INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT

OPEN ACCESS JOURNAL

Vol 11, Issue 4, (2022) E-ISSN: 2226-6348

Undergraduates' Motivation and Engagement in an Online learning (OL) Mathematics Class at a Public University

Betrice Janni[1], Sian-Hoon Teoh[2], Mei-Peng Low[3]

[1,2]Faculty of Education, Universiti Teknologi MARA Selangor, 42300 Bandar Puncak Alam, Selangor, Malaysia, [3]Faculty of Accountancy and Management, Universiti Tunku Abdul Rahman, Bdr Sungai Long, 43000 Kajang, Selangor, Malaysia

Corresponding Author Email: teohsian@uitm.edu.my

To Link this Article: http://dx.doi.org/10.6007/IJARPED/v11-i4/15859 DOI:10.6007/IJARPED/v11-i4/15859

Published Online: 16 December 2022

Abstract

Students at universities now routinely participate in online learning (OL), which has become the new standard. More recent research and attention are needed to understand the issue of their participation and motivation. Therefore, this study was conducted to investigate to what extent university students were engaged and motivated in OL mathematics classes at a selected public university in Malaysia. A quantitative approach with a correlational research design was used in this study. A series of survey questions were adapted from an earlier investigation. It was distributed to 169 mathematics education students. Both descriptive and inferential analyses were performed on the data that had been gathered. The findings demonstrated that university students were highly motivated and engaged in their mathematics classes. The findings also showed a moderately positive correlation between student motivation and involvement in a mathematics class. Further research is suggested to examine any causative relationship factors and to observe the nature of student engagement and motivation in a mathematics lesson.

Keywords: Motivation, Engagement, Mathematics Class, Online Learning (OL).

Introduction

The complexity of mathematics makes it challenging to fully comprehend its concepts (Espinoza et al., 2022). Therefore, it is essential that students engage in active participation. Students who are actively engaged in their learning process exhibit critical thinking and high levels of task persistence (Bonwell & Eison, 1991; Prince, 2004). Teachers who are putting their efforts into engaging students must also apply active learning strategies.

Literature Review

It was discovered that both teachers' inquiries and verbal feedback prompted students to engage in classroom discourse. Nevertheless, students should provide longer responses than the teacher's queries in the class discussion (Tharawoot, 2016). This context is usually related to students' and teachers' relationships with some mathematics values via engagement.

There are three dimensions to engagement, namely behavioral, cognition, and affective (emotion). These three aspects are the main components that involve students in any learning environment. To engage cognitively, one must have an interest in learning and a willingness to take up learning. On the other hand, students' emotions toward school, teachers, peers, and academics influence their willingness to participate in schoolwork. Lastly, behavioural engagement relates to the idea of active participation in academic and social activities, and it is viewed as crucial for the achievement of positive academic results (Attard, 2012). Students exhibit a different level of engagement when they are confronted with different types of activities. Some activities or contexts of learning may contribute to a high level of motivation. Filgona et al (2020) observed that students' motivation to study was affected by the teaching and the learning environment. This is a crucial factor that the instructor needs to take into account while encouraging students to participate in in-class activities. Teachers need to define the objective of a lesson clearly. They can assist the students to voice their thoughts and opinions, question the students, and provide as many hands-on activities as possible (Palmer, 2007). Students who were highly motivated showed genuine involvement in class. A case study conducted by Saeed and Zyngier (2012) found that students who were genuinely motivated were completely involved in class activities because they valued collaborating with their peers and taking part in productive group projects. In the classroom, student motivation refers to the degree to which a student puts effort into and concentrates on learning to attain successful outcomes (Filgona et al., 2020). For students to learn well, they must be motivated and interested.

Full engagement and high motivation are essential in an online learning environment since students have more responsibility for their learning. Online teaching methods such as e-learning and blended learning and their impact on students' academic achievement have been widely studied. Zakaria and Khalid (2016) highlighted that the teaching of mathematics involves multiple types of technology for many advantages. On the other hand, selecting a good platform for technology during online learning (OL) is important (Zakaria & Khalid, 2016). The learning environment definitely affects students' participation since the current situation of conducting OL is a new norm for all students. Nevertheless, students' achievement in mathematics is not solely dependent on effective teaching methods and the learning environment. The learning process has been identified as a complex task among teachers or educators.

Suneetha (2019) argued that the learning process is complex but non-linear. It is a universal and never-ending process that requires actual commitment, practical experience, and focused thinking. Learning causes some changes in the learner, which can be seen in their individual behaviour and beliefs. Lesson planning and design must take into account the beliefs that students hold. Active learning can therefore be imposed on the learning process. For example, the teacher may use a learning game strategy to pursue students' motivation and interests while working on the assigned task, along with giving verbal praise to the students to maintain student involvement in learning (Ayuwanti et al., 2020). In an OL, the teacher can use facilitation tactics such as weekly introductory videos, discussion boards, teacher-created content, interactive webinars, online announcements and emails, lecture recording, and formative quizzes to increase students' engagement in learning (Muir et al., 2020). In addition, it has been reported that motivation also plays a role in engaging students.

High levels of involvement indicate high levels of motivation. Damodaran (2020) reported that students exhibit a high level of engagement in learning, which is reflected in their abilities, performance, emotional state, and participation and interaction in a classroom. Students are also highly motivated in class, as evidenced by their connections with peers, a sense of belonging to the class, a willingness to learn, and the freedom to choose how they learn (Damodaran, 2020). The interest of students in crucial learning activities lies in motivation. Student interest in mathematics can be seen in how well the student is involved and takes part in any learning activities, including mathematical tasks as well as solving mathematical problems, and it may also vary depending on the gender. The majority of students are uninterested in learning mathematics. In comparison to the female student, the male student indicated a higher level of interest (Oluyemo et al., 2020). Students with better study habits, stronger self-esteem and self-efficacy, and a more positive attitude toward mathematics are more engaged in learning mathematics (Larino, 2019).

Classroom motivation has been found to influence students' engagement in learning (Damodaran, 2020). The student's engagement here refers to cognitive engagement, behavioural engagement, and affective (emotional) engagement. The student's level of motivation is related to either one of these types of engagement or all at once. For example, cognitive engagement is the most important predictor of student involvement in the classroom (Mustamiah & Widanti, 2018). This is demonstrated by the student's willingness to put up the effort required to comprehend a learning material and acquire a skill. Commonly, students demonstrated moderate levels of motivation in the classroom (Mastur et al., 2020). As a result, investigation of how students engage in a mathematics class is crucial. Thus, this study aims to identify the level of universality of students' engagement and motivation in learning mathematics. The outcomes of this study provide insights into how students engage in the learning of mathematics during OL at a public university.

The Objectives of this Study are

1) to identify students' levels of engagement in a mathematics class.
2) to identify students' levels of motivation in a mathematics class.
3) to evaluate any correlation between students' engagement and motivation in a mathematics class.

Methods

A quantitative research-based methodology was used in this study, and a correlational research design was employed. In an OL mathematics class, students' motivation and engagement level, as well as the correlations between the variables, were determined using correlational analysis. Students majoring in mathematics education at a certain public university in Malaysia served as the study's target population. Purposive sampling was the chosen sampling strategy. Students' participation in OL for at least four months was taken into account for determining eligibility. Their duration of affiliation with the faculty was taken into account while determining the exclusion criteria. The study eliminated participants who were in their first semesters and those who were completing teaching practical. As a result, only 169 students took part in the study. A questionnaire survey served as the study's primary research instrument to measure students' motivation and engagement. The questionnaire consists of 49 items (excluding demographic background). It was modified from an earlier

investigation. Ten-point rating scales were used to measure the variables in the questionnaires. The test instrument had a Cronbach's Alpha reliability score of more than 0.70. The collected data was analysed using both descriptive and inferential methods. The descriptive analysis (frequency, percentage, mean, and standard deviation) was used to answer research questions 1 and 2. The inferential analysis (Pearson Correlation) was used to answer research question 3. Both statistical analyses were run and analysed by using the SPSS software, with all items from the survey that sound negative in their meaning coded reversely in SPSS.

Findings

Descriptive Results

The first analysis involved in this study is descriptive. The descriptive analysis was used to identify students' levels of engagement in mathematics class and students' levels of motivation in mathematics class. In interpreting the students' level of motivation and engagement in OL mathematics classes, the mean score was described according to the referenced score as depicted in Table 1.

Table 1
Interpretation of Mean Score

Mean score range	Interpretation of Level
1.0 – 2.0	Very low
2.1 – 4.0	Low
4.1 – 6.0	Medium
6.1 – 8.0	High
8.1 – 10.0	Very high

Research Question One: *What are the students' levels of engagement in a mathematics class?*
The students' levels of engagement in mathematics class were measured by three dimensions of engagement, which are cognitive, behavioural, and affective/emotional. Overall, students' level of engagement in mathematics class was high, with M = 6.97 and SD = 1.25. In addition, the types of engagement students demonstrated in mathematics class the most were cognitive engagement, followed by affective engagement, and behavioural engagement (Table 2). The type of engagement that recorded the highest mean (M = 7.12, SD = 1.47) was cognitive engagement, which refers to student interest in learning mathematics, a willingness to take up learning, and effort and willingness to work on a task. The lowest mean (M = 6.77, SD = 1.27) was behavioural engagement, which refers to students' active participation in academic and social activities that include attention, involvement, and cooperation with peers in in-class activities (Attard, 2012). Furthermore, the mean for each dimension of engagement (Table 2) was also above the average mean, which indicates that students have a high level of engagement in mathematics class for each domain (cognitive, behaviour, and affective/emotional) (Figure 1).

Table 2
Three Dimensions of Student Engagement

Dimensions	Min	Max	M	SD
Cognitive Engagement	3.33	10.00	**7.12**	1.47
Behavioral Engagement	2.92	10.00	**6.77**	1.27
Affective Engagement	3.33	10.00	7.04	1.68
Overall Engagement	4.55	9.88	**6.97**	1.25

**Note: M=mean, SD=standard deviation, N=169*

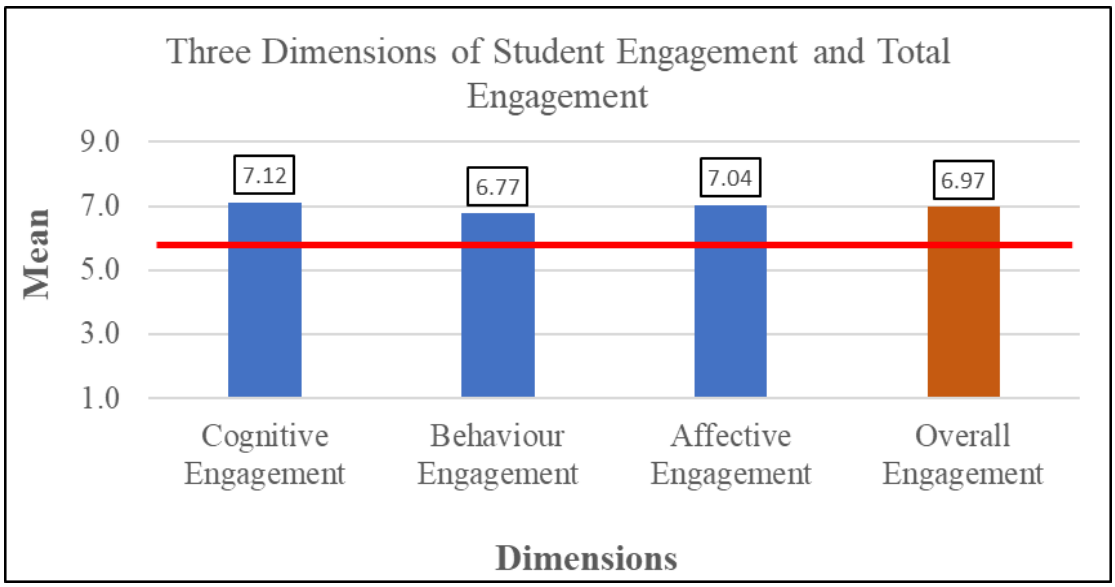

Figure 1. Student Level of Engagement in Mathematics Class

Research Question Two: *What are the students' levels of motivation in a mathematics class?* Students' levels of motivation in mathematics class were measured through five motivational factors in learning mathematics. Students' level of motivation in mathematics class overall was recorded as high with M = 6.70 and SD = 1.27. The student's motivation in learning mathematics with the highest mean was the ability (M = 7.57, SD = 1.83), which represents students' ability in studying mathematics independently, including students' capability and commitment to complete the mathematics task, solve mathematical problems independently without discontentment, and how students control themselves when facing a mathematics problem (Teoh et al., 2010). On the other hand, the lowest mean was reported for confidence (M = 5.36, SD = 1.78), which refers to students' confidence in studying mathematics, including their emotional reaction to facing the difficulty of mathematical problems and mathematics tasks. In a nutshell, students' motivation in mathematics class is more about their ability to study mathematics, followed by involvement, interest, effort, and confidence in studying mathematics (Table 3). In addition, the students demonstrated high motivation in mathematics class for ability, involvement, and interest but at a medium level for effort and confidence (Figure 2).

Table 3
Five Motivational Factors in Learning Mathematics

Motivation Factor	Min	Max	M	SD
Involvement	4.00	10.00	7.07	1.39
Confidence	1.33	10.00	**5.36**	1.78
Interest	2.00	10.00	6.76	1.80
Effort	1.00	10.00	5.66	2.66
Ability	1.00	10.00	**7.57**	1.83
Overall Motivation	3.38	10.00	**6.70**	1.27

**Note: M=mean, SD=standard deviation, N=169*

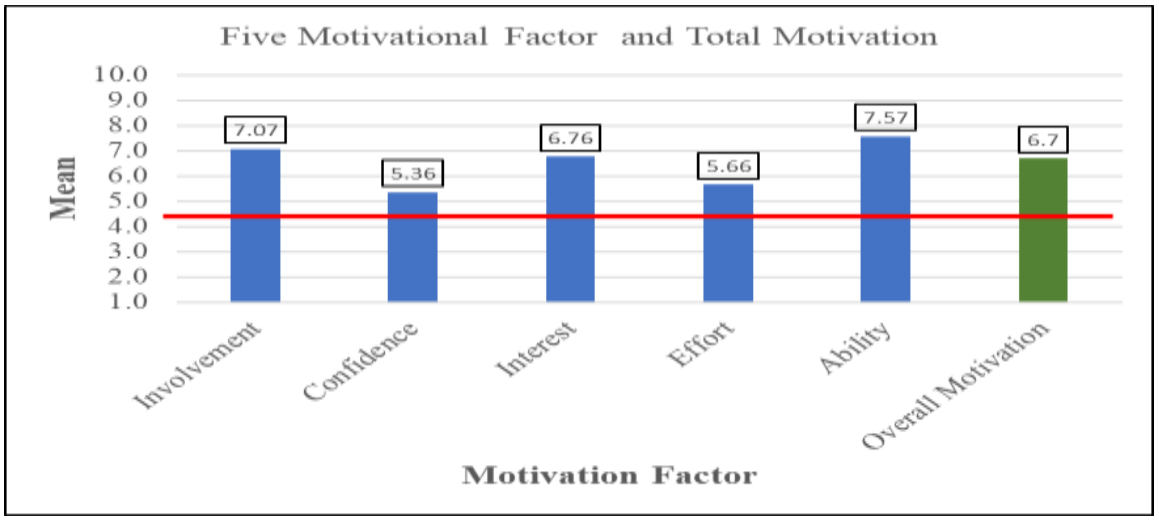

Figure 2. Student Level of Motivation in Mathematics Class

The inferential analysis employed was correlational analysis, which is Pearson's Correlation. Before performing the correlation analysis, all Pearson Correlation assumptions were met. The Pearson correlation was used to investigate the following hypothesis:

Ho: There is no correlation between student engagement and motivation in a mathematics class.

Ha: There is a correlation between student engagement and motivation in a mathematics class.

First, normality testing was run for the testing of assumptions in the Pearson correlation analysis. The normal Q-Q plot depicts the normality test. It demonstrates that both motivation and engagement are normally distributed variables (Figures 3 and 4).

Next, the scatterplot was used to describe the linear relationship that exists between the two variables, namely student motivation and engagement. Figure 5 shows that the points on the scatterplot follow a straight-line pattern and shows an upwards pattern that moves to the right and is mostly scattered along the straight-line pattern of the plotted data points. This demonstrates that there is a positive linear relationship between the variables (engagement and motivation).

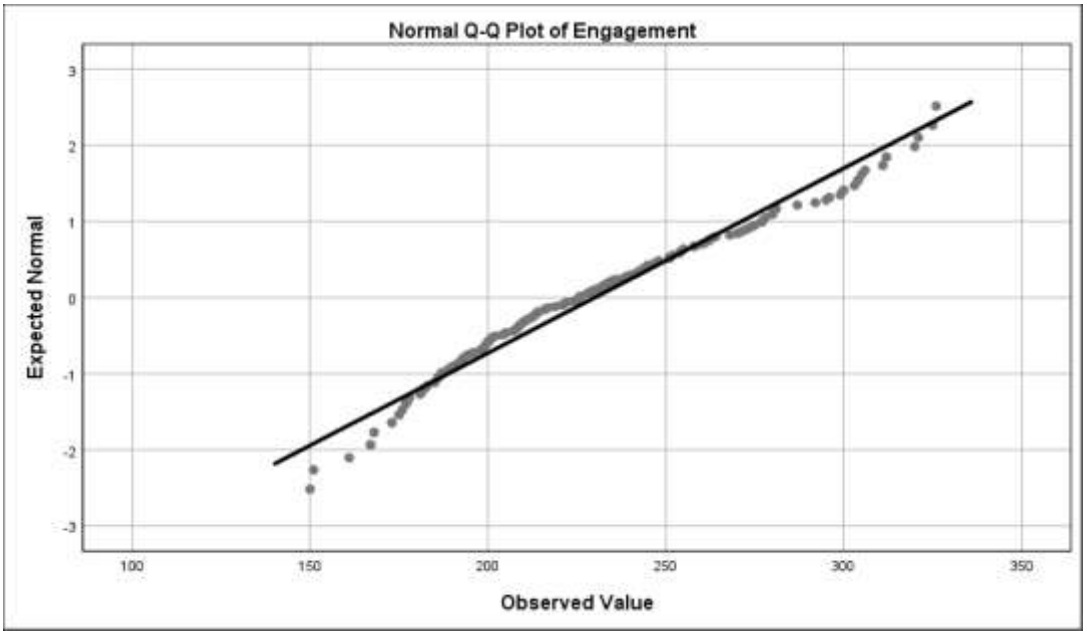

Figure 3. Normal Q-Q Plot of Engagement

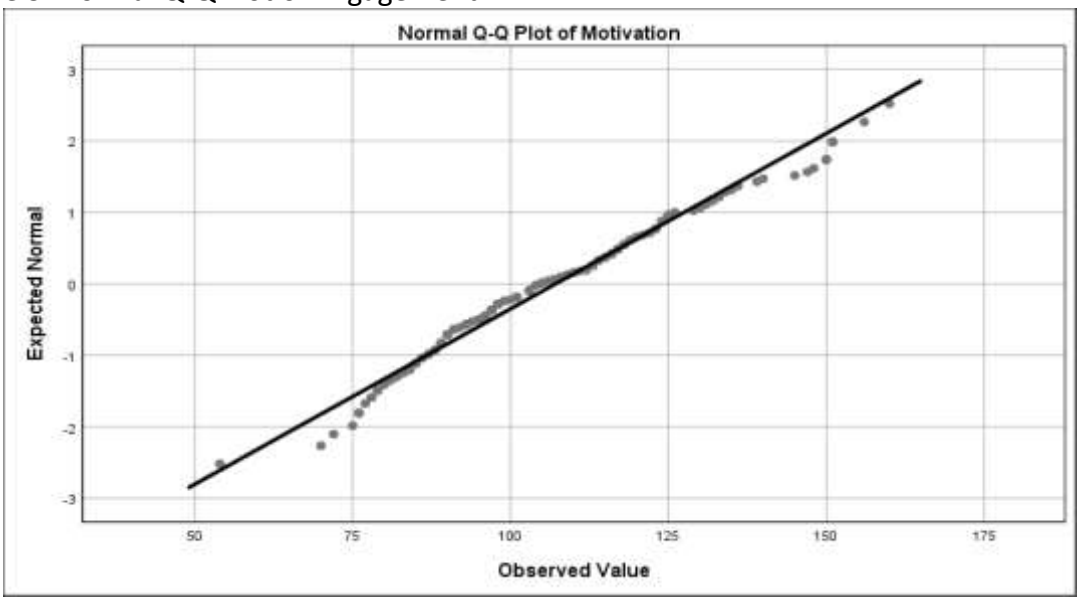

Figure 4. Normal Q-Q Plot of Motivation

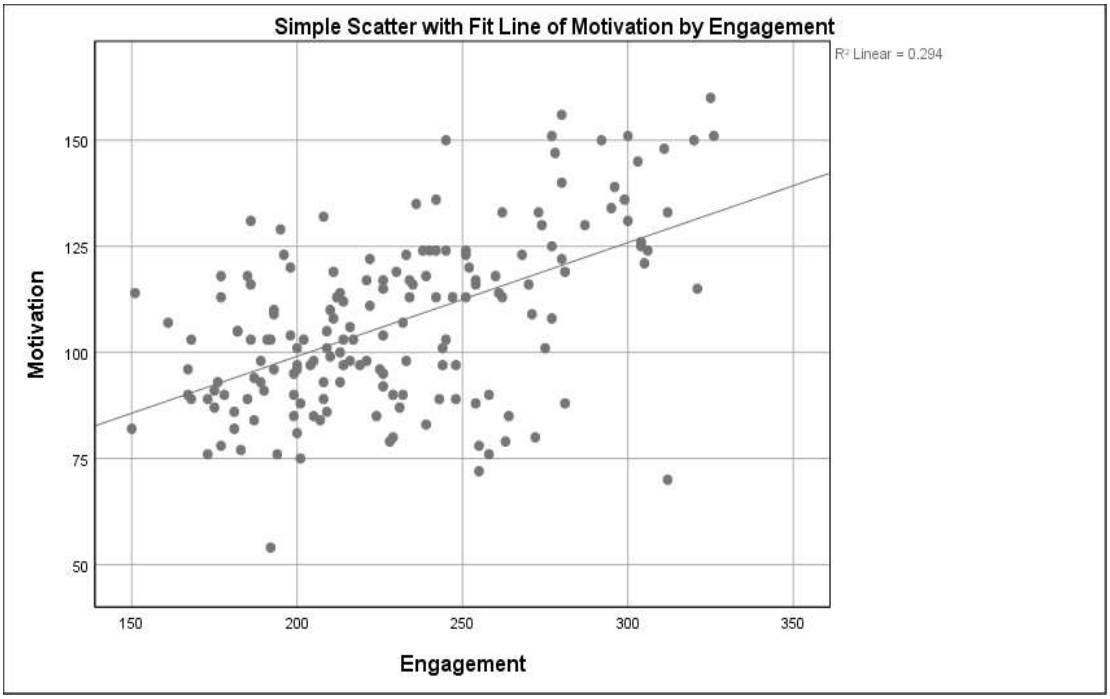

Figure 5. Scatterplot between Engagement and Motivation

Research Question Three: *Is there any correlation between student engagement and motivation in mathematics class?*

The Pearson correlation analysis shows that the Pearson correlation coefficient, r =.54 (Table 4). This indicates a moderately positive correlation between the variables, namely engagement, and motivation, with a p-value less than 0.05. Based on the Pearson Correlation analysis, it found that the correlation coefficient was 0.54, which indicates a moderate positive correlation between the two variables, engagement, and motivation. The significant value of less than 0.05 indicates that the null hypothesis was rejected. Hence, there was a moderate positive correlation between student engagement and motivation in OL mathematics classes among undergraduate students at a public university.

Table 4

Correlation between Students' Motivation and Engagement

	Engagement	**Motivation**
Engagement	.	.54**
Motivation	.54**	.

*Note:** Correlation is significant at the 0.01 level (2-tailed)*

Discussion and Conclusion

In this study, it was found that the undergraduate students' overall engagement level was high. The students put a lot of effort into engaging themselves cognitively and effectively in three main aspects, namely: (1) cognitive engagement refers to students' willingness to learn and work on mathematical tasks (e.g., figuring out and learning new information; understanding the learning material; making on examples when learning mathematics concepts; and trying to combine pieces of information when solving a mathematical problem); (2) behavioural engagement refers to students' effort and interest in learning

mathematics (e.g., work hard, pay attention in class, and actively participate in class activities); (3) affective engagement refers to students' enjoyment of learning (e.g., interested, happy, and looking forward to attending mathematics class). This indicates that the learning environment for the OL mathematics class was quite conducive, where most of the students were highly engaged in their learning activities and task performance. This challenged the study conducted by Barber et al (2017), which reported that students were moderately engaged in all areas of engagement (behavioral, emotional, and cognitive) in the classroom and learning. Hence, students' level of learning mathematics during the pandemic period was unexpected and remained at a moderately high level of engagement.

Furthermore, among the three dimensions of engagement, it appeared that cognitive engagement was the most significant in university students' engagement orientation. This is supported by Mustamiah and Widanti (2018) that cognitive engagement is the most important predictor of student participation in the classroom. This is demonstrated by the student's willingness to put up the effort required to comprehend a learning material and acquire a skill. The study conducted by Larino (2019) reported the same observation in which students exhibit a high degree of cognitive and affective involvement but an average level of behavioural engagement. This shows that students are more cognitively engaged in an online environment than behaviorally engaged. Rather than actively participating in in-class activities, students preferred to make an effort to comprehend the learning material and acquire a skill via OL.

As a result, this study challenges the study conducted by Mohammed et al (2015), which argued that students were more highly engaged emotionally than cognitively in class. Students reported being highly engaged in class when they felt like they belonged to the school and emotionally bonded with the school, teachers, and peers (Mohammed et al., 2015). The finding is somehow surprising and opposite to the general expectation that students are working hard, paying attention, and actively participating in class activities (e.g., discussions, forums, completing tasks, and games) to adapt to the online learning environment (Dixson, 2015). Task design, ignorance of responses, and introversion are some potential contributing aspects to these findings (Damodaran, 2020). But since this observation was merely supported by descriptive statistics, further research can be done to explore the potential of a causal association.

In this study, the students' motivation in the mathematics OL class was reported to be moderately high. This indicated that the undergraduate students were interested in and liked attending OL mathematics classes; confident in solving mathematical problems and tasks; and able to learn mathematical concepts and work on mathematical problems independently. This agrees with the study conducted by Damodaran (2020); Hikmawati (2018); Radovan and Makovec (2015) that found students are highly motivated in class and learning when they have learning connections with peers, a sense of belonging to the class, a willingness to learn, and the freedom to choose how they learn (Damodaran, 2020). Similarly, the study found that students were not only highly engaged, but also highly motivated to learn in an OL mathematics class by demonstrating their involvement, interest, self-confidence, effort, and ability in mathematics. However, students are not often motivated in class (Mohammed et al., 2015). This is due to factors such as math anxiety, students' prior knowledge, and

individual expectations (Ichinose & Bonsangue, 2014). In online learning, learning environments and challenges such as poor internet connection, instructional material accessibility, and teacher-student interaction are the reasons students have a low level of motivation in learning and class (Muslimin & Harintama, 2020; Fuqoha et al., 2018; Ayuwanti et al., 2020). Hence, the teacher needs to ensure the classroom setting is suitable and effective in stimulating the high motivation of the student in learning mathematics.

Furthermore, the study found that undergraduate students had the highest motivation towards ability, which involves their commitment to learning mathematics, while having the lowest motivation towards confidence, which refers to their capability and persistence in completing mathematics tasks. A study by Waini et al (2014) observed students' lack of confidence in learning mathematics and were unsure of their degree of confidence. This is because the students believe that it is difficult for them to learn a tough topic in mathematics and that they lack confidence in their ability to solve the issues. Evaluation of the students' confidence in mathematics is essential as self-confidence plays an important role in determining student involvement and participation in-class activities (Ciftci & Yildiz, 2019). To boost students' confidence in OL mathematics classes, the finding further suggests that the teacher needs to provide a learning environment that can boost student confidence in learning mathematics by encouraging student interaction with group members and participating in group activities such as sharing ideas, asking questions, discussing, and exchanging knowledge (Khun-Inkeere et al., 2017).

The results of the positive correlation between engagement and motivation indicated consistent findings from current studies. It is parallel with the study conducted by Damodaran (2020); Mustamiah and Widanti (2018) where students' motivation was positively correlated with their engagement. This means that when university students were motivated, they were also engaged in their mathematics classes. If there was a decrease in students' motivation to learn mathematics, there was also a decrease in their engagement in mathematics classes. Hence, enhancing student motivation in the classroom is important to encourage active participation of the students in class and learning activities. However, Mustamiah and Widanti (2018) reported that students' learning motivation is affected by students' engagement in the classroom, by which motivation is not only affected by students' overall engagement but also predicted by their specific domain of engagement in class (Atoum & Shalalfeh, 2018). The student's level of motivation is affected by either one of these types of engagement (cognitive, behavioural, or emotional) or all at once. On the other hand, a reversed description was provided. For example, Reinhold et al (2021) reported that emotional engagement and behavioural engagement predicted students' motivation in learning mathematics. Similarly, Mustamiah and Widanti (2018) reported that cognitive engagement predicted students' motivation in class. Hence, this study argued that despite being highly engaged in learning and the classroom, the student's motivation is not highly predicted by their high level of engagement in all aspects (cognitive, behavior, and emotional/affective) since the correlation showed a moderate correlation. Therefore, it is suggested that further investigation should be done to evaluate the causal relationship between both variables.

This study has reached the following conclusion

First, university students' levels of engagement in OL mathematics classes were high. The undergraduate mathematics education students did not only show a high level of engagement in mathematics class overall but also engaged themselves in mathematics class in terms of cognition, behavior, and affection/emotion. Cognitive engagement appears to be the significant engagement of university students in OL mathematics classes, followed by affection/emotion and behavioural engagement. Thus, it can be concluded that online learning provides a conducive environment in which the students are highly engaged in learning mathematics.

Second, university students had a high level of motivation in the OL mathematics class. The result of the study suggests that an OL mathematics class offers a motivating and self-assuring climate for students to pursue mathematics learning. Students demonstrated their level of motivation in the aspects of their ability, involvement, interest, effort, and confidence in learning mathematics, where ability was recorded as the highest contributor to students' motivation in OL mathematics class. According to the findings of the study, students were motivated to study mathematics independently, capable and committed to completing a mathematics task, capable of solving mathematical problems independently without dissatisfaction, and capable of controlling themselves when confronted with a difficult mathematics problem.

Third, there was a moderate positive correlation between student engagement and motivation in mathematics class. There was an increase in motivation among the students for learning mathematics, and there was also an increase in their engagement in mathematics class. However, it is suggested that further investigation of the causal relationship between the variables, engagement and motivation, be conducted.

Acknowledgement

The authors gratefully acknowledge the support given by Universiti Teknologi MARA (UiTM) Malaysia. Specifically, gratitude is extended to the Faculty of Education at UiTM for the continuous support in completing and publishing this research work.

Corresponding Author

Teoh Sian Hoon
Universiti Teknologi MARA, Malaysia
Email: teohsian@uitm.edu.my

References

Attard, C. (2012). Engagement with mathematics: What does it mean and what does it look like? *Australia Primary Mathematics Classroom*, 17(1), 9-13. Retrieved from https://files.eric.ed.gov/fulltext/EJ978128.pdf

Ayuwanti, I., Marsigit, & Siswoyo, D. (2020). Teacher-student interaction in mathematics learning. *International Journal of Evaluation and Research in Education (IJERE)*, 10(2), 660-667. doi:https://doi.org/10.11591/ijere.v10i2.21184

Barber, A. M., Buehl, M. M., & Beck, J. S. (2017). Dynamics of engagement and disaffection in a social studies classroom context. *Psychology in the schools,* 54(7), 736-755. doi:https://doi.org/10.1002/pits.22027

Bonwell, C.C. and Eison, J.A. (1991). Active learning: Creating excitement in the classroom. *(ASHE-ERIC Higher Education Report No. 1, 1991)*. Washington, D.C.: George Washington University Clearinghouse on Higher Education Retrieved from https://files.eric.ed.gov/fulltext/ED336049.pdf

Ciftci, S. K., & Yildiz, P. (2019). The effect of self-confidence on mathematics achievement: The meta-analysis of trends in international mathematics and science study (TIMSS). *International Journal of Instruction*, 12(2), 683-694. doi:https://doi.org/10.29333/iji.2019.12243a

Damodaran, S. (2020). The role of students engagement in the relationship between classroom motivation and academic achievement. *Master Thesis*, Universiti Malaya, Kuala Lumpur.

Deng, R., Benckendorff, P., & Gannaway, D. (2020). Learner engagement in MOOCs: Scale development and validation. *Br. J. Educ. Technol*., 51, 245-262. doi:https://doi.org/10.1111/BJET.12810

Dixson, M. D. (2015). Measuring students engagement in the online course: The online student engagement scale (OSE). *Online Learning*, 19(4). Retrieved from https://files.eric.ed.gov/fulltext/EJ1079585.pdf

Espinoza, J., Lupianez, J. L., & Segovia, I. (2022). A study of the complexity of problems posed by talented students in mathematics. *Mathematics,* 10(11), 1841. doi:https://doi.org/10.3390/math10111841

Filgona, J., Sakiyo, J., Gwany, D. M., & Okoronka, A. U. (2020). Motivation in learning. *Asian Journal of Education and Social Studies*, 10(4), 16-37. doi:https://doi.org/10.9734/AJESS/2020/v10i430273

Fuqoha, A. A., Budiyono, & Indriati, D. (2018). Motivation in mathematics learning. *Pancaran Pendidikan*, 7(1), 202-209. doi:https://doi.org/10.25037/pancaran.v7i1.151

Hikmawati. (2018). The correlation between classroom climate and students' motivation in English class at SMK Muhammadiyah 2 Bontoala. *Degree Thesis*, Muhammadiyah University of Makassar, English Education Department Faculty of Teacher Training and Education, Makassar. Retrieved from https://digilibadmin.unismuh.ac.id/upload/5165-Full_Text.pdf

Ichinose, C., & Bonsangue, M. (2014). Mathematics self-related beliefs and online learning. *The Learning Assistance Review*, 21(1), 55-70. Retrieved from https://files.eric.ed.gov/fulltext/EJ1095721.pdf

Khun-Inkeere, H., Omar-Fauzee, M. S., & Othman, M. K. (2017). The effect of students confidence level toward mathematics performance among southern Thailand primary school children. *International Journal of Academic Research in Progressive Education and Development,* 7(2), 20-34. doi:https://doi.org/10.6007/IJARPED/v6-i2/2934

Larino, L. B. (2019). Correlates of the learning engagement in mathematics of grade 10 science, technology and engineering (STE) students. *International Research Journal of Multidisciplinary Studies*, 5(5), 1-8. Retrieved from www.irjms.in

Mastur, R., Rofiqoh, & Suriaman, A. (2020). Correlation between students' motivation and English achievement at secondary school level. *Advances in Social Science, Education and Humanities Research,* 534, 112-119. Retrieved from http://creativecommons.org/licenses/by-nc/4.0/

Mohammed, Y. M., Yusuf, M., & Maria, S. (2015). Motivation and engagement as a predictor of students' science achievement satisfaction of Malaysian of secondary school

students. *European Journal of Social Science Education and Research,* 2(4), 25-33. Retrieved from https://revistia.com/files/articles/ejser_v2_i4_15/Mohammed.pdf

Muir, T., Douglas, T., & Trimble, A. (2020). Facilitation strategies for enhancing the learning and engagement of online students. *Journal of University Teaching & Learning Practice*, 17(3). Retrieved from https://ro.uow.edu.au/jutlp/vol17/iss3/8

Muslimin, A. I., & Harintama, F. (2020). Online learning during pandemic: Students' motivation, challenges, and alternatives. *Loquen: English Studies Journal*, 60-68. doi:https://dx.doi.org/10.32678/loquen.v13i02

Mustamiah, D., & Widanti, N. S. (2018). Learning motivation as predictor of student engagement in private junior high schools students. *Proceedings of the 3rd International Conference on Psychology in Health, Educational, Social, and Organizational Settings* (pp. 486-493). Science and Technology Publications, Lda. doi:https://doi.org/10.5220/0008591204860493

Oluyemo, A., Musbahu, A., Kukwil, I., Anikweze, C., & Shaluko, Y. (2020). Gender differences in mathematics interest and achievement in junior secondary school students, Niger state, Nigeria. *International Journal Research and Innovation in Social Science*, IV(X), 359-366. Retrieved from www.rsisinternational.org

Palmer, D. (2007). What is the best way to motivate students in science? *Teaching Science: The Journal of the Australian Science Teacher,* 53(1), 38-45.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, 93, 223-231. https://doi.org/10.1002/j.2168-9830.2004.tb00809.

Radovan, M., & Makovec, D. (2015). Relationship between students' motivation and perceptions of the learning environment. *C.E.P.S Journal*, 5(2), 115-138. Retrieved from https://files.eric.ed.gov/fulltext/EJ1128947.pdf

Saeed, S., & Zyngier, D. (2012). How motivation influences student engagement: A qualitative case study. *Journal of Education and Learning*, 1(2), 252- 267. doi:https://doi.org/10.5539/jel.v1n2p252

Suneetha, D. (2019). Course 3 learning and teaching perspective in education. Karnataka: Mangalore University. Retrieved from https://mangaloreuniversity.ac.in/sites/default/files/2019/Course-3%20Learning%20and%20Teaching%20(%20English%20Version).pdf

Teoh, S. H., Koo, A. C., & Singh, P. (2010). Extracting factors for students' motivation in studying mathematics*. International Journal of Mathematics Education in Science and Technology*, 41(6), 711-724. doi:https://doi.org/10.1080/00207391003675190

Tharawoot, Y. (2016). Questions and verbal feedback and their implications on Thai undergraduate students participation. *International Journal on Language Literature and Culture in Education*, 3(2), 3-23. doi:https://doi.org/10.1515/llce-2016-0007

Waini, I., Hamzah, K., Saidi, R. M., Miswan, N. H., Zainal, N. A., & Ahmad, A. (2014). Self-confidence in mathematics: A case study on engineering technology students in FTK, UTeM. *International Journal for Innovation Education and Research*, 2(11), 10-13. doi:https://doi.org/10.31686/ijier.vol2.iss11.262

Zakaria, N. A., & Khalid, F. (2016). The benefits and constraints of the use of information and communication technology (ICT) in teaching mathematics. *Creative Education*, 7(11), 1537-1544. doi:http://dx.doi.org/10.4236/ce.2016.711158