PACE-IT: Designing blended learning for accounting education in the challenging context of a global pandemic

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ABSTRACT

This paper describes the design of a blended learning intervention to enhance the student learning experience, incorporating innovative technologies and pedagogies within introductory accounting. The design-based research (DBR) methodology involved 68 learners in the participatory design of the intervention across three design iterations. Emerging from the design process, a framework informed by the key themes of Pedagogy, Autonomy, Collaboration, Engagement, Interaction and Technology (PACE-IT) was conceptualised, tested and developed. This study presents the PACE-IT model which offers guidelines to practitioners who seek to design blended learning to provide students with a rich and meaningful learning experience. The emergence of COVID-19 underscores the relevance of these findings. PACE-IT provides direction to accounting educators working within an unfamiliar educational context, today and in the future, where there is an imperative to develop new approaches to accounting education that combine face-to-face with online interaction and learning.

Keywords: accounting education; blended learning; design-based research; PACE-IT model; introductory accounting

1. Introduction

Technological advancements have engendered evolving work roles for professional accountants as they navigate the trajectory of their careers. This has prompted calls for the transformation of accounting education at tertiary level to incorporate innovative teaching practices which provide students with future-focused and lifelong learning skills, in preparation for employment in a dynamic global workplace (Abbott & Palatnik, 2018; Flood, 2014; Jackling & De Lange, 2009). The research question posed by this study was to investigate how blended learning (BL) could be designed in a tertiary level introductory accounting module to enhance the student learning experience.

Having observed students within accounting modules experiencing difficulties when grasping new accounting concepts with students passively absorbing information, rather than actively participating in the learning process, the researcher (and first author) perceived a need to explore ways to increase student participation, engagement, and interactivity in accounting classes, and promote more effective learning of the course material. The study findings will be of interest to accounting educators wishing to create an enhanced student learning experience supported by technology. The learning affordances provided by emerging digital technologies have enabled flexible ways of learning and teaching in serving an increasingly diverse student population. Furthermore, the COVID-19 pandemic has challenged accounting educators worldwide to consider new ways to engage their students, including through blended learning. Indeed, the disruption to traditional teaching has pushed the possibilities for how technology might be used to support and enhance learning, during the current, challenging times, and hopefully as we start to enter a world, post-pandemic.

To answer the research question, the study describes the design and implementation of a blended learning model with introductory financial accounting students. The study findings demonstrate that the flexibility offered by online resource provision through a BL approach can infuse autonomy among learners, encouraging them to take responsibility for their own learning, while also increasing levels of motivation, engagement and interest in the accounting subject. In particular, the use of teaching practices which encourage active student participation promotes effective learning, which should prepare graduates for a dynamic global workplace and the future world of work now emerging.

Blended learning (BL), which combines online learning with face-to-face (f2f) instruction, has become increasingly prevalent in higher education in recent years

(Adams Becker, Cummins, Davis, Freeman, Hall Giesinger & Ananthanarayan, 2017; Graham, Woodfield & Harrison, 2013). Assertions have been made that it is capable of extending learning and thinking through the integration of online reflective written communication with instantaneous verbal f2f interactions (Garrison & Kanuka, 2004; Kenney & Newcombe, 2011). Garrison and Kanuka (2004) proposed BL as a way to transform learning and teaching by compelling reflection on education design. Since then, BL has continued to gain traction in educational settings. Recognised as a key trend in higher education in the *2017 Horizon Report* (Adams Becker et al., 2017), through its ability to support policy objectives on widening access to higher education while also enhancing efficiencies in education provision, BL has recently been described as 'the harbinger of substantial change in higher education' (Dziuban, Graham, Moskal, Norberg & Sicilia, 2018, p.13). Laumakis, Graham and Dziuban (2009, p.86) assert that 'blended learning has established a culture of sustainability in higher education, providing accessibility to the most diverse student population in history; with the unanticipated side effects of raising students' expectations and their standards for learning as well.' When reflecting on the challenges involved in the relocation to remote teaching in response to COVID-19, higher education community members worldwide have advocated a blended approach to teaching, learning and assessment (National Forum for the Enhancement of Teaching and Learning in Higher Education, 2020; Singh, Steele & Singh, 2021).

The COVID-19 pandemic has led accounting educators to recognise the potential of BL as a learning and teaching approach (Sangster, Stoner & Flood, 2020). Indeed, the potential for educational technology to add value in accounting education has been recognised for some time now (Bonk & Smith, 1998; Bryant & Hunton, 2000; Pathways Commission, 2014). According to Coovadia and Ackermann (2021), the

involvement of students in the design of digital learning environments can offer significant advantages in accounting education. Yet, there still exists a paucity of research into educational technology use in accounting, despite its importance to accounting education practice (Bryant & Hunton, 2000; Marriott & Lau, 2008; Rebele & St. Pierre, 2015). Evolving delivery platforms, emerging mobile technologies, the changing HE infrastructure, and the need to respond to an increasingly technologically savvy population have led to a consistent appeal for research to identify the most effective uses of educational technology in accounting (Apostolou, Dorminey, Hassell & Rebele, 2010, 2013, 2017; Bryant & Hunton, 2000; Pathways Commission, 2014).

1.1 Contribution

The contribution of this study is threefold. Firstly, the research demonstrates, following a systematic methodological approach, that a BL intervention which enhances the learning experience of students can be effectively designed and implemented for use in introductory accounting education settings at tertiary level. Thus, this study makes a meaningful contribution to learning theory in the area of accounting education. Secondly, in response to criticisms of the disconnection of accounting educational research to practice, this study provides a practical research output in the form of the BL intervention and associated learning resources, which were designed within the introductory financial accounting modules to enhance learners' experience. Finally, the rich detailed narrative account of the BL intervention design, along with the PACE-IT design model and guidelines, may be adapted and adopted by other design researchers, educators and educational technologists to guide the development and implementation of similar learning interventions in cognate learning contexts. Therefore, this study makes a significant contribution to knowledge of learning and teaching, including use of educational technology, within the accounting education field.

The paper is structured as follows: the next section outlines the design-based research (DBR) methodology deployed in this study; this is followed by a description of how the BL intervention was designed and implemented using the PACE-IT framework; finally, the findings which were used to evaluate and refine the BL intervention are discussed, culminating in the design guidelines associated with the PACE-IT model.

2. Research method

Given the criticisms which have been levelled at the disconnect which exists between accounting education research and practice (Behn, Ezzell, Murphy, Rayburn, Stith & Strawser, 2012; Rebele & St. Pierre, 2015), there has been an acknowledgement by accounting education researchers of the importance of research which impacts on practice:

> Research in general makes us into more enquiring individuals, more reflective practitioners, and assists our teaching by making us better scholars. But research does not, in itself, make things any better for our students unless it can be woven into our teaching practice so as to generate similar impacts upon our students. (Wilson, Ravenscroft, Rebele & St. Pierre, 2008, p.109)

Therefore, a design-based research (DBR) methodology was adopted in this study owing to what Barab and Squire (2004) refer to as its pragmatic focus and ability to explore and deploy technological innovations to effect meaningful change for research participants and other stakeholders within education.

DBR involves the researcher working closely with study participants over an extended time period. A multiplicity of data is used to gain insights into students' learning experiences when encountering an innovative intervention within an educational setting (Barab & Squire, 2004; Wang & Hannafin, 2005). Grounded in real-

life settings rather than artificial laboratory settings, DBR is embedded in practical activities which are representative of the complexity of the setting (McKenney & Reeves, 2019; Wang & Hannafin, 2005).

The design process is principled in that it is guided and informed by theory at all stages. DBR allows the researcher to utilise multiple learning theories to create a new, tailored, multi-dimensional learning framework which addresses the multiple dependent variables present in the learning context while supporting the emergent design (Hall, 2020; Reeves, McKenney & Herrington, 2011). DBR links practice and theory due to its focus on creatively solving educational problems while also providing guiding design principles for use by others in solving educational problems in cognate contexts (Anderson & Shattuck, 2012; Reeves et al., 2011). Considering the paucity of research on BL use in the accounting discipline, the researcher believed a DBR approach was most suited to the study as it would provide a vital and necessary advancement of theoretical knowledge in the accounting education field and have a real impact on teaching practices and student learning in accounting.

Challenges associated with the use of DBR include the fact that interventions take place in 'messy' real-world settings, and the researcher's intimate involvement as designer of the intervention (Barab & Squire, 2004; Plomp, 2013). This was offset through the use of triangulation of data within this study, along with documentation of enactment cycles and adoption of practices employed by qualitative researchers to ensure the credibility and trustworthiness of research claims.

2.1 Study participants

The study was conducted in an Irish technological university with students on the Bachelor of Arts in Accounting and Bachelor of Arts in Accounting and Law programmes who were studying introductory Financial Accounting 1A and 1B as

compulsory 5-credit modules across two semesters with the researcher as instructor. This was a longitudinal study, taking place over three design cycles with a total of 68 student participants, which allowed the researcher to progressively test and refine the BL intervention through a series of successive iterative implementations. A profile of participants along with a breakdown of numbers participating across each cycle is given in Table 1.

Table 1. Participant profile

	Cycle 1 (2017-18)		Cycle 2 (2018-19)		Cycle 3 (2019-20)	
	No.	%	No.	%	No.	%
Total students	28	100%	24	100%	16	100%
Male	15	54%	9	37%	9	56%
Female	13	46%	15	63%	7	44%
Mature students (aged 23 years and over)	9	32%	4	17%	1	6%
No prior accounting knowledge	1	4%	2	8%	5	31%
International students	4	14%	8	33%	3	19%

The majority of study participants had completed the leaving certificate, which is the final examination of the Irish secondary school system, as their highest prior level of education. There was evidence of mixed levels of accounting knowledge within the group across each design iteration.

The next section describes the design and implementation of the BL intervention using the PACE-IT multi-dimensional framework.

3. Blended learning design and implementation

The BL approach adopted, based on the definition proposed by Garrison and Kanuka (2004), was defined as: the thoughtful integration of classroom f2f learning experiences and online learning experiences, to achieve synergies between innovative pedagogical and technological approaches.

The BL design was characterised by a 50/50 split between online and f2f hours. Two topics were selected for teaching in a blended format: bank reconciliation and ratio analysis. This resulted in approximately 20% of the course content being taught using a blended format. Online learning activities and assessments were delivered asynchronously via Moodle, the mainstream VLE within the college.

3.1 Design cycle one

The elements of the BL design in cycle one were as follows. An online multimedia resource was available to students on Moodle for each topic. Each resource comprised a presentation, videos, problem to work through and a quiz; to be viewed asynchronously. An orientation session took place in a computer laboratory at the commencement of the programme to introduce students to the online resources. Following viewing of online resources, students attended f2f classes where the lecturer introduced more advanced topic material. One lecture per week was timetabled in the computer lab setting which allowed integrated learning of financial accounting and MS Excel.

Online assessment quizzes taken outside of class time formed part of the continuous assessment for the module. In addition, a ratio analysis continuous assessment task was used whereby students were assigned an authentic task involving

the analysis and evaluation of a company's performance, culminating in the preparation of a report. As part of the task, students participated in an asynchronous discussion forum which allowed sharing of ideas in relation to the ratio analysis task. Outside of f2f classes, the lecturer communicated with students via email, an announcements forum and Whats App messaging via the class representative.

3.2 Design cycle two

In cycle two, the following improvements were made to the design. Additional asynchronous resources were provided in the form of worked example videos. At the commencement of each topic, a preliminary f2f class was scheduled to acquaint students with topic content before online resource viewing. An emphasis was placed on group and pair work during f2f classes, where students engaged in collaborative activities using authentic and challenging learning tasks. Clicker technology was introduced in cycle two to increase student participation and class contributions during f2f classes on the ratio analysis topic.

The ratio analysis continuous assessment task was amended, requiring students to perform a comparative evaluation of the performance of two companies rather than one, thus increasing the level of challenge associated with task. Students were provided with a grading rubric from cycle two onwards in relation to task. The final report requirements were amended to include a metacognitive awareness element, to increase learners' awareness of their own learning strategies[1]. To encourage student participation and knowledge-building on the asynchronous discussion forum associated with the task, warm-up discussion forum activities and e-moderating strategies were deployed.

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[1] The ratio analysis continuous assessment task and associated grading rubric are available in the PhD thesis on which this paper is based (see Kelly, 2020).

3.3 Design cycle three

The BL design elements and changes from cycle two were retained in cycle three. Following successful implementation and positive feedback, minimal changes were implemented in cycle three. However, a MS Excel tutorial was introduced to scaffold students in the use of the software. Furthermore, online multimedia resources pertaining to each topic were re-published for mobile viewing.

3.4 PACE-IT framework

A review of the literature revealed key issues which must be addressed within the BL design intervention in order to enhance the learning experience of introductory accounting students. The key salient, interrelated themes which emerged fell under the headings of Pedagogy, Autonomy, Collaboration, Engagement, Interaction and Technology. Hence, the blended learning (BL) design implemented within this study was rooted in an evolving theoretical framework, the PACE-IT framework, which informed the implementation of a BL approach in introductory accounting education (Kelly, 2020).

Table 2 outlines the six theoretical concepts underpinning the PACE-IT framework and how they influenced the BL design and impacted on the BL design elements outlined above.

Table 2. Theorists informing PACE-IT model themes and associated design impact

Theme	Incorporation in the BL design	Informing theorist
Pedagogy	• Accounting theory is applied through practical learning activities using pair and group work in f2f classes	Laurillard, 2002 Mayer, 2002 Sweller, 2006

	• Preliminary f2f class on each topic followed by independent viewing of a multimedia resource, designed based on cognitive load theory principles • Worked example videos available for out-of-class viewing before students move onto independent problem-solving	Sweller & Cooper, 1985
Autonomy	• 50/50 split between online and f2f hours to allow learners space to learn independently • Learning and assessment activities which are learner-centred, focusing on context of task rather than memorisation • Use of online multimedia resources and assessment quizzes to allow independent learning • Use of reflective practice and collaborative opportunities in learning and assessment activities	Blaschke, 2012 Knowles, 1984 Blaschke & Hase, 2016 Hase & Kenyon, 2000
Collaboration	• Scaffolding by instructor using step-by-step content delivery; provision of BL instructions handout in hard and soft copy • Collaborative activities to build learning community; asynchronous discussion forum for idea-sharing, knowledge-building and to extend the discourse outside of the classroom	Vygotsky, 1978 Scardamalia & Bereiter, 1994 Salmon, 2011

	• Scaffolding learners for online forum participation	
Engagement	• Provision of graded challenges (multimedia resource, worked example videos, questions) to maintain learner 'flow' • Reduced f2f contact to allow learners manage 'lifeload' • Use of collaborative, problem-based tasks and digital tools with real world relevance • Use of grading rubric to promote engagement with assessment; diverse range of learning activities to stimulate and sustain engagement	Csikszentmihalyi, 1990 Kahu, 2013 Kahu & Nelson, 2018 Kearsley & Shneiderman, 1998 Herrington, Oliver & Reeves, 2003 Herrington & Oliver, 2000
Interaction	• High-quality online resources which are mobile-compliant; appropriate student-lecturer communication channels, with the lecturer as 'partner' in the learning process • Easy-to-navigate, high-quality learner interface • Online forums providing peer and vicarious interactions	Moore, 1989 Hillman, Willis & Gunawardena, 1994 Sutton, 2000
Technology	• Scaffolding in online resource usage through orientation sessions and MS Excel tutorials; consideration of student connectivity issues and provision of support regarding technical	Soloway, Guzdial & Hay, 1994 Soloway, Jackson, Klein, Quintana,

issues	Reed, Spitulnik,
• Integrating learning of financial accounting and MS Excel in computer lab setting	Stratford & Studer, 1996
	Jackson, Krajcik &
• Adaptation of pedagogical practices in computer laboratory setting, for example through use of excel templates	Soloway, 1998
	Harel & Papert, 1990
	Mishra & Koehler, 2006

In addition, the following design informants influenced the design process and were key to achieving a successful design:

- Student's perspective - meeting the needs of the student and responding to student feedback and taking cognisance of students' prior experiences and knowledge.
- Lecturer's perspective - the lecturer's own technology self-efficacy and willingness to create a positive classroom climate and foster a learning community.
- Curricular requirements – aims and structure of the accounting programme and requirements of external accrediting bodies.
- Institutional context – local college influences including the academic calendar, timetabling constraints, availability of technology/wifi and support of management.
- External influences - trends in blended and online education and requirements of potential employers.

The six theoretical concepts which underpinned the BL design along with the five design informants synthesised to form the PACE-IT model, as displayed in Figure 1. The model emerged and was refined over the three design iterations (Kelly, 2020).
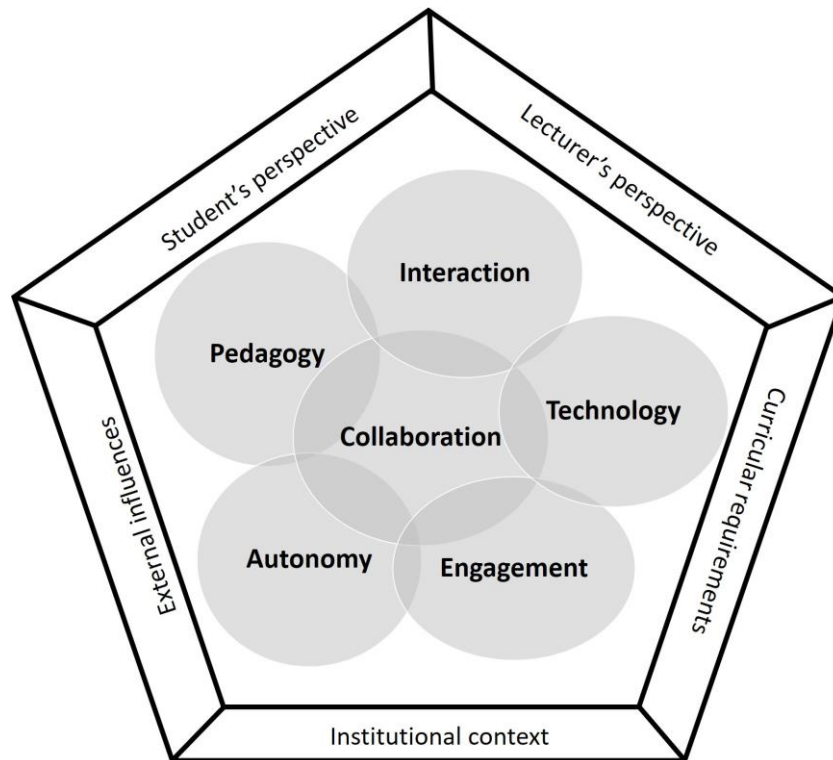
Figure 1. The PACE-IT model for blended learning in accounting

The next section describes the methods used to evaluate the BL design implemented across the three design cycles. Findings of the study are presented and discussed. Finally, the PACE-IT model design guidelines which represent a principal output of the study are outlined.

4. Evaluation of blended learning design

4.1 Data collection and analysis

Data collection took place using a range of methods including surveys, interviews, learning journals, virtual learning environment (VLE) activity logs, student assessment materials, think aloud protocols, discussion forum interactions and instructor observations. The data derived from these evaluations were the subject of critical analysis, informed by the PACE-IT design model, with resultant design changes

implemented in each subsequent cycle. Thus, the DBR approach adopted allowed student participants to have a voice in shaping and improving the BL design as the cycles progressed. Quantitative data obtained from the pre-and post-implementation surveys and student assessment materials were analysed using SPSS, while thematic coding of qualitative data was conducted using concept mapping. The researcher used the 'following a thread' model advanced by Moran-Ellis, Alexander, Cronin, Dickinson, Fielding, Sleney and Thomas (2006) to integrate the multiple datasets. This advanced the researcher's theoretical understandings of the BL design and provided an insightful interpretation of the learning experience of the students.

Ethical approval was obtained from the relevant institutional research ethics committees at the commencement of the study and the researcher was guided by BERA's (British Educational Research Association) Ethical Guidelines for Educational Research (2018). The researcher was cognisant of the multiple responsibilities and sensitivities associated with playing a dual role of lecturer-researcher, in particular the fact that students may feel an obligation to participate because of the hierarchical relationship which exists between lecturer and student. Thus, informed consent was obtained from all participants and they were assured of anonymity and confidentiality. The researcher incorporated reflexivity in her field note taking throughout the three design iterations and had regular conversations with a critical friend. In addition, practices recommended by Lincoln and Guba (1985) for use by qualitative researchers were adopted to ensure the credibility and trustworthiness of research claims.

4.2 Discussion of findings

The research findings are discussed according to the six key thematic areas of Pedagogy, Autonomy, Collaboration, Engagement, Interaction and Technology.

4.2.1 Pedagogy

Students remarked that their levels of confidence increased as a result of having a range of online resources to work on independently outside of class. In general, questionnaire respondents exhibited high levels of satisfaction with all elements of the blended learning (BL) design across all three cycles as demonstrated in Table 3.

Table 3. Perceived usefulness of BL design elements - 3 design cycles

	Rated as very/extremely useful		
	Cycle 1	*Cycle 2*	*Cycle 3*
Multimedia resource	71%	90%	100%
Worked examples	n/a	86%	80%
Online assessments	92%	95%	93%
Ratio analysis discussion forum	42%	95%	93%
Announcements/reminders from lecturer	92%	90%	87%
Notes and solutions on Moodle	92%	100%	93%
Assignment information and instructions	96%	90%	100%

The element which showed the greatest level of improvement was the ratio analysis discussion forum. Correspondingly, there was also an increased level of agreement that the ratio analysis forum improved perceived critical thinking skills among students (see Table 4). This increase in satisfaction coincided with an amendment to the ratio analysis task in cycle two, informed by Herrington et al. (2003), which required students to analyse and evaluate the comparative performance of two companies, increasing the level of challenge associated with the task. Moodle tracking logs revealed considerable increases in frequency of posting and viewing by students in cycle two. This coincided with the use of e-moderating strategies promulgated by

Salmon (2011) to stimulate greater participation levels. These strategies involved the lecturer maintaining a presence on the discussion forum through the use of 'summarising' and 'weaving' comments to maintain the discourse level.

Questionnaire data revealed evidence of enhanced understanding as well as greater confidence and interest in financial accounting among participants, having used the online resources pertaining to the module (see Table 4). This was corroborated within qualitative data where there was evidence of reduced reliance on rote learning, as confirmed by this student 'Being able to take my time with the online resource … helped with what I had previously learned but not understood at leaving certificate.' (2017-18 Student 9, survey response).

While there was reduced agreement that BL allowed easier revision of previously learned material in cycle three, this corresponded with the fact that there was a higher proportion of novice learners in this group in comparison with previous cycles. Similarly, while the percentage of respondents who agreed that BL led to increased learning outside of the classroom dropped in cycle three, no student expressed disagreement with this statement during that iteration.

Students valued the step-by-step approach taken during online and f2f learning content delivery. Applying Mayer's (2002) cognitive load theory principles in the design of online multimedia resources contributed to an easy-to-understand format. Use of a preliminary f2f class to introduce each topic ensured that students were comfortable when subsequently encountering learning material online.

Table 4. Levels of agreement on pedagogy post-questionnaire items - 3 design cycles

	Levels of Agreement		
	Cycle 1	Cycle 2	Cycle 3
BL led to better understanding of course content	79%	95%	87%

BL led to more confidence in ability in financial accounting	79%	90%	87%
BL led to greater interest in the financial accounting subject	54%	81%	80%
BL allowed easier revision of previously learned material	83%	71%	60%
BL led to increased learning outside of the classroom	92%	95%	60%
Ratio analysis forum improved critical thinking skills	38%	81%	79%
The assessment methods used evaluated my understanding of the accounting subject	79%	90%	80%
The use of clicker technology increased my understanding and learning of ratio analysis	n/a	88%	86%

There was also evidence of improved student performance on the ratio analysis continuous assessment task across the three design iterations. It was apparent that the provision of a grading rubric to students from cycle two onwards aided students in achieving higher marks on the assignment. There was evidence of a greater learning achievement for the class group in cycle three, with every participant achieving a first or second-class honours grade on the assignment.

It was clear from qualitative data across all three cycles, that students valued face-to-face (f2f) contact with lecturers and peers also, as reflected by this student who was emphatic that f2f interaction be considered as an integral part of any learning experience: 'I think one thing we need to make sure of is don't eventually end up with

learning that's only online because I think a lot of people do need that time to be able to talk to someone about what they're doing, so just leave it at blended, blended!' (2017-18 Student 9, group interview). While basic topic material proved particularly suitable for online delivery in this study, students valued the role of f2f contact time in effectively exploring advanced learning material. Students expressed a preference for f2f classes to be spread evenly so that long gaps with no f2f contact were avoided.

4.2.2 Autonomy

Group interviews and student learning log data revealed that students recognised the authenticity of their education, in having the opportunity to use a digital workplace tool such as Microsoft (MS) Excel and work on authentic problems from cycle two onwards. Student feedback on the requirement to reflect on their own learning as part of the ratio analysis task revealed that students were inexperienced at reflecting on their learning, but were mindful of the learning gains involved. 'It was different because I personally, like I never would have really reflected back on how I was taught a course like. It was just "do it, learn it, do the exam, then you're done!"' (2019-20 Student 7, group interview).

There existed strong agreement across all three design iterations that BL offered more flexible learning time for learners, culminating in 100% agreement in cycle three (see Table 5). Students particularly valued the opportunity provided by online resources to 'catch up' when a class was missed.

Table 5. Levels of agreement on autonomy post-questionnaire items - 3 design cycles

	Levels of Agreement		
	Cycle 1	*Cycle 2*	*Cycle 3*
BL allowed me to have more flexible learning	88%	76%	100%

time			
BL allowed me to take more responsibility for my own learning	n/a	90%	73%

There was evidence from various data sources that students valued the reduction in f2f hours within the BL design, to allow them space to work independently, in their own time and at their own pace. A survey question introduced in cycle two revealed high levels of agreement that BL allowed students to take more responsibility for their learning (see Table 5). However, in each cycle there was evidence of a minority of students experiencing difficulties taking responsibility for their own learning. Nonetheless, it was apparent from student logs and instructor field notes that these difficulties diminished as each academic year progressed, as evident from this student's comment 'It wasn't as nerve-wrecking doing it the second time. The first time you're like, "Oh my God I'm trying to learn this, there's no teacher here" and the second time you're thinking "Well I've done this already, so I probably have the capability of doing it again".' (2017-18 Student 2, group interview). This highlighted the importance of gradually transferring responsibility for learning independently to ensure that learners remain comfortable in the learner-centred environment (Blaschke & Hase, 2016; Hase & Kenyon, 2000; Herrington et al., 2003). It was evident that students developed positive attitudes towards BL as they became accustomed to its use, gaining autonomy as they gradually took responsibility for their own learning.

4.2.3 Collaboration

A greater focus was placed on collaborative activities from cycle two onwards based on the work of Scardamalia and Bereiter (1994) and Vygotsky (1978). There was a resultant increase in levels of agreement in relation to participants' ability to

collaborate, share ideas and learn from others. It was evident that the ability to work in groups improved team-working skills, while helping students to get to know one another and exposing them to the ideas of others, as one student affirmed 'There was more of a discussion about the comparisons. Do you remember that class we were all in fours working together? There was more comparison, like, "oh I didn't think of that".' (2019-20 Student 5, group interview). Following the addition of frequent pair work tasks, there was a higher sense of community in cycle three, with evidence of higher levels of connectedness and learning, as revealed in Table 6.

Qualitative datasets across cycles two and three indicated that the ratio analysis discussion forum exposed students to the ideas and perspectives of others. While there was some anxiety regarding participating on the forum at the outset, student logs revealed that this was alleviated as time progressed and students became accustomed to its use.

Table 6. Classroom community scale - design cycles two and three

	2018-19 (cycle two) N=21		2019-20 (cycle three) N=15	
	Mean	*SD*	*Mean*	*SD*
Connectedness subscale	22.52	4.77	26.73	3.73
Learning subscale	27.00	5.10	28.07	5.16
Classroom community	49.52	8.09	54.80	8.46

The researcher found that engagement with the ratio analysis discussion forum increased in cycle two when students were exposed to non-task 'warm-up' activities at the commencement of the module. According to Salmon (2011), discussion forum

'warm-up' activities are essential to familiarise students with discussion forum use, particularly for students who have no previous forum experience.

The researcher noted the importance of cultivating a positive classroom climate, remaining sensitive to any communication apprehensions that existed among students. Initial group work in class facilitated learners who were familiar with one another to sit together, to reduce any uncomfortable feelings that learners might have had when meeting new people. Allowing students to work frequently in pairs with those sitting nearby facilitated this and proved convenient, with minimal disruption or set-up time required.

4.2.4 Engagement

Qualitative datasets revealed that BL led to more enjoyable learning experiences for students, making topics 'more engaging and easier to learn' (2019-20 Student 14, survey response). Participants appreciated the diverse range of learning resources which assisted in advancing their understanding of financial accounting, leading to enjoyment, motivation and enthusiasm among participants: 'I found the clicker activity very useful. I think interactive learning activities such as this that encourage discussion while adding an element that's not usually used in the classroom are an excellent way of engaging. It ensures the content discussed will be remembered as it was discussed in a unique way. I also think group work encourages new ideas allowing you to gain an insight you may not have had before.' (2018-19 Student 8, semester 2 student log).

The provision of tasks of increasing complexity acted to scaffold learners, as they moved from the use of worked examples to independent problem-solving, while also sustaining engagement, in accordance with 'flow theory' (Csikszentmihalyi, 1990). This provided for diverse student needs as students with no prior accounting experience

were more likely to use online worked examples in this study, while advanced learners moved directly to independent problem solving.

Questionnaire respondents demonstrated an increased level of agreement that BL encouraged participation in class activities from cycle two onwards, as evident from Table 7. These increased participation levels corresponded with the introduction of f2f collaborative group tasks from cycle two onwards, inspired by Kearsley and Shneiderman (1998), coupled with the introduction of clicker technology aimed at boosting student engagement. The researcher also observed a sense of enjoyment among students during the clicker class along with more active discussion and participation, as well as greater evidence of 'knowledge building' among students rather than 'knowledge-transmission' from the lecturer.

Table 7. Levels of agreement on engagement post-questionnaire items - 3 design cycles

	Levels of agreement		
	Cycle 1	*Cycle 2*	*Cycle 3*
BL encouraged participation in class activities	33%	81%	73%
Clickers allowed more active class participation	n/a	88%	86%

Allowing students to work collaboratively on authentic tasks coupled with the integration of MS Excel, a workplace digital tool, fostered engagement while also adding to the 'authenticity' of learners' education (Herrington et al., 2003; Herrington & Oliver, 2000; Kearsley & Shneiderman, 1998).

Online quizzes scheduled during the semester promoted engagement with assessment activities. Many students indicated expending a greater study effort due to online assessments, noting the reduced stress associated with out-of-class online assessments. Kahu and Nelson (2018) emphasise the impact of 'lifeload' on student engagement. Students valued the 50% reduction in f2f contact hours provided under the

BL model as it allowed them to utilise their time productively in accessing online resources and managing outside commitments.

4.2.5 Interaction

Moodle tracking logs revealed high levels of interaction with the multimedia resources pertaining to the BL design. The researcher was cognisant of the fact that there was a mixed level of prior accounting knowledge within the class, so diverse resources were provided to cater for varying student needs. Albeit some students had completed the accounting topics under study previously at leaving certificate higher level, nonetheless there was evidence of high levels of interaction with the online multimedia resources, with 88% of participants viewing at least one of the two multimedia resources in cycle three. Additional worked example videos provided from cycle two onwards were used predominantly by novice learners, in line with the research literature by Sweller (2006) and Sweller and Cooper (1985) on the worked example effect. Students expressed a desire for resources which can be accessed on their phones for viewing at any time.

Table 8. Levels of agreement on interaction post-questionnaire items - 3 design cycles

	Levels of agreement		
	Cycle 1	*Cycle 2*	*Cycle 3*
BL provided better interaction with classmates	17%	52%	73%
BL provided good communication channels with the lecturer	75%	76%	80%
I disliked not being able to ask questions	33%	16%	21%

Group interview and student learning log data revealed that participants valued the use of group work in both fostering understanding, as well as getting to know one another. 'I think it kinda pushes you to talk to different people that you wouldn't really

talk to in the class.' (2018-19 Student 12, group interview). Questionnaire respondents revealed increasingly higher levels of agreement that BL led to better interaction with classmates as the research study progressed (see Table 8). This was also observed by the researcher and corresponded with an increased emphasis on both f2f and online collaborative activities and pair work from cycle two onwards.

There were also high levels of satisfaction across all three cycles in relation to the communication channels with the lecturer (see Table 8). The lecturer was available via email and an announcement forum initially, followed by the addition of Whats App messaging from design cycle two onwards. Messages and reminders were sent by the lecturer to the class representative who forwarded them onto the class group via Whats App. Students remarked positively on the lecturer's availability and interest in their welfare. In design cycle three, when surveyed on what they disliked most about the BL process, the inability to ask questions was not mentioned as a dislike by any participant. It is likely that levels of support put in place from cycle two onwards, informed by Luria and Vygotsky (1930) and Wood, Bruner and Ross (1976), including the addition of a preliminary f2f class on each topic and timetabling adjustments to reduce the gaps between f2f hours, acted to scaffold learners This may have reduced the need for the lecturer's presence during learning time, and allowed learners to progress towards learning independently.

Student feedback in relation to the Moodle page and discussion forum layout was generally positive from cycle two onwards following improvements to the interface, matched with higher participation levels on the discussion forum. This corresponds with the view of Hillman et al. (1994), that high-quality course interfaces which are simple to navigate must be provided. A VLE layout which ensures ease of access to online learning and assessment materials is of particular importance due to the

multitude of resources which are provided in a BL format. Moodle tracking logs revealed evidence of vicarious interaction on the ratio analysis discussion forum, with average student views on the ratio analysis discussion forum higher than average student posts. This corresponds with the literature on vicarious interaction and witness learning (Goldman, Crosby, Swan & Shea, 2005; Sutton, 2000) which asserts that students not directly participating in online discussion can benefit from observing and processing cognitively the interactions of others. This allows learners who are shy, to progress their learning without the fear of rejection that they may associate with sharing their own ideas. 'I learned from making my own comments by doing the ratios and comparing both years together. I also learned from reading other people's comments and seeing their views on the ratios.' (2019-20 Student 6, semester 2 student log).

Furthermore, qualitative datasets revealed that international students benefited from the group work and discussion forum in relation to interacting with and getting to know other students, and improving their spoken and written English. 'I think the group discussion is very useful, because I can learn about new students and make friends with them. … In fact, I like the model very much, because it can make me know more students and can practise my English.' (2019-20 Student 4, semester 1 student log).

4.2.6 Technology

In general, during all three cycles students exhibited a low desire for technical support. Orientation activities were provided in the computer lab setting in advance of the blended topics and the lecturer was accessible via email or using Whats App via the class rep outside of f2f hours, all of which acted to negate the need for technical support. There was some evidence to suggest that slow internet speeds affected online resource usage, although this varied across the three cycles and was most likely determined by the home location of the students and the accessibility of broadband

within their local area, consistent with the findings of the National Forum for the Enhancement of Teaching and Learning in Higher Education (2020). Some students mentioned difficulties regarding wifi quality within the college, evidence that the BL design can be constrained by institutional factors such as wifi quality and availability of technology.

A comparison of responses to pre-implementation and post-implementation survey items revealed increases in perceived computer and MS Excel skill levels across participant groups in all three design iterations. When surveyed at the end of design cycle one, the majority of respondents indicated moderate to very high levels of perceived skill improvement for both computer and MS Excel skills, with increasing levels of perceived improvement across subsequent cycles, as evident from Table 9. Qualitative datasets also revealed increased levels of confidence in use of IT and MS Excel among students. 'I didn't know how to use Excel before I came to college and now I feel really comfortable using it.' (2018-19 Student 8, group interview). This corresponded with the introduction of LanSchool classroom management software and increased use of MS Excel templates in design cycle two and the addition of a MS Excel tutorial at the commencement of the academic year in design cycle three. This reflected the views of Mishra and Koehler (2006) on the importance of adapting the instructor's pedagogical approach to facilitate learning with technology.

Qualitative data revealed higher levels of satisfaction with computer laboratory classes from design cycle two onwards, along with an appreciation by students of the ability to use a digital workplace tool 'I liked the fact that after completing the question we brought it one step further and used the computer because it made it more relatable to the work we will be doing in the future.' (2018-19 Student 22, semester 1 log).

A technological self-efficacy score was computed for questionnaire respondents at the end of each design cycle based on their responses to four survey items. The mean technological self-efficacy score increased in design cycle two, following on from the aforementioned design changes, resulting in no respondent exhibiting a low technological self-efficacy score (see Table 9).

Table 9. Technological self-efficacy - 3 design cycles

	Cycle 1	*Cycle 2*	*Cycle 3*
Moderate to very high perceived improvement in computer skill	58%	76%	100%
Moderate to very high perceived improvement in MS Excel	71%	76%	93%
Mean technological self-efficacy score (max = 20)	14.75	15.81	15.73
% with high technological self-efficacy score	54%	71%	80%
% with medium technological self-efficacy score	42%	29%	20%
% with low technological self-efficacy score	4%	0%	0%

4.3 The PACE-IT model: design guidelines

The study outcome provided a set of design guidelines which characterise the design of an effective BL intervention in introductory accounting education (Kelly, 2020). These guidelines are embodied within the newly developed multi-dimensional PACE-IT model and are delineated under the six key thematic areas of pedagogy, autonomy, collaboration, engagement, interaction and technology in Table 10. Moreover, the guidelines can be adopted and adapted by educators in similar settings who wish to deploy BL to enhance the learner experience.

Table 10. PACE-IT model design guidelines

Theme	Design guidelines
Pedagogy	Allows learners to contemplate theory with opportunities to share, discuss and reflect
	Aims to reduce student cognitive load through suitable online resource design and use of a f2f class to introduce each topic prior to online learning
	Provides scaffolding through online worked example videos
	Furnishes preliminary topic material in an online format and uses discussion forums and f2f contact time for advanced learning
Autonomy	Incorporates learning tasks which are context-focused and build on learners' prior experiences
	Deploys online resources which facilitate learners in working at their own pace and in their own time
	Offers opportunities to learners to reflect so as to build awareness of their own learning
	Scaffolds learners in gaining learner independence by gradually transferring responsibility for their own learning
Collaboration	Offers students opportunities to peer scaffold and collaborate, in online and f2f settings
	Creates a supportive classroom climate remaining sensitive to any communication apprehensions
	Provides non-task 'warm up' activities to familiarise learners with discussion forum use
	Scaffolds the learner through the provision of online solutions and

	detailed instructions
Engagement	Allows learners to work collaboratively on authentic tasks and use workplace digital tools, such as MS Excel
	Provides problem-solving tasks of increasing complexity
	Reduces f2f contact hours to allow students to manage their 'lifeload'
	Engages learners by providing a variety of activities, such as worked example videos, forums and clicker technology
	Deploys online assessment quizzes outside of f2f contact hours
Interaction	Provides online resources which are easily accessible and mobile-compatible
	Utilises appropriate communication channels to facilitate communication with lecturer outside of f2f contact hours along with strong lecturer presence on discussion forums
	Presents online resources using high quality course interfaces which are easy to navigate
Technology	Deploys classroom management software and pre-prepared templates when teaching in the computer lab setting
	Implements orientation activities at the outset to demonstrate online resources and software
	Provides lecturer support to address any technological difficulties

5. Conclusion

There was evidence that learning activities provided within the blended learning (BL) design were appropriate to learner needs, facilitated conceptual understanding, yielded

increased confidence, and nurtured a greater interest and more positive attitude towards the financial accounting subject. The provision of a diverse range of learning activities, along with collaborative activities and clicker technology, contributed to a student learning experience which encouraged sharing of ideas and learning from others as well as being enjoyable, interesting and engaging. Students' team-working skills were fostered and their understanding was transformed, having been exposed to the ideas of others. In addition, the support provided to learners acted to transform their perceptions of learning independently. The integration of financial accounting and MS Excel within the computer laboratory setting, nurtured IT and MS Excel skills among study participants, thereby enhancing the learning experience while equipping students with digital workplace skills. Thus, the BL design provided students with a rich and meaningful learning experience.

The PACE-IT model provides a framework for those in cognate educational settings wishing to use BL to enhance the learning experience in accounting. The findings of this research study support the co-design and implementation of a BL model with introductory accounting students within tertiary education using a design-based research (DBR) approach. The participatory nature of the design allowed students to play an active role in shaping the design, ensuring the success of the BL intervention. Nonetheless it must be acknowledged that the study is limited by the fact that study participants were studying financial accounting in first year of BA in Accounting and BA in Accounting and Law programmes, the majority of whom planned on pursuing careers in the accountancy field following graduation. Furthermore, a limitation of the study is that this was a relatively small cohort. Many other non-accounting student groups undertake compulsory introductory accounting modules as part of their college programmes, for example, students on general business or hospitality programmes.

Future research could explore how a BL intervention may be designed to support students on non-accounting specific programmes when learning introductory accounting. In addition, research into the use of BL at advanced accounting levels would throw light onto challenges which may be encountered, and adaptations necessary, when delivering more complex accounting material in a blended format.

The COVID-19 pandemic arose at the end of this study's final design iteration, following data collection in cycle three, with resultant implications for all levels of education in terms of learning and assessment practices. Since then, delivery mechanisms at tertiary level have been rapidly catapulted into blended and online formats with limited time available for planning and preparation. There exists scope for further research into suitable models of delivery for accounting in light of this new and unfamiliar educational context. PACE-IT provides direction to accounting educators working within an unfamiliar educational context, today and in the future, where there is the imperative to develop new approaches to accounting education that combine face-to-face with online interaction and learning.

References

Abbott, J. I., & Palatnik, B. R. (2018). Students' perceptions of their first accounting class: implications for instructors. *Accounting Education*, *27*(1), 72–93. https://doi.org/10.1080/09639284.2017.1381032

Adams Becker, S., Cummins, M., Davis, A., Freeman, A., Hall Giesinger, C., & Ananthanarayanan, V. (2017). *NMC Horizon report. 2017 Higher Education edition*.

Anderson, T., & Shattuck, J. (2012). Design-based research: A decade of progress in education research? *Educational Researcher*, *41*(1), 16–25. https://doi.org/10.3102/0013189X11428813

Apostolou, B., Dorminey, J. W., Hassell, J. M., & Rebele, J. E. (2017). Analysis of trends in the accounting education literature (1997–2016). *Journal of Accounting Education*, *41*, 1–14. https://doi.org/10.1016/j.jaccedu.2017.09.003

Apostolou, B., Dorminey, J. W., Hassell, J. M., & Watson, S. F. (2013). Accounting education literature review (2010-2012). *Journal of Accounting Education*, *31*, 107–161. https://doi.org/10.1016/j.jaccedu.2013.03.001

Apostolou, B., Hassell, J. M., Rebele, J. E., & Watson, S. F. (2010). Accounting education literature review (2006-2009). *Journal of Accounting Education*, 145–197. https://doi.org/10.1016/j.jaccedu.2011.08.001

Barab, S., & Squire, K. (2004). Design-based research: Putting a stake in the ground. *Journal of the Learning Sciences*, *13*(1), 1–14. https://doi.org/10.1207/s15327809jls1301_1

Behn, B. K., Ezzell, W. F., Murphy, L. A., Rayburn, J. D., Stith, M. T., & Strawser, J. R. (2012). The Pathways Commission on accounting higher education: Charting a national strategy for the next generation of accountants (executive summary). *Issues in Accounting Education*, *27*(3), 595–600. https://doi.org/10.2308/iace-10300

Blaschke, L. M. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. *The International Review of Research in Open and Distance Learning*, *13*(1), 56–71. https://doi.org/10.19173/irrodl.v13i1.1076

Blaschke, L. M., & Hase, S. (2016). Heutagogy: A holistic framework for creating twenty-first century self-determined learners. In B. Gros, Kinshuk, & M. Maina (Eds.), *The future of ubiquitous learning* (pp. 25–40). Springer. https://doi.org/10.1007/978-3-662-47724-3

Bonk, C. J., & Smith, G. S. (1998). Alternative instructional strategies for creative and critical thinking in the accounting curriculum. *Journal of Accounting Education*, *16*(2), 261–293. https://doi.org/10.1016/S0748-5751(98)00012-8

British Educational Research Association. (2018). *Ethical guidelines for educational research* (4th ed.). BERA.

Bryant, S. M., & Hunton, J. E. (2000). The use of technology in the delivery of instruction: Implications for accounting educators and education researchers. *Issues in Accounting Education*, *15*(1), 129–162. https://doi.org/10.2308/iace.2000.15.1.129

Coovadia, H., & Ackermann, C. (2021). Integrating digital pedagogies into a typical student learning lifecycle and its effect on exam performance. *Accounting Education*, *30*(1), 42–62. https://doi.org/10.1080/09639284.2020.1811993

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. Harper &

Row.

Dziuban, C., Graham, C. R., Moskal, P. D., Norberg, A., & Sicilia, N. (2018). Blended learning: the new normal and emerging technologies. *International Journal of Educational Technology in Higher Education*, *15*(1), 3. https://doi.org/10.1186/s41239-017-0087-5

Flood, B. (2014). The case for change in accounting education. In R.M.S. Wilson (Ed.), *The Routledge companion to accounting education* (pp. 81–101). Routledge.

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *Internet and Higher Education*, *7*(2), 95–105. https://doi.org/10.1016/j.iheduc.2004.02.001

Goldman, R., Crosby, M., Swan, K., & Shea, P. (2005). Qualitative and quizitive research methods for describing online learning. In S. R. Hiltz & R. Goldman (Eds.), *Learning together online: Research on asynchronous learning networks* (pp. 95–112). Lawrence Erlbaum Associates Inc.

Graham, C. R., Woodfield, W., & Harrison, J. B. (2013). A framework for institutional adoption and implementation of blended learning in higher education. *Internet and Higher Education*, *18*, 4–14. https://doi.org/10.1016/j.iheduc.2012.09.003

Hall, T. (2020). Bridging practice and theory: The emerging potential of design-based research (DBR) for digital innovation in education. *Education Research and Perspectives*, *47*, 157–173.

Harel, I., & Papert, S. (1990). Software design as a learning environment. *Interactive Learning Environments*, *1*(1), 1–35. https://doi.org/10.1080/1049482900010102

Hase, S., & Kenyon, C. (2000). From Andragogy to Heutagogy. *UltiBASE Articles*, *5*, 1–10.

Herrington, J., & Oliver, R. (2000). An instructional design framework for authentic learning environments. *Educational Technology, Research and Development*, *48*(3), 23–48. https://doi.org/10.1007/BF02319856

Herrington, J., Oliver, R., & Reeves, T. C. (2003). Patterns of engagement in authentic online learning environments. *Australasian Journal of Educational Technology*, *19*(1), 207–210. https://doi.org/10.14742/ajet.1701

Hillman, D. C. A., Willis, D. J., & Gunawardena, C. N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *American Journal of Distance Education*, *8*(2), 30–42. https://doi.org/10.1080/08923649409526853

Jackling, B., & De Lange, P. (2009). Do accounting graduates' skills meet the expectations of employers? A matter of convergence or divergence. *Accounting Education: An International Journal*, *18*(4–5), 369–385. https://doi.org/10.1080/09639280902719341

Jackson, S. L., Krajcik, J., & Soloway, E. (1998). The design of guided learner-adaptable scaffolding in interactive learning environments. In C. M. Karat, A. Lund, J. Coutaz, & J. Karat (Eds.), *Proceedings of CHI 98: Human factors in computing systems* (pp. 187–194). Addison-Wesley.

Kahu, E. R. (2013). Framing student engagement in higher education. *Studies in Higher Education*, *38*(5), 758–773. https://doi.org/10.1080/03075079.2011.598505

Kahu, E. R., & Nelson, K. (2018). Student engagement in the educational interface: understanding the mechanisms of student success. *Higher Education Research and Development*, *37*(1), 58–71. https://doi.org/10.1080/07294360.2017.1344197

Kearsley, G., & Shneiderman, B. (1998). Engagement theory: A framework for technology-based teaching and learning. *Educational Technology*, *38*(5), 20–23.

Kelly, O. (2020). *Designing blended learning for Accounting in tertiary education: The*

PACE-IT model. Unpublished PhD thesis. NUI Galway, Ireland.

Kenney, J., & Newcombe, E. (2011). Adopting a blended learning approach: Challenges encountered and lessons learned in an action research study. *Journal of Asynchronous Learning Networks*, *15*(1), 45–57.

Knowles, M. S. (1984). *Andragogy in action*. Jossey-Bass.

Laumakis, M., Graham, C., & Dziuban, C. (2009). The Sloan-C pillars and boundary objects as a framework for evaluating blended learning. *Journal of Asynchronous Learning Networks*, *13*(1), 75–87. https://doi.org/10.24059/olj.v13i1.1679

Laurillard, D. (2002). Rethinking teaching for the knowledge society. *EDUCAUSE Review*, *37*(1), 133–156.

Luria, A. R., & Vygotsky, L. S. (1930). The child and his behavior. In *Ape, primitive man, and child: Essays in the history of behaviour (E. Rossiter, trans.)*. Harvester Wheatsheaf.

Marriott, P., & Lau, A. (2008). The use of on-line summative assessment in an undergraduate financial accounting course. *Journal of Accounting Education*, *26*(2), 73–90. https://doi.org/10.1016/j.jaccedu.2008.02.001

Mayer, R. E. (2002). Cognitive theory and the design of multimedia instruction: An example of the two-way street between cognition and instruction. In D. F. Halpern & M. D. Hakel (Eds.), *Applying the science of learning to university teaching and beyond* (Vol. 89, pp. 55–71). Jossey-Bass. https://doi.org/10.1021/ed081p10

McKenney, S., & Reeves, T. C. (2019). *Conducting educational design research* (2nd ed.). Routledge.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108*(6), 1017–1054.

Moore, M. G. (1989). Three types of interaction. *American Journal of Distance Education*, *3*(2), 1–7. https://doi.org/10.1080/08923648909526659

Moran-Ellis, J., Alexander, V. D., Cronin, A., Dickinson, M., Fielding, J., Sleney, J., & Thomas, H. (2006). Triangulation and integration: processes, claims and implications. *Qualitative Research*, *6*(1), 45–59. https://doi.org/10.1177/1468794106058870

National Forum for the Enhancement of Teaching and Learning in Higher Education. (2020). *Reflecting and learning: The move to remote/online teaching and learning in Irish higher education*. https://www.teachingandlearning.ie/wp-content/uploads/NF-2020-Reflecting-and-Learning-web-ready.pdf

Pathways Commission. (2014). *Implementing the recommendations of the Pathways Commission: Year two*. http://commons.aaahq.org/

Plomp, T. (2013). Educational design research: An introduction. In T. Plomp & N. Nieveen (Eds.), *Educational design research* (pp. 11–50). Institute for Curriculum Development (SLO).

Rebele, J. E., & St. Pierre, E. K. (2015). Stagnation in accounting education research. *Journal of Accounting Education*, *33*, 128–137. https://doi.org/10.1016/j.jaccedu.2015.04.003

Reeves, T. C., McKenney, S., & Herrington, J. (2011). Publishing and perishing: The critical importance of educational design research. *Australasian Journal of Educational Technology*, *27*(1), 55–65. https://doi.org/10.14742/ajet.982

Salmon, G. (2011). *E-moderating* (Issue 3rd edition). Routledge.

Sangster, A., Stoner, G., & Flood, B. (2020). Insights into accounting education in a COVID-19 world. *Accounting Education*, *29*(5), 431–562. https://doi.org/10.1080/09639284.2020.1808487

Scardamalia, M., & Bereiter, C. (1994). Computer support for knowledge-building

communities. *The Journal of the Learning Sciences*, *3*(3), 265–283. https://doi.org/10.1207/s15327809jls0303_3

Singh, J., Steele, K., & Singh, L. (2021). Combining the best of online and face-to-face Learning: Hybrid and blended learning approach for COVID-19, post vaccine, & post-pandemic world. In *Journal of Educational Technology Systems* (Vol. 50, Issue 2). https://doi.org/10.1177/00472395211047865

Soloway, E., Guzdial, M., & Hay, K. E. (1994). Learner-centered design: The challenge for HCI in the 21st century. *Interactions*, *1*(2), 36–48. https://doi.org/10.1145/174809.174813

Soloway, E., Jackson, S. L., Klein, J., Quintana, C., Reed, J., Spitulnik, J., Stratford, S. J., & Studer, S. (1996). Learning theory in practice: Case studies of learner-centered design. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 189–196. https://doi.org/10.1145/238386.238476

Sutton, L. A. (2000). Vicarious interaction: A learning theory for computer-mediated communications. *Paper Presented at the Annual Meeting of the American Educational Research Association*.

Sweller, J. (2006). The worked example effect and human cognition. *Learning and Instruction*, *16*, 165–169. https://doi.org/10.1016/j.learninstruc.2006.02.005

Sweller, J., & Cooper, G. A. (1985). The use of worked examples as a substitute for problem solving in learning algebra. *Cognition and Instruction*, *2*(1), 59–89. https://doi.org/10.1207/s1532690xci0201_3

Vygotsky, L. S. (1978). Interaction between learning and development. In M. Cole, V. John-Steiner, S. Scribner, & E. Souberman (Eds.), *Mind in society: The development of higher psychological processes* (pp. 79–92). Harvard Universtiy Press.

Wang, F., & Hannafin, M. J. (2005). Design-based research and technology-enhanced learning environments. *Educational Technology Research and Development*, *53*(4), 5–23. https://doi.org/10.1007/BF02504682

Wilson, Richard M.S., Ravenscroft, S. P., Rebele, J. E., & St. Pierre, K. (2008). The case for accounting education research. *Accounting Education: An International Journal*, *17*(2), 103–111. https://doi.org/10.1080/09639280802196202

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, *17*, 89–100. https://doi.org/10.1111/j.1469-7610.1976.tb00381.x