

The Effect of Students Performance at Higher Education Institution with Open and Distance Learning (ODL) Methods Through Formative and Summative Assessments Aggregation During Movement Control Order (MCO), COVID-19

Jamal Othman, Rozita Kadar, Norazah Umar, Nurhafizah
Ahmad

Department of Computer and Mathematical Sciences, Universiti Teknologi MARA Cawangan
Pulau Pinang Malaysia

To Link this Article: <http://dx.doi.org/10.6007/IJARPED/v10-i2/10137>

DOI:10.6007/IJARPED/v10-i2/10137

Published Online: 26 May 2021

Abstract

The pandemic COVID-19 has changed the world to the new norms with tightened standard operating procedure (SOP) to restraint the virus transmission and infection in the community. The education ministry has instructed and advised all instructors at schools, colleges and university to change their current pedagogical method from face to face to appropriate e-learning methods as effective alternative. The main objective of this project is to examine the effectiveness of Open Distance Learning (ODL) as a new pedagogical method in teaching and learning (T&L). This paper will observe and evaluate group of undergraduate students' performance with Open Distance Learning (ODL) approach in one semester duration during the Movement Control Order (MCO), COVID-19. The finalized formative and summative assessments aggregation results for each student was gathered from one particular programming subject for undergraduate engineering students. The aggregation results were used to compare an ODL approach which was implemented in the recent semester, with the conventional approach which was practiced in the previous semester. The data analysis shows that an ODL methods has no significance on students' performance. Finally, the project future improvement is suggested at the last section of this paper.

Keywords: E-learning, T & L, ODL, MCO, COVID-19

Introduction

The year 2020 is the biggest challenge to all instructors at higher education institution due to pandemic of coronavirus disease 2019 (COVID-19) spreading worldwide. As of 15 October 2020, the statistics as reported by World Health Organisation (WHO) showed that 38,002,699 were infected by the virus with the total deaths of 1,083,234 (WHO, 2020). A Total of 61,129 patients are put in critical or serious zone. The situation shows that the pandemic is extremely dangerous. Instructors have been instructed by the Education Ministry, abruptly to practice

new pedagogical approach paradigm from the traditional face to face method to nonface to face or e-learning methods. All physical classes were not permitted, and the instructors must conduct the class virtually using available infrastructure. Instructors of all categories of backgrounds and ages have had to prepare and deliver their classes through online although most of them have little knowledge on the technical supports (Hodges et al., 2020). Nevertheless, there are many sources that shared advices, ideas, tips and tricks focuses on tools and materials that instructors can use to replace their face to face classes (Bates, 2020).

With the advancements in Information and Communication Technology (ICT) in industries and other sectors, the education sector has no exception in the explosion of the information age (Chow & Shi, 2014). Education sector has started to change the methodology of teaching delivery methods from face to face to e-learning methodology (Wu, 2016). Various of e-learning application have been developed to provide comprehensive as well as effective teaching and learning options among instructors and learners (Sarabadani, Jafarzadeh & ShamiZanjani, 2017). Good e-learning applications are able to influence the learners to be actively involved in virtual classrooms and enhance their knowledge, skills, proficiency and thinks creatively or critically (Fazlollahtabar & Muhammadzadeh, 2012).

E-learning can be defined as the use of modern computer devices, system applications and communication technology to provide teaching and learning contents to learners (Beqiri, Chase & Bishka, 2010). E-learning can substantially benefit the university to save cost in physical teaching and learning buildings or infrastructures, electricity and air conditioning utilities, appointments of the new recruitments of academic or administration staffs and students' physical accommodation (Bhuasiri et al., 2012). Through e-learning, learners are able to access the digitised resources such as books or articles at anytime and anywhere using the computers or mobile devices connected to the Internet (Kilburn, Kilburn & Cates, 2014). Indirectly, e-learning helps international learners' mobility to travel across boundaries to gain knowledge and skills as e-video conferencing and meeting provide full academic services to the foreign learners. Furthermore, e-learning mode completely controls the mood and rhythm among learners' study flexibility anytime and anywhere provided they have a proper studying plan, disciplined and continuously motivated (Bhuasiri et al., 2012).

The aim of this project is to examine the effect of Open Distance Learning approach (ODL) applies to undergraduate students at higher education institution as compared to face to face (F2F) or conventional class. The organization of this paper starts by explaining the literature review or the related works. The following section explained the methodology applied in this research. The results and discussion of analysis will be further discussed in the following section. The last section is the conclusion and suggestion of the project.

Literature Review

Pedagogy of teaching can be referred to the way of instructors deliver the contents of the syllabus to the students. When the instructors prepare a lesson, different ways of content delivery will be considered based on their experience, teaching preferences and the context that they will be taught (Tes, 2018). Pedagogy in education can be either teacher-centered or student-centered with less or high technological approach. Teacher-centered focuses on the delivery and sharing of knowledge contents, while the student-centered encouraged the students to be an active participant in the learning process (Cole, 2019).

Student-centered approach is applied by most universities and colleges to provide and enhance the best educational services for learners (Stodnick & Rogers, 2008). To provide the best educational with student-centered approach through e-learning platform, the appearance of facilities, equipment and personnel collectively are complement each other (Parasuraman, Zeithaml & Berry, 1988). Open Distance Learning (ODL) is a platform whereby the classes are conducted through online and the student-centered approach or autonomy is a vital ingredient to the effectiveness of intended learning outcomes (Nilson, 2013). Through the ODL contexts, enable teachers and learners to become future self-regulated teachers and lifelong learners. The ODL requires the learners to have proper time management and sustainable self-disciplined to pursue ambitions or dreams during their studies.

E-Learning has become a must in the education sector and caters the demand of modern-day learners. Infusing technologies in the classroom will stimulate and enhance learners' interaction and improve the understanding learning curve. The advancement of E-learning technology extends further possibilities of learning going beyond the traditional ways of teaching domain whereby e-learning allows easy access to materials, flexible space, time and pace of study, comprehensive interaction and communication as well as immediate feedback are some of the advantages that make the learning process effective (Arora, 2015).

The COVID-19 has led all schools and universities to be closed worldwide. As a result, the education teaching methods has changed dramatically to e-learning mode whereby teaching is undertaken remotely on the digital platforms. This sudden shift of traditional physical classroom teaching approach to online learning methods can give positive impact to the learning curve of the learners (Koedinger & Mathan, 2005), which affects almost 1.2 billion learners over the world. Since the COVID19 spreading worldwide, the tools such as language apps, virtual tutoring, video conferencing tools and online learning software have been widely accessed by learners. Universities and schools have instructed their instructors to apply available technologies such as the mobile devices and apps to continue the teaching process.

The major issue in e-learning is to determine the most comprehensive and appropriate technology to the nature of the subject matters to be delivered to learners effectively. In addition, providing optimum learning opportunities for the learners is also another important aspect that need to be given a serious attention. Various affordable technologies have been identified to support educational purposes. These include online surveys or quizzes generated for testing purposes or used as a learning tool that can be created through the Learning Management System (LMS) or web-based survey tools such as SurveyMonkey or Google Forms. The use of web-based application tools allows for automatic grading and feedback given directly from the targeted respondents (Buzzetto-More & Ukoha, 2009). Sophisticated software tools or open source compact disc (CD) complete with Closed-Circuit Television (CCTV) for online examination could replace the traditional examination and does not require many invigilators or the Information Technology (IT) Officer to invigilate the examination (Fluck, Pullen & Harper, 2009). Costagliola, Fuccella, Giordana and Polese (2009) have studied learners' behavioural patterns to monitor the learners' strategies during online tests or examination using data visualisation. This survey allows teachers to enhance and improvise the assessment given to the learners.

Email is a common asynchronous communication tool for one to one or one to many online communications. Email allows the transmission of text, files, images and other graphics tools. The advantages of email include immediacy and flexibility of message transmission, easy to use, secure and reliable, as well as the ability to connect and to be contacted (Dawley, 2007). However, it has some drawbacks, which are lacks of physical verbal communications if the instructors and learners continues using emails as their major platform for teaching and learning. Another asynchronous communication tool is the discussion forum, which allows the members or participants to post or share views and respond immediately. Discussion forum is the most comprehensive platform whereby it encourages learners' participation, interaction and dynamic collaboration through non face to face activities (Goold & Coldwell, 2005). Short message service (SMS) is also another method of asynchronous communication tool that has been widely used in the early 20's. Nowadays, SMS technology has been taken over by the widely used asynchronous communication tool called WhatsApp. WhatsApp allows the transmission of texts, files, graphics, videos, sounds and variety of attachments files beyond the ability of emailing technology.

Digital repository covers different contents of Learning Management Systems (LMS) and the search engine indexes. Digital repository typically implemented in higher education such as universities and at established colleges. It is created from the combination of in-house and third-party resources and incorporates online bibliographic databases that provide abstracts and indexing to the world's scientific and technical papers in various disciplines (Atkinson et al., 2009). Bibliographic databases, of which there are more than 100, include PubMed, IEEE Xplore, Scopus, Web of Knowledge, Web of Science and Google Scholar are easily accessible through institutional libraries. E-Portfolio is a type of digital repository that facilitates the learners and instructors to collect, reflect, share and present the learning outcomes through the digital medium of platform. E-Portfolio has been used widely in teaching English language for communication skills development context (Cheng & Chau, 2009).

Electronic Grading System is a comprehensive tool for teaching and managing students' grading systems such as reporting and tracking students' progress, overall details grading and plagiarism detection. Online plagiarism software like Turnitin is one of the demanding tools embedded in the electronic grading system especially at higher education to encourage the students in making proper reference and construct their own word to produce genuine assignments ethically (Dahl, 2007).

Photo Sharing is one of the potential communication tools for learners to open for dialogue, communication and learning. Flickr is a website that enables learners to upload, publish photos or images online, which can be shared publicly or privately. Users can make annotations, leave comments and have ongoing discussions about the images. The discussion generated by the group will remain visible in Flickr for future reference. This communication tool is widely used in the fashion or art fields (Buffington, 2008). Podcast or contraction of iPod and Broadcast as well as Streaming files are audio and video files in MP3 or MP4 format that can be downloaded or played in real time from the Internet through computer or mobile devices. This technology is widely used in distance learning program in which the instructors will record their lectures and share the files via Podcast or Streaming. Furthermore, it demonstrates versatility, efficacy and sustainability of students' motivation to engage the students in the learning process (Buffington, 2008).

Shared document is an application that enables the learners to store, edit, retrieve and review documents virtually. Documents retrieval can be accessed by multiple users provided they are given special privileges. Google Docs is a web browser that allows learners to access group's document to edit and save it at anytime and anywhere (Southavilay et al., 2009). This application is extremely convenient particularly to the learners at higher education whenever the instructors adopt the Gmail (Google mail) as their email system. Social networking applications such as Facebooks, Twitters, Instagram, WhatsApp and Tumblr are popular communication tools among learners and instructors. Informal discussions about a subject matter or topic are discussed and elaborated dynamically among the learners compared to the traditional face to face discussion in the physical classroom (De Villiers, 2010). Social network encourages the learners to express their views and assist them in improving their communication skills, skills of reading and writing, as well as developing their critical thinking and confidence level (Godwin, 2007).

Synchronous communication is a face to face communication technology that applies texts and videos and is supported by video, multimedia, desktop and documents sharing. Chat rooms, instant messaging and video-conferencing are examples of synchronous communication that are widely used in higher educational institution. The remote learners especially those who are engaging to distance learning program are required to use the synchronous tools whenever the face to face environment is not possible. A study conducted by Rutter (2009) stated that these tools can encourage the learners to work and learn independently, corporately and smartly in managing their time, pressure and office workloads (Bliesener, 2006).

Wikis is a collection of web pages that allows the users to create, edit and delete the web contents at any time and from anywhere. This application is particularly used to structure content, create links and track the history of contributions, which is suitable for group projects that require the group members to work collaboratively (O'Leary, 2008).

Methodology

This section will further explain the formative and summative assessments result aggregation which obtained from a degree programming subject for two consecutive semesters to measure and evaluate the effectiveness of ODL approach. The programming subject has offered in the second semester of the degree in engineering curriculum program structure. The data of two consecutive semesters are taken during the recent semester from March to July 2020 whenever the COVID-19 started to spread and the ODL approach newly started to implement. The second set of data are retrieved from the previous semester September – December 2019 of academic session which applied the face to face pedagogical approach. These two sets of data will be analysed to examine the effectiveness ODL in teaching and learning pedagogical approach.

The formative and summative assessments are two different types of evaluation methods to measure the students understanding level. The goal of formative assessment is regularly and continuously monitoring the student learning curves and identify whether the instructional objectives are achieved (Bell & Cowie, 2001). Example of formative assessments are tests, quizzes, laboratory assignments and individual project. The main purpose of summative assessment is to evaluate the student performance at the end of the instructional process or

semester. Aggregation of formative and summative assessments will be compared with a specified benchmark to characterize the level of overall student performance (Eberly, 2020). Example of summative assessments are the final examination or final project. For this research, the result of formative and summative marks is aggregated or summed up as single result for each student. The aggregated marks of recent semester results are compared with the same format of aggregated marks from the previous semester. The following table shows the overall structure of formative and summative assessments marks aggregation collected from two consecutive semesters.

Table 1:

Structure of Data Collection

Semester Sep – Dec 2019 (Face to face approach)							Semester Mar – Jul 2020 (Open Distance Learning approach – ODL)						
	Formative				Summative	Aggregation		Formative				Summative	Aggregation
P_n	F_t	F_q	F_{la}	F_p	S	$(S+F)$	P_n	F_t	F_q	F_{la}	F_p	S	$(S+F)$
P_1	9	9	9	9	99	99	P_1	9	9	9	9	99	99
	9	9	9	9				9	9	9	9		
*remarks: P_n – Student n F_t – formative marks for tests F_q – formative marks for quizzes F_{la} – formative marks for lab assignments F_p – formative marks for individual project S – summative mark for final examination $(S+F)$ – aggregation of formative and summative marks													

The formative and summative assessments are prepared based on the rubric that has been specified by the curriculum review board committee at the faculty level. The rubric for formative assessments has clearly mentioned the taxonomy level that should be assessed appropriately according to the subject level offered in the curriculum program structure. Similarly, for the summative assessments, the questions were designed base on the Test Specification Table (*Jadual Spesifikasi Ujian – JSU*). Since the programming subject offered in the second semester of the degree in engineering curriculum program structure, then the assessment rubrics will be focused on the knowledge, comprehension, and application of the taxonomy bloom level. The following figure 1 shows the bloom taxonomy of cognitive skills.

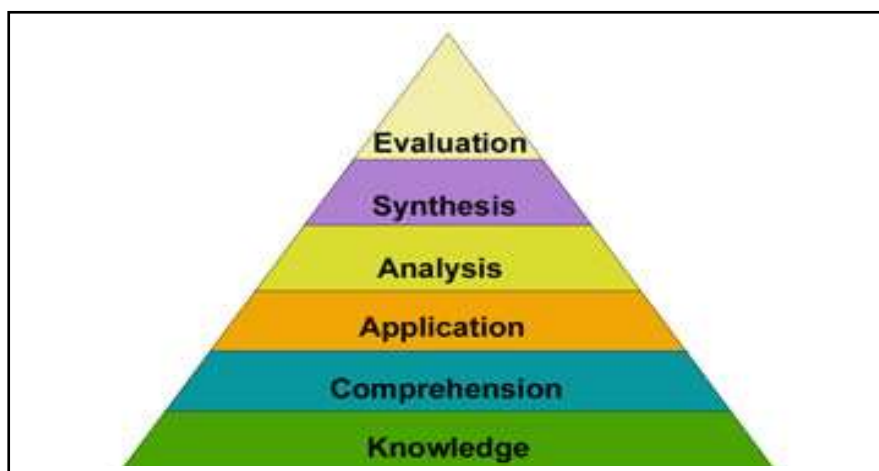


Figure 1: Bloom Taxonomy of Cognitive Skills (Adopted from <http://cehdclass.gmu.edu/ndabbagh/Resources/IDKB/bloomstax.htm>)

The training centre has conducted a series of webinars training during the Movement Control Order (MCO) to all instructors to assist them in e-learning or ODL classes. Basic communication tools, preparation of online test and storage sharing technology have been introduced. The introductory training really helps them to create more creative and attractive online assessments for the learners. Google Forms and Google Drive are the convenient platforms used to conduct online tests or quizzes and submission of the assignments. The Google Forms provide various question templates such as short and long questions, multiple choice questions and questions that require special files to be uploaded. Each form has a specific setting either open to public or privately to specific users.

Therefore, when the COVID-19 pandemic started spreading, online Google Forms is used as a new norm of the evaluation platform to evaluate the students' performance for the formative or summative assessments. In contrast to the evaluation platform before the COVID-19 pandemic, the students must sit the tests, quizzes and final examination in the classroom with the existence of invigilators.

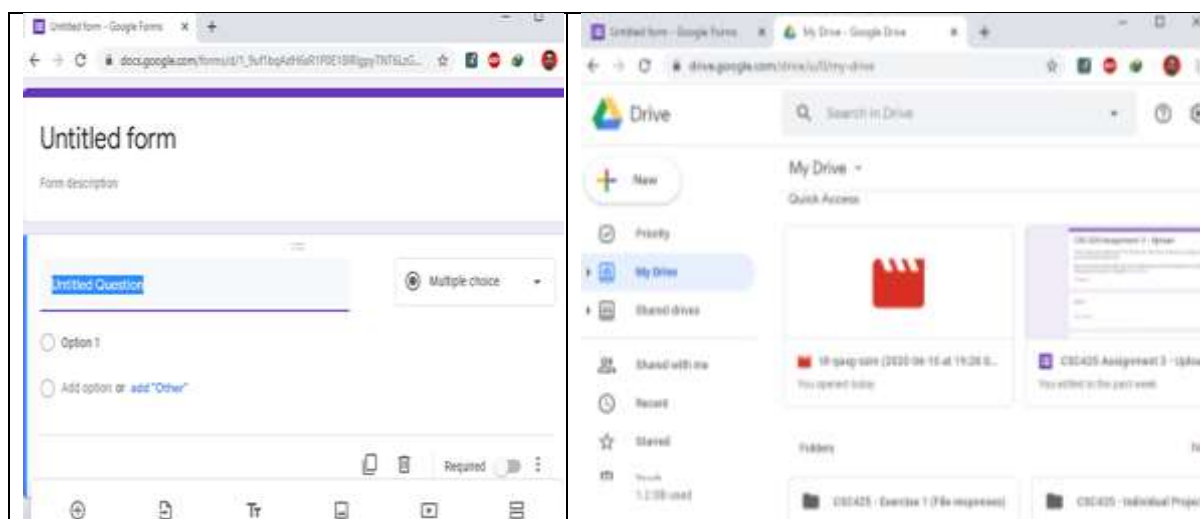


Figure 2: Google Forms and Google Drive

The responded answers or data from the students through the Google Forms are stored in the Google Drive and only accessible by the administrator or instructor. Thus, only the instructor can examine the answers given by the students through the answers submitted or uploaded files from Google Drive. The marking of the assessments will be done on the computer and not using the conventional method or marking as practiced before. Instructors used the special online software called KAMI, the special digital pad and pen to examine or mark the formative and summative assessments. Through online assessments evaluation using the Google Forms the students need the Internet connection for file submission. Since the implementation of ODL approach, the students do not have major problems in submitting their assessments and if there is a problem, they will be given alternatives such as WhatsApp, email application or parked on the cloud for assessment submission.

Data Analysis

This research used an important data among two groups of students; which is the formative and summative assessments scores. The data were analyzed using independent sample t-test. In terms of the objective of the present study, which is to examine the effect of ODL compare to face to face, the independent sample t-test was used to determine whether there are differences in the mean assessment score between a group with ODL approach and another group with the face to face method. This parametric test compares the means of two independent groups to identify whether there is statistical evidence that the associated population means are significantly different. The independent samples t-test requires the assumption of homogeneity of variance, which means that both groups have the same variance. The use of Statistical Package for Social Sciences (SPSS) conveniently includes a test for the homogeneity of variance, called Levene's Test, to show that an independent samples T test was run. The null hypotheses for Levene's test was the population variances of group 1 and 2 are equal. This implies that if the Levene's Test's null hypothesis is rejected, it shows that the variances between the two groups are not equal; and it indicates that the assumption of variance homogeneity is violated. The hypotheses for the independent t-test can be expressed as:

H₀: There is no significance difference on students' performance using the face to face and ODL method

H₁: There is a significance difference on students' performance using the face to face and ODL method.

Result and Discussion

The participants of this study comprised of 47.9% female and 52.1% male students from the total of 96 students. The assessment score for 57 students using face to face method and 39 students using ODL was taken. Table 3 reveals that the mean assessment score for group using face to face method is 72.57(SD=12.29) while 77.38 (SD =13.71) for group using the ODL. Both groups had fairly similar standard deviations.

Table 2:

Frequency and percentage of Teaching Method

	Frequency	Percentage
Face to face	57	59.4
ODL	39	40.6
Total	96	100.0

Table 3:

Mean assessment score for the two methods

Method	N	Mean Score	Assessment	Standard (SD)	Deviation
Face to face	57	72.5744		12.28602	
ODL	39	77.3772		13.71475	

Table 4:

Independent t-test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig (2 tailed)	95% Interval Difference Lower	Confidence of the Upper
Assessment Score	Equal Variances assumed	0.000	0.995	-1.794	94	0.076	-10.11833	0.51275
	Equal Variances not assumed			-1.757	75.70	0.083	-10.24705	0.64146

Table 4 above shows that the t-test assumes that the variances are approximately equal in two groups. Based on the results, it showed that there was no significant difference in mean assessment score (t-test = -1.794, p-value > 0.05) between students with face to face method and ODL approach. The results indicated that both online learners and classroom learners perform at the same level. This result consistent with the study carried out by (Paul & Jefferson, 2019), using chi-square analysis, it showed no significant difference in student performance in an environmental sciences class between online and face to face learning. The study conclude that teaching modality generated similar student performance. Further, a study by (Lorenzo-Alvarez et al., 2019) revealed that in an online learning platform, radiology education resulted in a similar academic outcome as face to face learning. Additionally, (Davies & Graff, 2005) found that there was no statistically better academic success for students who engaged and participated more in online discussion than students who were less involved in that discussion. (Kemp & Grieve, 2014) also discovered that both online and F2F learning for psychology students led to similar academic performance.

These findings are in contrast to the data reported by (Bir, 2019), which claimed that relative to the traditionally taught community, online pedagogy had a negative impact on student academic success. This was true for all students' demographics (gender, status of enrolment, nationality) and categories (high, medium and low academic performance). On the other hand, study by (Elfaki et al., 2019) found that the mean scores earned by the online learning group in the final exam by students are statistically higher than those for the face to face group.

Conclusion and Future Work

E-Learning can help instructors to conduct virtual classes with the learners. E-Learning can be effective if the instructors can create creative and innovative classes using a variety of tools that are easily retrieved by the learners. Another aspect that need to be considered is the retention of momentum and interest of students' enthusiasm continuously without feeling bored and tense.

Conclusively, from the survey that have been done, there is no significance of results for student's performance either the class in conducted as Open & Distance Learning (ODL) or face to face through conventional approach. Therefore, the instructors are encouraged to improve the teaching delivery and learning style among students by embedding attractive e-learning components and tools to boost immersive and unforgettable experience. One of the attractive multimedia tools is by embedding video component in helping students to increase their understanding and capability to remember the complicated or technical knowledge. Video is a powerful tool which provide multi-sensory learning environment that may improve learners' ability to sustain their knowledge. The use of comprehensive and interactive video can give positive impact to the learners in the sense of their learning curve and retention rate until 60% (Vaughan, 2011). In addition, the role of persuasive technology in determining the effectiveness of e-learning development is also important. Persuasive technology adaptations are seen to be successful in changing students' attitudes or behaviors towards more positive ones. Thus, our proposed work is to develop an e-content in a form of video that fulfil the ten principles of persuasive technology.

E-learning is a fast-developing educational model that is likely to replace the traditional learning and conventional teaching methods. E-Learning should be continuously improvised in a dynamic strategy so that the teaching and learning curve can be improved linearly. Finally, the instructors should be ready with the future advancement of e-learning technology to face the demands of high technological smart learners nowadays.

Corresponding Author

Jamal Othman

Department of Computer and Mathematical Sciences, Universiti Teknologi MARA Cawangan Pulau Pinang Malaysia

Email: jamalothman@uitm.edu.my

References

- Arora, A. (2015). Using eLearning Technologies To Improve Educational Quality of Language Teaching, Retrieved from <https://elearningindustry.com/using-elearning-technologies-improve-educational-quality-language-teaching>.
- Atkinson, K., Fluker, G., Ngo, L., Dracup, M., and McCormick, P. (2009). Introducing a Learning Repository Using a Blended Professional Development Approach, ASCILITE 2009 : Same places, different spaces, Auckland, New Zealand, in Proceedings of the 26th ASCILITE conference, Australian Society for Computers in Learning in Tertiary Education, pp. 35 - 39.
- Bates, A. W. (2020). Advice to those about to teach online because of the corona-virus. 9March. <https://www.tonybates.ca/2020/03/09/advice-to-those-about-to-teach-online-because-of-the-corona-virus/>. Accessed 30 April 2020.
- Bell, B., & Cowie, B. (2001). Characteristics of Formative Assessment in Science Education, *Science Education*, 85, 536-553.
- Beqiri, M., Chase, N., & Bishka, A. (2010). Online course delivery: An empirical investigation of factors affecting student satisfaction. *Journal of Education for Business*, 85, 95–100. <https://doi.org/10.1080/08832320903258527>.
- Bhuasiri, W., Xaymoungkhoun, O., Zo, H., Rho, J. J., & Ciganek, A. P. (2012). Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty. *Computers & Education*, 58(2), 843–855. <https://doi.org/10.1016/j.compedu.2011.10.010>.
- Bir, D. (2019). Comparison of Academic Performance of Students in Online Vs Traditional Engineering Course, *European Journal of Open, Distance and E-Learning*, 22(1), 1-13. doi: <https://doi.org/10.2478/eurodl-2019-0001>
- Bliesener, T. (2006). Training Synchronous Collaborative E-Learning', *International Journal on E-Learning* (5:2), pp. 185 - 196.
- Buffington, M. L. (2008). Creating and Consuming Web 2.0 in Art Education', *Computers in Schools* (25:3 - 4), pp. 303 - 313.
- Buzzetto-More, N., and Ukoha, O. (2009). The Efficacy of a Web-Based Instruction and Remediation Program on Student Learning, *Issues in Informing Science and Information Technology* (6), pp. 285 - 298.
- Cheng, G., and Chau, J. (2009). Digital Video for Fostering Self-Reflection in an Eportfolio Environment, *Learning, Media and Technology* (34:4), pp.337 - 350.
- Chow, W. S., & Shi, S. (2014). Investigating students' satisfaction and continuance intention toward e-learning: An extension of the expectation–confirmation model. *Procedia-Social and Behavioral Sciences*, 141, 1145–1149. <https://doi.org/10.1016/j.sbspro.2014.05.193>.
- Cole, K. (2019). Pedagogy in Education: More Than a Buzzword, Retrieved from <https://www.schoolology.com/blog/pedagogy-education-more-buzzword>.
- Costagliola, G., Fuccella, V., Giordano, M., and Polese, G. (2009). Monitoring Online Tests through Data Visualization, *IEEE Transactions on Knowledge and Data Engineering* (21:6), June 2009, pp. 773 - 784.
- Dawley, L. (2007). *The Tools for Successful Online Teaching*. Hershey: Information Science Publishing.
- Dahl, S. (2007). Turnitin: The Student Perspective on Using Plagiarism Detection Software', *Active Learning in Higher Education* (8:2), pp. 173 - 191.

- Davies, J., and Graff, M. (2005). Performance in e-learning: online participation and student grades. *Br. J. Educ. Technol.* 36, 657–663. doi: 10.1111/j.1467-8535.2005.00542.x
- De Villiers, R. (2010). Academic Use of a Group on Facebook', in Proceedings of InSITE Conference, Informing Science Press, Bari and Cassino, Italy, pp. 173-190.
- Eberly C. (2020). What is the difference between formative and summative assessment? Retrieved from <https://www.cmu.edu/teaching/assessment/basics/formative-summative.html>
- Fazlollahtabar, H., & Muhammadzadeh, A. (2012). A knowledge-based user interface to optimize curriculum utility in an e-learning system. *International Journal of Enterprise Information Systems*, 8(3), 34–53.
- Fluck, A., Pullen, D., and Harper, C. (2009). Case Study of a Computer Based Examination System, *Australasian Journal of Educational Technology* (25:4), pp. 509 - 523.
- Godwin, P. (2007). Information Literacy Meets Web 2.0: How the New Tools Affect Our Own Training and Our Teaching', *New Review of Information Networking* (13:2), pp. 101 - 112.
- Goold, A., and Coldwell, J. (2005). Teaching Ethics in a Virtual Classroom, in Proceedings of The 10th Annual Conference on Innovation and Technology in Computer Science Education, J. Cunha, W. Fleischman, V. Proulx and J. Lourenco (eds.), Monte de Caparica, Portugal: ACM, pp. 232 - 236.
- Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *Educause Review*, 27 March. <https://er.educause.edu/articles/2020/3/thedifference-between-emergency-remote-teaching-and-online-learning>. Accessed 15 June 2020.
- Kemp, N., and Grieve, R. (2014) Face-to-face or face-to-screen? Undergraduates' opinions and test performance in classroom vs. online learning. *Front. Psychol.* 5:1278. doi: 10.3389/fpsyg.2014.01278
- Kilburn, A., Kilburn, B., & Cates, T. (2014). Drivers of student retention: System availability, privacy, value and loyalty in online higher education. *Academy of Educational Leadership Journal*, 18(4), 1–14.
- Koedinger, K. R., and Mathan, S. (2005), Distinguishing qualitatively different kinds of learning using log files and learning curves. in ITS 2004 Log Analysis Workshop. 2004. Maceio, Brazil. p. 39-46.
- Lorenzo-Alvarez, R., Rudolphi-Solero, T., Ruiz-Gomez, M. J., and Sendra-Portero, F. (2019). Medical student education for abdominal radiographs in a 3D virtual classroom versus traditional classroom: a randomized controlled trial. *Am. J. Roentgenol.* 213, 644–650. doi: 10.2214/AJR.19.21131
- Nilson, L. B. (2013). Creating self-regulated learners: Strategies to strengthen students' selfawareness and learning skills. Sterling, VA: Stylus Publication.
- O'Leary, D. E. (2008). Wikis: from Each According to His Knowledge, *Computer* (41:2), pp. 34 - 41.
- Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, 64(1), 12–40.
- Paul, J., and Jefferson, F. (2019) A Comparative Analysis of Student Performance in an Online vs. Face-to-Face Environmental Science Course From 2009 to 2016. *Front. Comput. Sci.* 1:7. doi: 10.3389/fcomp.2019.00007
- Sarabadani, J., Jafarzadeh, H., & ShamiZanjani, M. (2017). Towards understanding the determinants of employees' e-learning adoption in workplace: A unified theory of

- acceptance and use of technology (UTAUT) view. *International Journal of Enterprise Information Systems*, 13(1), 38–49.
- Southavilay, V., Yacef, K., and Calvo, R. A. (2009). Writeproc: A Framework for Exploring Collaborative Writing Processes', *Fourteenth Australasian Document Computing Symposium*, J. Kay, P. Thomas and A. Trotman (eds.), Sydney, Australia: School of Information Technologies, University of Sydney, pp. 129 - 136.
- Stodnick, M., & Rogers, P. (2008). Using SERVQUAL to measure the quality of the classroom experience. *Decision Sciences Journal of Innovative Education*, 6(1), 115–133. <https://doi.org/10.1111/j.1540-4609.2007.00162.x>.
- Tes Editorial (2018), What is pedagogy?, Retrieved from <https://www.tes.com/news/what-is-pedagogy-definition>
- Vaughan, T. (2011). *Multimedia: Making It Work*. 8th edition, Mc Graw Hill.
- Wu, B. (2016). Identifying the influential factors of knowledge sharing in e-learning 2.0 systems. *International Journal of Enterprise Information Systems*, 12(1), 85–102 <https://dl.acm.org/citation.cfm?id=2942953>.
- WHO. (2020). WHO Coronavirus Disease (COVID-19) Dashboard, Retrieved from https://covid19.who.int/?gclid=EAlaIQobChMlvs_swPvf6QIVeYqCh2YogDFEAAAYASAAEgKVvD_BwE.