INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT

OPEN ACCESS JOURNAL

Vol 12, Issue 1, (2023) E-ISSN: 2226-6348

Effect of Online Distance Learning or Blended Learning Versus Face to Face for Fluid Mechanics Course

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To Link this Article: http://dx.doi.org/10.6007/IJARPED/v12-i1/16107 DOI:10.6007/IJARPED/v12-i1/16133

Published Online: 04 January 2023

Abstract

The change of learning approach due to Covid 19 from face to face to online distance or blended learning required knowing technology tools in the education. Distance learning is a technique of giving instruction using online tools and technology. Distance learning depends on information and communication technologies to distribute the course materials and engage with students. The main goal of remote delivery is to promote communication between students, allowing for interaction and knowledge sharing at any time. In that it can still support conventional learning tools, remote delivery is also compatible with other instructional strategies and technology of prior learning. However blended learning is the approach that combine face to face and online learning. Therefore, this paper aims to assess the effect of online distance learning or blended learning versus face-to-face learning for fluid mechanics' course. The study shows that ODL or blended learning can be a useful teaching strategy for the Fluid Mechanics course because the cognitive domain can still be reached. Additionally, when comparing ODL or blended learning to face-to-face learning, PO attainments are not affected much for both teaching approach. The percentage of failure rate also decrease during ODL, or blended learning semester compared to face-to-face semester.

Keywords: Online Distance Learning, Blended Learning, Programme Outcomes, Covid 19, Fluid Mechanics

Introduction

Numerous facets of life across the globe have seen significant alteration because of COVID-19. The lockdowns enforced in most of the countries forced the immediate closure of universities and schools. This effect the transition to remote delivery of all academic activities, which had an influence on the higher education sector as well (Tang *et al*., 2020). In this way, online learning which was formerly largely optional but has since gained popularity is now required.

Distance learning is a technique of giving instruction using online tools and technology, including online learning (Gonçalves *et al*., 2020).Distance learning depends on information

and communication technologies to distribute the course materials and engage with students (el Refae *et al*., 2021). Different technologies and applications can assist distance learning in a variety of ways. E-learning, blended learning, or mobile learning are all terms that can be used to describe it (Masalimova *et al*., 2022). The fact that the delivery is remote unites all these strategies. However blended learning is the approach that combine face to face and online learning (Mosleh *et al*., 2022). The main goal of online delivery is to promote communication between students, allowing for interaction and knowledge sharing at any time (Al-Mawee *et al*., 2021). In that it can still support conventional learning tools, online delivery is also compatible with other instructional strategies and technology of prior learning.

Programme Outcomes (PO) for Diploma Programme in Civil Engineering (EC110) that follow Engineering Technology Accreditation Council (ETAC) standard shown in Table 1. These POs refer to the fundamental characteristics of cognitive knowledge, psychomotor abilities, and affective behavior that students must develop when enrolled in an engineering programme. The POs that follow ETAC Standard 2020 include a well-defined engineering challenge that was put into practice through the course assessments. Other elements of the programme outcomes that required to be addressed include societal health and safety, study based on well-defined challenges, and current engineering and IT technologies.

For fluid mechanics, programme outcomes involve are PO1 and PO2 which is PO1 students should know how to apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to wide practical procedures and practices and PO2 students need to identify and analyse well-defined engineering problems reaching substantiated conclusions using codified methods of analysis specific to their field of activity. Therefore, this paper aims to assess the effect of online distance learning or blended learning versus face-to-face learning for Fluid mechanics' course.

Table 1
Programme Outcomes (PO) for Diploma Programme (EC110)

PO1	Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to wide practical procedures and practices.
PO2	Identify and analyse well-defined engineering problems reaching substantiated conclusions using codified methods of analysis specific to their field of activity.
PO3	Design solutions for well-defined technical problems and assist with the design of systems, components, or processes to meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations
PO4	Conduct investigations of well-defined problems; locate and search relevant codes and catalogues, conduct standard tests and measurements.
PO5	Apply appropriate techniques, resources, and modern engineering and IT tools to well-defined engineering problems, with an awareness of the limitations.
PO6	Demonstrate knowledge of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering technician practice and solutions to well defined engineering problems.
PO7	Understand and evaluate the sustainability and impact of engineering technician work in the solution of well-defined engineering problems in societal and environmental contexts.
PO8	Understand and commit to professional ethics and responsibilities and norms of technician practice.
PO9	Function effectively as an individual, and as a member in diverse technical teams.
PO10	Communicate effectively on well-defined engineering activities with the engineering community and with society at large, by being able to comprehend the work of others, document their own work, and give and receive clear instructions
PO11	Demonstrate knowledge and understanding of engineering management principles and apply these to one's own work, as a member or leader in a technical team and to manage projects in multidisciplinary environments
PO12	Recognize the need for and can engage in independent updating in the context of specialized technical knowledge.

Methodology

This course introduces students four main chapter included properties of fluid, fluid statics and hydrodynamics. Chapter one is properties of fluid comprise of continuum concept,

units and dimension, dimensional analysis, and various fluid properties. Chapter two cover fluid statics with subtopic hydrostatics concept for both fluid pressure and buoyancy. For chapter three it discusses hydrodynamics for fluid flow that include the introduction of Continuity Equation and Bernoulli's Principle and Momentum Equation. For last chapter it introduced hydrodynamics for ideal and real fluids.

This course involves PO1 and PO2 that student need to explain basic knowledge of fluid mechanics and formulate engineering problems related to fluid mechanics respectively. Table 2 show the course assessment plan for semester face to face. The assessment weightage (%) divided in to test 30% which is 5% PO1 and 25% PO2, assignment PO2 10% and 60% final exam which is 20% PO1 and 40% PO2 and the overall assessment is 100%. Teaching and learning activity involve throughout the semester was two hours lecture and one hour tutorial per week for 14 weeks. All assessment conducted face to face included final exam.

Table 2
Course Assessment Plan (Face to Face)

	COURSE OUTCOME	**PROGRAMME OUTCOME**	**TAXANOMY DOMAIN**	**TEACHING AND LEARNING ACTIVITY**	**ASSESSMENT WEIGHTAGE (%)**		
					TEST	**ASSIGNMENT**	**FINAL EXAM**
1	Explain basic knowledge of fluid mechanics	PO1	C3	Lecture & Tutorial	5	0	20
2	Formulate engineering problems related to fluids mechanics	PO2	C5	Lecture & Tutorial	25	10	40
				TOTAL	30	10	60

For semester ODL or blended learning the course assessment as shown in Table 3. The assessment weightage divided into quiz 30% which is 5% PO1 and 25% PO2, assignment PO2 10%, test 1 covered PO1 10.9% and PO2 19.1 % as total is 30%, test 2 total is 30% covered PO1 9.1% and PO2 20.9%. The distribution of PO1 and PO2 is same for face-to-face semester and ODL or blended learning semester as stipulate in the syllabus. For teaching and learning activity during ODL is fully online with synchronous and asynchronous method for two hours lecture and one hour tutorial per week for 14 weeks and for blended learning 30% face to face and 70% online with all the assessment through online.

Table 3
Course Assessment Plan (Online Distance Learning or Blended Learning)

	COURSE OUTCOME	PROGRAMME OUTCOME	TAXANOMY DOMAIN	TEACHING AND LEARNING ACTIVITY	ASSESSMENT WEIGHTAGE (%)			
					QUIZ	ASSIGNMENT	TEST 1	TEST 2
1	Explain basic knowledge of fluid mechanics	PO1	C3	Lecture & Tutorial	5	0	10.9	9.1
2	Formulate engineering problems related to fluids mechanics	PO2	C5	Lecture & Tutorial	25	10	19.1	20.9
				TOTAL	30	10	30	30

Results and Discussion

Revolution on Assessment for Student Monitoring System (i-RAS) system was developed by the Faculty of Civil Engineering, UiTM Penang, Malaysia, which was used to assess all COPO. This system has been created to enhance ineffective COPO analysis. Figure 1 indicates the percentage of PO1 for three semester face to face and three semester distance or blended learning, for semester face to face the percentage of PO1is above 50% for two semester 20184 and 20194 but for semester 20192 the percentage PO1 is below than 50%. For semester distance or blended learning all three semesters achieve PO1 above 50%. In Figure 2, all three-semester face to face and three semester distance learning or blended learning achieve PO2 above 50%.

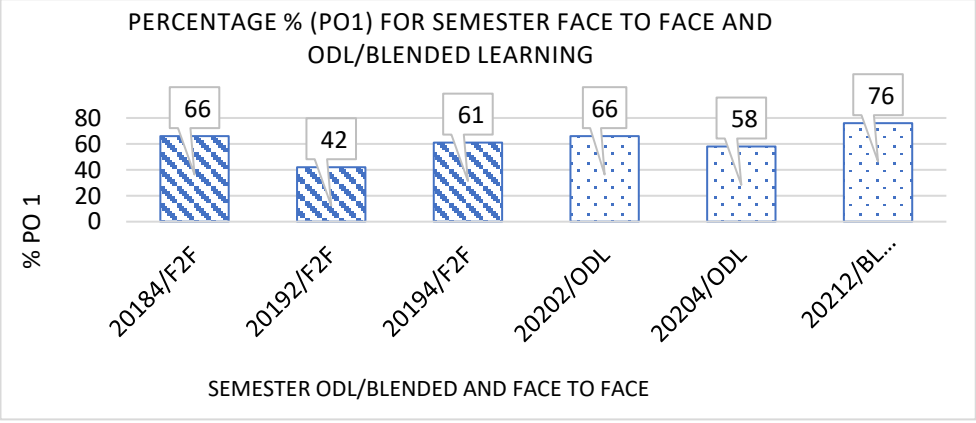

Figure 1: Percentage % (PO1) for Semester Odl/Blended and Face to Face

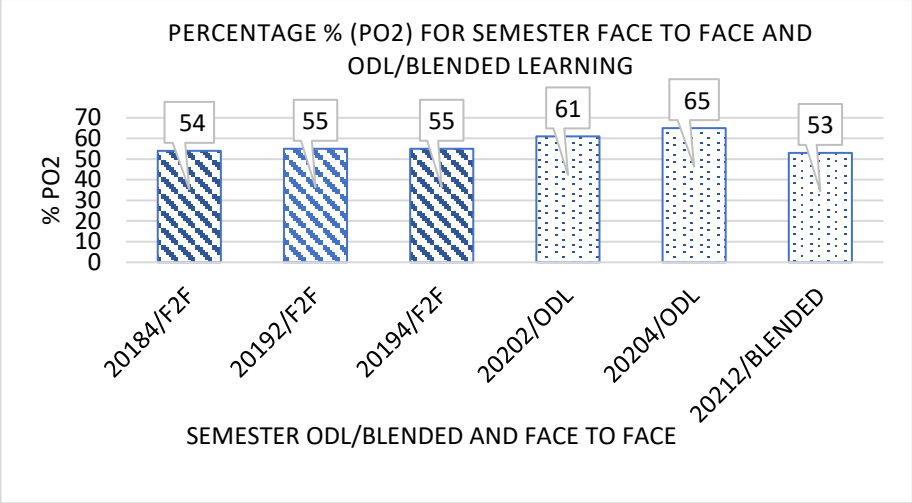

Figure 2: Percentage % (PO2) for Semester Odl/Blended and Face to Face

Based on Figure 3, percentage passing is 83% while 17% failed for semester face to face, but for semester distance or blended learning there are decrement in percentage of failure rate as shown in Figure 4 which is 91% passed while only 9% failed.

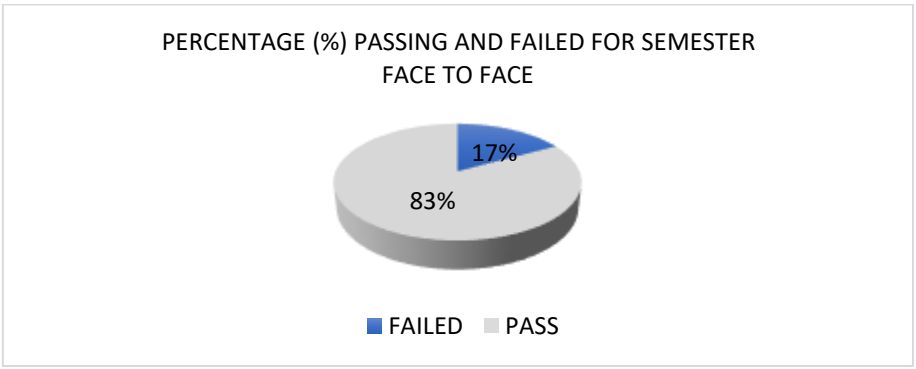

Figure 3: Percentage (%) Passing and Failed for Semester Face to face

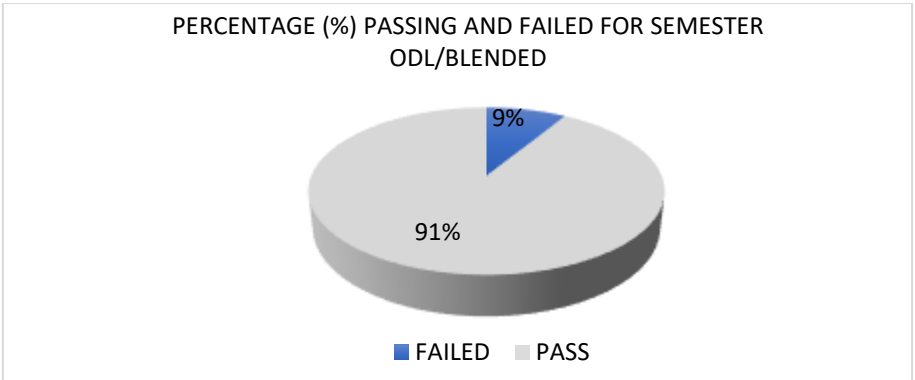

Figure 4: Percentage (%) Passing and Failed for Semester Odl/Blended

The findings suggest that ODL has a beneficial impact on attaining PO. According to a similar conclusion, the change in learning delivery techniques had no impact on the students' performance (Rudenko *et al.*, 2020). One of the factors leading to this result may be the eagerness to use the online e-learning resources. ODL's session recording feature is another important feature that benefit of online learning, even with the synchronous learning

approach, lecturers can record the lecture using any online tools like Microsoft Teams, Google Meets, Webex, and any other platforms. The students have the option to recall the session again at any time and any place. Moreover, according to Cotero *et al*., 2020, students preferred recorded lecture videos to other methods because they can play or pause more than one time if not understand the content.

Conclusion

Despite the serious effects that the COVID-19 epidemic has had on the implementation of the educational system, the study shows that ODL or blended learning can be a useful teaching strategy for the Fluid Mechanics course because the cognitive domain can still be reached. Moreover, when comparing ODL or blended learning to face-to-face learning, PO attainments are not affected much for both teaching approach. The percentage of failure rate also decrease during ODL, and blended learning semester compared to face-to-face semester. Additionally, students now could learn independently with the suitable technology and resources provided by the lecturers. Student success as measured by faculty reflects a crucial component of effective instruction. This study has demonstrated that there is little to no difference in student performance between online or blended learning and face-to-face learning. The effectiveness of online learning includes factors like student engagement and participation, cognitive engagement, technology self-efficacy, perceived usefulness of the used technology, and the relative benefit or weakness of online delivery.

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