

# Integrating Web 2.0 Learning Technologies In Higher Education: The Necessity, The Barriers And The Factors For Success\*

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## Abstract

The pace of technological advance has led to significant change within higher education. Technology can be an enabler to develop sought after 21<sup>st</sup> century skills but this requires that educators redesign teaching and learning activities. The aim of this case study was to uncover the factors impacting the integration of learning technologies in the classroom. It sought to measure the degree of technology adoption following usage of an online learning resource incorporating Web 2.0 tools.

A single cohort of eleven lecturers in Ireland used an online learning resource for a period of 6 weeks. The Technology Toolkit was developed on social constructivist principles using Captivate software. Participants completed surveys before and after they used the Toolkit and three of them were also interviewed.

A general confidence in technical abilities was reported on completion of the research despite time being a significant barrier to utilising technology. Participants declared a preference for a blended learning format accompanied by peer sharing sessions. Findings showed that lecturers regardless of age or experience can develop positive attitudes towards the adoption of technology enhanced learning.

A series of recommendations for integrating learning technologies are offered to support educators as they strive to innovate their pedagogy.

**Keywords:** Web 2.0, higher education, training, online learning, 21st Century skills, Twitter, Wikis, elearning, technology integration, barriers

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## 1. Introduction.

Technology innovation is leading to constant change. The paradigm shift from traditional communication and media methods to their digital counterparts over the last decades has greatly impacted how we connect with one another. The ability to click, connect and collaborate with others across social networks serves to make the world a much smaller place demanding new skills for those entering the workforce. Educators ultimately bear the responsibility to ensure the best preparation of their graduates for entry to this fast changing world.

Many groups have advocated for students to graduate with specific skills for the future, aptly named 21st century skills. Kay (2010) argues that these new competencies will enable individuals to keep learning and adjusting to change which will be key in a complex and collaborative culture. The major frameworks include:

- Partnership for 21st Century Skills (2006)
- The Metri Group and NCREL (2003)
- The American Association of Colleges and Universities (2007)
- Organization for Economic Cooperation and Development (2005)
- Revised ISTE student standards for technology in the curriculum (2007)

Dede (2010) conducted a comparison of 21st century skills and concluded that whilst there are minor differences in the rhetoric, the key concepts remain the same across all frameworks. Voogt & Pareja Roblin (2010, p.3) concur that “analysis shows that the models converge to a common set of 21st century skills”. Most literature sources claim Critical Thinking, Creativity, Communication, Collaboration, ICT Literacy and Responsible Citizenship as key requirements for students of the future. These skills need to be embedded as learning outcomes into the curriculum of 21st century education and this requirement will inevitably lead to systemic innovation and reform.

Kay (2010), Fullan (2000), and Dede (2011) call for a new model for education and such change at all levels of education. There is consensus across the literature that the use of learning technologies can lead to the development of 21st century skills (Dede 2011; Lightle 2011; Buchem and Hamelmann 2011). Ertmer and Ottenbriet (2010, p. 257) argue that “using technology simply to support lecture-based instruction falls far short of recommended best

practice” and educators must look to facilitating deeper, and more meaningful, learning with technology.

Web 2.0 technologies are at the forefront of change in pedagogical approaches. Dede (2008) highlights some of the technologies at the crest of the Web 2.0 wave as social bookmarking, wikis, podcasts, blogs, and social media software. McLoughlin and Lee (2007, p665) characterise this group of new technologies as a “*form of the World Wide Web that emphasises active participation, connectivity, collaboration and sharing of knowledge and ideas among users*”. The features of Web 2.0 technologies can be seen to be consistent with modern educational theories such as Vygotsky’s (1978) socio-constructivist learning theory. A socio-constructivist view to learning assumes meaningful learning occurs when people are involved in a social activity; and that meaning is created through their interactions with one another and their environment (Kim, 2001). The usage of Web 2.0 technologies in classrooms can empower learners to take a more active role in their learning through collaborative online opportunities.

Annan (2005) contends that rethinking learning experiences will only work if educators have a foundation of information technology skills. The ETNA 2012 survey reported by McLaughlin, Robertson and Nelson (2012) indicates high level of confidence amongst educators but only with basic technical tools. Skills with emerging and online technologies are considerably less, with only 3% of academics confident using Twitter and 14% confident with Wikis. Some factors impacting the adoption of technology consistent across the literature include: lack of digital skills; lack of time; infrastructure issues; and lack of administrative support. The increasing calls for technology integration have often led to technology resistance on the part of the educator. Johnson, Wisniewski, Kuhlemeyer, Isaacs, and Krzykowski (2012) argue that the biggest barrier is technology anxiety and that anxiety is inversely related to age and experience which would seem to align with Prensky’s (2001) digital immigrants/natives argument. Prensky stated that educators, as digital immigrants, would never fully master the ‘language’ of the digital age and would struggle to embrace technology innovations. It is evident that emergent technology holds great promise for transforming education but there are also many barriers to overcome. This lead to the research question central to this study - how can higher level educators be best supported in their adoption and integration of learning technologies to overcome any resistance?

The research further concerned itself with improving the skill sets of educators via carefully selected Web 2.0 technologies and measuring the degree of subsequent technology integration using well accepted frameworks. It sought to understand the barriers to adoption and whether the digital divide holds any resonance for the research participants of this study. Finally, the study offers guidelines to promote and support the future inclusion of learning technologies in the classroom focusing on lessening technology anxiety.

## 2. Methodology.

A case study approach is used in this research examining the question 'how can higher level educators be best supported in their adoption and integration of learning technologies?'. Yin (2003) states that case studies are the preferred methodology for research where 'how and why' questions are being posed.

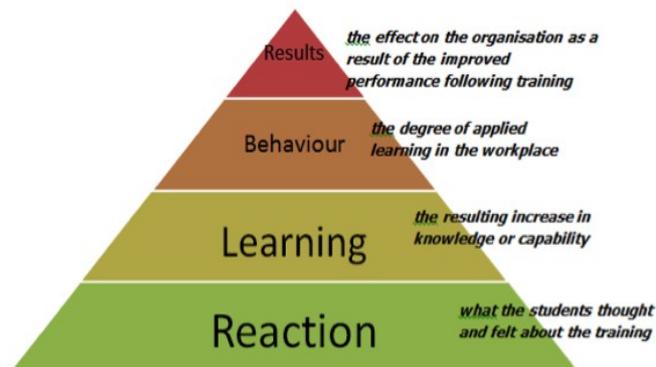
MacNealy (1997) states case study research is often defined as the study of a single unit, person or event. This qualitative study explored the barriers to the adoption of learning technologies within the bounded context of a single cohort of higher education lecturers. These study participants engaged with a Technology Toolkit online training resource over one semester, designed by the author as part of M.Sc research. The time available prevents the expansion of the study to multiple cases and a wider audience which may have allowed for greater generalisations to be made.

An interpretivist perspective was applied to this time and context bound research. The resulting methodology allows the presentation of a holistic view of the research. MacNealy (1997) states that the case study researcher will utilise more than one data collection tool and this study accommodated a variety of data collection methods including surveys, interviews, and monitoring of online participation levels via Twitter and Wiki accounts. Baxter and Jack (2008) liken this rounded exploration via multiple data sources to viewing a phenomenon through a "*variety of lenses*". Through these multiple sources, the study sought to enhance data credibility and support the triangulation of results.

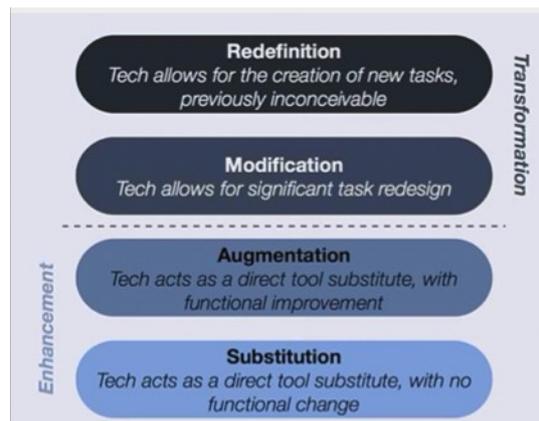
The participants engaged with a Technology Toolkit online resource for six weeks which provided training in selected Web 2.0 applications. The skills, attitudes and levels of technology integration of the educators were surveyed before, and after, using the resource. Both the surveys and the Technology Toolkit itself were available via a website created for this purpose - <http://lisadonaldso1.wix.com/technologytoolkit>.

The research utilised a number of frameworks to evaluate the participants experience with the learning resource and subsequent integration of the learning technologies so as to understand the impact of an online training Toolkit on technology adoption.

**Figure 1: Kirkpatrick's levels of evaluation. Adapted from Kirkpatrick (1996).**



**Figure 1: SAMUR Model (Puentedura, n.d.) Reprinted with kind permission.**



Kirkpatrick's Levels of Evaluation (Figure 1) was used to measure the effectiveness of the Technology Toolkit training resource. This evaluation framework has been widely used and respected for over fifty years. The Levels as described by Kirkpatrick (1996) are Reaction, Learning, Behaviour, Results. Each level provides additional information which when put together provides a chain of evidence to analyse the impact and effectiveness of the training. Bates (2004) argues that its popularity and longevity as an evaluation model may be due to its simplicity but that this simplicity may actually be a limitation. To overcome this and increase

the depth of analysis, it was combined with the SAMR model by Puentedura (n.d.), see Figure 2.

The level of evaluation in Kirkpatrick's scale of most relevance to this study is the Behaviour level, which analyses how far learners change their behaviour and apply the training to their work activities. To examine this aspect in greater detail, the SAMR model is used to better understand the type and degree of technology usage. This framework defines the transformative impact technology can have on teaching and learning activities. The levels on this scale are: Substitution, Augmentation, Modification, Redefinition. This research was particularly interested in understanding the barriers to technology integration that prevent teachers moving from little or no integration to higher levels.

The scope of the research was limited to a class of 13 students studying for a post graduate education qualification at Griffith College Dublin, eleven ultimately actively participated in the research. The participant sample was made up of four men and nine women aged between 24 and 49 lecturing across a number of disciplines. 15% were aged under 29, 53% aged between 30 and 39, and 31% aged between 40 and 49. Afterwards, three lecturers were purposefully selected for interview to represent a cross section of ages, genders and experience.

## **2.1 The design of the Technology Toolkit resource.**

Literature espouses that Communication and Collaboration are two of a number of proficiencies that will be required of 21st century graduates. There are myriad learning technologies that may support the development of these skills. Initially, any applications featuring in the top 100 tools for learning from the Centre for Learning and Performance technologies (Hart 2013) were considered for inclusion in the study. Project restraints however, specifically time, necessitated that only a small number could be included in the Technology Toolkit resource.

The technologies ultimately chosen for inclusion specifically lent themselves to peer interaction mediated by the instructor and enabled innovative classroom activities while enhancing communication skills and collaborative engagement. The tools showcased were Twitter and Wikis, including the 'wikiesque' tools of Padlet and Popplet.

Twitter is the number one tool in the top 100 tools for learning for the sixth year now. Greenhow and Gleeson (2021) posit that Twitter can help develop new literacies whilst Dunlap and Lowenthal (2009) state that its offers just in time communication both within the class and with a wider, global community. Thus, Twitter can be seen as a multimodal communication

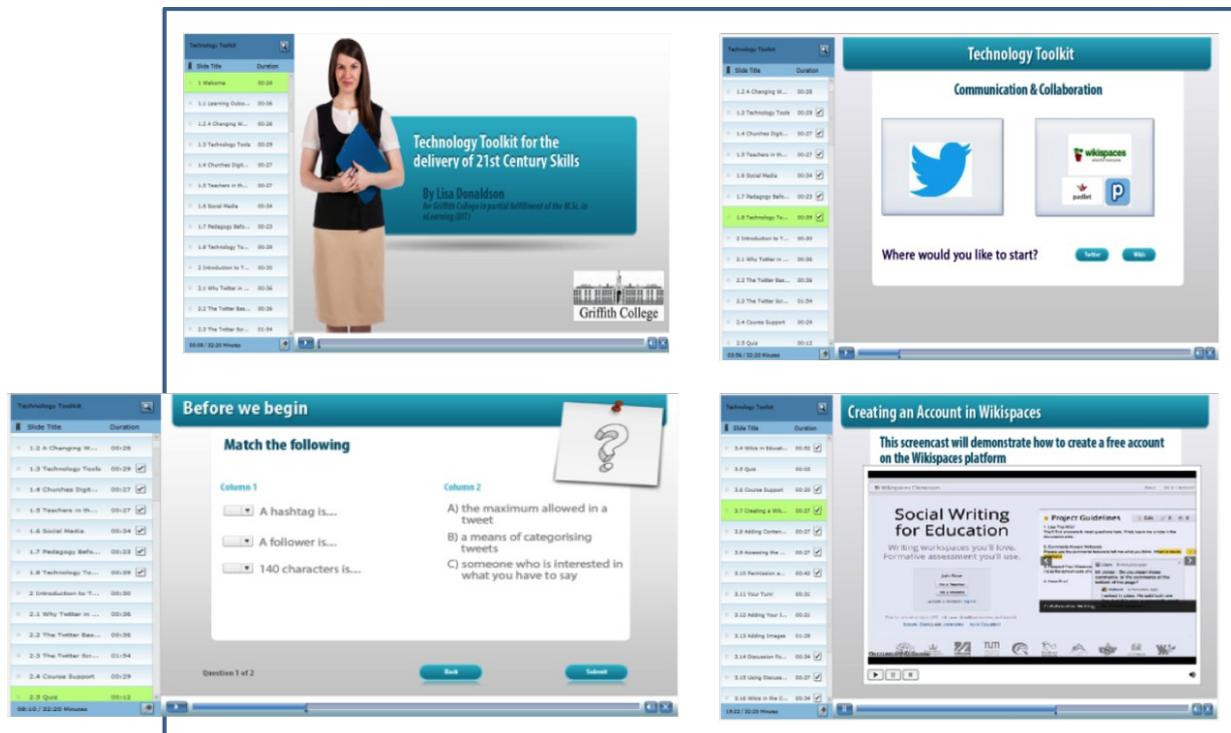
medium which offers the potential for many instructional interventions. These factors argued strongly for the inclusion of the application in the Toolkit. Parker and Chao (2007) contend that Wikis facilitate cooperative online learning. Hadjerrouit (2012) agrees that Wikis can offer many benefits for collaborative writing and peer review.

A primary aim of the Technology Toolkit was to develop educator competencies with Twitter and Wikis and this was done by providing learning activities demonstrating how to use the selected Web 2.0 tools, as well as providing best practice models for their pedagogically appropriate classroom integration. The overall design of the resource was predicated upon the social constructivist theory of learning described by Beetham and Sharpe (2013, P.286) as "achieving understanding through dialogue and collaboration". With this in mind, the design of the Technology Toolkit encompassed multiple opportunities to share with, and learn from, the participating students and tutor. Exercises were designed to encourage the participants to work together and share their expertise via the class wiki and the class Twitter hashtag (#dittecht toolkit). Peer interaction was mediated by the tutor and scaffolding in the form of online support provided for the students as the course progressed.

The resource, shown in Figure 3, was developed using Adobe Captivate software following the ADDIE model of instructional design. It was structured around a clear and robust navigation mechanism and included text, audio and video elements. Participants were supported via email and a wiki created in tandem with the resource.

Kwik Surveys, an online survey tool, was used to develop questionnaires which allowed for both quantitative and qualitative style questions to be asked and provided analytical tools and charts to present the data collected. Interviews with three participants were conducted and transcribed. These provided greater clarity around training preferences and the barriers to technology integration. Online metrics such as number of participant tweets, and comments in Wikispaces discussion forums were also monitored and analysed to assist with tracking the degree of technology adoption. These multiple methods of data collection ensured robust results and triangulation of data.

Figure 3: Screenshots of the Technology Toolkit



### 3. Results And Discussion.

To best capture the complexity of meaning encapsulated in the research data, thematic analysis as described by Aronson (1994) was conducted. This allowed patterns to be identified and commonalities, differences and relationships to be highlighted. From this analysis of the qualitative data, a number of key themes emerged:

- Teachers are generally comfortable introducing technology to the classroom particularly after exposure to a training resource such as the Technology Toolkit.
- There is little conclusive evidence of an obvious digital divide between students and participating educators
- The preferred approach to educator training is a blended format that encompasses peer assisted sharing and learning.
- The main barrier that prevents the integration of technology tools is time.
- A strong preference for and engagement with Wikis occurred among participating educators.

Each theme will now be considered in turn.

### **3.1.1 Teachers are generally comfortable introducing technology to the classroom particularly after exposure to a training resource such as the Technology Toolkit**

The initial survey indicated that 100% of participating lecturers strongly believe that technology has a place in the classroom. Of these, 77% of participants believed themselves to be competent interacting with technology but only 69% were confident to use it in the classroom. These findings would appear to be supported by results from the ETNA survey reported by McLaughlin, Robertson and Nelson (2012) which found that technology had generally been embraced by lecturers and they were mostly positive in their attitudes about the potential contribution of learning technologies.

While it was important that this study was successful in teaching participants how to use certain digital tools, another significant aim was to reduce technology anxiety allowing them to continue to be innovative in their teaching/learning environments. At the conclusion of the Technology Toolkit study, 81% of participating lecturers described themselves as confident and excited to explore new technology tools with their classes. The increase from 69% to 81% in confidence and abilities can be attributed to the training provided by the resource. This general confidence level with technology was confirmed by the data drawn from the study interview process. All interviewed participants concurred that they felt comfortable introducing new technologies and that this confidence had grown after exposure to the Technology Toolkit. Some sample responses included: "I'm more confident now having gone through the toolkit" and "I was so confident after having done your online training. From that moment I was going to introduce both (Twitter and Wikis)"

At an institutional level, technology in learning was actively supported by 77% of institutions in which participants were based, yet none of these higher education institutions (HEIs) offered regular professional development training in this area. Instead, periodic workshops or on the job training were the most common type of support offered. Georgina and Hosford (2009) argue that making the technology available is not enough, training is required. The increase in educator confidence following the provision of training via the Technology Toolkit from this study strongly supports this position and indicates institutions are doing a disservice to their faculty by not formally supporting training.

The study also sought to understand what types of learning technologies are being used by educators. Participants in this Technology Toolkit study were asked about learning technologies currently used in their classrooms and the most commonly cited tools were Powerpoint and Moodle. Prior to using the Toolkit, 39% of participants had little or no confidence in the use of Web 2.0 tools such as blogs/wikis/web applications. These results

mirror the ETNA 2012 survey which indicated low confidence with these tools and indicates that lecturers are not engaging with Web 2.0 technologies that can lead to real innovation in teaching and learning activities.

The data drawn from examining the metrics of the Twitter and Wikis accounts created for this study are also significant. Most participants went far beyond the requirements of the course. 11 of the 13 participants embraced the tools to tweet or post to the course wiki many more times than necessary within the monitoring period of the study. Following usage of the Technology Toolkit resource, 80% of educators participating in this study indicated that they would consider integrating Twitter or Wikis in their classes.

The high level of interest in using Web 2.0 tools as evidenced by the post training survey results and the degree of engagement with the Toolkit resource indicates the significant impact that relevant and timely professional development can make. All the data garnered from this study and the literature points to a profession that has a good degree of competence with IT although not with Web 2.0 tools which might support more innovative teaching practices. Johnson et al. (2012) argue that professional development for educators will lessen the technology anxiety experienced and therefore encourage adoption of learning technologies. This study has shown success in advancing participant technical competencies however, ongoing support and training is vital to increase educator confidence and enable them to meet the challenge of a constantly evolving academic landscape.

### **3.2 There is little conclusive evidence of an obvious digital divide between students and participating educators.**

This study sought to examine the claims by Prensky that 'digital immigrants' speak a different language to the younger generation and find it difficult to adapt to new technologies. Results are contrasting across interview and survey data making it difficult to conclusively state that there is an obvious digital divide.

The pre-survey results indicated that 46% of the participating lecturers agreed or strongly agreed that their students were more technically literate than themselves and within the oldest group of lecturers in the survey (40 to 49) who fall firmly into the digital immigrant category, the filtered data showed that 75% believed their students were more technically literate than they were. This would initially seem to reinforce the premise of a digital divide in terms of technical abilities. Results however, showed this older group all had basic ICT skills in handling files, using Word, and internet search tools and demonstrated that, with support, they were also able to achieve competency with Web 2.0 technologies as evidenced by the

completion of all course activities and their willingness to continue usage after the training period.

Interestingly, the overall survey results on the digital divide were contradicted in the semi structured interviews whereby all interviewees including one from the 40 to 49 age bracket disagreed when asked if they felt that there was a difference in technical literacies between students and themselves. The lack of a digital divide was, in fact, quite strongly protested in all participant interviews regardless of age. Sample comments included: "It didn't seem to be an issue for me any way with that class" and "I wouldn't really regard them as more technically literate".

Margaryan, Littlejohn and Vojt (2011) agree that lecturers skills with, and usage of, learning technologies is less than their students. They contend, however, that the digital native/immigrant debate is not universally correct as research has shown that student abilities are very often mixed, and in fact, students actually look to lecturers for assistance and leadership with technology based learning. This view is echoed by White and Le Cornu (2011) and Kennedy, Judd, Churchward, Gray, and Krause (2008). They argue that one cannot generalise about technical skills and that students actually possess a wide variety of skills and proficiency. So while some educators in this study may feel that their students are more technically literate, it may well be that this may be more perceived than actual. All participants in this study proved that with training and support they were more than capable of adopting new technologies and this success spurred their confidence to explore other technology tools. Results show that 100% of participants felt more open to exploring additional learning technologies after using the resource. These are not the characteristics of a Digital Immigrant as described by Prensky (2001). Instead it proves that, with support, all lecturers regardless of age or experience can develop positive attitudes towards the adoption of technology enhanced learning.

### **3.3 The preferred approach to educator training is an online format that encompasses peer assisted sharing and learning (blended learning).**

This study offered an online resource to participants. A key part of the research was to investigate if this was an appropriate approach to training higher level educators. The results strongly indicated a preference for a blended learning approach.

Over 91% of the participants surveyed after using the resource initially stated they preferred an online format. This is at odds from the ETNA survey (2012) where over 90% preferred a face-to-face format and the Georgina and Hosford (2009) study which also showed a face-to-

face offering was preferred.

While the survey data for this research strongly indicated a preference for online learning, the interview data offered a different perspective. All interview participants indicated their preference for a blended learning approach, that is, the addition of a face-to-face element to the online training. Sample feedback included: "Blended is definitely what I like for myself" and "Ideally a face-to-face class and then supplemented with online availability of question and answer". Sharing information, technology tips, and examples of technology usage in the classroom amongst peers was seen as particularly useful for educators undertaking technology training and the online training format did not fulfill this need. The social constructivist nature of the resource should have enabled this kind of connection making, and indeed 81% of respondents connected with their instructor, peers or a wider network, as part of the training but the interview results make it clear however that the effectiveness of the learning experience could be augmented by a face-to-face element. This would facilitate questions and sharing with knowledgeable peers.

In this, the findings appear to concur with both Georgina and Hosford (2009) and Annan (2005) who advocate for a learning technologies mentor to help foster peer-to-peer training and promote the application of elearning. Learning from and being supported by peers can result in deeper and more situated learning and facilitate more effective adoption of technology (Ertmer et al. 2012; Annan, 2005).

Based on these research findings and literature review, a series of online technology training resources similar to the Technology Toolkit are proposed. These resources featuring practical applications of learning technologies supplemented by regular face-to-face sessions, online tutor support, and guidance by a technology mentor provide the most advantageous approach for training educators.

### **3.4 The main barrier that prevents the integration of technology tools is time.**

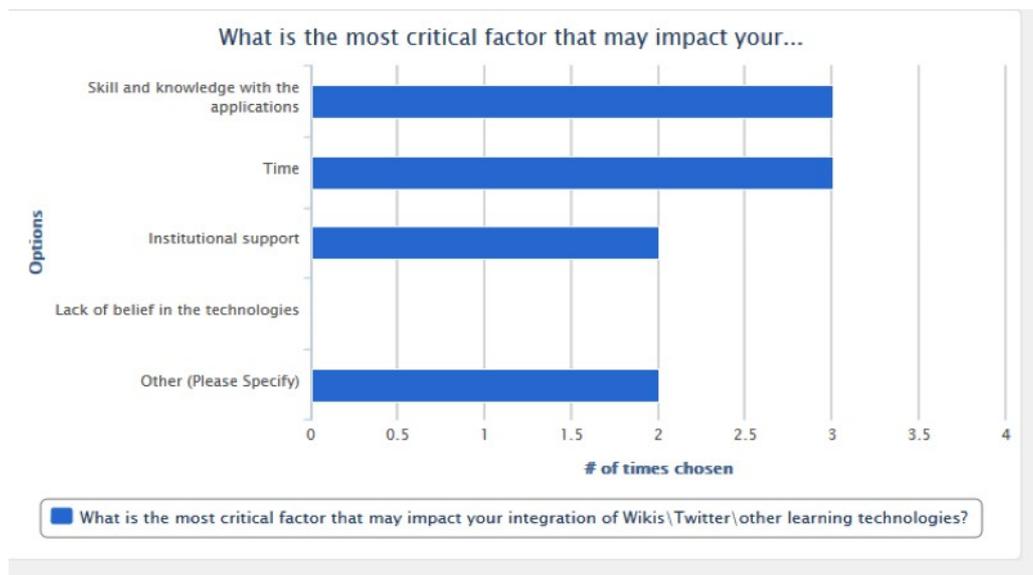
77% of research respondents agreed or strongly agreed that student outcomes for the modules on which they taught could be improved with the integration of technology elements/approaches. This research sought to understand why there is a gap between this belief and the actual adoption of technologies in classrooms. Knowledge of the barriers that may impede the implementation of learning technologies is central to this understanding. Much has been written on barriers to technology implementation. Ertmer (2012) found that the key barriers to technology integration are mainly external – support, state standards, money, access and time. Some factors impacting the adoption of technology as identified by

Margaryan et al. (2011) include: digital skills; reluctance to change; and problems such as lack of time and infrastructure issues. Annan (2005) posits that academic staff may just not have the time or interest to learn about new teaching technologies

This research sought to mitigate some of the reasons typically cited as barriers, notably, a lack of training and support and a lack of access to technology. The Toolkit training resource was designed using readily accessible and free tools for the classroom and made available to all participants. Before exposure to the Technology Toolkit, the most impactful issue on integrating technology cited by participants in the survey was time. 77% of participants indicated this as a negatively impacting their ability to bring technology into the classroom. All educators interviewed as part this research also strongly agreed that time was the main barrier to technology integration – Comments included *“Purely I think a time issue”* and *“It got frustrating that I didn’t have the time to see how they worked and get to grips with them”*. When the participants were asked what were most critical factors impacting on their adoption and usage of Twitter/Wiki in the post training survey, the most significant issues were identified jointly as skill with, and knowledge of, the applications as well as the time to develop technology based interventions (see Figure 4). It is reasonable to conclude that time consistently is considered one of the biggest barriers to the integration of learning technologies.

Lightle (2011) references one of the barriers to integrating technology in the classroom as educators’ lack of knowledge which aligns strongly with the findings of this research. The Technology Toolkit was designed to fill this knowledge gap and provide best practice models in using technology in an educational setting however results show that lecturers still feel their technical competencies are deficient. Changes to the training resource from online to a blended format with a technology mentor may positively impact this finding.

**Figure 4: Barriers impacting technology interventions**



100% of participating educators strongly believe that technology has a place in the classroom indicating it is not an attitudinal shift in educators that is required. The participants of this study clearly demonstrated the right attitude to technology via the breadth of their online interactions and continued usage of the tools. Ertmer et al. (2012) argue that when barriers are equal to all, it is a teacher's beliefs and skills that enable or disable the integration of technology in the classroom. This is best summed up by one of the interviewees "I've six modules and I'm very busy, but I'm still 100% going down the road of Twitter and Wikis even though its my first semester." It would appear that with the right attitude, even the obstacle of lack of time can often be overcome.

It would seem that access to timely and appropriate training and supports is key to empower educators integrate technical tools into their classroom. Institutions must ensure that training be provided in such a way that does not add a significant burden of work on to the educator. Offering blended training options may solve this by allowing lecturers to learn in their own time and space. They should then be facilitated to participate in regular peer technology sharing sessions to collaborate with colleagues and time allowed for technology integration.

### 3.5 A strong preference for and engagement with Wikis occurred among participating educators.

Dempsey, Gormley, and Reidel (2011, p. 48) define wikis as "appropriate and powerful web spaces which provide opportunities to capture, discuss, and review individual, group, project or organizational activities". Simply put, a Wiki is a website which allows users to easily share, collaborate and offer feedback to one another. Lai and Wong (2011) suggest that such

student-centred Web 2.0 applications can help underpin learning because they can so easily facilitate teacher and peer feedback.

The Technology Toolkit online resource featured the Wikispaces Wiki, as well as the wikiesque tools, Padlet and Popplet. The same degree and type of instruction was used for all types of applications yet there was a considerable difference in the engagement levels of participating educators with Wikis compared to Twitter, the other tool incorporated.

The post survey data indicated that over 72% felt confident in using Wikis and ready to consider integrating them to their classrooms compared to 36% considering Twitter. On examination, the metrics for the Technology Toolkit wiki site recorded 89 distinct interactions compared to the 4 requested. This represents a considerable engagement on the part of the participants over and above the requirements of the course. Much of the additional postings to the wiki revolved around the sharing of and commenting on resources, an excellent example of the collaborative nature of the tool.

Some of the information ascertained at interview indicated even more strongly an engagement with the tool. Sample quotes included: *"I really like the wiki, it would be brilliant for resources, to get all that information together so that ... they have access to all that information"* and *"I've introduced the wiki to one group that are doing a group project which is most appropriate for them."* These comments validate research by Elgort, Smith and Toland (2008), who argued that educators saw value in utilising wikis as a collaboration tool and state that instructors agreed using wikis allowed easier management and grading of groupwork.

The educators interviewed as part of this research seem to have found an immediate use for Wikis to support innovative activities in the classroom. Spotts' (1999) illustrates that the greater the perceived benefit to teachers, the greater the use of technology. The practical application of Wikis has reinforced participants' learning and improved their confidence with the tool. The importance of the usability and practical nature of a learning technology is paramount – a simple application that delivers visible efficiencies and offers original pedagogical approaches will be more easily accepted by educators. This is corroborated by an interviewee who noted *"Because teachers, you know, they never want to use stuff unless it makes their lives easier"*.

### 3.6 Evaluation of technology integration.

This case study sought to measure the degree and type of technology integration of study participants by using the Kirkpatrick and SAMR evaluation matrices. At the Reaction level of the Kirkpatrick model, which seeks to understand how well the training was received, results were very positive. 91% of respondents believed the Technology Toolkit content met their needs as a lecturer and 100% rated their experience of the online resource as very good or excellent. Kirkpatrick's Learning Level measures how much participant knowledge has increased as a result of training. Participants in this study were tasked with completing a series of tasks with Twitter and Wikis designed to prove their skills and knowledge with these tools. 10 of 11 participants successfully completed these tests indicating their technical competency following training.

At the Behaviour Level, which examines how much participant behavior has changed as a result of the training, the SAMR model was applied to assess the degree and type of technology usage post training. 46% of respondents indicated they had zero technology integration into their classes prior to training however following Toolkit usage, all respondents placed themselves somewhere on the SAMR scale which indicated a degree of technology integration.

The number of educators who believed themselves to be at Redefinition level - where technology allows for the creation of new tasks previously inconceivable – more than doubled from 9% to 25% since training and support was provided. This indicates the potential to transform learning activities through technology was actively embraced by participants which may support Dede's (2011) call to radically alter teaching to best serve students of the future. Interview data however indicates that the majority of participating educators are still at the start of their journeys to transformation through technology as illustrated by interviewees who stated: "It surprised me that I hadn't gone as far up the scale as I'd expected" and "If I'm honest, it's Substitution". This basic degree of technology integration is not unusual. Chell and Dowling (2013) quote Puentedura as saying that it may take three years following the integration of technology for faculty to reach the Redefinition phase. Rogers (2000) also contends that teachers need time and support to adapt to utilising new media and new teaching paradigms in the classroom. Most often, there is no instant epiphany for educators and it will take time to change their pedagogy and allow for the integration of new technologies.

#### 4. Conclusion.

By reviewing the experience of a group of lecturers utilising the Technology Toolkit online training resource, this case study sought to ascertain how to best support educators as they adopt and integrate learning technologies which are vital to prepare students for the 21st century. The findings proved that they are now both confident and competent to do so although participants in this study are really just beginning to consider technology as part of their pedagogy.

The scale of this research was limited to a single cohort of lecturers and a single online resource as a pilot project. It would be useful to revisit participants in the coming academic terms to measure the actual degree of technology integration compared to the stated expectation that 80% of this cohort would consider integrating Twitter or Wikis in their classes. This may illuminate other barriers to adoption and lead to further support measures that should be considered.

The research has indicated a number of measures that Institutions should consider to help support their lecturers on this journey towards pedagogical innovation:

- Develop a suite of online resources enabling lecturers to learn in their own time with online tutor support available.
- Develop online resources illustrating examples of use which are practically focused and offer immediate benefits to the educator for teaching and learning activities.
- Establish a regular schedule of professional development training for educators to engender confidence and reduce technical anxiety. The schedule should include a regular, perhaps quarterly, series of technology peer sharing workshops to enable the sharing of best practice examples.
- Assign eLearning mentors or champions to work with and support lecturers locally.

Make time. The assimilation and subsequent integration of learning technologies in the classroom will take time. Ensure that educators and institutional heads understand that time will need to be dedicated to achieve the huge potential that technology offers to education. It is important to remember that the overarching factor when considering technology in higher education contexts should be that the technological approach should only be considered by educators where it will actually benefit the students and not simply for its own sake.

Steve Wheeler (2014, p. 1) sums this up succinctly: *"If you believe that technology can be used to engage students, to enhance or extend learning or to enrich the life of your community of practice then go for it. If you can't see any way technology can do any of these things, then close the catalogue, leave the store, walk away. There is nothing for you to see here."*

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