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DigiExplanation driven assignments for personalising learning in construction education

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Abstract

Personalising learning is critical for universities to achieving excellence in education. It entails maintaining an education system that is responsive to the learning needs, aptitudes and interests of individual students. Rather than imposing a 'one-size fits all' model, personalising learning is anticipated to ensure that every learner achieves his/her highest potential. Pedagogical literature suggests that learning-oriented assessments that are engaging, authentic and relevant are an effective mode for personalisation. DigiExplanation is a novel approach that requires students to create short digital media to communicate their ideas to ordinary audiences. It offers an opportunity for research-based authentic learning by harnessing digital media that exist outside of their institution and their digital competencies to create personally relevant and interesting resources. The aim of the research was to investigate the effectiveness of digiExplanation driven assessments for improving personalised learning in construction education. A case study approach was adopted in the research. A first-year subject from the construction management degree was chosen as the case, which had a class of 159 students. A new assignment scheme was introduced for which students were required to develop digiExplanations in groups of five. The assessment criteria comprised: rationale for

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the study; depth and breadth of the discussions for the topic; appropriateness of media used in the discussions; creativity in the use of media (storyboarding); design of digiExplanation; quality of conclusion; and proper acknowledgement of materials used. After the submission deadline, an online survey was conducted with the students to assess how the new assessment approach facilitated personalised learning. Several findings emerged from the study. The digiExplanation based assignment provided similar learning experiences for students with different characteristics concerning their first language, domestic/international student status, work situation and digital competencies. Moreover, the study found that some considerations are more significant than others in designing assessments that can drive personalised learning, which are: personally relevant/interesting, engagement, harnessing internet resources and progressive feedback. The survey findings further suggest that while the new pedagogical approach achieved its intended aim, few students perceived it a cumbersome method as it required more efforts than traditional assignments.

Keywords:

Construction education, personalised learning, assessments, digiExplanation, student learning.

Introduction

In a rapidly changing world, education in any field of study requires effective teaching and learning strategies that would effectively adapt and suit those drastic changes and innovations. Tertiary education, which is the key doorway to the fast-developing construction industry, demands education systems that harness a workforce with flexible and adaptive skills in learning the latest industrial innovations. According to Sampson, Karagiannidis and Kinshuk (2002), it is important that education and training would cater to the knowledge-based economy. In order to fulfil these industrial demands, universities need to set apt graduate attributes with related learning outcomes that contextualise educational courses. Among a vast array of graduate attributes in tertiary education programmes, key graduate attributes that are recognised to address construction industry requirements are: creativeness, professional competence, problem-solving skills, communication skills, teamwork and life-long learning capabilities (Biggs and Tang 2011). In response to these demands, pedagogical specialists have introduced an educational concept, called 'personalised learning' (Bartle, 2015; Hanover Research, 2014; McLoughlin 2013; Sampson, Karagiannidis and Kinshuk 2002).

Pedagogical literature suggests that learning-oriented assessments that are engaging, authentic and relevant are an effective mode for personalisation. A study attributed to Glasser (1999, cited in Biggs and Tang, 2011) indicated that most people learn 80% of what they apply in real life and 95% of what they teach others. Assessments which involve students' own exploration, research, experimentation, effective communication and presentation contribute to a more complete and comprehensive deep learning. The profound influence of assessment design on approaches to learning has been brought into the light by Gibbs (1999). However, most of the traditional assessment methods limit to written reports or PowerPoint presentations that reduce learner enthusiasm, interactive learning and also restrict the learner and teacher engagements (Bartle, 2015; Bates, 2014). Assessments could be made more beneficial if the presentation method of the content is made more attractive and interactive (Xu et al., 2017).

Recently, amidst the backdrop of technological advancements, a novel presentation method called 'digiExplanation' has emerged in academia (Megaw et al., 2016; Hoban and Nielsen, 2013). Students create short digital media to communicate their ideas to non-specialist audiences while satisfying assessment criteria. In this method, students are expected to harness suitable digital media that already exist on the Internet or in other locations outside of their institution and their digital competencies to create personally relevant and interesting submissions; offering an opportunity for research-based authentic learning (Reyna and Meier, 2018; Reyna, Hanham and Meier, 2018). Pedagogical literature indicates a wide use of digiExplanation in academic disciplines such as health science, mathematics and social sciences (Reyna and Meier, 2018; Fotinatos, 2014) but rarely been used in construction education (Kamardeen, 2013; 2014; 2015). Moreover, in the present era of the fourth industrial revolution, the changing workplace landscape of the construction industry demands greater emphasis on digital literacy that facilitates innovation and global connectivity (Pearce and Vanderlelie, 2016; Committee for Economic Development of Australia (CEDA), 2015). Hence, it is deemed important that construction education programmes support these industrial requirements by increasing the digital literacy by incorporating methods such as digiExplanation, which uses entry level technologies.

To that end, the study aims to experiment the effectiveness of digiExplanation for personalising learning in construction education. The aim was achieved via three coherent objectives, such as: (1) developing an assessment model that leverages digiExplanations for construction education; (2) operationalising the assessment model; and (3) measuring its effectiveness for personalising learning for students. The remainder of the paper is laid out in the following manner. First, a literature review on personalised learning and how digital technologies can be utilised for it is explained. Second, the study approach is elaborated, followed by the analysis of the effectiveness of the new assessment model. Then, the challenges faced, and lessons learnt in the application of the new assessment model is discussed. Finally, conclusions and recommendations are drawn.

Literature review

DEFINING PERSONALISED LEARNING

Personalised learning, which is also known as 'tailored learning' or 'learnacy' (Burton 2007), could be considered as a popular approach in the worldwide contemporary education lexicon (Gillet et al., 2013; Béres, Magyar and Turcsányi-Szabó, 2012; Heller et al., 2006). According to Sampson, Karagiannidis and Kinshuk (2002) this is due to the upsurge of the knowledge-oriented society and the knowledge-based economy in the present context. Personalised learning was also presented as 'differentiated learning' in 1990's pedagogical discourses. According to Weston (1996), differentiation was a strategy used by educators to empower each student individually to achieve their own learning targets. Later in 2001, the Department for Education and Skills, UK (DfES 2001, p.20) further discussed this as 'individualised learning', which promoted that every learner can be instructed in a unique way and pace which suits his/her aptitudes, needs and interests. More recently, this is widely addressed as 'personalised learning', where Downes (2006) depicted it as a methodology, not an application, one that recognises personality and encourages the formation of communities of inquiry. Moreover, it is argued that learning instructions ought not to be confined by place, time or any other

obstructions, rather it should be customised to the individual learner's needs, aptitudes, previous knowledge, and interests (Sampson, Karagiannidis and Kinshuk 2002).

It is apparent from the above definition that personalised learning implies a drastic departure in education lexicon from traditional general and inactive learning environment to more personalised and active learning environments. Atwell (2007, cited in McLoughlin 2013) characterised personalisation in terms of learner participation; the principles behind it imply that personalised learning offers a real opportunity for learners to participate fully and become co-creators of knowledge. In this venture, the use of digital technology to facilitate personalised education is identified significant (Pearce and Vanderlelie, 2016). It is usually implemented by assessing the learner's current knowledge state, personal characteristics and learning preferences (Heller et al., 2006). Hence, educators are challenged to leverage resources that exist outside the formal institutional boundaries and the already known digital skills and interests of learners to facilitate authentic, active learning that is personally relevant to students (McLoughlin 2013).

Similar to the above discussed significance of personalised learning adaptations in the general academia, the construction education discipline also identifies its importance. Since personalised learning aims to create an education system that is receptive to the varied learning goals of individual learners rather than imposing a 'one-size fits all' model (Bartle, 2015), it will significantly benefit the construction education cohort.

CHARACTERISTICS OF PERSONALISED LEARNING

Hanover Research (2014) defined the fundamental features of personalised learning as: tailoring learning plans/paths to suit the needs of individual students; supporting students to realise their potential; engaging and motivating students by making learning activities authentic and relevant to their life, interest and goals; providing flexibility in how, what, when and where students learn; encouraging relationships between students, educators, the institution and community; and preparing students to be life-long learners. Similarly, Keamy and Nicholas (2007) argued that personalised education has four features.

- Learner centred approach – it involves a well-designed approach that emphasises on the interests and learning needs and styles of students at the centre, heavily engaging students, (meaningful assessment tasks for and from students, and a commitment to reducing the achievement gap between students.
- Advanced use of ICT – using ICT infrastructure to provide better diversity in learning methods, enhance individual interactivity between learners and educators, offer flexible learning beyond classroom, and facilitate student learning globally with external resources that exist on the Internet.
- Lifelong learning – involves developing skills and strategies to enable self-management of learning for employability (how to research, organise and present data, working in teams, learning to review and reflect, and analysing, explaining, justifying and developing arguments).
- Communities of collaboration – develop and promote learning networks to underpin mentoring and knowledge building through connectivity.

FRAMEWORK OF PERSONALISED LEARNING

Based on the characteristics identified in the literature (DfES, 2001; Sampson, Karagiannidis and Kinshuk 2002; Bartle, 2015; McLoughlin 2013; Hanover Research, 2014; Keamy and Nicholas 2007) a framework for implementing personalised learning models is proposed, as shown in Figure 1. The framework encompasses four concentric rectangles, namely: learner, teaching, ICT and organisation. The framework postulates that the learner is the central focus of personalised learning and three key pedagogical components are essential to achieve the learner-centred education, with each component supporting the other.

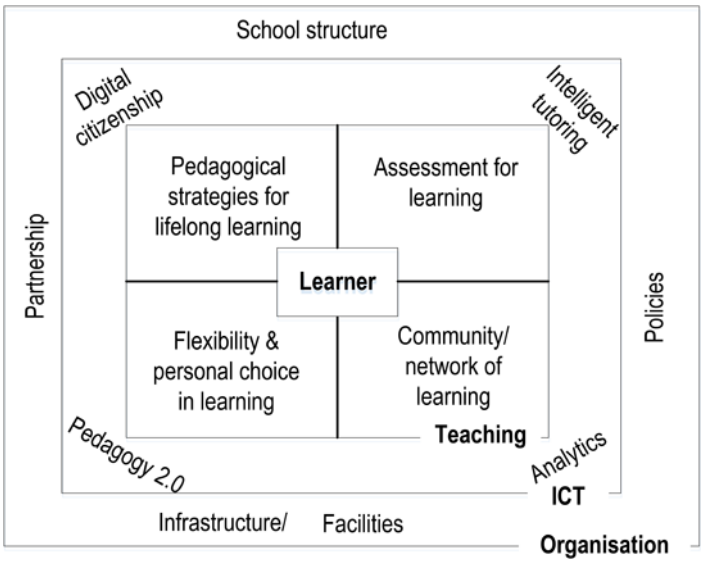

Figure 1 Framework for personalised learning

The first component, represented by the second rectangle, explains four essentials in teaching that are required to enable personalised learning (see Figure 1). They are:

- *Flexibility and personal choice in learning:* teaching needs to provide flexibility and personal choice in what, how and where students learn. This mainly focuses on learners' interest. Therefore, the course/subject structure and delivery mode should fit in to any environment, time or space.
- *Pedagogical strategies for nurturing lifelong learning skills:* utilise strategies that train students for lifelong learning. Teaching the skills for learning is important as they would be of immense use even after graduation, as expected by tertiary education. In this fast-developing world, focused skills outdate fast and therefore students are required to keep learning new skills. It is therefore important to provide and nurture learners with skills for lifelong learning. This could be achieved through pedagogical strategies such as project-based learning, research-based learning, case study-based learning, and inquiry-based learning. These kinds of pedagogical strategies would train students as self-directed learners, where students are able to find their own tactics for learning and gaining new skills and knowledge.
- *Assessment for learning:* assessments should be used as a tool for teaching and to provide feedback to reinforce further learning. For example, continuous constructive feedback on project-based assignments is helpful in student learning, where the comments could be

utilised in additional learning and in revising the original task. Therefore, constructive comments could underpin students' progress in learning.

- *Community/network of leaning:* this is to go outside the classroom where learning can happen anywhere with anyone. It is to go beyond the traditional teaching and to direct students to an appropriate network relevant to the specific subject. This direction could be into a network of people or network of information such as forums, seminars, resource collection or even industry. Furthermore, networking could also be enabled through student group formation, where peer learning could take place.

The third rectangle in the framework (see Figure 1) denotes Information and Communication Technologies (ICT). The teaching methods identified above to facilitate learner centred personalised learning are enabled by them. ICT could be utilised effectively with pedagogical strategies in providing flexibility, dealing with community and network or even to set up assignments and provide feedback. Among many ICT tools/ methods suitable to facilitate personalised learning are analytics, pedagogy 2.0, intelligent tutoring and digital citizenship.

The outer most rectangle of the framework is the organisation of the institute. Key components within an organisation that enable personalised learning are:

- *Infrastructure/ facilities:* to facilitate the flipped classroom strategy, for example, ICT facilities are needed to prepare digital learning materials, video recordings of lecturer and classrooms with workshop arrangements. Therefore, the organisation should be equipped with this kind of specific infrastructure in supportive of the unique teaching strategy.
- *Policies:* organisational policies on teaching should facilitate these unique methods of teaching for personalised learning, whether it is through the allocation of adequate budgets or encouraging staff through incentives and grants.
- *School structure:* the above discussed unique pedagogical strategies for personalised learning require more resources, time and energy, which may not be feasible to be handled by a single person. Therefore, if the school structure encourages team based teaching or shared subjects, experts with specialised skills such as technical, contextual, media and delivery could work together to form a more comprehensive course that facilitates personalised learning.
- *Partnership:* the organisation can form partnerships with the industry to facilitate work-integrated learning which facilitates personalised learning. Organisational policies and facilities need to be aligned to harness partnerships.

This proposed framework for personalised learning summarises key attributes of student-centred learning in institutional set-ups. It informs contemporary academia of what is required to adopt to the digital age. It will support utilising suitable ICT strategies and technologies to support flexibility and personal choices in learning, gaining lifelong learning competencies, learning networks, and assessment-based learning.

Study method

In response to the proposed framework for personalised learning (Figure 1), this research integrated "assessment for learning" in the second rectangle with "pedagogy 2.0" in the third rectangle to facilitate personalised learning through a a method, namely digiExplanation. Pedagogy 2.0 is a model of teaching in that students are empowered by resources and networks that exist in the web 2.0 space to engage, communicate and create knowledge and thereby experience a high level of personalisation, ownership and control over learning.

DigiExplanations offer a mechanism to bridge pedagogy 2.0 and assessments and involves learning tasks that require students to create short, interactive digital media to communicate to non-specialist audiences while satisfying the marking criteria. The types of digital media developed for this purpose include: podcasts, digital stories, videos, slowmations (slow animations) (Hoban and Nielsen, 2013), video scribes/ whiteboard animation or blended media. Further information on digiExplanations can be found on http://www.digiexplanations.com/. Since the digiExplanation require only basic knowledge and skills to use the easily accessible technology and digital media, it is considered the most suitable method to implement in tertiary education structure (Pearce and Vanderlelie, 2016). According to Hoban et al. (2019), at present students are increasingly using their own digital technologies such as mobile phones, iPads and computers to create digital representations to explain academic concepts. They are recognised to be able to make podcasts (audio explanation), video (audio and image) as well as animations and slowmations (Hoban and Nielsen, 2013) to explain their understanding of a subject. These can be shared with others by uploading to Internet sites such as YouTube or to other sites such as "60 Second Science" or "Scientific American" (Hoban et al., 2019).

A case study approach was adopted to operationalise the proposed pedagogical model and test its effectiveness for personalised learning. A first-year subject, Construction and Property Economics, in the Bachelor of Construction Management and Property degree program was selected as the case. The research process involved two distinct stages, viz.: (1) implementing a digiExplanation-based assessment in the subject; and (2) conducting a questionnaire survey to evaluate the effectiveness of the model for personalised learning. The ensuing sections elaborate on these stages. The case study with an embedded questionnaire survey was deemed the most suited strategy for this research because Cohen, Manion and Morrison (2011) argued that in educational research case studies can help understand causes and effects ('how' and 'why'); they reveal effects in real contexts and allow in depth understandings. Moreover, several previous studies in construction education have successfully adopted this strategy; for example, Kamardeen 2013; Kamardeen 2014; Kamardeen 2015.

Implementation of a digiExplanation based assessment

A group assignment was designed by the authors according to the proposed digiExplanation model and introduced at the beginning of the academic session. A brief description of the assignment is shown in Exhibit 1. Assessment criteria were made available to allow students understand the expected quality of submissions and to direct their efforts accordingly. The assessment criteria comprised: rationale for the study; depth and breadth of the discussions for the topic; appropriateness of media used in the discussions; creativity in the use of media (storyboarding); design of the digiExplanation; quality of the conclusion; and proper acknowledgement of materials used. Moreover, a progress review scheme was in place whereby group progress was reviewed three times within ten weeks, prior to final submission, and formative feedback was provided for improvement. Additionally, an online site of interactive resources on how to use technologies to create digital media was set up on the Moodle eLearning platform.

The authors' observations on the student learning process witnessed the following key characteristics during the course of the assignment: (1) most students were actively involved in the learning process and showed ownership for activities and contents they created; (2) learning was largely driven by students and the lecturer provided only basic information or guidance; (3) discussions and collaborations for problem solving within constraints were

integral parts of their learning; (4) the task was felt challenging yet fun and enjoyable; and (5) scholarly enquiry and information seeking/ research was a constant habit of the students. Though it was the first time for producing digital media or doing an assignment for that, students created media of reasonable quality. Their submissions can be found on YouTube with the search term of 'BLDG1302'.

DigiExplanations for the Construction Industry

Scenario:

The NSW government aspires to set up a knowledgebase about the performance of the local construction industry to benefit small and medium sized builders, clients and investors. In order to achieve it, the government is intending on creating an e-portfolio. The government has decided to cover topics related to ten themes, including: Improving productivity in construction; Work health and safety in construction; Subcontracting practices in the construction industry; Cultural diversity in the construction industry; Sustainable construction; Construction trade unions; Financing methods for construction projects; Global construction markets; Disputes in the construction industry; and Ethics in construction business. In order to improve information richness and interactivity in presentation, the government has decided to leverage a novel approach, namely "DigiExplanations", for creating the e-portfolio.

Task:

Students are to form groups of five and produce a 3–5 minute long digiExplanation on a topic interesting to them, using a video, slowmation, digital storey, videoScribe or blended media form. Groups shall use their own technologies to create the digiExplanation: they can use computers with windows movie maker or imovie (for Mac); mobile phones; and/or still/video cameras. In creating these media, students can use their own images and videos or use existing ones that were created by others. When using existing media, groups must make sure they are copyright free. They can use google images and/or youTube clips and integrate with their own images and videos to create an effective digiExplanation for their topic. In order to filter copyrighted media, use the creative commons website at: creativecommons.org.au.

Exhibit 1 Summary of assignment

Effectiveness of the teaching model

After the submission of the assignment, an online questionnaire survey was administered with the students to evaluate the effectiveness of the teaching model for personalised learning. The questionnaire had three parts; the first part gathered background details of participants, the second part assessed how the digiExplanation approach satisfied the characteristics of personalised learning, discussed above in the literature review; i.e. relevance, flexibility, building on prior knowledge, engagement, collaboration, capitalise digital competence, harnessing internet resources, self-managed learning and feedback. These were assessed on a 5-point Likert scale consisting of strongly disagree, disagree, neutral, agree and strongly agree; and the last part received feedback on the overall learning experience, including written comments. A sample of the questionnaire that was used can be found in the Appendix.

SURVEY PARTICIPANTS

All 159 students in the class were invited to respond to the online survey, however only 108 of them participated, making a response rate of 68%. Table 1 shows the profile of survey respondents. Of the total of 108 respondents, around 80% were first year students. About 75% of the respondents were domestic students and around 36% respondents were from non-English background/ English as Second Language (ESL) students. Over a half of the

respondents had no work experience in the construction industry and around 20% of the respondents had more than one year's work experience. Most of the students had used digital media before and among them more than 30% of them were frequent users.

Table 1 Survey participants

Student characteristic	Response category	Count	Percent
Study stage	1st year	86	79.6
	2nd year	10	9.3
	3rd year	6	5.6
	4th year	6	5.6
Student type	Domestic student	80	74.1
	International student	28	25.9
Enrolment type	Full-time student	105	97.2
	Part-time student	3	2.8
First language	English	69	63.9
	Other	39	36.1
Work circumstance	Work fulltime	12	11.1
	Work part Time	38	35.2
	Work casually	37	34.3
	Do not work	21	19.4
Digital media use	Hardly ever	20	18.5
	Occasionally	25	23.1
	Sometimes	13	12.0
	Frequently	35	32.4
	Almost always	15	13.9
Work experience in the construction industry	No experience	58	53.7
	Less than 12 months	25	23.1
	12 to 24 months	16	14.8
	25 to 36 months	2	1.9
	37 to 48 months	1	0.9
	More than 48 months	6	5.6

Findings and discussions

OVERALL RESULTS

Figure 2 illustrates the spread of responses to the questions asked to the students and their responses are summarised below.

- *Relevance:* over half of the students found the digiExplanation assignment was interesting and relevant to them. Only about 6.5% of the students were somewhat less interested in the assignment or found it irrelevant to them. About 37% of the students kept a neutral attitude on this issue.
- *Flexibility:* a majority of the students (more than 70%) considered the digiExplanation was a flexible way to present their work and ideas in a way they like. Only a small portion (less than 6.5%) of them thought the digiExplanation was not a flexible way.
- *Building on prior knowledge:* more than 70% of the students testified that the assignment model enabled them to build on their previous knowledge on the subject whilst only a minority 5% disagreed and the rest was neutral.
- *Engagement:* nearly two-third of the students believed that the digiExplanation assignment was an engaging way to learn. Almost 30% of them were neutral and about 6.5% found it less engaging.
- *Collaboration*: over 70% of the students agreedthat the digiExplanation assignment encouraged collaborative knowledge building and teamwork, while 22% students stood neutral and a few (about 7.4%) believed it was not a good way to facilitate collaboration.
- *Capitalise digital competence*: more than 60% of the students agreed that they could apply their previous digital skills in the assignment. Less than 10% of the students did not agree that their digital competencies were helpful in the assignment.
- *Harnessing Internet resources*: more than 65% of the students agreed that the assessment model fostered authentic learning that is meaningful to them by harnessing existing Internet resources. More than 25% of the students were neutral on this issue and less than 8% disagreed.
- *Self-managed learning*: nearly 75% of the respondents agreed that the digiExplanation assessment encouraged self-managed learning of new knowledge. Only a small portion of the students (less than 5%) disagreed and 21% of them were neutral.
- *Feedback*: more than 60% of the students agreed that the progressive feedback provided helped them to realise their potential. About 30% of the respondents remained neutral and less than 10% had negative responses and did not think progressive feedback was supportive.

Overall, the digiExplanation assignment received positive feedback. More than 84% of the students responded that they had a good personalised learning experience with it in the course, and within which, more than 30% of them rated the learning experience was "very good" or "excellent". Furthermore, some direct quotes from the students about the assignment model, which were found in the qualitative feedback, are as follows:

> **"It was very different to other assignments such as essays and reports thus making it more entertaining to undertake. It was great to collaborate in groups so knowledge from each individual could be shared, subsequently leading to more ideas and information being put forward. The use of technology was also a very positive learning**

> **experience which will be very useful in other university assignments and in the real world."**
>
> **"It allows for students to learn new skills not only with the use of computers, but researching, strengthens confidence and allows for current skills to be furthered. An all-round effective method in learning a topic as a whole whilst developing other skills."**
>
> **"Very easy to learn from the digi explanations, easy again for ESL students who can watch the video if they don't understand."**
>
> **"Adaptive learning, the use of multimedia allows us to exploit different methods and platforms/channels of communicating our topic across. Enables collaboration and actual team effort."**
>
> **"Make use of hobbies and multimedia experience in conveying or delivering research/ report."**
>
> **"Interactive learning by bringing ideas across, through creative interpretation, on a globally recognised media stage (YouTube)."**

Qualitative feedback given by the students was subjected to a content analysis to obtain insights into why some students remained in a neutral position in their responses to quantitative questions. Some challenges faced by the students in undertaking this assignment were mentioned, which may be the reasons for their position. The challenges were:

- More work is required to produce a good digiExplanation compared to a traditional report.
- Lack of prior skills in digital media creation in some group members burdens others.
- Inadequate contributions or delays by some group members make others hate group tasks as it pulls everyone down.
- Lack of examples of previous assignments as this was the first time the model was implemented.

However, overall most of the students appreciated the novel approach to assignment, the level of engagement and enthusiasm nurtured by it as well as the new research and presentation skills they learnt. There was a desire among the students to see similar assignment methods implemented in other subjects too.

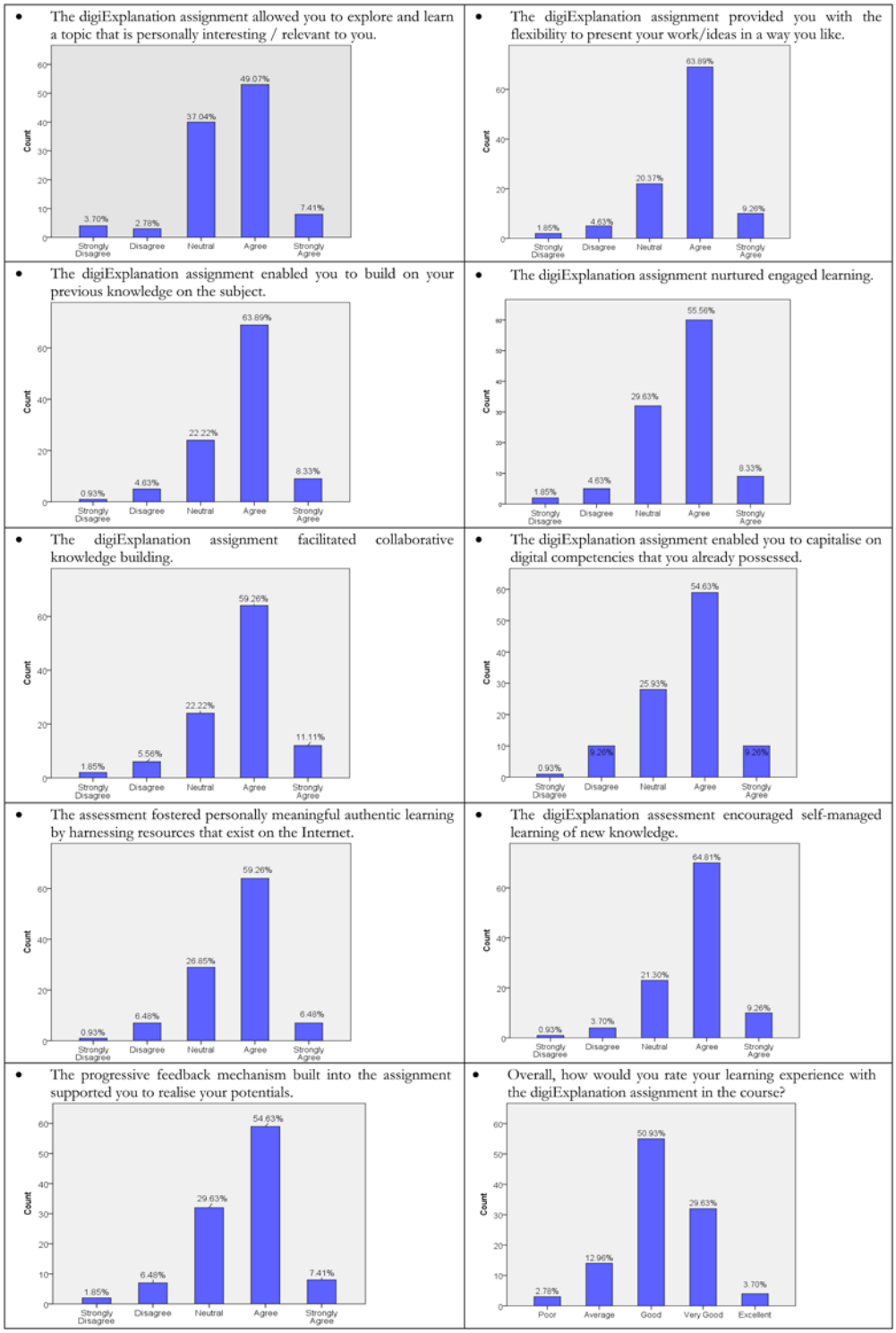

Figure 2 Overall survey results

STUDENT CHARACTERISTICS AND VARIATIONS IN LEARNING

The above results indicate the overall responses. Further analyses were undertaken to investigate whether the responses would vary due to student characteristics such as first language, student type (domestic/international student) , working/non-working status and

digital knowledge level. It was hypothesised that the digiExplanation based assignment would satisfy the expectations of students with the diverse characteristics above and would enable them to achieve the same level of learning. The string-based, Likert-scale student ratings were assigned numerical coding to allow parametric analyses as follows: strongly disagree = 1, disagree = 2, neutral/moderately agree =3, agree = 4 and strongly agree = 5. Subsequently, ANOVA tests were performed to validate the hypothesis; results are shown in Tables 2 to 5.

Based on anecdotal evidence that was available in the authors' faculty, it was observable generally that students whose first language is not English find it difficult to perform well in assignments. However, in this particular type of assignment, as shown Table 2 (p-values >0.05), learning has been consistent and there was no significant difference due to first language differences. In other words, this type of assignment breaks the language barrier to perform well and provides the same opportunity to students of all language backgrounds.

Table 2 ANOVA test results for first language of students

Personalised learning attribute	First language of student (mean ratings)			ANOVA stats.	
	English (N=69)	Other (N=39)	Total	F stat.	Sig.
Personally relevant	3.55	3.51	3.54	0.052	0.820
Flexibility	3.75	3.72	3.74	0.054	0.817
Build on prior knowledge	3.70	3.82	3.74	0.758	0.386
Engagement	3.62	3.67	3.64	0.077	0.782
Collaboration	3.72	3.72	3.72	0.002	0.967
Capitalise digital competencies	3.65	3.56	3.62	0.288	0.593
Harnessing internet resources	3.59	3.72	3.64	0.691	0.408
Self-managed learning	3.80	3.74	3.78	0.144	0.705
Progressive feedback	3.52	3.72	3.59	1.515	0.221
Learning experience	3.12	3.31	3.19	1.400	0.239

Table 3 ANOVA test results for student types

Personalised learning attribute	Student type (mean ratings)			ANOVA stats.	
	Domestic (N=80)	International (N=28)	Total	F stat.	Sig.
Personally relevant	3.56	3.46	3.54	0.292	0.590
Flexibility	3.78	3.64	3.74	0.615	0.434
Build on prior knowledge	3.73	3.79	3.74	0.148	0.701
Engagement	3.64	3.64	3.64	0.001	0.975
Collaboration	3.73	3.71	3.72	0.004	0.952

Table 3 continued

Personalised learning attribute	Student type (mean ratings)			ANOVA stats.	
	Domestic (N=80)	International (N=28)	Total	F stat.	Sig.
Capitalise digital competencies	3.64	3.57	3.62	0.135	0.715
Harnessing internet resources	3.65	3.61	3.63	0.069	0.794
Self-managed learning	3.81	3.68	3.78	0.754	0.387
Progressive feedback	3.56	3.68	3.59	0.437	0.510
Learning experience	3.18	3.21	3.19	0.048	0.826

Table 4 ANOVA test results for work situation of student

Personalised learning attribute	Working situation of student (mean ratings)					ANOVA stats.	
	Fulltime N=12	Part-time N=38	Casual N=37	No work N=21	Total	F stat.	Sig.
Personally relevant	3.50	3.55	3.49	3.62	3.54	0.125	0.945
Flexibility	3.67	3.66	3.78	3.86	3.74	0.380	0.768
Build on prior knowledge	3.75	3.63	3.78	3.86	3.74	0.519	0.670
Engagement	3.58	3.47	3.70	3.86	3.64	1.230	0.302
Collaboration	3.67	3.55	3.86	3.81	3.72	1.047	0.375
Capitalise digital competencies	3.42	3.61	3.68	3.67	3.62	0.326	0.807
Harnessing internet resources	3.42	3.68	3.59	3.76	3.64	0.636	0.594
Self-managed learning	3.75	3.76	3.78	3.81	3.78	0.026	0.994
Progressive feedback	3.25	3.55	3.62	3.81	3.59	1.315	0.273
Learning experience	3.00	3.13	3.19	3.38	3.19	0.667	0.574

There is a similar understanding among academics about the work situation of students and its impact on their academic performance. One belief is that most domestic students work in the industry full-time or part-time whereas international students do not work or work part-time. As a result, international students have more time to attend to assignments, particularly to a different type of assignment like this. However, Tables 3 and 4 show that there are no significant differences in learning with the new assignment across student types. In other words, the assignment was not adding further burden or study load to working students.

In assignments that use high levels of digital resources, it can be expected that students who have a high level of experience or exposure to online digital resources and applications in other dimensions of their life would find the assignment and learning easier. However, Table 5 shows that the assignment did not disadvantage students who had little prior experience with online digital resources and applications.

Table 5 ANOVA test results for digital experience of student

Personalised learning attribute	Using media resources other purposes (mean ratings)						ANOVA stats.	
	Hardly N=20	Occasionally N=25	Sometime N=13	Often N=35	Always N=15	Total N=108	F stat.	Sig.
Personally relevant	3.70	3.64	3.54	3.37	3.53	3.54	0.636	0.638
Flexibility	3.85	3.76	4.00	3.46	4.00	3.74	2.203	0.074
Build on prior knowledge	3.85	3.64	3.77	3.60	4.07	3.74	1.383	0.245
Engagement	3.70	3.72	3.77	3.60	3.40	3.64	0.555	0.696
Collaboration	3.85	3.68	3.77	3.63	3.80	3.72	0.298	0.879
Capitalise digital competencies	3.45	3.76	3.54	3.63	3.67	3.62	0.436	0.782
Harnessing internet resources	3.55	3.84	3.69	3.49	3.73	3.64	0.981	0.422
Self-managed learning	3.85	3.84	3.85	3.66	3.80	3.78	0.386	0.818
Progressive feedback	3.70	3.64	3.77	3.43	3.60	3.59	0.634	0.294
Learning experience	3.30	3.36	3.38	3.00	3.00	3.19	0.073	0.990

CRITICAL ASPECTS FOR IMPROVED STUDENT LEARNING EXPERIENCE

A regression analysis was performed to investigate the degree of influence by each of the variables identified as key characteristics of personalised learning by the framework; i.e. personally relevant/interesting, flexibility, building on prior knowledge, engagement, collaboration, capitalise on digital competencies, harnessing Internet resources, self-managed learning and progressive feedback, on personalised learning experience. Tables 6 to 8 illustrate the results. Table 6 explains the overall regression model fit. As explained by the value of R^2, 62.5% of the outcome is predictable by the independent variables, which suggests a reasonably good model fit. Table 8 explains the model that predicts learning experience with the digiExplanation based assignment. Any predictor variable that yields a p-value of smaller than 0.05 is significant for the prediction model. Hence, only four independent variables are statistically significant for the model, which are: personally relevant/interesting, engagement, harnessing internet resources and progressive feedback. The findings are beneficial whereby insights can be drawn that assessment designs that aim to drive personalised learning should consider these four factors very significantly.

Table 6 Overall model fit

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.791[a]	.625	.590	.519

a. Predictors: (Constant), Progressive Feedback, Self-managed Learning, Capitalise on Digital Competencies , Collaboration, Build on Knowledge, Personally Interesting/Relevant, Engagement, Flexibility, Harnessing Internet Resource

Table 7 ANOVA table

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	43.928	9	4.881	18.140	.000[b]
	Residual	26.368	98	.269		
	Total	70.296	107			

a. Dependent Variable: Learning Experience
b. Predictors: (Constant), Progressive Feedback, Self-managed Learning, Capitalise on Digital Competencies, Collaboration, Build on Knowledge, Personally Interesting/Relevant, Engagement, Flexibility, Harnessing Internet Resource

Table 8 Parameter estimates

Coefficients[a]						
Model B		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		Std. Error	Beta			
1	(Constant)	-.539	.361		-1.493	.139
	Personally Interesting/Relevant	.172	.079	.175	2.164	.033
	Flexibility	-.041	.099	-.038	-.411	.682
	Build on Knowledge	.027	.098	.024	.276	.783
	Engagement	.315	.095	.303	3.327	.001
	Collaboration	.005	.089	.005	.053	.958
	Capitalise on Digital Competencies	-.032	.070	-.032	-.455	.650
	Harnessing Internet Resource	.312	.106	.286	2.952	.004
	Self-managed Learning	.039	.092	.034	.428	.669
	Progressive Feedback	.233	.093	.229	2.489	.015

a. Dependent Variable: Learning Experience

Challenges faced and lessons learnt

The introduction of the new assessment model resulted in a good degree of personalised learning experience for the students and positive feedback for the educators. However, two significant challenges had to be overcome for a successful implementation, as expounded on below.

EXTRA EFFORTS FROM THE EDUCATOR

Developing the digiExplanation approach demanded more pedagogical inputs, time and efforts from the authors than that of traditional assessments. A significantly challenging task was to create a model digiExplanation submission. Numerous examples and previous submissions existed for traditional models of assignments, but a single past example of digiExplanation assignment related to construction. Hence, the authors had to produce one example, using the whiteboard animation technique (e.g. VideoScribe), which consumed much effort and time and was also an uncommon practice. Nonetheless, the process of creating the digiExplanation made the authors realise the possible challenges that the students may face in the assignment and thereby enabled them to produce a more pragmatic assessment task that the students would enjoy doing.

NEGATIVE ATTITUDES OF STUDENTS

This form of assignment demanded significant engagements, efforts and collaborations from students throughout the learning process. Even though students realised the long-term benefits presented by the new model, some posed a negative attitude towards it due to the above factor. In this particular course, the negative feeling was reinforced as the assignment submission date coincided with submissions for other courses. Hence, it will be worthwhile planning the submission time away from other subjects or the usual busy periods to minimise such negative perceptions from students.

Conclusion and recommendations

Personalising learning is regarded as an essential direction for attaining academic excellence and higher rankings for universities. The implementation of this agenda entails a well-thought-out framework that allows effective transformation of traditional pedagogical practices and institutional set ups. Utilising advanced and apt ICT strategies and technologies to support flexibility and personal choices in learning, offering lifelong learning competencies, learning networks, and assessment-based learning, are core ingredients for personalising learning for students. Identifying and leveraging right ICT strategies and technologies to satisfy the expected learning outcomes may be a challenge for lecturers. This research has demonstrated how a digiExplanation-driven assessment was utilised to personalise learning in a large class of less-experienced, first year students. It was found that students perceive learning tasks that embody three features better support personalised learning, which are: harnessing resources that already exist on the Internet, high engagement in learning and with other students, and receiving progressive feedback for improvement. On the flipside, learning tasks that are excessively technically challenging and demand more work or hours than traditional tasks may not be received positively by some students though they may be effective pedagogical strategies. Lecturers should take some precautionary steps in order to reap the full benefits of this new assessment model. They should show some exemplary submission(s) to students, even if it involves them creating one, and plan the final submission date away from the busy period in the academic calendar.

Some significant life-long learning and digital literacy skills were learnt by students in this assignment. These include sourcing digital media for a construction related issue, learning construction process knowledge from YouTube clips and researching for information. These are essential for construction professionals to keep them abreast of new knowledge all the time. Moreover, learning the skills of communicating through video media would nurture the

students to be good communicators. Hence, it is recommended that lecturers consider the adoption of similar approaches in their subjects to facilitate not only personalised learning but also for nurturing life-long learning and effective communication skills.

Whilst the case study approach that experimented with the new assessment model enabled a detailed investigation, the findings cannot be generalised to other disciplines or subjects. It may work better or worse in other cases, depending on the type of subject or knowledge taught. This inability to generalise findings may be regarded as a limitation of this research. Nonetheless, the case study can be considered as a past example to draw valuable insights for other lecturers. Further experiments may be conducted in other subjects in construction education. Moreover, the study has experimented with only a single combination (pedagogy 2.0 with assessment for learning) from the framework proposed in the paper and has demonstrated its soundness. Further studies may be conducted to test other combinations from the framework.

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Appendix: Questionnaire

A) Background information

Please provide background details in this section.

1. Your study stage: ☐ 1st year ☐ 2nd year ☐ 3rd year ☐ 4th year
2. You are a: ☐ Local student ☐ International student
3. You are a: ☐ Fulltime student ☐ Part time student
4. Your first language is: ☐ English ☐ Other
5. What is your work circumstance?
   ☐ Work fulltime ☐ Work part time ☐ Work casually ☐ Do not work
6. How often do you use digital media resources available on the Internet for work, studies, hobbies and other purposes?
   ☐ Hardly ever ☐ Occasionally ☐ Sometimes ☐ Frequently ☐ Almost always
7. What is your recent/most held job title in the construction industry? _____
8. What is the length of your work experience in the construction industry (in months)?
   ☐ No experience ☐ Less than 12 months ☐ 12 to 24 months ☐ 25 to 36 months
   ☐ 37 to 48 months ☐ More than 48 months

B) About the DigiExplanation Assignment

Please provide your feedback on the DigiExplanation approach to assignment via the questions below.

1. The digiExplanation assignment allowed you to explore and learn a topic that is *personally interesting / relevant* to you.
   ☐ Strongly disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly agree
2. The digiExplanation assignment provided you with the *flexibility* to present your work/ ideas in a way you like.
   ☐ Strongly disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly agree
3. The digiExplanation assignment enabled you to *build on your previous knowledge* on the subject.
   ☐ Strongly disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly agree
4. The digiExplanation assignment nurtured *engaged learning*.
   ☐ Strongly disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly agree

5. The digiExplanation assignment facilitated *collaborative knowledge building*.

☐ Strongly disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly agree

6. The digiExplanation assignment enabled you to *capitalise on digital competencies that you already possessed.*

☐ Strongly disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly agree

7. The digiExplanation assessment fostered authentic learning that is personally meaningful to you by *harnessing resources that exist on the Internet*.

☐ Strongly disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly agree

8. The digiExplanation assessment encouraged *self-managed learning* of new knowledge.

☐ Strongly disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly agree

9. The *progressive feedback mechanism* built into the digiExplanation assignment supported you to realise your potentials.

☐ Strongly disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly agree

C) About your learning experience

1. Overall, how would you rate your *learning experience* with the digiExplanation assignment in the course?

☐ Poor ☐ Average ☐ Good ☐ Very good ☐ Excellent

2. You would like to see digiExplanation assignments implemented in other courses too.

☐ Strongly disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly agree

3. What are the best features of this approach to university learning?

4. How may this approach be improved to further enhance student learning experience?

End of questionnaire

Thank You Very Much for Your Participation!