CIRCLES - RESPONSES

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A Case Study Analysis of the Provision and Efficacy  
of Literacy and Numeracy Training in the  
Initial Teacher Education Programme at GMIT, Letterfrack.

---

Researcher:

Patricia O'Regan  
G00238648@gmit.ie  
0879870371



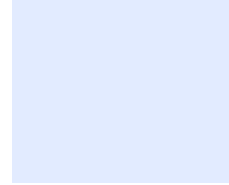
## Break-out Circle Group - Responses

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Record-keeper to record responses in the spaces below

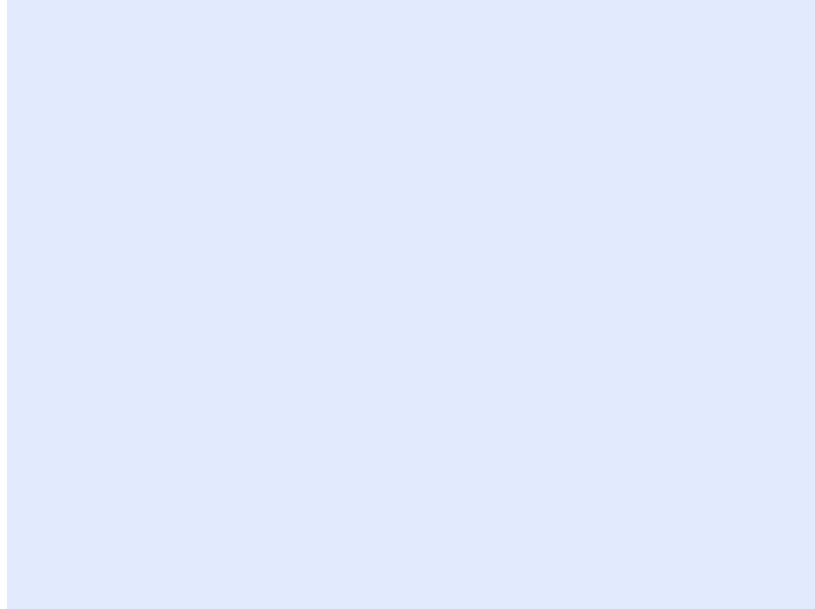
Group No.:

*Please write corresponding group number in the box provided*



### 1. Defining the terms literacy and numeracy.

*You have reflected on the terms- 'literacy' and 'numeracy':  
How do you understand 'literacy', in light of today's explorations?  
What have you learned that is new, in relation to literacy?  
How do you understand numeracy, in light of today's explorations?  
What have you learned that is new in relation to numeracy?  
Can you agree with each other on the meaning of these terms?  
Do you think anything has been left out?  
Do you think literacy and numeracy are linked with oracy? If so, in what way?  
Do you think literacy and numeracy are linked with graphicacy? If so, how  
What is the difference between numeracy and maths?  
Has your understanding of these terms changed because of this conversation?*



## 2. Personal literacy and numeracy skills.

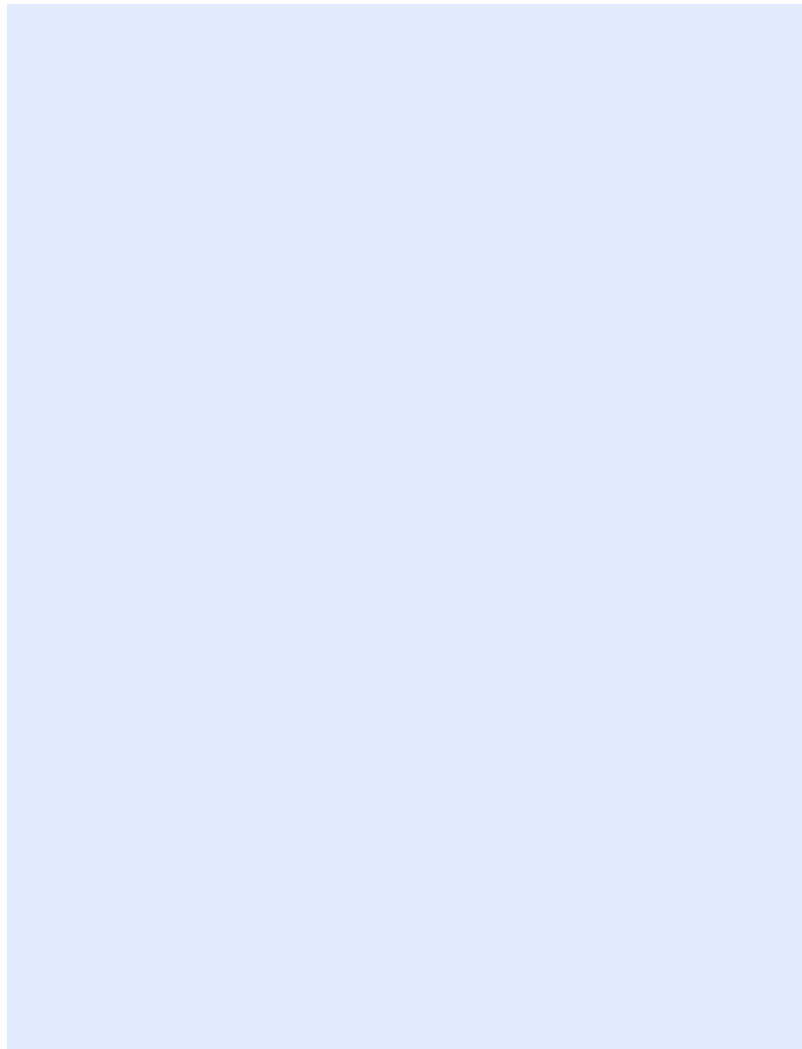
*Does being personally literate and numerate, make it easier to teach your specialised subjects?*

*Have you done anything to better your literacy and numeracy skills since commencing college?*

*Are you aware of supports that you can get in this area: GMIT Maths Centre and Academic Writing Centre?*

*Would you consider using these support services? Why/ why not?*

*Is anyone in the group comfortable sharing their personal confidence levels in literacy and numeracy? If so, are you aware of any contributing factors?*



### 3. Literacy and numeracy throughout education.

*At what stage of education are learning literacy and numeracy skills most developed?*

*Was this the case for you? Why/why not?*

*Do you think it is your job to teach these skills at post-primary level?*

*Do you think it is the job of third level lecturers/tutors to teach you these skills?*

#### 4. Training within the Teacher Education programme.

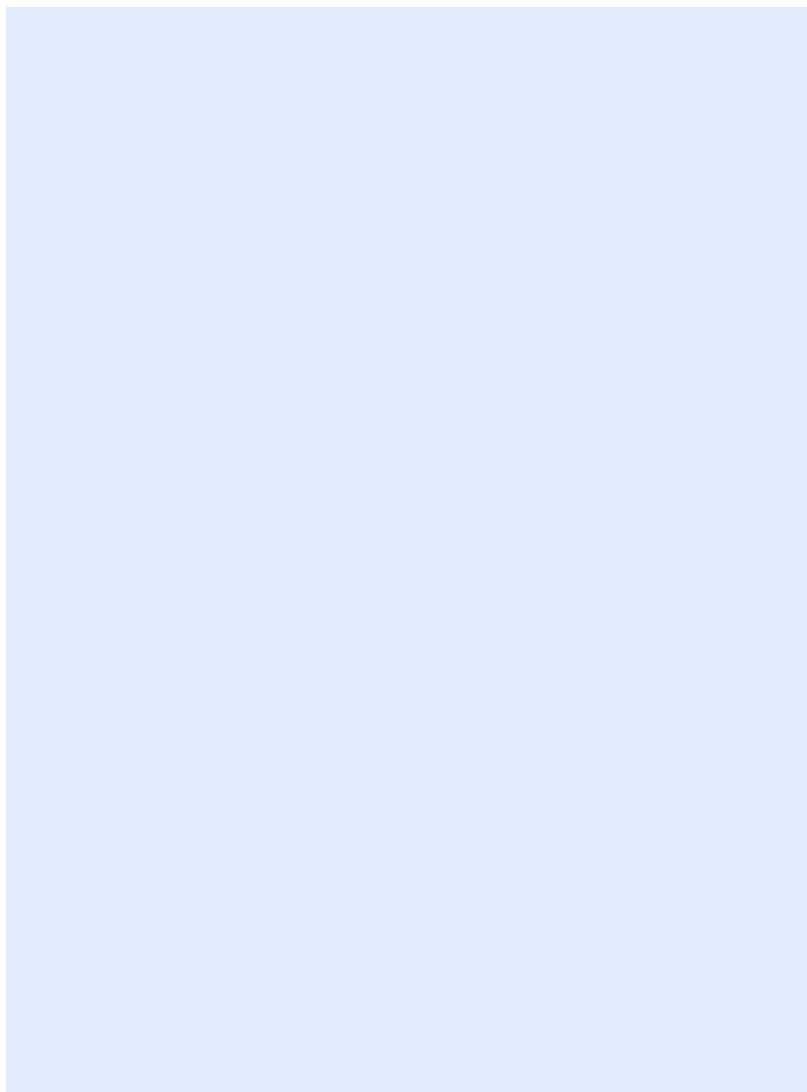
*Have you any recollection of exploring literacy and numeracy on the programme?*

*Was literacy and numeracy evident in all/any modules on the programme?*

*Can you provide examples of training in developing literacy and numeracy in specific modules?*

*In your School Placement Planning Grids and Lesson Plans, did you incorporate literacy and numeracy strategies?*

*Did you successfully implement these strategies while on School Placement?*



5. Strategies to promote and assess literacy and numeracy.

*Are you currently promoting literacy and numeracy in the classroom?*

*If so, please share what you are doing to promote literacy and numeracy in your teaching.*

*If not currently, how might you in the future?*

*Are you currently assessing literacy and numeracy in the classroom?*

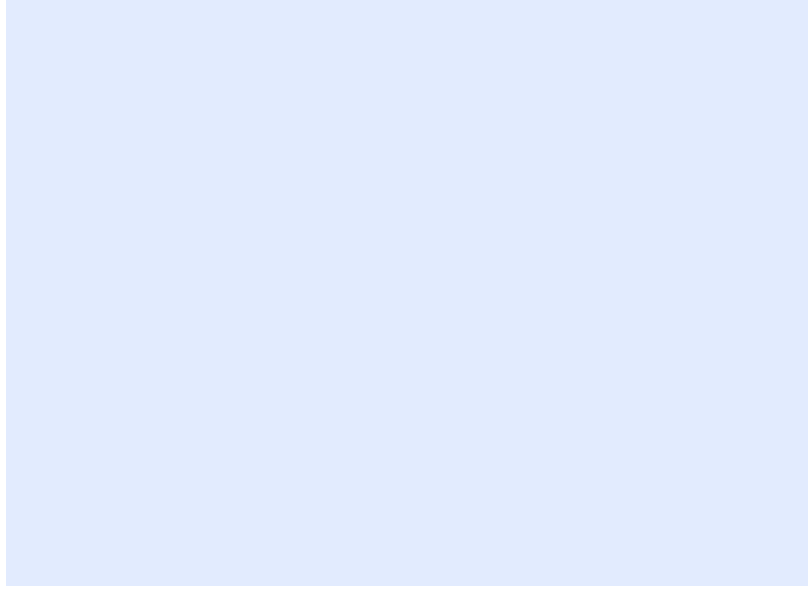
*If so, please share what you are doing to assess literacy and numeracy in teaching.*

*If not currently, how might you in the future?*

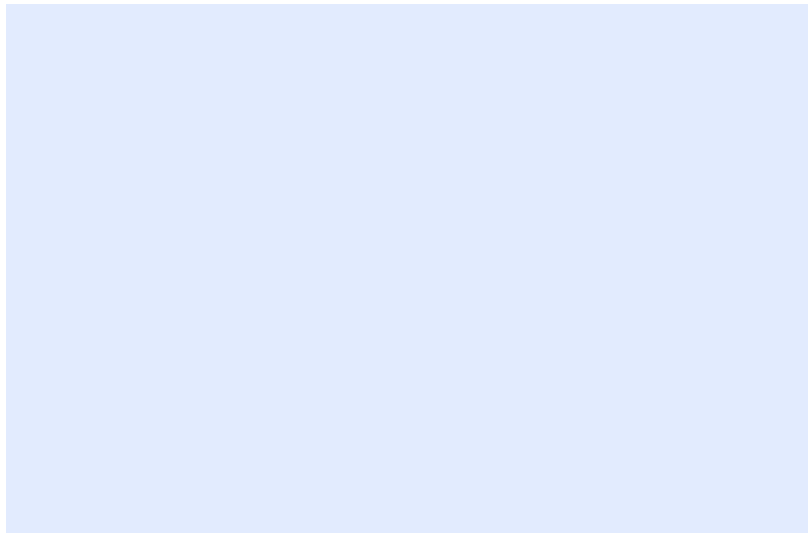


6. Key learnings from conference.

*As a group, collectively agree the three dominant learnings from the key speakers today, in order of priority.*



7. Any other comments



# Literacy and Numeracy Training and Teaching

## Consent & Research Information

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A Case Study Analysis of the Provision and Efficacy  
of Literacy and Numeracy Training in the  
Initial Teacher Education Programme at GMIT, Letterfrack.

---

Researcher:

Patricia O'Regan  
G00238648@gmit.ie  
0879870371



## PARTICIPANT INFORMATION LEAFLET

---

1. **Working Title of the Study:** *A Case Study Analysis of the Provision and Efficacy of Literacy and Numeracy Training in the Initial Teacher Education Programme at GMIT, Letterfrack.*
2. **Introduction to the Study:** The promotion of Literacy and Numeracy is a significant theme in Initial Teacher Education (ITE). This research project investigates what training, if any, is currently being provided in one case, namely, the *B. Sc. in Education* (Honours) degree programme at GMIT Letterfrack, regarding the promotion and development of literacy and numeracy skills in Teacher Education. The aim of this study is to identify strengths and weaknesses of GMIT delivery and make recommendations for future implementation.
3. **Research Procedures:** Data to be gathered by way of a focus group/interview using an online platform such as Microsoft Teams or similar.
4. **Benefits of the Research:** This research will lead to the enhancement of delivery in this B. Sc. in Education programme at GMIT Letterfrack and will therefore be of benefit to future students enrolling in the ITE programme at Letterfrack and to graduates moving into the profession.
5. **Risks of the Research:** There are no material risks, discomforts or side effects associated with this research.
6. **Confidentiality:**
  - Participants can remain anonymous if they so wish.
  - If so, no identifying factors relating to participants will be in evidence in the final thesis report and/or any disseminated research (i.e. conference papers and/or presentations, publications, etc.)
7. **Compensation:** This study is covered by standard institutional indemnity insurance. Nothing in this document restricts or curtails your rights.
8. **Voluntary Participation:** You have volunteered to participate in this study. If you wish to withdraw, *please contact the researcher within one month of initial participation*. If you decide not to participate, or if you withdraw, you will not be penalised and will not give up any benefits that you had before entering the study.
9. **Stopping the Study:** You understand that the researcher(s) may withdraw you from participation in the study at any time without your consent, for legitimate reasons.

10. **Permission:** This research has approval from the *Research Sub Committee of Academic Council*.
  11. **Further Information:** You can get more information or answers to your questions about the study, your participation in the study and your rights, from Patricia O'Regan who can be telephoned at 0879870371 or e-mailed at G00238648@gmit.ie
  12. **New Information Arising:** If the researcher or research supervisors learn of important new information that might affect your desire to remain in the study, or if any conflicts of interest emerge during the course of the study, you will be informed at once.
-

## INFORMED CONSENT

**Working Title:** *A Case Study Analysis of the Provision and Efficacy of Literacy and Numeracy Training in the Initial Teacher Education Programme at GMIT, Letterfrack*

**Principal Researcher:** Patricia O'Regan ([G00238648@gmit.ie](mailto:G00238648@gmit.ie))

**Background to the Study:** Literacy and Numeracy is a significant theme in the training of second-level teachers. This research project investigates what training, if any, is being provided in the *B. Sc. in Education* (Honours) degree programme at GMIT Letterfrack, regarding the promotion and development of literacy and numeracy skills as a student-teachers, with a view to further improvements.

**Participant Declaration** (Tick 'Yes' or 'No', as appropriate.)

- |  |                              |                             |
|--|------------------------------|-----------------------------|
| I have read the information sheet read to me and I understand the contents.  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| I have been given an opportunity to ask questions and am satisfied with the answers.   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| I have given consent to take part in the study.  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| I understand that participation is voluntary and if I wish to withdraw I can do so within one month of initial participation.                    | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| I understand that withdrawal will not affect my access to services or legal rights.  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| I consent to possible publication of results.  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| I (the participant) give my permission for the data obtained from me to be used in other future studies without the need for additional consent. | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

**Researcher Declaration** (Tick 'Yes' or 'No', as appropriate.)

- |  |     |    |
|--|-----|----|
| I have explained the study to the participant.                             | Yes | No |
| I have answered questions put to me by the participant about the research. | Yes | No |
| I believe that the participant understands and is freely giving consent.   | Yes | No |

**Participant Statement:** I have read this consent form. I have had the opportunity to ask questions, and all my questions have been answered to my satisfaction. I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights. I understand I may withdraw from the study at any time. I have received a copy of this consent form.

Please Tick: YES  NO

**Researcher Statement:**

I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I offered to answer any questions and have fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

**Researcher Signature:**

**Date:**

*By completing and submitting this consent form and by participating in the focus group/ interview you are agreeing that any related data obtained may be used in this research study and in any future dissemination of the research.*

**Participant Signature:**

---

**Date:**

*If you would rather remain anonymous, please tick the box below.*

**Consent to be an anonymous participant:**

## Appendix 8: Information & Informed Consent - Focus Groups & Interviews

### Literacy and Numeracy Training and Teaching

#### Consent & Research Information

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A Case Study Analysis of the Provision and Efficacy  
of Literacy and Numeracy Training in the  
Initial Teacher Education Programme at GMIT, Letterfrack.

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Researcher:

Patricia O'Regan  
G00238648@gmit.ie  
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4. **Benefits of the Research:** This research will lead to the enhancement of delivery in this B. Sc. in Education programme at GMIT Letterfrack and will therefore be of benefit to future students enrolling in the ITE programme at Letterfrack and to graduates moving into the profession.
5. **Risks of the Research:** There are no material risks, discomforts or side effects associated with this research.
6. **Confidentiality:**
  - Participants can remain anonymous if they so wish.
  - If so, no identifying factors relating to participants will be in evidence in the final thesis report and/or any disseminated research (i.e. conference papers and/or presentations, publications, etc.)
7. **Compensation:** This study is covered by standard institutional indemnity insurance. Nothing in this document restricts or curtails your rights.
8. **Voluntary Participation:** You have volunteered to participate in this study. If you wish to withdraw, *please contact the researcher within one month of initial participation*. If you decide not to participate, or if you withdraw, you will not be penalised and will not give up any benefits that you had before entering the study.
9. **Stopping the Study:** You understand that the researcher(s) may withdraw you from participation in the study at any time without your consent, for legitimate reasons.



10. **Permission:** This research has approval from the *Research Sub Committee of Academic Council*.
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  12. **New Information Arising:** If the researcher or research supervisors learn of important new information that might affect your desire to remain in the study, or if any conflicts of interest emerge during the course of the study, you will be informed at once.
-

## INFORMED CONSENT

**Working Title:** *A Case Study Analysis of the Provision and Efficacy of Literacy and Numeracy Training in the Initial Teacher Education Programme at GMIT, Letterfrack*

**Principal Researcher:** Patricia O'Regan ([G00238648@gmit.ie](mailto:G00238648@gmit.ie))

**Background to the Study:** Literacy and Numeracy is a significant theme in the training of second-level teachers. This research project investigates what training, if any, is being provided in the *B. Sc. in Education* (Honours) degree programme at GMIT Letterfrack, regarding the promotion and development of literacy and numeracy skills as a student-teachers, with a view to further improvements.

**Participant Declaration** (Tick 'Yes' or 'No', as appropriate.)

- |  |                              |                             |
|--|------------------------------|-----------------------------|
| I have read the information sheet read to me and I understand the contents.  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| I have been given an opportunity to ask questions and am satisfied with the answers.   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| I have given consent to take part in the study.  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| I understand that participation is voluntary and if I wish to withdraw I can do so within one month of initial participation.                    | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| I understand that withdrawal will not affect my access to services or legal rights.  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| I consent to possible publication of results.  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| I (the participant) give my permission for the data obtained from me to be used in other future studies without the need for additional consent. | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

**Researcher Declaration** (Tick 'Yes' or 'No', as appropriate.)

- |  |     |    |
|--|-----|----|
| I have explained the study to the participant.                             | Yes | No |
| I have answered questions put to me by the participant about the research. | Yes | No |
| I believe that the participant understands and is freely giving consent.   | Yes | No |

**Participant Statement:** I have read this consent form. I have had the opportunity to ask questions, and all my questions have been answered to my satisfaction. I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights. I understand I may withdraw from the study at any time. I have received a copy of this consent form.

Please Tick: YES  NO

**Researcher Statement:**

I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I offered to answer any questions and have fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

**Researcher Signature:**

**Date:**

*By completing and submitting this consent form and by participating in the focus group/ interview you are agreeing that any related data obtained may be used in this research study and in any future dissemination of the research.*

**Participant Signature:**

---

**Date:**

*If you would rather remain anonymous, please tick the box below.*

**Consent to be an anonymous participant:**

## Appendix 9: Focus Group – School Placement Tutors (Questions & Schedule

### Literacy and Numeracy Training and Teaching

#### Focus Group – School-Placement Tutor

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A Case Study Analysis of the Provision and Efficacy  
of Literacy and Numeracy Training in the  
Initial Teacher Education Programme at GMIT, Letterfrack.

---

Researcher:

Patricia O'Regan  
G00238648@gmit.ie  
0879870371



## PART 1: INTRODUCTION: 15 mins

### 1. Introduction

Welcome and thank you

My research project – Exploring literacy and numeracy development training within the teacher education programme at GMIT, Letterfrack, to identify areas where improvements can be made

Aim of this focus group –

To follow on from the questionnaires at the Conference in February.

This discussion will give deeper insight into the reasoning or rationale behind the responses previously given on your understanding of L&N, your training, examples of observations on school placement and the further facilitation of L&N within the programme.

Not just the what, but the why.

### 2. General themes arising from data to date

- a. Majority of students have only a very basic understanding of what literacy is (Reading/writing)
- b. Students are more comfortable and confident dealing with developing numeracy
- c. The in-classroom-examples of L&N were of a basic level
- d. There is a disjunction between student's opinions of their personal L skills and what was presented in the questionnaire responses.
- e. The key speeches at the conference contributed to the student's understanding of numeracy.

### 3. focus group process

2 parts

part 1 – SP tutors' experiences and observations.

part 2 – Suggestions for improvement

20 minutes each (each videoed)

with consent

### 4. Consent

now that they are aware of the process and content,

if willing to participate in the research, remain on,

if not, feel free to leave the group.

by participating, you are consenting.

## PART 2 VIDEO- 20 mins

SP tutor's experiences and observations.

The meaning of 'literacy' and 'numeracy':

- Can you agree on the meaning of these terms?
- Are they connected? If so, how?
- Does the meaning of these terms change, depending on the context? depending on the level of education (early years to 3<sup>rd</sup> level)?

Assessment and observations:

- There are 14 items that you are assessing on the **SP feedback rubric**. How do you prioritise L&N on this list?  
  
Would a further breakdown of the different items be beneficial, or would it complicate the assessment unnecessarily?
- Are you assessing the student-teacher's **personal skills** or their ability to **develop the skills of their students**?
- Is there an **alignment** between what is being taught in **lectures/tutorials** and what is being **assessed** on school placement?
- What examples of **best practice** have you observed on school placement?
- Have you experienced any **challenges** with assessing L&N on school placement visits?
- Anything else of significance on the topic of assessment and your observations?

Extra prompt questions:

- \*Have students explicitly sought support on L&N during School visits?
- \*Have they expressed interest in the topic of L&N?
- \*Is this a priority for students when planning?
- \*Have any students written a critical reflection on the topic?
- \*Did you observe any impressive examples of L&N implementation on placement visits?
- \*In general, have you found SP files to be appropriately proofread?
- \*Are students generally highlighting numeracy explicitly in lessons?
- \*Typical how is L&N promoted (or otherwise) in observed classes?

STOP VIDEO and  
introduce PART 3

### PART 3: VIDEO- 20 mins

Suggestions for improvement of the programme:

#### Student-teacher training:

It is apparent that students on this programme require training/tutoring in this area. The feedback from students is that they would appreciate some practical examples of how to embed L&N into their own teaching.

- How could this efficiently be **incorporated** into the programme?  
Modules? All?
- What **form** should additional training take?  
In class, one-off tutorials, conferences?
- **Incremental** training from 1<sup>st</sup> year to 4<sup>th</sup> year?

#### Staff training:

At present, school-placement tutors rely on previous training/qualifications to assess student-teachers on school placement (different levels of experience, educational backgrounds, qualifications)

- Considering the different levels of experience, can you suggest a means by which the SPTs can adopt a **more cohesive** approach?
- Would a more definitive **set of guidelines** be helpful for the assessment of L&N?
- Can you suggest what might benefit you in terms of training in this area?
- Any other comments on the topic of training students and staff to enhance L&N within this programme?

\*Have you received any formal training on L&N in teaching, to date?





## Appendix 10: Focus Group – School-Placement Tutors (PowerPoint Slides)

### Literacy and Numeracy Training and Teaching

#### Focus Group – School-Placement Tutor

A Case Study Analysis of the Provision and Efficacy  
of Literacy and Numeracy Training in the  
Initial Teacher Education Programme at GMIT, Letterfrack.

Researcher:  
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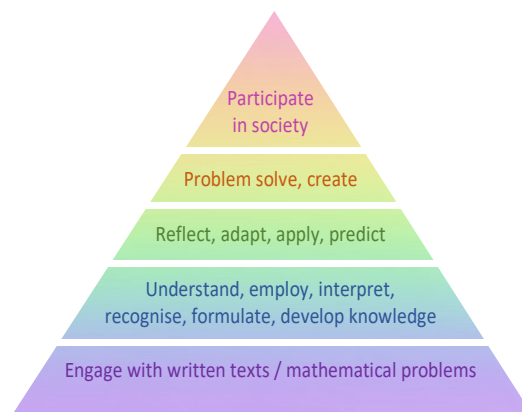
#### PART 1

Introduction

General themes arising from data

Focus Group Process

Consent



Taxonomy of Literacy and Numeracy

## PART 2 – School-placement tutor’s experiences and observations:

### The meaning of ‘literacy’ and ‘numeracy’:

- Can you agree on the meaning of these terms?
- Are they connected? If so, how?
- Does the meaning of these terms change, depending on the context? depending on the level of education (early years to 3<sup>rd</sup> level)?

### Assessment and observations:

- There are 14 items that you are assessing on the **SP feedback rubric**. How do you prioritise L&N on this list? Would a further breakdown of the different items be beneficial, or would it complicate the assessment unnecessarily?
- Are you assessing the student-teacher’s **personal skills** or their ability to **develop the skills of their students**?
- Is there an **alignment** between what is being taught in **lectures/tutorials** and what is being **assessed** on school placement?
- What examples of **best practice** have you observed on school placement?
- Have you experienced any **challenges** with assessing L&N on school placement visits?
- Anything else of significance on the topic of assessment and your observations?

## PART 3 - Suggestions for improvement of the programme:

### Student-teacher training:

- It is apparent that students on this programme require training/tutoring in this area. The feedback from students is that they would appreciate some practical examples of how to embed L&N into their own teaching.
- How could this efficiently be **incorporated** into the programme? Modules? All?
- What **form** should additional training take? In class, one-off tutorials, conferences?
- **Incremental** training from 1<sup>st</sup> year to 4<sup>th</sup> year?

### Staff training:

- At present, school-placement tutors rely on previous training/qualifications to assess student-teachers on school placement (different levels of experience, educational backgrounds, qualifications)
- Considering the different levels of experience, can you suggest a means by which the SPTs can adopt a **more cohesive** approach?
- Would a more definitive **set of guidelines** be helpful for the assessment of L&N?
- Can you suggest what might benefit you in terms of training in this area?
- Any other comments on the topic of training students and staff to enhance L&N within this programme?

## Appendix 11: Management Focus Group - Question Schedule

A qualitative discussion guided by the following questions:

1. Having had time to reflect on the *Creativity and Innovation in the Classroom: Initial Teacher Education Conference (GMIT 2020)*, how useful was the input regarding literacy and numeracy development, as a training exercise?
2. How could a training exercise such as this be improved?
3. How relevant would this type of training be for all staff on the Letterfrack campus?
4. Would you consider a whole campus strategy to address literacy and numeracy for all Letterfrack students? and what are the implications for the whole campus if a training programme or module were set up?
5. What would you consider to most valuable training methods to ensure the embedding of good practices regarding the teaching of literacy and numeracy?
6. Who should this training be aimed at, student-teachers or staff, or both?
7. What type of training would be most practical(usable) and most feasible?

## **Appendix 12: Question Schedule - Numeracy Expert 1**

A qualitative discussion guided by the following questions/topics:

1. What does numeracy mean for today's society?
2. Discuss findings from my research to date, including
3. the challenges in defining both literacy and numeracy,
4. the difference between literacy and numeracy within the technical subjects
5. student-teacher confidence in their personal literacy and numeracy abilities, and their ability to develop these skills in the classroom,
6. the misalignment between student-teacher' confidence and practice.
7. How are you dealing with disciplinary numeracy within subjects where it may not be obviously present?
8. Can you recommend any Models or frameworks to assist the promotion and embedding of numeracy development within the programme but also to improve student-teachers' practices in this regard?
9. Can you recommend any current literature on the topic of numeracy development, that may not have considered?
10. Can you suggest any authors in the field of numeracy development?

## Appendix 13: Question Schedule - Numeracy Expert 2

A qualitative discussion guided by the following questions/topics:

1. Discuss findings from my research to date, including
2. the challenges in defining both literacy and numeracy,
3. the difference between literacy and numeracy within the technical subjects
4. student-teacher confidence in their personal literacy and numeracy abilities, and their ability to develop these skills in the classroom,
5. the misalignment between student-teacher' confidence and practice.
6. How do you define numeracy and its relationship to literacy, considering the use of the term 'mathematical Literacy' being used to define numeracy?
7. Do you consider literacy and numeracy to be connected?
8. How can the numeracy model which you developed be applied to subjects outside of the STEM disciplines?
9. Can you recommend any other models or frameworks to assist the promotion and embedding of numeracy development within the programme but also to improve student-teachers' practices in this regard?
10. Can you recommend any current literature on the topic of numeracy development, that may not have considered?
11. Can you suggest any authors in the field of numeracy development?

12.

## **Appendix 14: Question Schedule - Literacy Expert 1**

A qualitative discussion guided by the following questions/topics:

1. Discuss some of your publications relevant and that are being referred to in my thesis.
2. Discuss findings from my research to date, including the challenges in defining both literacy and numeracy.
3. How are you addressing these same issues in the literacy and numeracy development in the post-primary classroom module?
4. How does your module ensure that the student-teachers are making the relationship between theory and practice?
5. How do you view the relationship between literacy and numeracy and how is this relationship dealt with, within the module?
6. How are you assessing your student-teachers ability to develop literacy and numeracy skills in practice?
7. What training did your staff engage in to teach on the module?
8. Can you recommend any Models or frameworks to assist the promotion and embedding of literacy development within the programme but also to improve student-teachers' practices in this regard?
9. Can you recommend any current literature on the topic of literacy development, that may not have considered?
10. Can you suggest any authors in the field of literacy development?

## Appendix 15: Question Schedule - Literacy Expert 2

A qualitative discussion guided by the following questions/topics:

1. Discuss some of your publications relevant and that are being referred to in my thesis.
2. Have you published anything else regarding the topic of literacy development since your article in 2014?
3. How do you perceive technical subject teachers regarding the development of literacy skills?
4. Discuss findings from my research to date, including the challenges in defining both literacy and numeracy.
5. Can you recommend any Models or frameworks to assist the promotion and embedding of literacy development within the programme but also to improve student-teachers' practices in this regard?
6. Can you recommend any current literature on the topic of literacy development, that may not have considered?
7. Can you suggest any authors in the field of literacy development?

## Appendix 16 – Participant Information

### Section A: Information and Consent

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#### PARTICIPANT INFORMATION LEAFLET

1. **Working Title of the Study:** *A Case Study Analysis of the Provision and Efficacy of Literacy and Numeracy Training in the Initial Teacher Education Programme at GMIT, Letterfrack.*

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2. **Research Procedures:**

Data will be gathered at the GMIT Letterfrack *Creativity and Innovation in the Classroom 2020*. It will be a two-stage process:

- Stage 1. Hard-copy questionnaires will be distributed to all research participants and instructions will be given by the researcher to assist the completion of the questionnaire.
- Stage 2. Follow-on break out circles (of mixed groups of student teachers and tutors), led by a tutor-facilitator, will explore the questionnaire responses in greater depth and summary data will be collated by a record keeper in each group.

4. **Benefits of the Research:** This research will lead to the enhancement of delivery in this *B. Sc. in Education* programme at GMIT Letterfrack and will therefore be of benefit to future students enrolling in the ITE programme at Letterfrack and to graduates moving into the profession.

5. **Risks of the Research:** There are no material risks, discomforts or side effects associated with this research.



**6. Exclusion from Participation:** You cannot participate in this study if you are not a student teacher on the B. Sc. in Education programme at GMIT, Letterfrack, or School Placement Tutor on the programme.

**7. Confidentiality:**

- The questionnaires do not request student or tutors' names.
- No identifying factors relating to participants will be in evidence in the final thesis report and/or any disseminated research (i.e. conference papers and/or presentations, publications, etc.)

**8. Compensation:** This study is covered by standard institutional indemnity insurance. Nothing in this document restricts or curtails your rights.

**9. Voluntary Participation:** You have volunteered to participate in this study. If you wish to withdraw, *please contact the researcher within one month of initial participation*. If you decide not to participate, or if you withdraw, you will not be penalised and will not give up any benefits that you had before entering the study.

**10. Stopping the Study:** You understand that the researcher(s) may withdraw you from participation in the study at any time without your consent, for legitimate reasons.

**11. Permission:** This research has approval from the *Research Sub Committee of Academic Council*.

**12. Further Information:** You can get more information or answers to your questions about the study, your participation in the study and your rights, from Patricia O'Regan who can be telephoned at 0879870371 or e-mailed at G00238648@gmit.ie

**13. New Information Arising:** If the researcher or research supervisors learn of important new information that might affect your desire to remain in the study, or if any conflicts of interest emerge during the course of the study, you will be informed at once.

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## Appendix 17 – Informed Consent 1: Individual Research Participants

### INFORMED CONSENT FORM 1: INDIVIDUAL RESEARCH PARTICIPANTS

**Working Title:**

*A Case Study Analysis of the Provision and Efficacy of Literacy and Numeracy Training in the Initial Teacher Education Programme at GMIT, Letterfrack*

**Principal Researcher:**

Patricia O'Regan (G00238648@gmit.ie)

**Background to the Study:**

Literacy and Numeracy is a significant theme in the training of second-level teachers. This research project investigates what training, if any, is being provided in the *B. Sc. in Education* (Honours) degree programme at GMIT Letterfrack, regarding the promotion and development of literacy and numeracy skills as a student-teachers, with a view to further improvements.

**Participant Declaration** (Tick 'Yes' or 'No', as appropriate.)

I have read or have had the information sheet read to me and I understand the contents.	Yes	No
I have been given an opportunity to ask questions and am satisfied with the answers.	Yes	No
I have given consent to take part in the study.	Yes	No
I understand that participation is voluntary and if I wish to withdraw I can do so within one month of initial participation.	Yes	No
I understand that withdrawal will not affect my access to services or legal rights.	Yes	No
I consent to possible publication of results.	Yes	No
I (the participant) give my permission for the data obtained from me to be used in other future studies without the need for additional consent.	Yes	No

**Researcher Declaration** (Tick 'Yes' or 'No', as appropriate.)

I have explained the study to the participant.	Yes	No
I have answered questions put to me by the participant about the research.	Yes	No
I believe that the participant understands and is freely giving consent.	Yes	No

**Participant Statement:**

I have read or had read to me this consent form. I have had the opportunity to ask questions, and all my questions have been answered to my satisfaction. I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights. I understand I may withdraw from the study at any time. I have received a copy of this consent form.

Please Tick:

YES       NO

**Researcher Statement:**

I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I offered to answer any questions and have fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

**Researcher Signature:**

**Date:**

## **Appendix 18 – Informed Consent 2: Questionnaire and Breakout Circles**

**INFORMED CONSENT FORM 2:  
RESEARCH PARTICIPANTS IN SURVEY  
(QUESTIONNAIRE AND BREAK OUT CIRCLES)<sup>1</sup>**

**INFORMATION SHEET**

<b>Purpose of the research study.</b>	For a Masters programme at GMIT I am required to carry out a research study. This survey aims to identify current strengths and areas for improvement in training and teaching practice, regarding literacy and numeracy skills. The research project is concerned with developing literacy and numeracy skills for students of the teacher education programme at GMIT Letterfrack, with a view to making recommendations to address literacy and numeracy learning needs within the programme.
<b>What the research study will involve.</b>	The study will involve students and tutors of the teacher education programme at GMIT Letterfrack, answering questions and giving their opinions on their own literacy and numeracy skills and the provision for such training within the programme. This will happen by way of a questionnaire and a break-out circle group and will be completed at the Creativity Conference 2020.
<b>Why you have been asked to take part in this research study.</b>	The researcher has chosen both student teachers and School Placement tutors to take part in this study because they have experienced first-hand what is being provided in terms of literacy and numeracy training in the teacher education programme at GMIT Letterfrack. Student teachers and school placement tutors may be able to provide insight into ways that this aspect of the programme can be developed to benefit them.
<b>The confidentiality of your participation in the research study.</b>	Those who will/may have access to the research data include: the primary researcher, research advisory panels (including the research supervisors), internal examiners and external examiners.
<b>What will happen to the information which you give?</b>	The information that is give in this questionnaire and break-out circle group will be kept confidential from any third parties. The data will be kept confidential for the duration of the study. On completion of the thesis, they will be retained for a further five years in a secure environment and then destroyed.
<b>What will happen to the results?</b>	The results will be presented in the thesis. They will be seen by my supervisor, a second marker and the external examiner. The thesis may be read by future students on the course. The research findings and analysis may be disseminated in future conferences and academic publications.
<b>Are there any possible disadvantages of taking part?</b>	There are no material risks, discomforts or side effects associated with this research.
<b>If a problem arises in relation to</b>	If a participant wishes to withdraw from this study, they are free to do so within one month of participation (without providing a reason). To withdraw, you should contact the principal researcher

<sup>1</sup> The document draws extensively on a work produced by Dr R. Swain of UCC, and is used with permission. Copyright is vested in same and all rights therein remain with Dr Swain.

**research participation.**

Patricia O'Regan who can be telephoned at 0879870371 or e-mailed at G00238648@gmit.ie

**Which body has reviewed this study from the perspective of ethical clearance?**

The Research Sub Committee of Academic Council.

**Any further queries?**

If you need any further information, you can contact me: Patricia O'Regan at 0879870371 or G00238648@gmit.ie

*By completing and submitting this questionnaire and/or by participating in the breakout circles you are agreeing that any related data obtained may be used in this research study and in any future dissemination of the research.*

**Appendix 19: Frequency Analysis Information - PST Education Stages  
(Development of Literacy and numeracy Skills) (Q4):**

Literacy Education	1st Year	2nd Year	3rd Year	4th Year	total	/100	%
Pre-School	1	0	0	0	1	0.01449275	1%
Primary School	8	10	5	6	29	0.42028986	42%
Post-Primary School	10	3	9	5	27	0.39130435	39%
Third Level	1	3	4	4	12	0.17391304	17%
						0	
	20	16	18	15	69	1	
			0.5	0.33333333			
			50%	33%			

Numeracy Education	1st Year	2nd Year	3rd Year	4th Year	total	/100	%
Pre-School	0	1	0	0	1	0.01449275	1%
Primary School	11	6	4	3	24	0.34782609	35%
Post-Primary School	8	6	13	11	38	0.55072464	55%
Third Level	1	3	1	1	6	0.08695652	9%
	20	16	18	15	69		
			0.72222222	0.73333333			
			72%	73%			

Comaprison - L&N	Literacy	Numeracy	total	/100	%
Pre-School	1	1	2	0.01449275	1%
Primary School	29	24	53	0.38405797	38%
Post-Primary School	27	38	65	0.47101449	47%
Third Level	12	6	18	0.13043478	13%
Total			138		

## Appendix 20: Frequency Analysis Information - School Placement Tutors'

### Pedagogical Confidence(Q4):

Confidence to Develop Literacy and Numeracy			
	Literacy	Numeracy	Total
Stronly Disagree	0	0	0
Disagree	0	0	0
Neither Agree/Disagree	0	1	0
Agree	2	3	1
Strongly Agree	3	1	5



## Appendix 21: Frequency Analysis Information - PST Personal

### Confidence(Q3):

	Literacy							
Personal Skills	1st Year	2nd Year	3rd Year	4th Year	Total	/100	%	
Stronly Disagree	0	0	0	0	0	0	0	0
Disagree	0	0	3	1	4	0.057971	6%	
Neither Agree/Disagree	9	2	13	2	26	0.3768116	38%	
Agree	10	14	2	12	38	0.5507246	55%	
Strongly Agree	1	0	0	0	1	0.0144928	1%	
					0	0		
	20	16	18	15	69	1		
			Agree	0.8				
				80%				

	Numeracy							
	1st Year	2nd Year	3rd Year	4th Year	Total	/100	%	
Stronly Disagree	0	0	1	0	1	0.0144928	1%	
Disagree	0	0	0	0	0	0	0	
Neither Agree/Disagree	6	0	2	1	9	0.1304348	13%	
Agree	9	12	12	10	43	0.6231884	62%	
Strongly Agree	5	4	3	4	16	0.2318841	23%	
					0	0		
	20	16	18	15	69	1		
			agree	0.6666667				
			strongly ag	0.2666667				

Personal - Comparison			Literacy	Numeracy	
Stronly Disagree	1.00%		0	1%	0.005
Disagree	3%		6%	0	0.03
Neither Agree/Disagree	25.00%		38%	13%	0.255
Agree	59.00%		55%	62%	0.585
Strongly Agree	12%		1%	23%	0.12

## Appendix 22: Frequency Analysis Information - PST Pedagogical

### Confidence(Q6):

Literacy Pedagogical Skills		1st Year	2nd Year	3rd Year	4th Year	Total	/100	%
Stronly Disagree		0	0	0	0	0	0	0
Disagree		5	1	0	0	6	0.08695652	9%
Neither Agree/Disagree		10	4	4	4	22	0.31884058	32%
Agree		3	10	14	11	38	0.55072464	55%
Strongly Agree		2	1	0	1	4	0.05797101	6%
						0	0	
		20	16	18	16	70	1.01449275	

Numeracy Pedagogical Skills		1st Year	2nd Year	3rd Year	4th Year	Total	/100	%
Stronly Disagree		0	0	0	0	0	0	0%
Disagree		5	2	0	0	7	0.10144928	10%
Neither Agree/Disagree		5	2	1	0	8	0.11594203	12%
Agree		7	9	14	12	42	0.60869565	61%
Strongly Agree		3	3	3	3	12	0.17391304	17%
						0	0	
		20	16	18	15	69	1	

Overall Confidence (Skills Combined)			Literacy	Numeracy	
Stronly Disagree	0.00%		0%	0%	0
Disagree	9%		9%	10%	0.095
Neither Agree/Disagree	22.00%		32%	12%	0.22
Agree	58.00%		55%	61%	0.58
Strongly Agree	11%		6%	17%	0.115
	100.00%				1.01

**Appendix 23: Frequency Analysis Information - PST Personal Confidence Vs Pedagogical Confidence (Q3 & Q6):**

Personal Vs Pedagogical			
Literacy			
	Personal Literacy Skills	Pedagogical Literacy Skills	
Strongly Disagree	0%	0%	
Disagree	6%	9%	
Neither Agree/Disagree	38%	32%	
Agree	55%	55%	
Strongly Agree	1%	6%	

Personal Vs Pedagogical			
Numeracy			
	Personal Numeracy Skills	Pedagogical Numeracy Skills	
Strongly Disagree	1%	0%	
Disagree	0%	10%	
Neither Agree/Disagree	13%	12%	
Agree	62%	61%	
Strongly Agree	23%	17%	

**Appendix 24: Frequency Analysis Information - PST Confidence in Literacy Vs  
Confidence in Numeracy (both personal and Pedagogical) (Q3 & Q6):**

Literacy Vs Numeracy (personal and pedagogical combined)			
	literacy totals	Numeracy totals	
Stronly Disagree		0%	1%
Disagree		8%	5%
Neither Agree/Disa		35%	13%
Agree		55%	62%
Strongly Agree		4%	20%
Total dis.		8%	6%
Total Agr.		59%	82%

**Appendix 25: Frequency Analysis Information - PST Presence of Development of Skills in the ITE Programme(Q5):**

Student no.	20	16	18	15
	1st Year	2nd Year	3rd Year	4th Year
Literacy	11	13	17	15
Numeracy	15	14	18	15
No	5	2	0	0

Percentages	20	16	18	15
	1st Year	2nd Year	3rd Year	4th Year
Literacy	55.0%	81.3%	94.4%	100.0%
Numeracy	75.0%	87.5%	100.0%	100.0%
No	25.0%	12.5%	0.0%	0.0%

## Appendix 26: Frequency Analysis Information - PST Teaching Strategies to Develop Literacy and Numeracy in Practice (Q7):

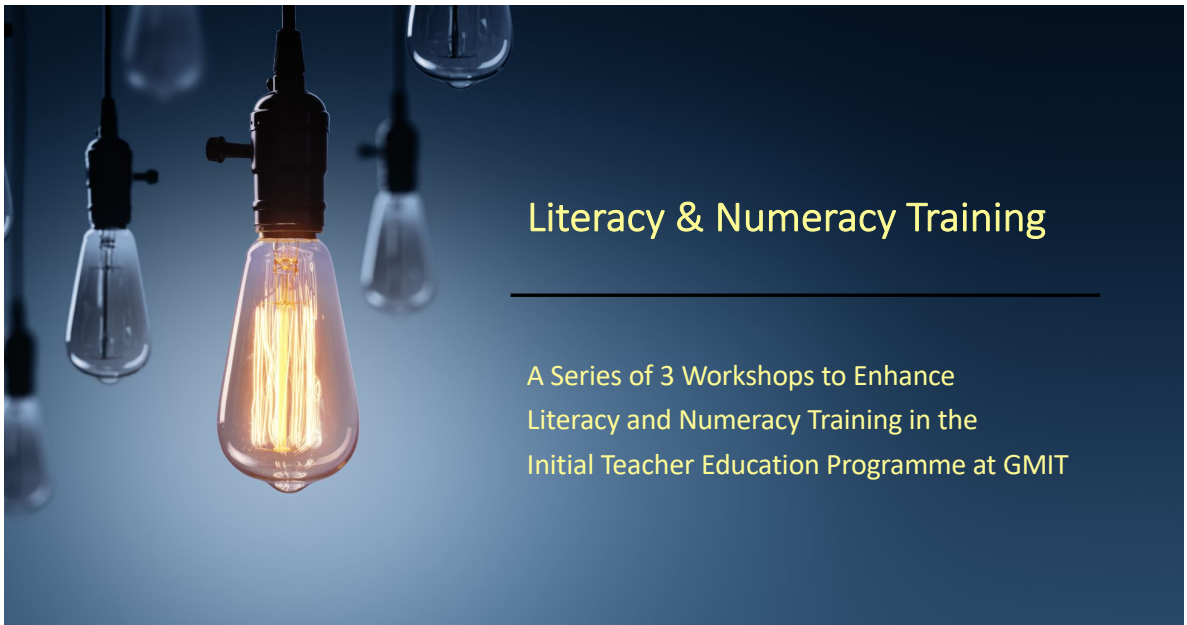
Literacy Strategies	Year 1	Year 2	Year 3	Year 4	Total	/100	%
Wordwall/Keywords	4	7	10	9	30	0.3658537	37
Demo/Present/Talk	2	1	4	5	12	0.1463415	15
Questioning	5	4	1	1	11	0.1341463	14
Reading	0	4	2	3	9	0.1097561	11
Labelling	0	0	3	3	6	0.0731707	7
Writing	0	1	2	1	4	0.0487805	5
Portfolio/poster	0	0	1	3	4	0.0487805	5
Irish Language Promotion	0	0	1	0	1	0.0121951	1
Reflection	0	0	1	0	1	0.0121951	1
Spelling	0	0	1	0	1	0.0121951	1
Flipped Classroom	0	0	1	0	1	0.0121951	1
Student Research	0	0	1	0	1	0.0121951	1
Think ,Pair,Share	0	0	0	1	1	0.0121951	1
<b>Total responses</b>	<b>11</b>	<b>17</b>	<b>28</b>	<b>26</b>	<b>82</b>	<b>1</b>	<b>100</b>
<b>% of total</b>	<b>0.1341463</b>	<b>0.2073171</b>	<b>0.3414634</b>	<b>0.3170732</b>	<b>1</b>		
<b>no of students</b>	<b>20</b>	<b>16</b>	<b>18</b>	<b>15</b>	<b>69</b>		
<b>% of cohort</b>	<b>0.2898551</b>	<b>0.2318841</b>	<b>0.2608696</b>	<b>0.2173913</b>	<b>1</b>		

Numeracy Strategies	Year 1	Year 2	Year 3	Year 4	Total	/100	%
Measuring/dimensions	9	7	6	0	22	0.3013699	30
Conversion of Measurements	6	3	1	5	15	0.2054795	21
Working Drawings	0	3	9	1	13	0.1780822	18
Missing Dimensions	0	4	5	2	11	0.1506849	15
Scaling/Ratios	1	0	1	4	6	0.0821918	8
Design Projects	0	0	0	2	2	0.0273973	3
Student Demos	0	1	1	0	2	0.0273973	3
Percentage Calculation	0	0	1	0	1	0.0136986	1
Estimating	0	0	0	1	1	0.0136986	1
<b>Total</b>	<b>16</b>	<b>18</b>	<b>24</b>	<b>15</b>	<b>73</b>	<b>1</b>	<b>100</b>
<b>% of Total</b>	<b>0.2191781</b>	<b>0.2465753</b>	<b>0.3287671</b>	<b>0.2054795</b>	<b>1</b>		
<b>no of students</b>	<b>20</b>	<b>16</b>	<b>18</b>	<b>15</b>	<b>69</b>		

**Appendix 27: Frequency Analysis Information – Other Educational Professionals’ Suggestions for Programme Improvement (Q5):**

Suggested Strategies	No. responses	Personal	Pedagogical	Transversal	Discipline specific
Crossover between modules	4	x		x	
Mix of assessments	1	x			
Use of multimedia & technology	3	x		x	
Real word/practical examples	7	x	x	x	x
Workshop at start of programme	1	x	x	x	x
Application within technical subjects	2		x		x
Application of practical examples - pre-place	1		x		x

## Appendix 28: Workshop PowerPoint (Sample Introduction)



### Literacy & Numeracy Training

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A Series of 3 Workshops to Enhance  
Literacy and Numeracy Training in the  
Initial Teacher Education Programme at GMIT

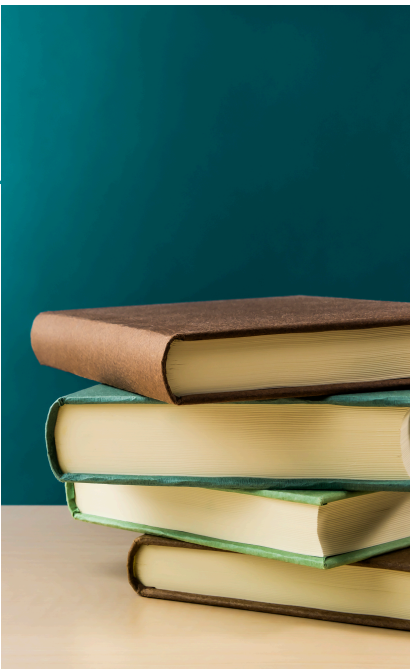
Designed by Patricia O'Regan

## Introduction

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**i** **Goal:**  
to create an awareness among the participants of what literacy and numeracy mean in the context of ITE and to develop a tool to assist the enhancement of literacy and numeracy training for technical subject classrooms

-  **Workshop 1**      Defining Literacy & Numeracy
-  **Workshop 2**      Literacy & Numeracy in ITE  
Confidence & Competence
-  **Workshop 3**      Literacy & Numeracy in Practice







## Learning Outcomes

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Workshop 1 L01 Clearly **define the terms literacy and numeracy**, relevant to the society of the 21<sup>st</sup> century

Workshop 2 L02 Distinguish between the development of **transversal and disciplinary** literacy and numeracy skills, in the context of ITE and in the classroom.





L03 Differentiate between the development of **personal** literacy and numeracy skills and the development of **pedagogical** knowledge of literacy and numeracy teaching, on the ITE programme.

L04 **Self-assess** their personal literacy and numeracy abilities, based on an ITE literacy and numeracy test, and on their own definitions of these terms.

Workshop 3 L05 Participate in the development of a **framework/model** to assist PS teachers to develop literacy and numeracy, specifically in the technical subjects

## Teaching Approaches

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-  Collaborative Learning & Problem-Based Learning
-  Teamwork, Engagement
-  Facilitator & Participant input
-  Constructivist (Jean Piaget)  
Social Constructivist (Lev Vygotsky)



## Appendix 29: Workshop Activity 3 – Transversal Vs Disciplinary Literacy and Numeracy

Which of the statements below refer to transversal literacy and numeracy skills vs disciplinary literacy and numeracy skills?

Statement	Transversal	Disciplinary
The terminology, nomenclature, and/or classification systems appropriate to the subject area	<input type="radio"/>	<input type="radio"/>
To produce a detailed, accurate working drawings that will enable you to set out and make a specified piece of furniture - a hall table.	<input type="radio"/>	<input type="radio"/>
Advanced methods for acquiring, interpreting and analysing subject-specific information, with a critical understanding of the appropriate contexts for their use through the study of texts and original papers	<input type="radio"/>	<input type="radio"/>
Source, interpret and apply appropriate and referenced literature and other information sources	<input type="radio"/>	<input type="radio"/>
A recorded animated PowerPoint presentation demonstrating a step-by-step solution to the question clearly linked with 3D representations of how the solution is built up using the key graphical principles	<input type="radio"/>	<input type="radio"/>
SolidWorks Digital Models & Working Drawings	<input type="radio"/>	<input type="radio"/>
Communicate scientific information in a variety of forms to specialist and non-specialist audiences	<input type="radio"/>	<input type="radio"/>
Real-life visual aids explaining graphics principles	<input type="radio"/>	<input type="radio"/>
Present and engage in debate relating to general scientific issues	<input type="radio"/>	<input type="radio"/>
Contribute to the development of the role of the scientist in society	<input type="radio"/>	<input type="radio"/>
Employ advanced data analysing, synthesising and summarising skills in a scientific work setting	<input type="radio"/>	<input type="radio"/>
Apply advanced numerical and statistical analysis skills	<input type="radio"/>	<input type="radio"/>
Identify and quantify the external structure of your house	<input type="radio"/>	<input type="radio"/>
Use advanced scientific skills to critically interpret existing knowledge and apply in new situations	<input type="radio"/>	<input type="radio"/>

Write an academic essay on a 21<sup>st</sup> century designer



**Discussion points:**

Where might you find evidence of the development of transversal literacy and numeracy skills?

.....discipline specific literacy and numeracy skills?

## Appendix 30: Workshop Activity 4 – Literacy and Numeracy Self-Assessment

Examples taken from: <https://this.deakin.edu.au/study/can-you-pass-this-literacy-and-numeracy-test>.

### Question 1:

'All students have been given explicit instructions about how to record their findings during the excursion'. Which of the following is closest in meaning to 'explicit'?

- Extensive
- Simple
- Hands-on
- Clearly stated

### Question 2:

The Australian Bureau of Statistics conducts a census every five years. In 2011, the population of Australia was 22 million. About 2% of these people lived in remote or very remote areas. About how many people lived in remote or very remote areas in Australia in 2011?

- 11,000
- 44,000
- 110,000
- 440,000

**Question 3:**

'Our Year 9 students will be spending two weeks in a rural community to learn more about life there. Students will focus on issues that have affected these settlements over time. They will be given opportunities to meet and talk with local residents. Students will work on assignments designed to help explain their history'. Which reference in the text is ambiguous?

- Life there
- These settlements
- They
- Their history

**Question 4:**

The weight of a box of stationery is 3.2kg. What is the weight of 100 such boxes?

- 3200kg
- 320kg
- 32kg

**Question 5:**

Below are four versions of a sentence from a student's assignment. Which version has acceptable punctuation?

- 'Our community, is not static', she said. 'It is constantly changing'.
- 'Our community is not static' she said 'It is constantly changing'.
- 'Our community is not static', she said. 'It is constantly changing'.
- 'Our community is not static', she said, 'It is constantly changing'.

**Question 6:**

	<b>Gym only (\$)</b>	<b>Swim only (\$)</b>	<b>Gym and Swim (\$)</b>
<b>12 Months (upfront)</b>	596	461	773
<b>12 Months (monthly debit)</b>	51	33	66
<b>6 Months (upfront)</b>	330	295	502
<b>Casual (per visit)</b>	12	5	15

Here is the schedule of costs for Gym and Swim memberships at a sports facility. For a 12-month 'Gym and Swim' membership, how much more does it cost to pay by monthly debit rather than upfront?

- 19
- 231
- 59

**Question 7:**

'It is no exaggeration to say that the students' insights into historical processes and social conditions were impressive'. Does the sentence contain a spelling error?

- Yes
- No

**Question 8:**

Of the government's total operating expenditure on education in 2011–2012, 51% was spent on primary and secondary education and 36% on tertiary education (universities and TAFEs). What percentage of the total operating expenditure on education in 2011–2012 was spent on the remaining aspects of the education budget?

- 15
- 13
- 19
- 12

## Appendix 31: Workshop Activity 5 – Literacy Development within Technical Subjects

As a teacher....

Elements	Description
<b>Break codes:</b>	Are you developing your students' ability to break the codes of text?  Are you probing students on their ability to see patterns and structure in texts?
<b>Participate in the meaning:</b>	Do your students demonstrate understanding and the ability to compose meaningful, relevant and purposeful texts?  Are they making a connection between what they are reading/composing and real life?
<b>Using/ functionality:</b>	Do you create opportunities for your students to use, and recognise how these texts can influence social relations and actions? Inside and outside the classroom?  Do you create an awareness among your students that some texts are presented in a way which may be designed to influence them to think in a certain direction?
<b>Critique and transform:</b>	Do you provide opportunities for your students to critique and redesign texts provided for them?

Ask yourself the same questions... as a teacher of technical subjects.

Do you see these four elements present in your classroom?



**Appendix 32: Workshop Activity 6 - Numeracy Development within  
Technical Subjects**

