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Near Peers: Harnessing the Power of the Populous to Enhance the Learning Environment

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Abstract

NearPod is a multiplatform e-learning tool that allows students to engage with each other and the lecturer in real time, independent of learning space size or type. This research investigated the impact of NearPod use in two different third level educational settings. The rationale was the practical implementation of key trends in higher education, and enhancing the student learning experience, through the integration of BYOD (Bring Your Own Device) and flipped classroom learning. One aim of this project was to identify if NearPod, could address these trends in a simple, cost effective way. Secondly, the research sought to investigate if embedding engaging technology into the learning environment could enhance the student learning experience and create a truly interactive environment.

The impact of NearPod as an interactive learning tool was evaluated in terms of student interaction, engagement and participation through NearPod facilitated synchronous learning activities. Evaluative data were collected in several forms; anonymous questionnaires, academic facilitated discussion fora with purposefully sampled students and a staff reflective diary. The data were qualitatively and quantitatively analysed, leading to a triangulated data set ensuring only valid themes emerged. Overall, the students perceived use of the technology, and the academic's personal reflective writings, suggested that the learning environment evolved towards a student-orientated, interactive space where the students took ownership for their participation in the learning activity. Students became responsible for constructing their learning 'product'; created by the students, for the students and, hence, their learning overall.

1. Introduction

Interactive teaching methodologies are synonymous with an interactive, student-centred, learning environment in which interactions, typically peer-peer or peer-teacher, help to create knowledge and understanding. Interactive teaching methodologies encourage student participation to be at a high level of autonomy. Riley and Myers (2014) proposed that interactive teaching, and associated methodologies, are encouraged in a learning environment where students' contributions are encouraged, expected and extended to others. Additionally,

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they suggested that students' participation should be at a higher level of autonomy, beyond the traditional initiation-response-feedback approach. In this approach to teaching, student engagement is central to the learning process, but extends beyond the typical constructivist learning paradigm. Active learning carried out in a constructivist learning environment may appear similar to interactive learning. However, there is a clear difference between active learning, constructive learning and interactive learning, as outlined in Table One.

Table One: Learning approach synopsis comparing active, constructive and interactive teaching approaches. Adapted from Chi (2009).

Learning approach	Typical actions
Passive Learning	Learners are not required to partake or engage with the learning event. Content is delivered didactically.
Active Learning	Engage the learners' attention by focusing upon key aspects of the learning material, repeating the material, or manually manipulating the learning material provided.
Constructive Learning	Requires learners to produce some outputs, which may result in new ideas, such as in self-explaining, drawing a concept map or inducing hypotheses and reflecting.
Interactive Learning	Learners participate in two kinds of dialogue patterns Discussion with experts; for example with the teacher (termed instructional dialogues) Discussion with peers, for example classmates (termed joint dialogues).

The use of active, constructive and interactive teaching do not have to be mutually exclusive. Chi (2009) suggests a hierarchical, and symbiotic, approach to learning in an 'active' classroom. She suggests that active learning is more engaging than passive learning, that constructive learning is more likely to generate new understanding than active learning and that interactive learning is more likely to develop substantive, new understanding compared to constructive learning alone. The participation in specific dialogue patterns is the basis of interactive teaching and learning. Hybridisation of the two main dialogues patterns can be pedagogically powerful. For example, teacher-student based interactions can follow a guided-construction approach whereby a student is asked to revise an essay based on constructive feedback. For peer-peer interactions, learners can participate in co-construction learning activities whereby students critically analyse a peer's contribution. Step-wise incorporation of active, constructive and interactive approaches will, therefore, guide students to a deeper understanding. An example of how this hierarchical approach can be applied to a typical student centered classroom is outlined in Figure One.

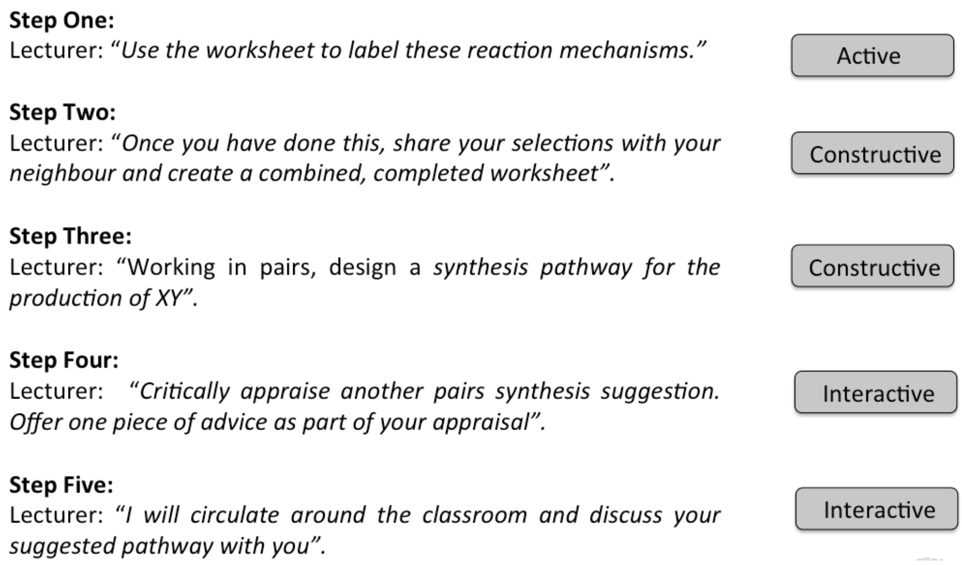

Figure 1: An example of a modelled hierarchical teaching philosophy to progressively promote a learning event from an active approach, through constructive, to an interactive approach. This modelled example is based on a typical first year foundation organic chemistry topic; organic reaction mechanisms and synthesis.

Achieving an interactive classroom in large, higher education, lecture theatres can be challenging where, typically, both student-student and student-teacher interactions tend to decrease as student numbers increase (Hornsby & Osman, 2014). One approach to increasing, and enhancing, meaningful interactive dialogues in large class settings is to embed technology enabled interactions (Tlhoaele, et al., 2014). Beauchamp and Kennewell's (2009) *Interactive Teaching with Technology* paradigm provides an adaptable approach to quantifying the level of interactivity offered by the use of a given technology. In this model interactions, supported by technology, are classified across four levels, as outlined in Table Two.

Table Two: Classification, and comparison, of the different levels of teaching enabled by technology with relevant technologies and sample case studies provided. Adapted from Beauchamp and Kennewell (2010).

Classification	**Characteristics**	**Sample Technology**	**Reference**
Authoritative	The primary opinion supporting student understanding is that of the academic; there is little or no student discussion or contribution.	Slideshow presentation	DiPiro (2009)
Dialectic	Student contribution is encouraged; however, the interactions are focussed on resolving student misconception and is academic facilitated.	Personal Reseponse System (e.g. Clickers)	Barbour (2013)
Dialogic	Sustained and in-depth use of discursive interactions	Interactive Presentation	Simpson & Walsh (2014)

	between students and academic resulting in purposeful outputs, from different perspectives, that develop student understanding.	Software (e.g. Nearpod)	
Synergistic	Contextualised, open ended problems act as triggers that allow students and the academic of develop new knowledge.	Interactive White Boards	Van Laer, Beauchamp, & Colpaert (2014)

A technology-enabled approach, married with a judicial pedagogical underpinning, can result in a large interactive classroom whilst simultaneously aligning to emerging educational trends. A recent NMC Horizon Report (Johnson et al., 2015) cites that the higher education adoption of BYOD (Bring Your Own Device) and flipped classroom learning is imminent; however, practical implementation of these strategies remains unclear, particularly in the context of large class teaching. This research aims to investigate, at a practical level, if the use of an interactive presentation technology, *NearPod*, can address these two key trends in a simple, cost effective way. Furthermore, the investigation queries if integrating this technology can assist current challenges facing many Further and Higher Education institutes; specifically improving enhancing the student learning experience. From a learner's perspective, embedding engaging technology into the learning environment was hypothesised to enhance the learning experience. Technology enhanced learning, aligned to a flipped classroom pedagogy has many benefits including allowing the academic to adapt learning activities to the specific learner's style, pace and learning needs (Hwang, Lai, & Wang, 2015), resulting in a student-orientated learning environment where the student(s) take ownership for their participation in the learning activity, and subsequently, their knowledge development. As such, the research question that structured the research described here was:

> *Can embedding an interactive presentation technology, NearPod, into the learning environment enhance in-class interactivity and the overall student learning experience in large STEM lectures?*

2. Methods

The research question limited the research boundary to a specific case and as such the methodology employed was an intrinsic case study (Noor, 2008). In line with best practice, the participants were protected following the guidelines of the Dublin Institute of Technology Research Ethics Committee (DIT, 2017) according to ethical approval (Ref: 65/10). These guidelines include the core principles of ethics in research: voluntarily participation, fully informed consent, ability to withdraw, anonymity, do no harm to the participant or researcher, privacy, confidentiality and data storage. The data collected took several forms; an anonymous, online multiple choice questionnaire (n=30 year one cohort equating to a 22% participation rate and n=41 year two cohort equating to a 38% participation rate), an independent academic facilitated discussion forum (n=1) after the students completed their relevant module, an anonymous standard institute module review form (n=53 year one cohort and n= 48 year two cohort), and a personal reflective researcher diary (n=1).

The study participants comprised a mixed (Level 6 and 8) first year foundation organic chemistry cohort (n= 136) and a Level 8 only, second year introductory biochemistry group (n=109). All data were collected once the students had completed their modules, with the exception of the reflective diary, which was recorded by the researcher on an on-going basis. The reflective diary recorded 'informal' discussions with students, personal researcher observations and comments. Students were asked for consent to allow the researcher to record any interesting or relevant point raised during an informal discussion.

Quantitative data were manipulated with basic mathematical functions in *Microsoft Excel* and used to produce graphical outputs. Qualitative data were coded onto several key themes and sub-themes based on researcher interpretation influenced by Strauss and Corbin's (1990) Method of Constant Comparison and Braun and Clarke's (2006) Six Step Approach to Data Analysis. Data saturation was observed, as per the qualitative coding method employed. Data triangulation was utilised to ensure only valid themes were investigated and that the examples and findings are based on feedback from as broad a student base as possible (Jick, 1979).

2.1 Limitations and Bias

In this study, the researcher adopted the role of an 'insider-researcher', based on his role as both the academic and researcher. This power relationship with the participants could lead to researcher bias and skewed data. Appropriate methodology, leading to data triangulation, was used to circumvent this bias, with the benefit of the insider-researcher role deemed an advantage to this research (Chavez, 2008). One of the major limitations of this study is the relatively low response rate and corresponding population sample that formed the basis of this research. Data were collected from two class cohorts from one School, within a single higher education institution. Additionally, participants self-selected for the questionnaire component and, in all data collection methods, volunteered to take part. This may have resulted in a bias toward strongly engaged or dis-engaged participants.

3. Findings and Discussion

Data analysis was carried out interrogating the data based on the research question and four key, dominant, themes emerged, namely; impact on interactivity, impact of technology, impact on learning, and impact on student ownership.

3.1 Impact on Interactivity

All participants, in the questionnaire and discussion forum, described interactivity as the key benefits of a NearPod enabled class. The participants did not explicitly note their interactions as either instructional or joint dialogues, as defined by Chi (2009); however, the examples they provided mapped onto both of these interactive dialogue patterns. Students commented on how the interactions felt "*real*", "*worthwhile*" and allowed them to connect, on a meaningful level, with their peers and the academic.

> "*It felt like a one-to-one tutorial class*" (UG_02_Yr1)

The design of the NearPod enabled classes in this research were strongly informed by both Chi (2009) and Beauchamp and Kennewell's (2009) classification of interactive approaches to technology informed teaching. The level of interactivity observed in class, and noted in the researchers reflective diary, could not have taken place without the use of technology. Quite simply, the large class size would not have allowed meaningful instructional and joint dialogues to take place unsupported. However, the introduction of technology to the class did, at times, inhibit interaction. Students noted that they struggled to stay on task during some activities and the ease of access to their smart device, coupled with ability browse the internet, proved too tempting a distraction in some cases. Student distraction is a commonly noted problem in the technology-enabled classrooms (Goundar, 2014); however, recent research attempts to identify ways to circumnaviagte this perpetual problem (Chen, 2016).

3.2 Impact of Technology

Unsurprisingly the role technology played in their in-class activities dominated the student evaluation and the participants had both positive and negative perceptions and outcomes from the use of technology in the lecture hall. The vast majority (>90%) of all questionnaire respondents and all the participants of the discussion forum noted the ease of use of the technology. They appreciated the seamless connectivity between the different devices (smart phone, tablet and laptop) and the ability to digitally record their interactions, with peers and the academic. All individual student activities were recorded and could be securely saved to the students *Google Drive*; and those that participated in the questionnaire and discussion forum noted that this added value to the class notes as they created their own version of the notes through the structured, interactive activities. This was also observed as a positive for the academic, as an overall class engagement file (as a *.pdf*, with each students engagement, collated by activity) could be downloaded and reviewed after class. This review process allowed the academic to prepare for the next class with Beauchamp and Kennewell's (2009) classification in mind; for example, to identify areas of misconception (i.e. dialectic teaching) or student generated ideas worth exploring (i.e. synergistic teaching).

Both cohorts cited the limitations of the wifi network as a major to widespread and continued usage. These limitations were both hardware (i.e. capacity of the wifi router) and student related (i.e. ability of students to log on to the EduRoam network, particularly the first year cohort). Students were not willing to use their own 3G/4G data plans on a regular basis for in-class activities. The availability and capability of wifi networks is a known limitation for technology enhanced classrooms (Riyukta, Anker & Nortcliffe, 2016); however, an unexpected additional limitation was the effect of extended use of NearPod on the battery life of smart devices and laptops and this mirrors previous research exploring barriers to student use of polling software on smart phones (Warnich & Gordon, 2015). The teaching spaces where this research was carried out did not have charging points accessible to the students, and this resulted in students not engaging with all activities to 'save their battery'.

3.3 Impact on Learning

The majority of questionnaire participants, from both cohorts, suggested that a NearPod enabled class was the most interactive class in comparison to a traditional (non-technology enhanced) class or a blended (mix of traditional and technology enhanced) class, see Figure 2. A difference between the two cohorts is noted in the decrease between Years 1 and 2 who perceived a blended learning model to be the most interactive. Interestingly, the Year 2 cohort also indicated a stronger perceived positive impact of a NearPod enabled class (78%, n=32; compared with the Year One cohort 47%, n=14; see Figure Three). This data suggests that the Year 2 cohort felt a stronger perceived benefit from the NearPod class; however, additional factors, such as the cohort type (Year Two cohort were Level 8 students only), content of the curriculum (Year Two curriculum was a traditionally popular *Introductory Biochemistry* module) and the personal development of the student in terms of maturity and awareness of their role in learning should also be considered.

The flipped classroom approach was adopted in the NearPod classes that underpinned this research, and was supported by the pervasive use of technology. This aligned to Strayer's (p.172, 2012) position that "*regular and systematic use of interactive technology*" enables technology enabled flipped classes to empower students to deeper levels of understanding and knowledge development, more so than more traditional, non-technology enhanced classes. Although the Year One students in this study had experienced traditional flipped classes; they may not have yet developed the maturity and skill set to become independent learners in comparison to the more experience Year Two cohort, resulting in a differing perceived impact on learning. This echoes previous research, which outlines how early year undergraduate students can initially struggle with flipped classroom learning, but with experience develop the skills set and maturity required to learn effectively under that teaching paradigm (Mason, Shuman, & Cook, 2013). Additionally, perhaps the Year One cohorts' larger perceived benefit of a blended approach (30%, n= 9; versus 5%, n=2 for Yr2; see Figure Two) reflects the transitional nature of the first year group recently exposed to technology enhanced learning.

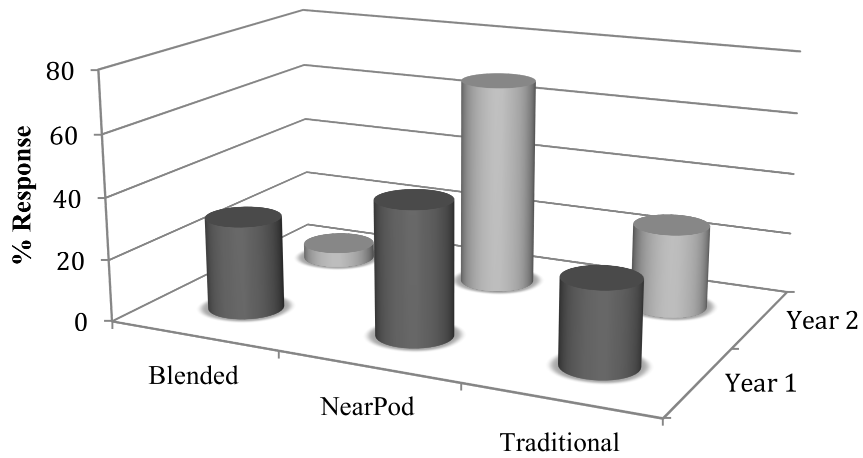

Figure 2: Comparative chart depicting the perceived most interactive class. Year one cohort (n=30), Year Two cohort (n=41); Trad = Traditional non-technology enhanced class.

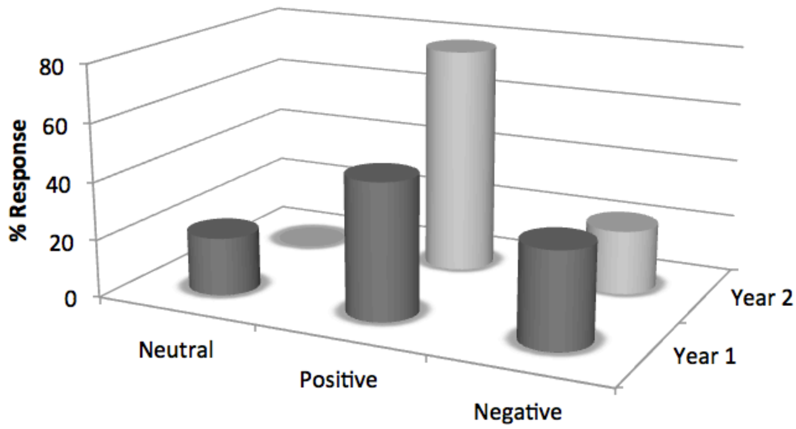

Figure 3: Comparative chart depicting the perceived impact (neutral, positive or negative) on learning in a NearPod class. Year one cohort (n=30), Year Two cohort (n=41).

3.4 Impact on Student Responsibility

A comparative emergent trend was the perceived impact on student responsibility for their own learning. Again, two opposing categories were observed here; students that saw NearPod as empowering them to learn and those that questioned the role of the academic in the flipped classroom. The majority of participants (>70%) students felt enabled not only by the flipped classroom approach but also by the inclusion appropriate technology.

> *"I'm more interactive in a NearPod class; it requires me to pay attention, think, answer and discuss the questions"* (UG_11_Yr1)

> *"Forces you to engage with the lecture material, the lecturer and classmates"* (UG_27_Yr2)

A re-occurring theme was the sense that the technology placed the student at the centre of the class and gave them a voice, even within large lecture theatres. This sense of student creative freedom, voice, ownership and belonging has also been described in similar flipped classroom research (Al-Zahrani, 2015 and Baytiyeh & Baytiyeh, 2017).

> *"I felt my input was important to the class*" (UG_41_Yr2)

> *"Allows for creativity and a student voice"* (UG_09_Yr1)

Additionally, some common issues noted by students with the flipped classroom were also observed in this study; specifically the desire for exam-focussed learning. This is perhaps a hangover from the traditional approach to teaching and assessment that these students have become accustomed to, particularly in secondary school.

> *"It would be more helpful if* [the academic] *continued to teach as previous – cause* [sic] *that was actually helpful in preparing for our exams".* (UG_36_Yr2)

Indeed, one student comment succinctly summarises some students' struggles with their (inter)active role in flipped class learning and taking responsibility for their own learning:

> *"The lecturer asked us to work on questions on topics we were supposed to teach ourselves. I only learned and understood them when I sat down and studied the notes myself before class".* (UG_12_Yr1)

4. Conclusion

Centralising the student is critical in the learning and knowledge creation process, particularly in large undergraduate classes. Engaging students in an interactive learning environment, in large lecture theatre can be difficult and requires judicious curriculum and pedagogical design. In this intrinsic case study it was demonstrated that interactive teaching can be achieved in large classroom environments; enabled and facilitated by technology and underpinned by an appropriate pedagogy. While not the panacea for all large class-teaching issues, it does offer an alternative approach to engage students in meaningful dialogue and can result in an enhanced learning experience. In this research, an interactive presentation software was evaluated as having a positive impact on the student learning environment and promoted self-responsibility and ownership within the case study cohort.

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