An approach to reinforce active learning in higher education for IT students

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ABSTRACT: In this article, the authors present the findings of introducing interactive learning in higher education. The study was conducted on first-year undergraduate students of information technology in the United Arab Emirates (UAE). One of this study's primary goals was to change the lecture-based classes of introductory courses from rote learning to interactive learning mode. Another goal was to verify the impact of interactive learning on improving higher education students' motivation and engagement in the learning process. Finally, this study tested the role of Nearpod as a tool for interactive learning. Because Nearpod can be integrated with Zoom, it facilitated on-line learning during the Covid-19 pandemic. Students' response to the new teaching style was measured through a quantitative research method. A questionnaire was prepared for this purpose and distributed to the students through Google forms. The results of the questionnaire showed a high level of students' satisfaction towards the learning method. They also responded positively to using Nearpod as a tool for interactive learning, and they recommended that it be used in all their courses.

Keywords: Interactive learning, higher education, student-centred learning, Nearpod

INTRODUCTION

There is a significant shift in teaching paradigms in modern learning experiences to support student-centred learning. Students with all their needs and skill levels have to be involved in the instructional journey for better achievement on the academic level. In the student-centred approach, the instructor acts as the mediator for knowledge perceived by the student. Studies, such as by Radzali et al show the effect of student-centred learning on the level of achievements of the students [1].

The 21st Century has marked a revolution of digital transformation that shaped the learner's personal and academic life. Every student is involved in technology and has at least one smart device that is being used daily. Hence, it is impossible to imagine a classroom that ignores technology. Students have to be actively engaged and involved in their learning experience to meet the digital era competencies [2].

The rapid increase in the usage of interactive technology within the early years of education has led to a new generation of students entering university. There is now a greater reliance on visual imagery and active participation in the learning process [3].

Using interactive technology within teaching has been demonstrated to encourage students' engagement by facilitating constructivist approaches for promoting an active learning environment [4]. Besides, student feedback reports very favourably on technology integration, suggesting it increases their comprehension and retention of learning material, while also enhancing student satisfaction. Moreover, the Covid-19 pandemic forced all educational institutions to shift on-line. This shift demanded tuning in the teaching strategies to fit the new virtual environment. The teacher has to make an extra effort to attract students to the on-line class and keep them engaged. Thus, there is a call for new on-line tools to be used. Nearpod is one of these tools.

In the UAE, where this study was conducted, higher education institutions are actively adopting e-learning strategies and tools within their curricula. This new wave of integrated IT systems in education has directly reflected on these institutions' instructional procedures. As noted by the Minister of Education, Hussain Ibrahim Al Hammadi, the UAE continues to keep pace with the global technical education integration in higher education through advanced smart learning and services to fulfil the UAE 2021 Vision Plan [5].

To develop students' learning experiences, instructors started updating their learning environment that requires each student to be equipped with digital devices. Therefore, students are requested to have their own digital devices for learning purposes during the classroom session. It is significant to note that in many other research studies, students' digital devices, mainly iPads and laptops, were actively used in their daily learning session regardless of the major [6].

Undoubtedly, integrating the science, technology, engineering, arts and mathematics (STEAM) approach in education is becoming the new norm. STEAM enables learners to invest in their inquiry-based learning, and it also guides them to boost their critical thinking mindset for lifelong learning. In his study, Fang presented the correlation between students' motivated strategies in an engineering dynamics course [7]. Seventy-one students participated in the research. The findings showed that the students' academic and performance achievement is attributed to cognitive factors.

Nikou and Economides stated that the findings of numerous research studies targeted the usefulness and effectiveness of digital learning, mobile learning more specifically, where it is an inevitable achievement to increase student motivation, engagement and performance [8].

Chatwattana focused her research on the concepts of an interactive, adaptive learning system architecture design in an active learning environment [9]. The research study goal was to synthesise an architecture from the five steps of creative problem solving combined with a cloud learning ecosystem [9].

According to Dutta et al, there is an opportunity of integrating virtual curricula situated on-line, with the aspect of distance learning to reach the stage of teaching and learning without borders [10]. Their report also stresses that implementing information and communication technology approaches in education will enable millions of individuals to embrace independent learning and, thus, at a later stage, contribute to the economy. Various learner needs are supported by mobile technology's innovative functions, which makes it possible to personalise individual learning experiences and engage users in the learning environment [10].

Nearpod is a free application that can be downloaded onto all interactive devices (laptop, tablet or smartphone) or opened in a Web browser on a desktop computer. This interactive learning tool facilitates a creative yet simple way to compile and incorporate multimedia, share interactive lessons, and assess learning in real-time, enabling quick, personalised feedback for students. It generates reports about the student activities within the class instruction allowing instructors to interpret their learning development.

Shehata et al aimed at investigating the instructor's approach to using Nearpod in their course instruction and how it affected students' motivation in learning [11]. Their findings collected through surveys and focus groups showed that using Nearpod improved students' motivation and engagement in the teaching-learning process with significant positive impact on their overall academic performance. Ali conducted a similar study at Fujairah Higher Colleges of Technology Foundations Programme in the United Arab Emirates [12]. The study explored how instructors and students integrate iPads to develop a pedagogical accessibility to a better constructed classroom environment.

In this study, 14 instructors with 194 students were part of the data collection process following surveys and class observation that tackled six classes. The results showed that easy use of digital technology, in their case iPad, fosters a collaborative learning environment. As a matter of fact, many digital tools facilitate it, and more precisely Nearpod, as stated by McClean and Crowe [13]. The authors stressed that Nearpod acts as a learning resource and content developmental tool that is used across students' digital devices that allow them to actively engage and participate regardless the large size of the class.

Adding to this, this new need for interactive technologies that include the usage of smartphones and other digital devices created and improved interactive discussions that stressed on students' academic performance and achievement [14].

PROBLEM STATEMENT

The problem faced in introductory courses of information technology (IT) major is the vast amount of information and definitions that the student has to acquire every class. Such courses introduce the basic concepts of information technology as a pre-requisite to other courses in the major. The only way to deliver this course is to provide a lecture defining all the concepts in a PowerPoint presentation. However, students are less engaged in such lecture-based classes. Also, such rote learning styles started to prove their inefficiency in learning even with higher education students. In this article, a method to enhance higher education student engagement and reinforce active learning in introductory courses is discussed. The study utilises Nearpod as a tool for interactive learning to engage the students in the lesson without affecting the course content.

CONTRIBUTION

This article contributes to the educational trend of customised interdisciplinary learning fostered by a strategic educational technology ecosystem to be implemented in higher education. When interactive learning is discussed,

the main focus is on schools. However, there is a need to invest in such new teaching techniques in universities. Usually, teaching IT, courses are divided into two parts, theoretical lectures and practical laboratories. Because there is a practical part of the course, the theoretical part is given in a rote-teaching style.

This study shows the need to change the teaching styles for higher education students. The results reveal students' satisfaction towards interactive learning among higher education students. Investing in Nearpod for creating an interactive learning environment is essential as education is shifting to the virtual environment with the Covid-19 pandemic. Nearpod as a tool can be integrated with the Zoom platform, which facilitates interactive on-line learning.

METHODOLOGY

Sample

The study took place at Zayed University in Abu Dhabi, United Arab Emirates. The Centre of Educational Innovation at Zayed University funded the project and provided a gold account to the instructor. A cohort of 120 students, divided equally into five sections, participated in the study. The research was conducted in the Introduction to Information Technology course. This course is a general requirement for all university students. The course consists of definitions that introduce new concepts to the students. Although there is a practical part, the theoretical part is dominant. Hence, there is a student engagement problem that may arise while delivering the material. Hence, this particular course was chosen for the project.

Instructional Planning

The course is composed of nine lessons on different topics. Each unit has a set of PowerPoint presentations, videos and links to other Web sites added, based on the lesson requirements and end-of-lesson worksheets. Because Nearpod allows adding questions between the slides, extra activities are embedded within the lesson slides to separately assess each learning outcome. These activities are used for formative assessment all over the lesson. There are many features in Nearpod that can be used for creating the activities. In this study, matching-pairs, draw-it, quizzes and open-ended questions were used.

The matching-pairs feature is used to revise the key terms of the lesson and their definitions. The teacher prepares the list of key terms and their corresponding definitions, and students can match the possible random tiles. When the answer is correct, the tiles light in green and disappear from the tiles view. Otherwise, the colour is red, and the student can try again.

The draw-it feature is another feature that is used in the lesson. It allows the student to draw or insert a picture or text freely. This feature is mainly used in the Computer Networks lesson to allow students to draw different networks and data flow.

Quizzes feature provides the option to give students multiple-choice and true/false questions. Multiple answer questions are also available. An attractive property of these quizzes is the report generated when students finish doing the quiz. This report shows students' responses with an analysis of each question. Also, students have a page of their answers and whether they are correct or not. In case they answered wrongly, the correct answer is shown to them. Quizzes are mainly used for end-of-chapter worksheets.

The open-ended question feature allows students to write an answer text to a given question freely. During the lesson's brainstorming stage, students can write their thoughts and ideas about the lesson before it starts.

Student Preparation

It is easy to use Nearpod by students. They have previous knowledge that the class will be conducted using Nearpod. Using Nearpod is simple and requires no training for students. They get to use it for the first time. Students can access the lesson on Nearpod through a link posted to them on the learning management system, Blackboard. No prior registration is needed. Once students click the link, Nearpod prompts them to enter their names, and then Nearpod will directly redirect them to the lesson page. Students should bring their own devices, laptop, mobile phone or tablet.

Conducting the Session

Nearpod gives the option to have different modes of lesson delivery. In this study, two modes are invested: live-participation and student-paced. Live-participation mode is a synchronous mode. The teacher controls the lesson from a central device, whereas students can follow up and participate from their own devices. Whatever appears on the teacher's screen will also appear on the student's screen. This mode is the one used in the class during the session. The student-paced mode is used by students when they study at their own pace at home. The student has full control over the lesson. For both modes, lesson links should be shared with students on the University's learning management system, Blackboard.

Feedback

Nearpod allows providing students with immediate feedback. As a question slide comes across the lesson, students are prompted to answer, and the teacher can check the responses. Nearpod provides reports about each student or aggregate student data. Hence, the teacher can instantly check which student needs help. The teacher can share the results of the whole with students. To protect the student's privacy, Nearpod has an option to hide students' names.

Nearpod also provides a feature to generate a post-session report that can be generated at the end of the lesson, so that the teacher can check the whole lesson statistics. This report shows the percentage of students' participation in every activity. It shows whether the student completed an activity or not, the number of tries per student and the number of matches for matching-pairs activity.

For the quizzes, the report shows the answer per student and whether it is correct or not. For every activity, statistics are available in a pie-chart format to show the percentage of students who passed each activity.

An exciting feature that Nearpod also provides is the ability to generate a student report. It shows the student's level of participation in comparison with the overall class level. It also shows students their answers, along with the correct answer if the answer is wrong. This feature can be used by the teacher to follow-up with low achievers. The teacher can check the progress of the student and check the weakness levels.

QUESTIONNAIRE

A questionnaire was used to collect the students' feedback such that the effectiveness of the study could be measured. It is assumed that every student had a smart device and Wi-Fi was available.

The questionnaire was prepared on Google forms. The link to the survey was sent to the students via e-mail. The questionnaire was a mix of free-response questions and Likert-scale questions. The questionnaire was distributed to the students during the last week of the semester.

Along with the questionnaire, a consent form was attached to explain how their data and responses will be used. Besides, it is clear that …*it is OK to say no*, and not to participate in the questionnaire. The survey was anonymous and did not collect any personal data that identifies the student.

RESULTS AND DISCUSSION

Figure presents the students' responses to Likert-scale questions. It consists of options: strongly agree, agree, neutral, disagree and strongly disagree. Table 2 presents the free-response questions along with the answers.
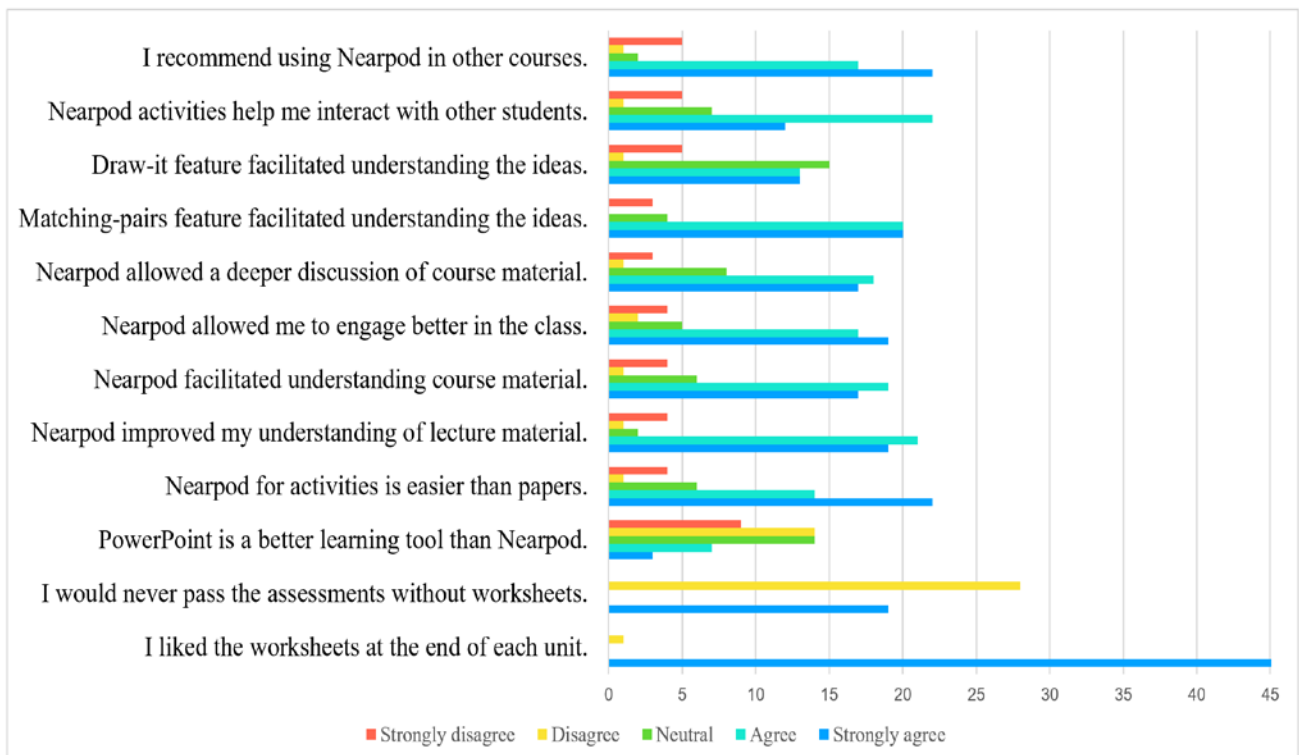

Figure 1: Students' responses to closed-ended questions.

Table 1: Free-response questions in the questionnaire.

Question	Responses
What other activities can be done, so that you get more engaged in the lesson?	• We need an editable version. We cannot take notes on Nearpod lessons. • If Nearpod allows to record the conversation it would be better. We can also have a copy of what the teacher said about each slide. • If Nearpod provides the model answer of the quizzes and exercises on a separate slide, it would help us while studying.
Would you like to add any positive thought about your experience?	• Nearpod is an efficient tool for a better understanding. • I recommend it for other courses because it really helps students to understand and interact more in the class. • The questions embedded in the lesson helped us a lot to understand the ideas.

The results of the students' responses show a degree of relation between their common answers and expectations. Looking for editable versions, recording options, model quizzes and exercises with answers were typical for the first question, referred to as Q1 in Table 1. As for question 2, Q2, some students shared that Nearpod is an efficient tool for a better understanding. They recommend it for other courses because it helps students understand and interact more in the class, stressing that the lesson's questions helped them understand the ideas explained in the course.

Considering the implications of the responses and their relation to the article's focus points in hand, the authors come to analyse deeply each question's contribution to the topic.

When students were asked about the sufficiency of PowerPoint alone as a better learning tool compared to the interactivity of Nearpod, it is noted that 15 respondents had neutral answers and 23 disagreed with the statement, while only 11 agreed that PowerPoint is enough. The results revealed that students show a degree of appreciation and preference for this interactive learning tool over the traditional use of PowerPoint in the instruction.

Another question verified the assumption that using Nearpod for activities was more comfortable than having them printed on paper. Thirty-seven students out of 49 agreed and favoured this integration, with only six students preferring the traditional paper method. When asked about using Nearpod improves their understanding of lecture material, 42 agreed to this fact, with only five who found faults in it.

The research question aimed at exploring whether or not Nearpod helped students understand lecture material. Thirty-seven respondents agreed with merely five who ignored this fact and opposed it. Moreover, when investigating the assumption of Nearpod allowance of better engagement in class, 38 respondents had a positive view with six marginal disagreeableness to this statement. Significantly, when exploring the fact that Nearpod allows a more in-depth discussion of learning material, 37 strongly agreed to this statement, with just four disagreeing with it. Managing to understand the interactivity of Nearpod where students are encouraged to engage with other students to learn, 35 students were optimistic about it, with six respondents who were unable to find pleasure in engaging with others while learning.

Finally, there was a question of whether they recommended using Nearpod in other courses or not. Forty students revealed a firm decision toward having Nearpod used in other course material instructions.

CONCLUSION AND FUTURE WORK

The present study goal was to identify students' satisfaction towards using Nearpod as a tool for interactive learning in higher education. The responses were collected through an on-line questionnaire. Analysis of students' responses shows their interest in using on-line learning tools in the class. The results prove the necessity to change teaching styles in higher education to be more interactive and increase students' engagement in the lesson. Nearpod was a successful tool for this goal because of its various features that facilitate lesson discussions, student feedback and formative activities.

With the current trend of shifting face-to-face education to virtual mode, especially during the Covid-19 period, Nearpod can be invested in to make sure that students participate in the lesson by checking their response rates through the reports feature.

As future work, there is a plan to use Nearpod in other courses, such as cybersecurity and programming courses to compare students' level of engagement between different courses and different teaching styles. Besides, Nearpod is a suitable environment for applying the flipped classroom. Ready-to-use lessons are available on Nearpod to be used for the flipped classroom. This experience will be integrated as well in the course to measure its efficiency for higher education students. Furthermore, Nearpod allows students to work on collaborative projects. There is a collaborate feature that allows students to input their ideas to be viewed by the teacher or other group members. This feature will be used in the course project, especially when the teacher has to monitor each group's progress.

REFERENCES

1. Radzali, U.S., Mohd-Yusof, K. and Phang, F.A., Changing the conception of teaching from teacher-centred to student-centred learning among engineering lecturers. *Global J. of Engng. Educ*., 20, **2**, 120-126 (2018).
2. Sriratanaviriyakul, N. and El-Den, J., Pedagogical discussion cases in higher education: the role of knowledge sharing in students' learning. *Procedia Computer Science*, 161, 215-225 (2019).
3. Black, B., Heatwole, H. and Meeks, H., Using multimedia in interactive learning objects to meet emerging academic challenges. *Learning Objects: Theory, Praxis, Issues and Trends*, 209-257 (2007).
4. Sternberger, C.S., Interactive learning environment: engaging students using clickers. *Nursing education perspectives*, 33, **2**, 121-124 (2012).
5. Gitsaki, C., Robby, M.A., Priest, T., Hamdan, K. and Ben-Chabane, Y., A research agenda for the UAE iPad initiative. *Learning and Teaching in Higher Educ.: Gulf Perspectives*, 10, **2** (2013).
6. Kay, R. and Schellenberg, D., Comparing BYOD and one-to-one laptop programs in secondary school classrooms: a review of the literature. *Proc. Society for Infor. Technol. & Teacher Educ. Inter. Conf.*, 1862-1866 (2019).
7. Fang, N., Correlation between students' motivated strategies for learning and academic achievement in an engineering dynamics course. *Global J. of Engng. Educ*., 16, **1**, 6-12 (2014).
8. Nikou, S.A. and Economides, A.A., Mobile-based assessment: a literature review of publications in major referred journals from 2009 to 2018. *Computers & Educ.*, 125, 101-119 (2019).
9. Chatwattana, P., Concepts of an interactive adaptive learning system architecture design in an active learning environment through a cloud learning ecosystem. *Global J. of Engng. Educ.*, 20, **3**, 181-189 (2018).
10. Dutta, S., Geiger, T. and Lanvin, B., Global Information Technology Report 2015 (2021), 28 December 2020, https://www.weforum.org/reports/global-information-technology-report-2015
11. Shehata, N., Mitry, C., Shawki, M. and El-Helaly, M., Incorporating Nearpod in undergraduate financial accounting classes in Egypt. *Accounting Educ.*, 29, **2**, 137-152 (2020).
12. Ali, B.H., Pedagogical affordances, challenges and limitations of the iPad as it is used in the foundation program of the Fujairah Higher Colleges of Technology in the United Arab Emirates. *University of Exeter* (2015).
13. McClean, S. and Crowe, W., Making room for interactivity: using the cloud-based audience response system Nearpod to enhance engagement in lectures. *FEMS Microbiology Letters,* 364, **6** (2017).
14. Gikas, J. and Grant, M.M., Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *The Internet and Higher Educ.*, 19, 18-26 (2013).

BIOGRAPHIES

Sanaa Kaddoura holds a PhD in computer science from Beirut Arab University, Lebanon. She is currently employed as an assistant professor of information security at the College of Technological Innovation, Zayed University, United Arab Emirates. She is a fellow of the Higher Education Academy, Advance HE (FHEA) since 2019. In addition to her research interests in information security and natural language processing, she is an active researcher in higher education teaching and learning related to enhancing the quality of instructional delivery to facilitate students' acquirement of skills and smooth transition to the workplace.

Fatima Al Husseiny holds a Master's degree in educational management from the Lebanese International University, Lebanon. She earned her BA in English language and literature from the Lebanese University, Lebanon. Her research interests are educational technology and social media. Her professional goals are related to developing academic research in her fields of interest. She has been awarded two achievement certifications for her contributions to Wikipedia, and she is actively engaged in editing more articles there. She has various certifications from Google, Coursera, and Udemy on Social Media and Educational Technology topics.