

# THE DIGITAL EXPLOSION: IT'S IMPACT ON INTERNATIONAL STUDENT ACHIEVEMENT

## **Abstract**

The purpose of this study is to conduct empirical research into the use of an interactive e-book in a predominantly international MSc Business Management cohort, evaluating its impact on engagement, and academic achievement. There is a lacuna in the current state of research into interactive e-books, and a lack of attention on international students studying in the UK. Quantitative data was obtained and analysed using t-tests and correlational analysis. The key findings were that those students who used the interactive e-book scored significantly higher coursework and examination marks than those students who did not. Student engagement was critical to the effectiveness of the interactive e-book, with students performing better when it was adopted as summative as opposed to formative assessment. The paper contributes to the literature on blended learning and the use of digital technology, and strongly highlights the benefits of its use in an international student cohort.

Keywords: blended learning, digital interactive e-book, student achievement, international student

## ***Introduction***

This study aims to address a gap in research regarding blended learning with a focus on digital interactive e-books and their impact on international students' academic achievement within the UK. Higher education is a major economic contributor to the UK, with student numbers reaching 2,343,095 in 2017 (HESA, 2019). Due to its importance, much research has been conducted on improving the outcomes of students (Dziuban, Graham and Moskal, 2018; López-pérez et al, 2011; Chetcuti, Hans and Brent, 2014; Jungic et al, 2015). However, there is a scarcity of research focusing on improving the attainment and experience of international students (Bartram, 2008; Madge, Raghuram and Noxolo, 2015). With numbers reaching 442,375 in 2017 (HESA, 2019), this is crucial considering the challenges these students face (Yu and Moskal, 2018; Norton, Cherastidtham and Mackey, 2018). Due to the impact of both home and international students on the UK economy, and society as a whole (OECD, 2012; Madge, Raghuram and Noxolo, 2015), this is something that needs to be remedied.

Extensive research has focussed on the use of blended and flipped learning as tools to improve achievement with mixed results. Some research has found that blended and flipped learning enhance student interaction while others have found it does not as it relies on student independence and motivation (Johnson et al, 2016; Dziuban, Graham and Moskal, 2018; Boelans, Wever and Voet, 2017; Herodotou et al. 2018). However, there is a lack of studies focusing on the use of digital interactive e-books, with the majority focussing on digital textbooks with no interactivity (Junco and Clem, 2015; Ju Joo, Park and Shin, 2017; Smith and Carlin, 2012), and very often a lack of focus on the UK in comparison to the US. This distinction is important due to the social and political differences between the two countries (Norton, Cherastidtham and Mackey, 2018). The rise of the so called education 4.0 (Hussin, 2018; Dong et al, 2020), along with wide scale changes to the social and technological

environments in which students now find themselves (Judd, 2018), suggests that research is required in this area. Consequently, this research adds to the knowledge on the use of interactive digital technology as a form of blended learning, with particular focus on the impact on international students' academic achievement. For the purposes of this study, impact on academic achievement is defined as a statistically significant increase in student marks. The key gap addressed is the lack of focus on interactive digital textbooks and their impact on international students studying in the UK.

The first part of this paper analyses the key changes that have occurred in higher education in recent years. The literature review then provides a critical analysis of blended learning and interactive e-books. The methodology adopted and the key results are then presented, before an analysis of the key research contributions. These include firstly the finding that interactive e-books significantly impact on student academic achievement, secondly the best way to engage students through summative, as opposed to formative assessment and finally the extension of the pedagogic theoretical literature on the international student population in the context of interactive digital technology. Suggestions for further research are then provided.

## ***Literature Review***

### ***Changes in higher education***

Now, more than ever, higher education establishments are facing an increasingly complex and competitive environment (Daniel, 2014). One of the complexities relates to the fact that, in recent years, numbers of international students in universities have increased dramatically (Brauss, Lin and Baker, 2015; OECD, 2012; Norton, Cherastidtham and Mackey, 2018; Sablina, Soong and Pechurina, 2018; Holloway, O'Hara and Pimlott, 2012; Sidu et al, 2011). The Organisation for Economic Co-operation and Development (OECD) defines an international student as one who has left their country of birth in order to study in another (OECD, 2012). The number of international students across the world increased from 0.8 million in 1975 to 4.1 million in 2010 (OECD, 2012). In total there were 485,600 international students studying in the UK in 2018-19 (Hubble and Bolton, 2020). The UK is considered to be one of the biggest receiver countries of international students (Madge et al, 2015), and with internationalisation on the strategic mind of many higher education establishments, the increase is likely to continue (Knight, 2012).

Although international students play an important role in UK universities, the growth creates challenges in teaching and learning (Lomer and Anthony-Okeke, 2019). Firstly, it is noted that international students will have experienced different teaching approaches in their home country, and may find styles used abroad challenging (Arkoudis et al, 2019; Norton, Cherastidtham and Mackey, 2018). This is supported by Hammersley-Fletcher and Hanley (2016) who argue that international students may be unfamiliar with the concept of critical thinking. Another significant challenge for both the students and educator is language barriers (Yu and Moskal, 2018), something that could potentially be aided by the adoption of different pedagogic methods. Despite their importance, there is a lack of research focusing on international students and teaching pedagogies (Madge, Raghuram and Noxolo, 2015). In addition to a high proportion of international students, it has been found that large class sizes in educational settings can lead to lower motivation and engagement (Harfitt and Tsui, 2015; Almarghani and Mijatovic, 2017). Research conducted by the UK Council for International

Student Affairs found that international students faced challenges relating to exams, assignments and understanding lectures as well as large class sizes (UKCISA, 2016). This research concluded that online resources could aid students through these issues. This is crucial as many studies have identified underperformance among international students in the UK (Iannelli and Huang, 2013; Crawford and Wang, 2014). Studies have found that students want to receive immediate and continual feedback throughout the learning process, something difficult to accomplish, especially with large cohorts (Snowball, 2014; Wanner and Palmer, 2018). Chen, Breslow and DeBoer (2018) argue that digital technology has many benefits, including immediacy and interconnectivity, thus it could be adopted to overcome such issues. Add to these changes the introduction of the teaching excellence framework (TEF, 2017), and the result is a rapidly changing higher education environment.

There is a growing need to ensure international students are aided as much as possible, due to the value they bring. International students add new perspectives to the classroom and enable enhanced cultural understanding (Wu et al, 2015). They also contribute to the economy and social prosperity (Conlon, Halterback and Julius, 2018). It is therefore essential that higher education pedagogy focuses on overcoming challenges presented to them through developing new approaches to teaching and learning, and that this feeds into higher education policy development.

There have also been significant changes to the social and technological environment in which students are living. These include the social media revolution, and the evolution of the internet and smartphones, leading to, what has been termed the web and education 4.0 generation (Hussin, 2018). The changes create a move towards digital technology in education, with Johnson et al (2016) arguing that digitalisation fits with students current expectations. It is argued in the literature that today's students are the first generation of digital natives, experienced in the use of technology (Judd, 2018; Dede, 2005; Sprenger 2009). Consequently, incorporating digital technology may be the best way to engage and motivate them. Johnson et al (2016) noted that higher education institutions will need to adopt learning analytics over the coming years. Related to this is the development of the term Education 4.0 in which people and technology are aligned to create new possibilities for education (Hussin, 2018). The recent impact of the coronavirus COVID-19 on higher education establishments around the world highlights the critical need for the use of interactive digital pedagogic techniques and has acted to accelerate the speed of education 4.0. The pandemic has increased awareness and use of technology within the education sector (Iwai, 2020). Through the use of things like interactive digital textbooks students have been able to continue to access resources relating to their courses and to engage with content. This is critical to reducing the impact of this global pandemic on education, learning and student experience and development. The impact of COVID-19 on the future of education will be transformative and one in which digital technology will play a crucial role.

### ***Blended learning***

Alongside, and partly due to the aforementioned changes, there has been a dramatic increase in blended learning within universities, and research conducted into its effectiveness (Castano-Munoz, Duart and Vinuesa, 2014; Johnson et al, 2016; Graham, Woodfield and Harrison, 2013; Dziuban et al, 2018; Boelans et al, 2017; Herodotou et al, 2018). At the most basic level, blended learning is “a combination of face-to-face and online learning” (Spanjers et al, 2015:59). Others define it as a mixture of physical classroom teaching combined with a

virtual environment (Bonk, & Oh, 2008; Mohamed-Amin, Norazah and Ebrahim, 2014). However, there is no unified definition, leading to a fragmented literature base (Picciano, 2009). Johnson et al (2016) highlights blended learning as being one of the key trends affecting higher education in the coming years. There has also been an increase in research on flipped learning; defined as the extension of learning through online platforms (Karabulut-Ilgü et al, 2018) or whereby “events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa (Lage et al, pp30). Blended learning is an important pedagogic tool, as students are more likely to use this type of learning, not only in higher education but also within industry (Dziuban, Graham and Moskal, 2018).

Within the literature, the effectiveness of blended and flipped learning has been mixed (Johnson et al, 2016; Dziuban et al, 2018; Boelans et al, 2017; Herodotou et al, 2018). Highlighting student engagement as being one of the key challenges at present, Henrie, Halverson and Graham (2015) indicate that blended learning is critical. Ashour (2019) also emphasises its importance in improving student success, highlighting the need for more research into impact for international students. Castano-Munoz, Duart and Vinuesa (2014) argue that blended learning is more effective than face-to-face learning, as long as some sort of interaction between educator and student takes place. This suggests blended learning should be mixed with traditional methods, as suggested by Jones, Jones and Packham (2009). Dziuban, Graham and Moskal (2018) in particular found that blended learning improved student success rates in both minority and non-minority students. Therefore its use in an international student population may well be warranted. Importantly it has been found to increase student interaction (Stockwell et al, 2015), as well as improve success (López-pérez et al, 2011). This is echoed by Johnson et al (2015) who found that these types of learning enable further engagement with the material as well as greater peer interaction (Johnson et al, 2015). It could be argued that blended learning can encourage students to become more independent learners (Eddy, Nor-Aziah and Jasmine, 2014). Bishop and Verleger (2013) found students viewed flipped learning positively, while it is also found to encourage students to be more prepared in lectures (Chetcuti, Hans and Brent, 2014; Jungic et al, 2015). Importantly, it can also be used to personalise the student learner experience and therefore suit multiple learning styles (Al-Khanjari, 2014; Downes, 2005).

However, both blended and flipped learning have disadvantages. They rely on students completing work in their own time and having the motivation to do this outside of the classroom (McConnell, 2017; McDonald, 2014; Van Laer & Elen, 2016). This is often referred to as transactional distance (Moore, 1993). The social constructivist perspective criticises blended learning for removing the strengths of face-to-face interaction and human connection (Woo & Reeves, 2007). Research has also found that for low achievers, blended learning may not be as beneficial due to lack of motivation for independent learning (Owston, York and Murtha, 2013; Tsai & Shen, 2009), resulting in lower participation (Heaney & Walker, 2012; Lotrecchiano et al, 2013). This criticism has sometimes led to blended learning elements being adopted for summative rather than formative assessment, almost forcing the student to engage (Vermunt & Verloop, 1999). This suggests blended learning should be approached with care, especially when used for assessment. Timmis et al (2015) concur with this, arguing that technology enhanced assessment must be adopted cautiously. Much of the research on blended learning analyses the impact on student achievement and the benefits and disadvantages of its use (Dziuban et al, 2018; Van Laer & Elen, 2016; McDonald, 2014; Chetcuti, Hans and Brent, 2014; Jungic et al, 2015). This research aims to be more focussed; analysing the impact of blended learning through the use of a digital interactive e-book on international student academic achievement within the UK.

The literature review so far highlights an increase in the use, and need for, digital technology and blended learning in higher education. One type of digital technology that can be utilised for blended learning is e-books. Traditional e-books are defined as a digital reproduction of a printed book (Wang and Bai, 2016), whereas interactive e-books are improved digital books that enable interactivity at a high level between user, book and environment (Bozkurt and Bozkaya, 2013a; 2013b). Significant amounts of research have been conducted on e-books in general (Junco and Clem, 2015; Ju Joo et al, 2017; Smith and Carlin, 2012). However, there is a lack of research examining the use and impact of interactive e-books that allow users to actually interact with, and test their knowledge (Kesim and Yidirim, 2017; Bozkurt and Bozkaya, 2015). There is also a significant amount of research on learning analytics technology, but this has mainly taken place in the US (Dziuban, Graham and Moskal, 2018; Bowyer and Chambers, 2017), with limited research conducted in the UK.

A key issue across all universities is the difficulty in encouraging students to engage with course material, and the detrimental effect this can have on learning (Young, Robinson and Alberts, 2009; Daniel and Woody, 2013; Wang and Degol, 2014). Pearson (2019) established that students learn best through a mixed media approach to learning. They developed an interactive e-book called Revel that enables students to process information through encoding and retrieval processes (Cheon, Crooks and Chung, 2014), allowing knowledge to be absorbed more effectively. Revel is the interactive e-book that was used for this study. Research also shows that reducing extraneous cognitive load improves the processing of knowledge (van Merriënboer and Sweller, 2005; Pearson, 2019). Revel does this by allowing the reader to comprehend smaller amounts of text, and incorporating interactive exercises that have been shown to boost active and constructive engagement with taught material (Freeman et al, 2014). Students often have issues with the delay in feedback (Carless, 2006; Orsmond & Merry, 2011) and yet the use of interactive e-books allows for immediate feedback. Kirkwood and Price (2013) argue that technology enhanced learning tends to be technology led as opposed to being situated to solve a student need or challenge. This research focuses on the latter, as highlighted throughout the literature review.

For the purposes of this research Revel was used as a digital interactive online textbook and students were assigned key chapters and associated activities to complete throughout the semester. Revel presents small chunks of text interspersed with interactive exercises to allow students to embed the knowledge. Students were expected to complete these prior to the lecture and seminar with which the chapters were associated. The chapters were also referred to and activities shown during lectures, thus incorporating both blended and flipped learning. All students were based in Swansea on campus for the duration of their teaching and all teaching took place face to face.

### ***Theoretical framework***

Social constructivism learning theory conventionally argues that learning is a social process that does not take place individually (Atwater, 1996; Rogoff, 1998). Traditionally it does not consider that learning can occur outside of social interaction, through for instance digital technologies. However, it has been more recently adapted, with many authors arguing that learners engage with, and learn through, digital technology as well as face-to-face social interaction (Reynolds, 2016; Barak, 2016). Social constructivism views learning as being constructed and not acquired, thus it is reasonable to argue that this construction of knowledge can also be generated through digital means. It also tends to view learning as both

a social and cultural process (Alt, 2016), consequently its application to international students is fitting. However, consideration of more technology based learning theories was required due to the focus of this research.

Connectivism learning theory has been developed for e-learning environments and is considered a relatively new theory, first documented by Siemens (2005). Siemens (2006) argues that learning is influenced by both technology and socialisation, and traditional learning theories were created at a time when digital technology was not evident. Connectivism argues that learning is distributed amongst many different mediums and environments. It has been mostly applied to online courses that have minimal or no face-to-face interaction (Goldie, 2016), but it has also been combined with social constructivism to analyse the use of digital technologies in more traditional learning environments (Anderson and Dron, 2011; 2012).

As well as the development of learning theories, more practical models have been developed to aid the development of learning material and courses. It is important to focus on these types of models and to analyse their connections with learning theories. For the purposes of this research the Addie model was deemed most fitting for the development of a digital learning resource. Molenda (2015) argues that this model is used in the literature to describe any model that uses a process based approach to design instructional content. The Addie process is argued to be unique because it involves an iterative design process with constant evaluation. Its steps involve analyse, design, develop, implement and evaluate (Taylor, 2004). However, literature on the use of the Addie model is limited, thus this research adds to this body of knowledge (Hess and Greer, 2016). Figure 1 illustrates the entirety of the Addie model, adopted for the purpose of this research.

This paper takes the approach of the combination of both social constructivism and connectivism learning theory, supported practically through the use of the Addie model. Although some of these theories have been widely researched within the literature, it is the combination of them, with the focus on digital interactive e-books in an international student population that is unique in this study. Consequently, this research will add to the body of knowledge on each of these theories and models.

### ***Summary and Conceptual Model***

In summary, it is evident that we are faced with a rapidly changing social and technological environment, and therefore a fast moving higher education landscape. Not only do universities have to deal with rising student numbers, but also a changing digital arena (HESA, 2019; Brauss et al, 2015). There is a large amount of research that has been conducted on blended and flipped learning, along with the use of digital technology in the educational field. However, there is a distinct lack of research focusing on the use of this blended, digital interactive technology in relation to large international cohorts of students, particularly in the UK. Much of the research has been conducted in the US or further afield, and there is a lack of focus on international students. This is something that deserves further attention due to the fact that this group of students is educationally, culturally and linguistically different from home students, and yet in many universities they contribute to very large student numbers (Bartram, 2008). It is critical to focus research on large cohorts of students, as this is something that is only going to increase in the coming years. Finally, it is also important to focus research on the UK, especially with the impending separation from

the European Union. This study conducts research into educational technology, an area that is current and yet requires further development (Girvan, 2018).

Based on the preceding literature review, Figure 2 highlights the Addie model process guiding this research. The model demonstrates that analysis took place of the cultural forces impacting students, as well as the changing higher education landscape. This led to the design phase where interactivity and digital blended learning were focused on through introducing Revel. The development phase led to pilot testing in phase one, the use of Revel for formative assessment in phase two, and the use of Revel for summative assessment in phase three. Implementation took place through raising student awareness and linkage to assessment. Finally, evaluation took place on the impact of Revel on academic achievement. The conceptual model shown in Figure 3 argues that international student populations are aided by interactivity and digital blended learning, leading to an increase in academic attainment. Ultimately, the research question focuses on whether the use of interactive digital blended learning can impact large international cohort's academic achievement.

INSERT FIGURE 2 HERE

INSERT FIGURE 3 HERE

## ***Methodology***

A sample size of 399 Swansea University international master's students was used throughout the duration of this research. The students were from two cohorts, across two consecutive academic years (2017-2018 and 2018-2019). The international students countries of origin include China, Malaysia and India. Two modules, which took place during both academic years, incorporated the interactive e-book into the learning process. Data was obtained from students from both modules, across both academic years, resulting in data from four modules. In 2017-2018, adoption of the e-book was optional, with no marks awarded for its use. During 2018-2019, the interactive e-book was made a compulsory element for both modules, with up to 20% of the total module marks made available to students. Marks were awarded based on tasks students undertook and their achievement.

The methodology adopted for this research involved several steps. Firstly, data was obtained directly from the interactive e-book platform, with students who had used the interactive e-book being identified using their student number. The marks they achieved for each of the tasks completed were collated, along with the time they spent using the platform. In addition to this, the marks for the module were collected, including coursework marks, examination marks and overall module marks. All of the data was matched up using student identification numbers.

In addition to the data obtained from the interactive e-book and the module marks, as is the case with other research in higher education examining students, an online questionnaire was conducted to obtain student opinions and experiences of the interactive e-book (Adams and Umbach, 2012; Estelami, 2015). The questionnaire was sent to students enrolled on the course during 2017-2018 and 2018-2019. Out of the 225 enrolled during 2017-2018, 123 completed the questionnaire (54.6%). During 2018-2019, the response rate was 67.8%, with 118 students participating. Students were asked to give feedback on the interactive e-book in terms of how they felt it contributed to their learning and engagement with the course, which activities they found most useful, and any difficulties they

experienced with the platform. Precedential to other literature in the field, a variety of closed and open response questions were included, with the open questions aiming to enrich responses to the closed response questions, which included likert scale questions (Jamaludin and Osman, 2014; O’Flahery and Phillips, 2015; Cassidy, 2016).

### ***Methodology of Data Analysis***

The research adopted several data analysis stages, using SPSS version 25. Prior to examining the data from the interactive e-book and module marks, basic descriptive analysis was conducted on the data obtained from the online questionnaire. This provided an overview of student perceptions of the interactive e-book.

With the use of the interactive e-book being optional for 2017-2018, not all students chose to use it. Consequently, the next stage of analysis involved conducting independent samples t-tests to compare mean coursework, examination and overall marks of two groups of students; those who used the interactive e-book versus those who did not. A method adopted in previous research exploring student outcomes under two different scenarios (Powell, Victor and Tracy, 2003; Rivera and Rice, 2002). The analysis was performed for both modules and sought to identify significant differences in the marks between those students that chose to use the interactive e-book and those who did not. Before conducting independent samples t-tests, Levene’s test for equality of variances was performed to confirm the variability within the different groups was equal (Brown and Forsythe, 1974), and to ensure the statistics were robust (Gastwirth, Gel and Miao, 2009).

In addition to comparing the groups of students that had engaged with the interactive e-book with those who had not, the average module marks were compared for the two modules across the two academic years. This examined the difference in grades when the interactive e-book was adopted as a form of formative assessment, versus when it was used as summative assessment. Comparisons were also made with previous years when the interactive e-book had not been in place. As we were examining cohorts here, rather than individual students, the marks compared were simply the average scores for coursework and exams achieved each year by the entire cohort. Likewise, the failure rate for the two modules across the two cohorts were analysed and compared.

The next stage of analysis involved Pearson’s correlations on data from both academic years and for both modules. Pearson’s correlation is frequently adopted in studies into student outcomes (Lopez-Perez, Perez-Lopez and Rodriguez, 2011). Here, the students’ grades achieved on the interactive e-book platform were correlated against their assignment marks, examination marks and overall marks for the module. The analysis sought to identify any significant correlations between students’ achievements on the platform, and their overall outcomes for the course. The principal was to explore whether more time spent on the platform to achieve higher marks on the activities available would result in higher module marks. The analysis involved testing for significant correlations, as well as strength and direction.

### ***Results***



In the first year of the study (2017-2018), Revel was optional for students and although it was an additional learning tool, students were not awarded with any marks for taking part in using it or completing the activities. Even so, 163 out of 225 students (72.4%) that were enrolled on the first module chose to use Revel. The uptake was much lower for second module, but almost half (46.3%) of the students still opted to explore the content and take part in the activities .

Although uptake levels differed, independent samples t-tests revealed that, for both modules, the marks of those students who chose to use Revel were significantly higher than for those who did not. As summarised in Table 1, the average overall mark of Revel users in the first module of the 2017-2018 academic year was 53.1%, whereas the mark of those who did not use it was significantly lower at 46.8% (p=.001). Similarly, for the second module, the average overall mark of those students who used Revel was significantly higher at 63.6% compared to 52.9% for non-users (p=.006).

**Table 1: t-test results comparing marks of Revel users v. non-user (2017-2018)**

	No. users	Mark Compared	Mean mark (users)	Mean mark (non-users)	t-value	p-value
<b>Module 1 (n=225)</b>	163 (72.4%)	Examination	46.7%	42.7%	2.0	.049*
		Coursework	62.6%	51.2%	3.9	.000**
		Overall	53.1%	46.8%	3.4	.001**
<b>Module 2 (n=225)</b>	104 (46.2%)	Examination	67.1%	58.3	-4.0	.000**
		Coursework	60.1%	47.6%	-4.6	.000**
		Overall	63.6%	52.9%	-5.1	.000**

\*indicates significant difference at p<0.05 level

\*\*indicates significant difference at p<0.001 level

Both modules consisted of coursework and examination, Revel indicated a significant impact on both elements of assessment, for both modules. Table 1 also shows that the average mark of Revel users for the examination of the first module was 46.7%, significantly higher than the average mark of 42.7% for non-users (p=.049). Similarly, for the coursework, the average mark for non-users was significantly lower at 51.2%, compared to 62.6% for those who used Revel (p=.000). For the second module, the examination and coursework marks for the Revel users were 67.1% and 60.1% respectively, whereas the non-users had significantly lower marks of 58.3% for the examination (p=.000) and 47.6% for the coursework (p=.000).

Looking in more depth at the points achieved on Revel activities, and the impact on student performance, Pearson’s correlation analysis revealed significant relationships. For the second module of 2017-2018, a significant positive correlation between the number of points achieved on Revel and the examination mark was found (p=.006, r=0.39). Similarly, although slightly weaker, a significant positive correlation was found to exist between the number of points achieved on Revel and the overall module mark (p=.003, r=0.32). However, no significant correlation was found to exist in terms of the coursework mark and Revel points.

In the second year of the study (2018-2019), the use of Revel was compulsory for both modules. Consequently, it was not possible to conduct independent t-tests to compare

users versus non-users. However, as shown in Table 2, Pearson’s correlation analysis revealed significant positive correlations in terms of the number of points achieved on the platform and students’ marks. For the first module, a moderate positive correlation was found between Revel points and examination marks ( $p=0.000$ ,  $r=0.46$ ). In addition, a strong and significant positive correlation existed between Revel scores and the overall module marks ( $p=0.000$ ,  $r=0.62$ ). The second module was coursework based, but the same pattern was demonstrated. A very strong positive and significant correlation was found between the amount of points gained in Revel and the group coursework mark ( $p=0.000$ ,  $r=0.76$ ), as well as the individual coursework mark ( $p=0.000$ ,  $r=0.81$ ).

**Table 2: Pearson’s correlation results comparing Revel marks with module marks (2018-2019)**

	Assessment	Mean mark	Pearson’s Correlation with Revel Marks	
			(r-value)	p-value
<b>Module 1 (n=174)</b>	Examination	47.0%	0.46	.000**
	Revel	85.3%	-	-
	Overall	54.7%	0.62	.000**
<b>Module 2 (n=174)</b>	Individual Coursework	54.6%	0.81	.000**
	Group Coursework	56.7%	0.76	.000**
	Revel	58.5%	-	-
	Overall	53.6%	.98	.000**

\*\*indicates significant correlation at  $p<0.001$  level

Comparing the module results across the years, Revel appears to have had a positive impact. Of particular interest, the pass rate rose from 65% when Revel was adopted as a formative element of the course, to 71% when it was incorporated as a summative element. Likewise, the average mark for the module increased to 55.6% in 2018-2019, from 51.7% in 2017-2018. Examining marks before the introduction of Revel also reveals that adoption of the e-book (as a form of either summative or formative assessment), has led to an increase in average marks (from 60% prior to adoption to 62% after).

Aside from the promising statistical analysis of the positive impact of Revel on student marks, the research also confirms that students have a very positive view of Revel. 257 (64.4%) of the students completed an online survey about their experiences. This revealed that 87.2% agreed that it was helpful in aiding their learning of the module content throughout the duration of the course. One of the important features of the platform is its ability to provide students with immediate feedback, and for the lecturer to be able to respond immediately to gaps in knowledge. Overall, 90% found this feature useful. In addition, by engaging with the platform, 73.8% claimed it had given them more confidence in participating in lectures and seminars. Further supporting students’ positive views, almost 9 out of 10 said they would be either extremely likely (31.5%) or somewhat likely (57.2%) to recommend it.

## ***Discussion***

The aim of this research was to investigate the impact of interactive e-books on academic achievement in a mainly international student cohort. The paper addresses a gap in the current literature through focusing on an international student cohort, the use of an interactive e-book as opposed to a traditional e-book, and through focusing on the UK. There are a number of key contributions that this paper makes, including the finding of the significant impact of interactive-e books on student achievement, to the role of summative assessment and the knowledge added to the blended learning and theoretical literature.

The biggest contribution is through the finding that the use of interactive e-books significantly impacts student achievement. The data concludes that those students that engaged with Revel, and actively undertook the reading and activities, scored significantly higher marks than those who did not. Correlation between the points awarded in Revel and assessment marks (both coursework and examination) were found to be significant and positive, thus demonstrating the harder students work on the platform activities, the better they perform across their assessments. The paper adds to the literature on the digital nature of modern day student cohorts (Judd, 2018; Sprenger 2009). The use of technology is a good way to engage and inspire them, which was supported by the data and module feedback. These findings support Johnson, Becker, Cummins, Estrade, Freeman and Halls (2016) notion of the importance that learning analytics has in higher education. The data and analysis concludes and supports Massing's (2015) finding that digital technology has many benefits, including immediacy and interconnectivity.

The results also provide important findings regarding how best to engage students with digital interactive learning. The key contribution here is that including it as summative assessment was far more effective than when it was incorporated as formative assessment. Its inclusion as summative assessment improved progression rates and average marks on both modules. This supports extant literature that suggests this almost forces the student to engage (Vermunt and Verloop 1999) and improves attainment rates (Lopez-perez, Perez-Lopez and Rodriguez, 2011). Student success has long been heralded as a key issue (Henrie, Halverson and Graham, 2015; Castano- Munoz, et al 2014), and whilst Revel only contributed to 20% of the overall marks, the research concludes that engagement increases, and consequently, overall results improve on both coursework and examinations.

This paper also adds to the pedagogic theoretical literature through its confirmation that a combination of a social constructivist and connectivism approach can be successful and is critical to student success. Student achievement was raised through a mix of a movement to a more connectivism learning style, while also keeping the core basis of a more social constructivist approach. The research also adds to knowledge of the Addie model by suggesting that its cyclical approach is a pedagogy that aids student academic success. Finally, the conceptual model presented at the end of the literature review is supported, as findings confirm that international student populations are aided by interactivity and digital blended learning, leading to an increase in academic attainment.

The paper supports the literature on blended and flipped learning, which currently highlights mixed results regarding their effectiveness (Henrie, Halverson and Graham, 2015; Castano- Munoz, Duart and Vinuesa, 2014; Dizuban et al, 2018). It supports this complexity in effectiveness, particularly in 2017-2018, where Revel was used as formative assessment. Those students that opted out performed significantly worse than those that used Revel in both coursework and examination. This supports the finding that for low achievers, blended learning may not be the best pedagogy, given these students lack motivation for independent learning (Oweston et al, 2013; Tsai and Shen, 2009). This leads to low participation levels

(Heaney & Walker, 2012; Lotrecchiano et al, 2013), and was matched with poorer results. Marks may not always be an effective measure of learning (Schwab et al, 2018), highlighting a potential limitation of this study. However, this is acknowledged as a limitation and the study has also incorporated student perceptions of Revel in terms of the value it added to their learning experience. The student experience survey revealed that by engaging with Revel, students felt better equipped, more prepared and more confident to take part in lecture and seminar activities, supporting the literature on blended learning (Chetcuti et al, 2014; Jungic, Kaur, Mulholland and Xin, 2015). It also supports the development of independent learning (Johan Eddy et al 2014) and suggests that engagement in blended learning and digital technology is crucial.

The implications of this paper for academic practice are that the use of digital learning technologies are to be encouraged and supported. The findings suggest that the digitally native generation engage with this type of learning resource, and therefore it should be encouraged across the higher education curriculum. The influence on student academic achievement is significant, particularly when it is mandatory. This suggests that higher education strategic thought needs to move towards the adoption of interactive e-books for summative assessment, in order to overcome issues universities are facing with students completing basic reading and engagement. The strategic direction of higher education needs to move towards the use of differing forms of assessment and must embrace digital technology that students are learning within. This is even more critical given the impact of macro-environmental events such as COVID-19. The results of this paper propose that digital interactive e-books could play a crucial role in the future of higher education online pedagogy.

Adopting digital interactive e-books for large cohorts of international students with often low student to staff ratio allows for a much improved strategic approach to assessment, feedback and learning; with the lecturer in control of the key reading material and questions. Assessment and feedback are seen as key issues for national student surveys and the teaching excellence framework and interactive digital e books support this. Providing students with a wide variety of learning and teaching methods, that can be assessed and fed back across the length of the module, are crucial for a wide variety of learners and improved progression. With such large numbers of international students studying in the UK, their importance to the UK economy is going to remain robust (HESA, 2018). Consequently, as educators we must harness technology, blended and flipped learning, that is carefully mixed with more traditional learning and teaching pedagogies. This will provide students with a more diverse and inclusive assessment and feedback strategy, specifically engaging with the digital generation. This research suggests it is possible to increase international student academic achievement through a focus on alternative pedagogies more suited to this cohort. It is critical that future higher education policies are created aimed specifically at aiding this important group of students.

This research supports and extends the literature on blended and flipped learning, especially in the context of interactive e-books and UK based international students. However, further research is planned and will analyse the impact of students as curators of their own learning experiences; picking and choosing which aspects of the interactive e-books to focus upon, as well as the impact of embedding longer types of assessment into these types of digital platforms. There is little evidence of best practice approaches with regard to international students and interactive e-books, therefore this research helps build best practise and contributes to the gap in literature.

## References

- Adams, M. J. D. and Umbach, P. D. 2012. Non-response and online student evaluations of teaching: understanding the influence of salience, fatigue and academic environments', *Research in Higher Education*, 53, 576-591. <https://doi.org/10.1007/s11162-011-9240-5>
- Al-Khanjari, Z. A. 2014. Applying Online Learning in Software Engineering Education. In L. Yu (Ed.), *Overcoming Challenges in Software Engineering Education: Delivering Non-Technical Knowledge and Skills* (pp. 460-473). Hershey, PA: Engineering Science Reference. DOI:10.4018/978-1-4666-5800-4.ch024.
- Almarghani, E. M. and Mijatovic. 2017. Factors affecting student engagement in HEIs – it is all about good teaching, *Teaching in Higher Education*, 22(8), 940-956. <https://doi.org/10.1080/13562517.2017.1319808>
- Alt, D. 2016. Contemporary constructivist practices in higher education settings and academic motivational factors. *Australian Journal of Adult Learning*, 56(3), 375-399.
- Anderson, T., & Dron, J. 2011. Three generations of distance education pedagogy. *The International Review of Research in Open and Distributed Learning*, 12(3), 80-97. <https://doi.org/10.19173/irrodl.v12i3.890>
- Anderson, T., & Dron, J. 2012. Learning technology through three generations of technology enhanced distance education pedagogy. *European Journal of Open, Distance and e-learning*, 15(2).
- Arkoudis, S., Dollinger, M., Baik, C. and Patience, A. 2019. International students' experience in Australian higher education: can we do better? *Higher Education*, 77(5), 799-813. <https://doi.org/10.1007/s10734-018-0302-x>
- Ashour, S. 2019. How technology has shaped university students' perceptions and expectations around higher education: an exploratory study of the United Arab Emirates. *Studies in Higher Education*. <https://doi.org/10.1080/03075079.2019.1617683>
- Atwater, M.M. 1996. Social constructivism: Infusion into the multicultural science education research agenda. *Journal of Research in Science Teaching*, 33(8), 821-837. [https://doi.org/10.1002/\(SICI\)1098-2736\(199610\)33:8%3C821::AID-TEA1%3E3.0.CO;2-Y](https://doi.org/10.1002/(SICI)1098-2736(199610)33:8%3C821::AID-TEA1%3E3.0.CO;2-Y)
- Barak, M. 2016. Science teacher education in the twenty-first century: a pedagogical framework for technology integrated social constructivism. *Research in Science Education*, 47, 283-303. <https://doi.org/10.1007/s11165-015-9501-y>
- Bartram, B. 2008. Supporting international students in higher education: constructions, cultures and clashes. *Teaching in Higher Education*, 13(8), 657-668. <https://doi.org/10.1080/13562510802452384>
- Bishop, J. L., & Verleger, M. 2013. The flipped classroom: A survey of the research. *Proceedings of 120th ASEE Annual Conference & Exposition*, Atlanta, GA.

Boelens, R., De Wever, B., & Voet, M. 2017. Four key challenges to the design of blended learning: A systematic literature review. *Educational Research Review*, 22, 1-18. <https://doi.org/10.1016/j.edurev.2017.06.001>

Bowyer, J., and Chambers, L. 2017. Evaluating blended learning: Bringing the elements together. *Research Matters*, 23, 17-26.

Bozkurt, A., and Bozaya, M. 2013a. Etkileşimli e-kitap Değerlendirme Kriterleri. Eskişehir: Anadolu Üniversitesi Yayınları. Retrieved from [http://www.academia.edu/6007097/Etkileşimli\\_e-kitap\\_Değerlendirme\\_Kriterleri](http://www.academia.edu/6007097/Etkileşimli_e-kitap_Değerlendirme_Kriterleri). Accessed 28<sup>th</sup> January 2020.

Bozkurt, A., & Bozkaya, M. 2013b. Etkileşimli E-Kitap: Dünü, Bugünü ve Yarını. Akademik Bilişim 2013. (s.375-381). Akdeniz Üniversitesi, 23-25 Ocak, Antalya. Retrieved from [http://www.academia.edu/2536903/Etkileşimli\\_E-Kitap\\_Dunu\\_Bugunu\\_ve\\_Yarini](http://www.academia.edu/2536903/Etkileşimli_E-Kitap_Dunu_Bugunu_ve_Yarini). Accessed 28<sup>th</sup> January 2020.

Brauss, M.R., Lin, X., and Baker, B.A. 2015. International Students in Higher Education: Educational and Social Experiences. *Institute for Learning Styles Journal*, 1, 54-71.

Broadbent, J., Panadero, E., and Boud, D. 2018. Implementing summative assessment with a formative flavour: A case study in a large class. *Assessment and Evaluation in Higher Education*, 43(2), 307-322. <https://doi.org/10.1080/02602938.2017.1343455>

Carless, D. 2006. Differing perceptions in the feedback process. *Studies in Higher Education*, 21, 219-233. <https://doi.org/10.1080/03075070600572132>

Cassidy, S. 2016. Virtual learning environments as mediating factors in student satisfaction with teaching and learning in Higher Education. *Journal of Curriculum and Teaching*, 5(1), 113-123. <http://dx.doi.org/10.5430/jct.v5n1p113>

Castano-Munoz, J., Duarte, J.M., and Vinuesa, T.S. 2014. The internet in face-to-face higher education: Can interactive learning improve academic achievement? *British Journal of Educational Technology*, 45(1), 149-159. <https://doi.org/10.1111/bjet.12007>

Chen, X., Breslow, L. and DeBoer, J. 2018. Analyzing productive learning behaviours for students using immediate corrective feedback in a blended learning environment. *Computers & Education*, 117, 59-74. <https://doi.org/10.1016/j.compedu.2017.09.013>

Cheon, J., Crooks, S. and Chung, S. 2014. Does segmenting principle counteract modality principle in instructional animation? *British Journal of Educational Technology*, 45(1), 56–64. <https://doi.org/10.1111/bjet.12021>

Chetcuti, S. C., Hans, J. T., & Brent, J. P. 2014. Flipping the engineering classroom: Results and observations with non- engineering students. *Proceedings of 121st ASEE Annual Conference & Exposition*, Indianapolis, IN.

Conlon, D., Halterbeck, M., and Julius, J. 2018. The costs and benefits of international students by parliamentary constituency. Report for the Higher Education Policy Institute and Kaplan International Pathways.

Crawford, I., and Wang, Z. 2016. The impact of placements on the academic performance of UK and international students in higher education. *Studies in Higher Education*, 41(4), 712-733. <https://doi.org/10.1080/03075079.2014.943658>

Daniel, D.B., & Woody, W.D. 2013. E-textbooks at what cost? Performance and use of electronic v. print texts. *Computers & Education*, 62, 18–23. <http://dx.doi.org/10.1016/j.compedu.2012.10.016>

Daniel, B. 2014. Big Data and analytics in higher education: Opportunities and challenges. *British Journal of Educational Technology*, 46(5), 904-920. <https://doi.org/10.1111/bjet.12230>

Dede, C. 2005. Planning for neomillennial learning styles. *Educause Quarterly*, 8(1), 7-12.

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

Dong, N., Chen, Z., Seldon, A., and Abidoye, O. 2020. The fourth education revolution: will artificial intelligence liberate or infantilise humanity. *Higher Education*, <https://doi.org/10.1007/s10734-020-00506-5>

Eddy, L. J., Nor-Aziah, A., & Jasmine, J. 2014. Blended Learning: Examining Concepts and Practices. In E. Mohamed-Amin (Ed.), *Blended & Flipped Learning: Case Studies in Malaysian HEIs*. Bangi: Pusat Pengajaran & Teknologi Pembelajaran, Universiti Kebangsaan Malaysia.

Estelami, H. 2015. The effects of survey timing on student evaluation of teaching measures obtained using online surveys. *Journal of Marketing Education*. 37(1). 54-64. <https://doi.org/10.1177%2F0273475314552324>

Freeman, S., Eddy, S.L., McDonough, M., Smith, M.K., Okoroafor, N., Jordt, H., and Wenderoth, M.P. 2014. *Active learning increases student performance in science, engineering and mathematics*. Proceedings of the National Academy of Sciences of the United States of America, 111(23), 8410-8415. <https://doi.org/10.1073/pnas.1319030111>

Gastwirth, J. L., Gel, Y. R. and Miao, W. 2009. The impact of Levene's test of equality of variances on statistical theory and practice. *Statistical Science*, 24(3), 343-360. <http://dx.doi.org/10.1214/09-STS301>

Goldie, J.G.S. 2016. Connectivism: a knowledge learning theory for the digital age? *Medical Teacher*, 38(10), 1064-1069. <http://dx.doi.org/10.3109/0142159X.2016.1173661>

Graham, C.R., Woodfield, W., and Harrison, J.B. 2013. A Framework for Institutional Adoption and Implementation of Blended Learning in Higher Education, *The Internet and Higher Education*, 18, 4-14. <https://psycnet.apa.org/doi/10.1016/j.iheduc.2012.09.003>

Hammersley-Fletcher, L., and Hanley, C. 2016. The use of critical thinking in higher education in relation to the international student: Shifting policy and practice, *British Educational Research Journal*, 42(6), 978-992. <https://doi.org/10.1002/berj.3246>

Harfitt, G.J., and Tsui, A.B.M. 2015. An examination of class size reduction on teaching and learning processes: a theoretical perspective, *British Educational Research Journal*, 41(5), 845-865. <https://doi.org/10.1002/berj.3165>

Heaney, C. A., & Walker, N. C. 2012. The challenges and opportunities of teaching sport and exercise psychology at a distance. *Sport & Exercise Psychology Review*, 8(2), 65-71. <http://oro.open.ac.uk/id/eprint/32838>

Herodotou, C., Muirhead, D. K., Aristeidou, M., Hole, M. J., Kelley, S., Scanlon, E., & Duffy, M. 2018. Blended and online learning: a comparative study of virtual microscopy in Higher Education . *Interactive Learning environments* , 1-16. <https://doi.org/10.1080/10494820.2018.1552874>

Holloway, S.L., O'Hara, S.L., and Pimlott, H. 2012. Educational mobility and the gendered geography of cultural capital: the case of international student flows between Central Asia and the UK. *Environment and Planning A*, 44 (9), 2278-2294. <https://doi.org/10.1068%2Fa44655>

Henrie, C.R., Halverson, L.R., and Graham, C.R. 2015. Measuring Student Engagement in Technology-Mediated Learning: A Review. *Computers & Education*. 90, 36-53. <http://dx.doi.org/10.1016/j.compedu.2015.09.005>

Hess, A.N., and Greer, K. 2016. Designing for engagement: Using the Addie model to integrate high-impact practices into an online information literacy course. *Communications in Information Literacy*, 10(2), 264-282. <https://doi.org/10.15760/comminfolit.2016.10.2.27>

HESA 2018. Higher Education Student Statistics: UK 2016/2017. Where students come from and go to study. Retrieved from <https://www.hesa.ac.uk/news/11-01-2018/sfr247-higher-education-student-statistics/location>. Accessed on 15<sup>th</sup> January 2020.

HESA 2019. Higher Education Student Statistics: UK 2017/18. Retrieved from <https://www.hesa.ac.uk/news/17-01-2019/sb252-higher-education-student-statistics/numbers>. Accessed on 15<sup>th</sup> January 2020.

Hubble, S., and Bolton, P. 2020. International and EU students in higher education in the UK FAQs. House of Commons Library, Briefing Paper Number CBP 7976, 4<sup>th</sup> March 2020. Retrieved from <https://commonslibrary.parliament.uk/research-briefings/cbp-7976/>. Accessed on 15<sup>th</sup> January 2020.

Hussin, A.A. 2018. Education 4.0 made simple: Ideas for Teaching. *International Journal of Education and Literacy Studies*, 6(3), 92-98. <http://dx.doi.org/10.7575/aiac.ijels.v.6n.3p.92>

Iannelli, C. and J. Huang. 2013. Trends in participation and attainment of Chinese students in UK higher education. *Studies in Higher Education*, 39(5), 805-22. <https://doi.org/10.1080/03075079.2012.754863>

Jamaludin, R. and Osman, S. 2014. The use of a flipped classroom to enhance engagement and promote active learning. *Journal of Education and Practice*, 5(2), 124-131.



- Johnson, L., Adams Becker, S., Estrada, V., and Freeman, A. 2015. *NMC Horizon Report: 2015 K-12 Edition*. Austin, Texas: The New Media Consortium.
- Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A. & Hall, C. 2016. *NMC Horizon Report: 2016 Higher Education Edition*. Austin, Texas: The New Media Consortium.
- Jones, P., Jones, A., and Packham, G. 2009. E-learning induction design for an undergraduate entrepreneurship degree. *International Journal of Management Education*, 8 (1), 37-51.
- Ju Joo, Y., Park, S., and Shin, E.K. 2017. Students expectation, satisfaction and continuance intention to use digital textbooks. *Computers in Human Behavior*, 69, 83-90.  
<https://doi.org/10.1016/j.chb.2016.12.025>
- Judd, T. 2018. The rise and fall (?) of the digital natives. *Australasian Journal of Educational Technology*, 34(5), 99-119. <https://doi.org/10.14742/ajet.3821>
- Junco, R., and Clem, C. 2015. Predicting course outcomes with digital textbook usage data. *Internet and Higher Education*, 27, 54-63. <http://dx.doi.org/10.1016/j.iheduc.2015.06.001>
- Jungic, V., Kaur, H., Mulholland, J., & Xin, C. 2015. On flipping the classroom in large first year calculus courses. *International Journal of Mathematical Education in Science and Technology*, 46, 1–8. <https://doi.org/10.1080/0020739X.2014.990529>
- Kesim, M., and Yidirim, H. 2017. A literature review and content analysis on interactive e-books. *Interactive Learning Environments*, 1(3), 2.  
<http://dx.doi.org/10.21125/edulearn.2017.0856>
- Kirkwood, A and Price, L. 2013. Missing: Evidence of a scholarly approach to teaching and learning with technology in higher education, *Teaching in Higher Education, Critical Perspectives*, 18(3), 327-337. <https://doi.org/10.1080/13562517.2013.773419>
- Knight, J. 2012. Student Mobility and Internationalisation: Trends and Tribulations. *Research in Comparative and International Education*, 7(1), 20-33.  
<https://doi.org/10.2304%2Frcie.2012.7.1.20>
- Lage, M.J. and Platt, G., 2000. The internet and the inverted classroom. *The Journal of Economic Education*, 31(1), 11-11
- Lomer, S. and Anthony-Okeke, L. 2019. Ethically engaging international students: student generated material in an active blending model. *Teaching in Higher Education*, 24(5), 613-632. <https://doi.org/10.1080/13562517.2019.1617264>
- López-pérez, M. V., Pérez-López, M. C., & Rodríguez-Ariza, L. 2011. Blended learning in higher education: Students' perceptions and their relation to outcomes. *Computers & Education*, 56(3), 818–826.
- Lotrecchiano, G. R., McDonald, P. L., Lyons, L., Long, T., & Zajicek-Farber, M. 2013. Blended learning: Strengths, challenges, and lesson learned in an interprofessional training program. *Matern Child Health J*, 17, 1725-1734.  
<http://dx.doi.org/10.1016/j.compedu.2010.10.023>

Madge, C., Raghuram, P., and Noxolo, P. 2015. Conceptualising international education: From international student to international study. *Progress in Human Geography*, 39(6), 681-701. <https://doi.org/10.1177%2F0309132514526442>

McConnell, D. 2017. E-learning in Chinese higher education: the view from inside. *Higher Education*, 75(4), 1031-1045. <http://dx.doi.org/10.1007/s10734-017-0183-4>

McDonald, P. L. 2014. Variation in Adult Learners' Experiences of Blended Learning in Higher Education. In A. G. Picciano, C. D. Dziuban, & C. R. Graham (Eds.), *Blended Learning: Research Perspectives* (Volume 2, pp. 215–234). New York: Routledge

Moore, M. G. 1993. Theory of transactional distance. In D. Keegan (Ed.), *Theoretical Principles of Distance Education* (pp. 22–38). London: Routledge.

Mohamed-Amin, E., Norazah, M. N. & Ebrahim, P. 2014. Overview of Blended Learning. In E. Mohamed-Amin (Ed.), *Blended & Flipped Learning: Case Studies in Malaysian HEIs*. Bangi: Pusat Pengajaran & Teknologi Pembelajaran, Universiti Kebangsaan Malaysia.

Molenda, M. 2015. In search of the elusive ADDIE model. *Performance Improvement*. 42, 34-36. <https://doi.org/10.1002/pfi.21461>

Norton, A., Cherastidtham, I., and Mackey, W. 2018. *Mapping Australian Higher Education 2018*. Grattan Institute. ISBN: 978-0-6483311-2-4

OECD. 2012. *Equity and Quality in Education: Supporting Disadvantaged Students and Schools*, OECD Publishing. Retrieved from <http://dx.doi.org/10.1787/9789264130852-en>. Accessed on 20<sup>th</sup> January 2020.

O'Flaherty, J. and Phillips, C. 2015. The use of flipped classrooms in higher education: A scoping review. *The Internet in Higher Education*. 25, 85-95. <https://doi.org/10.1016/j.iheduc.2015.02.002>

Orsmond, P. & Merry, S. 2011. Feedback alignment: effective and ineffective links between tutors' and students' understanding of coursework feedback. *Assessment and Evaluation in Higher Education*, 36, 125-136. <https://doi.org/10.1080/02602930903201651>

Owston, R., York, D., & Murtha, S. 2013. Student perceptions and achievement in a university blended learning strategic initiative. *The Internet and Higher Education*, 18, 38–46. <http://doi.org/10.1016/j.iheduc.2012.12.003>

Pearson. 2019. The learning science behind Revel. Retrieved from <https://www.pearsonhighered.com/revel/educators/learning-science/>. Accessed on 15<sup>th</sup> December 2019.

Picciano, A. G. 2009. Blended learning: Implications for growth and access. *Journal of Asynchronous Learning Networks*, 10(3), 95-102.

Powell, J. V., Victor G. A. Jr, and Tracy C. A. 2003. A comparison of student outcomes with and without teacher facilitated computer-based instruction. *Computers & Education*, 40(2), 183-191. [https://doi.org/10.1016/S0360-1315\(02\)00120-3](https://doi.org/10.1016/S0360-1315(02)00120-3)

Reynolds, R. 2016. Defining, designing for and measuring “social constructivist digital literacy” development in learners: A proposed framework. *Educational Technology Research and Development*, 64, 735-762. <https://doi.org/10.1007/s11423-015-9423-4>

Rivera, J. C., and Rice, M. L. 2003. A comparison of student outcomes and satisfaction between traditional and web based course offerings. *Online Journal of Distance Learning Administration*, 5(3), 151-179.

Rogoff, B. 1998. Cognition as a collaborative process. In Damon, W., Kuhn, D., and Siegler, R.S. *Handbook of child psychology* (5<sup>th</sup> ed, vol 2) New York, Wiley

Sablina, S., Soong, H., and Pechurina, A. 2018. Exploring expectations, experiences and long-term plans of Chinese international students studying in the joint Sino-Russian degree. *Higher Education*, 76(6), 973-988. <https://doi.org/10.1007/s10734-018-0256-z>

Schwab, K., Moseley, B. and Dustin, D. (2018). Grading grades as a measure of student learning. *A Journal of Leisure Studies and Recreation Education*, 33(2), 87-95.

Siemens, G. 2005. Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, 2(1), 3-10.

Siemens, G. 2006. Connectivism. Learning theory or pastime for the self-amused? Retrieved from [http://www.elearnspace.org/Articles/connectivism\\_self-amused.htm](http://www.elearnspace.org/Articles/connectivism_self-amused.htm). Accessed on 10<sup>th</sup> December 2016.

Smith, S., and Carlin, A.P. 2012. Use and perception of ebooks in the University of Ulster: A case study. *New Review of Academic Librarianship*, 18, 176-205. <https://doi.org/10.1080/13614533.2012.719851>

Snowball, J. D. 2014. Using interactive content and online activities to accommodate diversity in a large first year class. *Higher Education*, 67, 823-838. DOI: 10.1007/s10734-013-9708-7. <https://doi.org/10.1007/s10734-013-9708-7>

Spanjers, I. A., Könings, K. D., Leppink, J., Verstegen, D. M. L., Jong, N. D. J., Czabanowska, K. and van Merriënboer, J. J. G. 2015. The promised land of blended learning: Quizzes as a moderator. *Educational Research Review*. 15, 59-74. <https://doi.org/10.1016/j.edurev.2015.05.001>

Sprenger, M. 2009. Focusing the digital brain. *Educational Leadership*, 67(1), 34-39.

Stockwell, B. R., Stockwell, M. S., Cennamo, M., & Jiang, E. 2015. Blended Learning Improves Science Education. *Cell*, 162(5), 933–936. <https://doi.org/10.1016/j.cell.2015.08.009>

Taylor, L. 2004. 'Educational Theories and Instructional Design Models. Their Place in Simulation', *Nursing Education and Research* .

Teaching Excellence and Student Outcomes Framework Specification (TEF). 2017. Department for Education, October 2017. Retrieved from <https://www.gov.uk/government/publications/teaching-excellence-and-student-outcomes-framework-specification>. Accessed on 28<sup>th</sup> October 2019.

Timmis, S., Broadfoot, P., Sutherland, R., and Oldfield, A. 2015. Rethinking assessment in a digital age: Opportunities, challenges and risks, *British Educational Research Journal*, 42(3), 454-476. <https://doi.org/10.1002/berj.3215>

Tsai, C.-W., & Shen, P.-D. 2009. Applying web-enabled self-regulated learning and problem-based learning with initiation to involve low-achieving students in learning. *Computers in Human Behavior*, 25(6), 1189–1194. <https://doi.org/10.1016/j.chb.2009.05.013>

UK Council for International Student Affairs. 2016. Research into the international student experience in the UK 2015-16. Retrieved from <https://www.ukcisa.org.uk/Research--Policy/Grants-research/Research-into-student-experience>. Accessed on 30<sup>th</sup> January 2020.

Van Laer, S., & Elen, J. 2016. In search of attributes that support self-regulation in blended learning environments. *Education and Information Technologies*. <http://doi.org/10.1007/s10639-016-9505-x>

Van Merriënboer, J.J.G., and Sweller, J. 2005. Cognitive load theory and complex learning: recent developments and future directions. *Educational Psychology Review*, 17(2), 147-177. <https://doi.org/10.1007/s10648-005-3951-0>

Vermunt, J. D., & Verloop, N. 1999. Congruence and friction between learning and teaching. *Learning and Instruction*, 9, 257–280. [https://doi.org/10.1016/S0959-4752\(98\)00028-0](https://doi.org/10.1016/S0959-4752(98)00028-0)

Wanner, T., and Palmer, E. 2015. Personalising learning: Exploring student and teacher perceptions about flexible learning and assessment in a flipped university course. *Computers and Education*, 88, 354-369. <https://doi.org/10.1016/j.compedu.2015.07.008>

Wang, S., and Bai, X. 2016. University Students Awareness, Usage and Attitude towards E-Books: Experience from China. *The Journal of Academic Librarianship*, 42, 247-258. <http://dx.doi.org/10.1016/j.acalib.2016.01.001>

Wang, M., and Degol, J. 2014. Staying engaged: Knowledge and research needs in student engagement. *Child Development Perspective*, 8(3), 137-143. <https://dx.doi.org/10.1111%2Fcdep.12073>

Woo, Y., & Reeves, T. 2007. Meaningful interaction in web-based learning: A social constructivist interpretation. *Internet and Higher Education*, 10, 15–25. <https://doi.org/10.1016/j.iheduc.2006.10.005>

Young, M. S., Robinson, S., & Alberts, P. 2009. Students pay attention! Combating the vigilance decrement to improve learning during lectures. *Active Learning in Higher Education*, 10, 41–55. <https://doi.org/10.1177%2F1469787408100194>

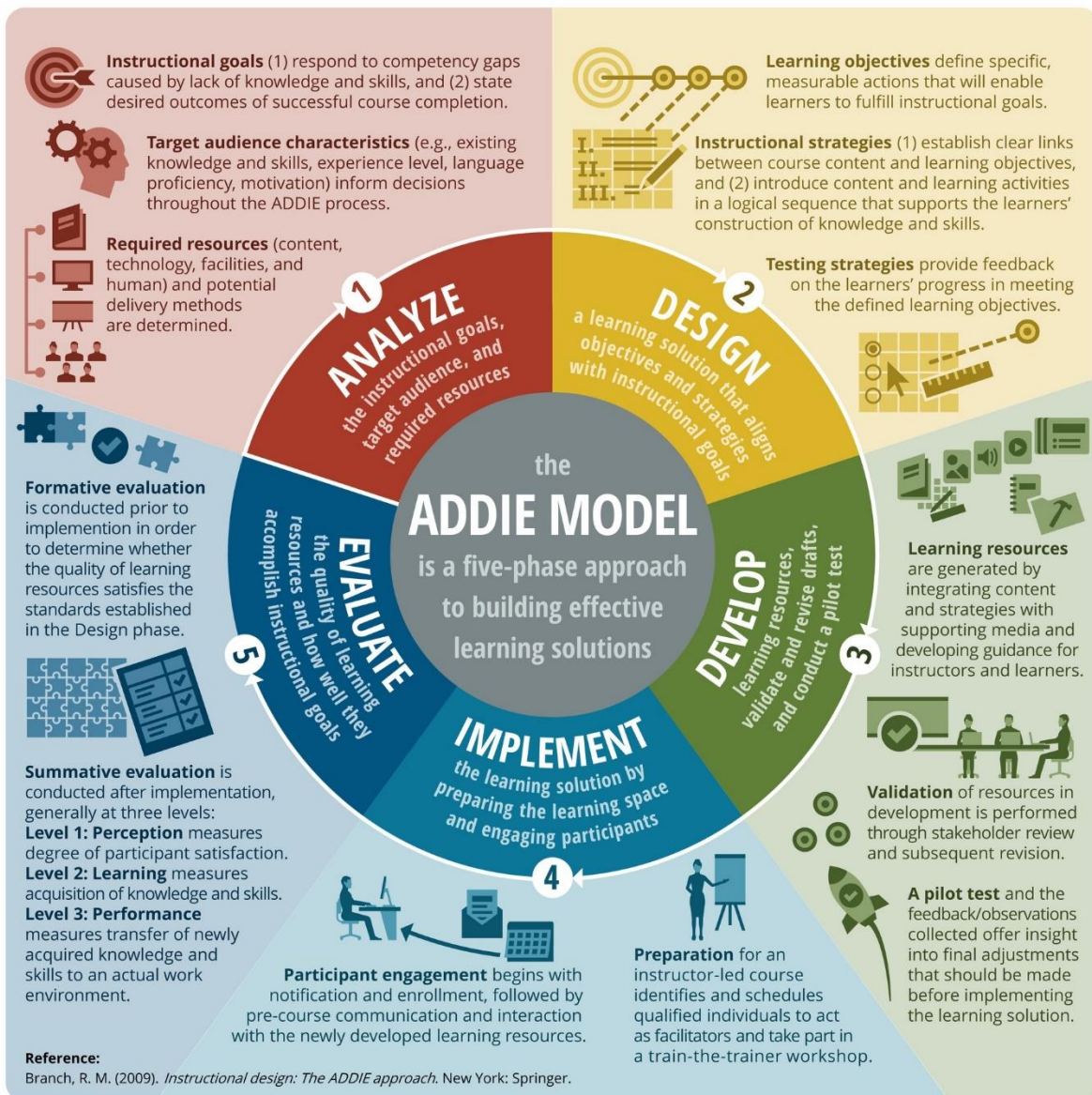


Figure 1: The Addie model

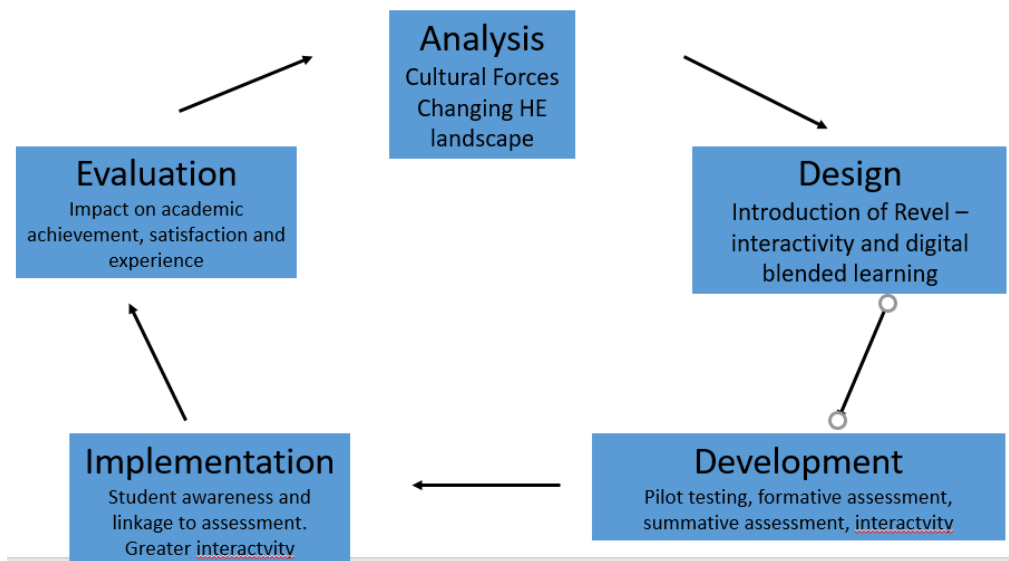


Figure 2: The Addie model as applied in this research



Figure three: The conceptual model guiding the research