# Student Number Size as Moderator in Affecting the Four Factors of Students' Perceived Engagement in Task-based Learning under Blended English Learning Environment

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## ABSTRACT

This article delves into utilizing blended learning and addresses the tasks given for this approach. During the pandemic, blended learning tasks will be assigned to the learners. However, the effectiveness of using tasks might not serve the purpose. Hence the study in this article has evaluated students' perceived engagement in the tasks designed for blended learning from the perspective of timeliness of task, richness of task, accuracy of task and adaptability of task. There were also moderating effects on the relationships studied. The research study described in this article employed a survey designed to investigate the impact of student size on students' perceived engagement (SPE) in English as a Foreign Language (EFL) task-based activities in a blended learning environment. The study aims to examine the impact of student number size as a moderator on the four factors of students' engagement in task-based learning within a blended English learning environment. The study aims to determine the impact of student number size on students' engagement in task-based learning in a blended English learning environment. An ANOVA (Analysis of Variance) test was conducted to achieve this. The focus is on how student number size acts as a moderator in affecting the four factors of students' engagement: timeliness of task, richness of task, accuracy of task, and adaptability of task. The study's results contribute to understanding how student number size can impact students' perceived engagement in blended learning and provide insights for educators to optimize blended learning environments to maximize student engagement.

Keywords: *task-based learning, timeliness of task, richness of task, accuracy of task, adaptability of task, students number size*

## INTRODUCTION

During the pandemics, blended learning tasks were assigned to the learners via blended learning environment. However, the effectiveness of using tasks might not serve the purpose. Blended learning is a teaching method that combines traditional in-person instruction with technology-based learning, such as online activities, videos, and educational software. Blended learning can enhance the educational experience by providing students with flexibility, personalized learning, and access to a wider range of resources. Tasks assigned for blended learning include online discussions, group projects, quizzes, and virtual lectures. The key to successful blended learning is finding the right balance between technology and in-person instruction and ensuring that the tasks assigned are aligned with learning objectives and are engaging for students. In the blended learning environment, students could involve in a class taught or directed by a teacher in a face-to-face classroom setting and complete the online learning component of the course independently, outside of the classroom, through an online platform (Sriwichai, 2020). The blended learning approach has two main delivery modes: face-to-face classroom learning and online-based learning experience. The use of a blended approach to learning is growing in popularity as it offers the benefits of both modes of delivery, such as the interactive and collaborative nature of face-to-face instruction combined with the flexibility and accessibility of online learning. (Rasheed et al.,

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2020; Albiladi & Alshareef, 2019; Hrastinski, 2019). Hence, blended learning can incorporate online learning tools and activities into face-to-face classroom instruction (Sriwichai, 2020).

Having clarified the meaning of a blended learning environment set for English Learning, it is essential to reflect on whether the tasks given for English Learning have served their purposes. Feedback and perceptions from the learners are vital. Hence the study in this article has evaluated students' perceived engagement in the tasks designed for blended learning from the perspective of task timeliness, the task's richness, accuracy of task and adaptability of the task.

Additionally, the relationships might be affected by the moderating effects of student number size. Therefore, this moderator has to be given due attention. And it is the focus of this study.

## PROBLEM STATEMENT

The consequence of not doing this research is that educators and institutions may miss out on the potential benefits of understanding how student number size can impact engagement in task-based learning under a blended English learning environment. This understanding could inform decisions around teaching strategies and course design, ultimately leading to more effective and engaging student learning experiences.

## LITERATURE REVIEW

### An Overview of Literature Review

Framing students' engagement in a blended learning environment requires understanding the mechanisms of students' success in a blended learning environment (Kahu, 2013; Kahu & Nelson, 2018). These areas of understanding would certainly cover understanding tasks given under the blended learning environment in supporting learning. Measuring students' engagement in technology-mediated learning, such as blended learning, is thus called for (Henrie et al., 2015). Therefore, the relevance of tasks that affect perceptions of learning engagement should not be ignored.

Timeliness of tasks is defined as the timely arrangement of learning tasks provided in the blended learning environment. It is vital as it affects the positive learning experience through the timely learning content provided to the learners (Wang & Wang, 2018). Once the students are convinced that the learning content provided is timely and can enhance their learning, they will be keen to be involved in all the assigned tasks. Hypothesis H1 states that the number of students in a blended learning environment can impact their perceptions of the timeliness of tasks in task-based activities for English as a Foreign Language (EFL). The hypothesis suggests that there may be a relationship between the number of students and the perception of the task's timing and that larger student groups may lead to different perceptions of task timeliness compared to smaller groups. This is an important issue, as effective time management in task-based activities is crucial for a successful learning experience. Further research is needed to test this hypothesis and understand the relationship between student size and timeliness perceptions in a blended learning environment for EFL.

According to Prasetya et al. (2020), the diversity of learning tasks is crucial in determining the richness of tasks provided in a blended learning environment. The richness of tasks should not be overlooked to promote engagement in blended learning among the learners. Students might be bored doing monotonous, repetitive and unchallenged tasks. Hypothesis H2 states that the number of students in a blended learning environment can influence their perceptions of the richness of tasks in task-based activities for English as a Foreign Language (EFL). The hypothesis suggests that there may be a correlation between the size of the student group and the perceived richness of the task and that larger student groups may result in differing perceptions of task richness compared to smaller groups. Understanding the relationship between student size and perceptions of task richness is important as it can help educators to design and deliver effective task-based activities that meet the needs of their students in a blended learning environment. Further research is necessary to validate this hypothesis and to deepen our understanding of this complex relationship.

Additionally, the accuracy of tasks is often related to the suitability of developing language skills designed for the particular courses (Brudermann et al., 2021). Hypothesis H3 posits that the number of students in a blended learning environment can impact their perceptions of the accuracy of tasks in task-based activities for English as a Foreign Language (EFL). The hypothesis suggests that there may be a relationship between the size of the student group and the perceived accuracy of the task and that larger student groups may lead to different perceptions of task accuracy compared to smaller groups. Accuracy in this context refers to how the task accurately reflects the learning objectives, measures the appropriate language skills, and provides accurate feedback. This is a critical aspect of task-based activities as it affects the quality of learning and the validity of the assessment. Further research is needed to test this hypothesis and provide a deeper understanding of the relationship between student size and task accuracy perceptions in a blended EFL learning environment.

The purpose of having task adaptability is to look into the diversity in need during the learning process. Learning analytics is required to suit the adaptability of tasks for learners of various levels of capability and competencies (Tempelaar, 2020). Therefore, it is essential to have adequate communication between the instructor and learners, as this will assist the instructor in being flexible and adaptive to the learning needs of the students. Hypothesis H4 states that the number of students in a blended learning environment can influence their perceptions of the adaptability of tasks in task-based activities for English as a Foreign Language (EFL). The hypothesis suggests that there may be a correlation between student group size and the perceived adaptability of the task and that larger student groups may result in different perceptions of task adaptability compared to smaller groups. Further research is necessary to validate this hypothesis and to deepen our understanding of the relationship between student size and perceptions of task adaptability in an EFL context.

The learners' socio-demography and moderating effects have grabbed the attention of many scholars (Akbar, 2013). This is because these socio-demographic characteristics, such as age, gender, educational background, locations of studies, etc., often bring about moderating effects of the timeliness of task, richness of task, accuracy of the task, and adaptability of task on students' perceived engagement in EFL task-based activities in the blended learning environment. This study will verify the effects of the moderator of student number size on the relationships studied. Hypothesis H5 suggests that the number of students in a blended learning environment can impact their perceived engagement in task-based activities for English as a Foreign Language (EFL). The hypothesis postulates that there may be a relationship between student group size and the students' perceived level of engagement and that larger student groups may result in different levels of perceived engagement than smaller groups. Engagement in this context refers to the extent to which students are involved, motivated, and interested in the task. This is a critical aspect of task-based activities as it directly affects students' motivation, participation, and, ultimately, their learning outcomes. Further research is needed to test this hypothesis and to gain a deeper understanding of the relationship between student number size and perceived engagement in a blended learning environment for EFL.

In sum, there are five research hypotheses in this study. They are:

- H1: Student number size affects students' perceptions of timeliness of task (TT) in EFL task-based activities in the blended learning environment.
- H2: Student number size affects students' perceptions of the richness of task (RT) in EFL task-based activities in the blended learning environment.
- H3: Students' number size affects the perceptions of the accuracy of task (AT) in EFL task-based activities in the blended learning environment.
- H4: Students' number size affects the perceptions of the adaptability of task (ADT) in EFL task-based activities in the blended learning environment.
- H5: Student number size affects the perceptions of the students' perceived engagement (SPE) in EFL task-based activities in the blended learning environment.

**METHODOLOGY**

The research design is a quantitative survey. It was conducted at four Shandong universities in China with 255 student participants. A course in English was offered during Spring 2022 for these students using blended learning with task-based teaching methods. A questionnaire was administered at the semester's end to solicit student feedback. The research process is shown in Figure 1 below. Demographic information for these participants is presented in Table 3.
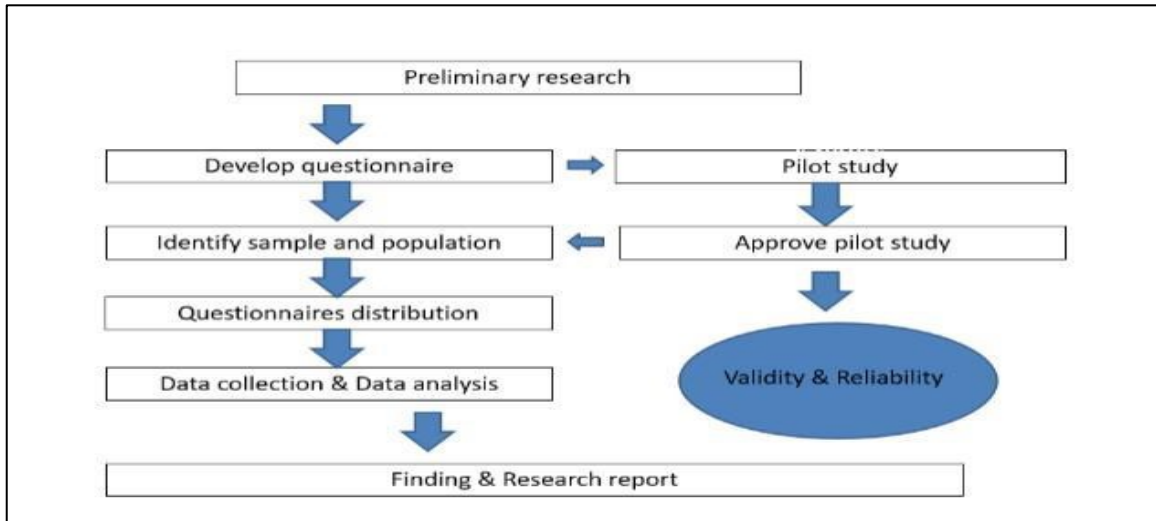


**Figure 1.** Research Process

Table 1 below shows the survey items used to assess the model's constructs in this study. Table 2 shows Cronbach's Alpha value if the item is deleted. All values are above 0.7, indicating higher and stronger reliability indices. The reliability indices for all dimensions were above 0.7 and below 0.95. Even though there are two values which are slightly high than .95, as a whole, they are accepted. Thus, no issues of multicollinearity and auto-collinearity occurred. This instrument is suitable for PLS-SEM analysis later in this study.

**Table 1.** Items in the Instrument of This Study

| Item number | Item | Reference |
|---|---|---|
| Dv | Students' perceived engagement (SPE) | |
| 1 | I'm actively engaged in completing tasks. | |
| 2 | I'd like to take part in task-based learning activities. | |
| 3 | I think that actively completing these tasks facilitates my study. | |
| 4 | I think that these task-based activities are important. | |
| Iv 1 | Timeliness of task (TT) | |
| 5 | When instructor posts a class announcement the tasks I should do, I can receive the message immediately. | Lan & Sie (2010) |
| 6 | When peer replies a discussion topic on the tasks, I can receive the replied message automatically. | |
| 7 | I can regularly acquire the reports of learning status from the learning system on the tasks that I am doing. | |
| 8 | Overall, I think that the tasks I am doing are timely. | |
| Iv 2 | Richness of task (RT) | |
| 9 | I think that the tasks I am doing are rich in contents. | |
| 10 | The tasks consist of text and various media types to describe a learning activity that I should do. | |

| 11 | Overall, I find that the tasks involve various media types (e.g., text, image, sound, or animation). |
|---|---|
| Iv 3 | Accuracy of task (AT) |
| 12 | I think that the tasks are clear. |
| 13 | I can easily understand the tasks I should do. |
| 14 | Overall, I think that the tasks are explicit and easy to understand to support my learning. |
| Iv 4 | Adaptability of task (ADT) |
| 15 | I think that the tasks are presented in different viewing modes to reveal the difference of specific subject. |
| 16 | I think the tasks' feedbacks are demonstrated in different results based on same subject. |
| 17 | Overall, I think that the tasks given are adapted to my learning abilities. |

**Table 2.** Reliability Indices of the Dimensions

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Squared Multiple Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|
| SPEM | 15.5078 | 14.161 | .951 | .905 | .924 |
| TTM | 15.6549 | 14.942 | .867 | .776 | .939 |
| RTM | 15.6124 | 14.998 | .802 | .703 | .951 |
| ATM | 15.6595 | 15.286 | .853 | .763 | .941 |
| ADTM | 15.6124 | 15.065 | .852 | .905 | .941 |

## RESULTS

Table 3 gives some information about the demographics of the participants, respectively, calculated in SPSS.

**Table 3.** Demographic Information of the Study

| | Frequency | Percentage |
|---|---|---|
| Gender | | |
| Female | 128 | 50.2 |
| Male | 127 | 49.8 |
| School type | | |
| Comprehensive | 125 | 49 |
| Professional | 130 | 51 |
| Discipline | | |
| Arts | 124 | 48.6 |
| Science | 131 | 51.4 |
| Number of classmates | | |
| ≤60 | 126 | 49.4 |
| >60 | 129 | 50.6 |

1 refers to less and equal to 60 students per class. 2 refers to the more than 60 students per class. Table 4 below depicts the descriptive statistics findings of this study. It was found that classes in smaller numbers of students, mean: 4.1627, had a more positive view on Timeliness of Tasks (TT) compared to classes in bigger numbers of students, mean: 3.5581. classes with the smaller size of numbers of students, mean: 4.2540, were having more positive view on the richness of tasks (RT) compared to classes in bigger numbers of students, mean: 3.5530. classes in the smaller size of numbers of students, mean: 4.1984 were having more positive view on the accuracy of task (AT) compared to classes in bigger numbers of students, mean: 3.5142. classes in the smaller size of numbers of students, mean: 4.2778, had a more positive view on the adaptability of task (ADT) compared to classes with bigger numbers of students, mean: 3.5297. classes in smaller numbers of students, mean: 4.4101 were having

more positive view of students' perceived engagement (SPE) compared to classes in bigger numbers of students, mean: 3.6072.

**Table 4.** Descriptive

|  |  |  | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  | Lower Bound | Upper Bound |  |  |
| TT | | 126 | 4.1627 | .68287 | .06084 | 4.0423 | 4.2831 | 1.25 | 5.00 |
|  | | 129 | 3.5581 | 1.22614 | .10796 | 3.3445 | 3.7717 | 1.00 | 5.00 |
|  | Total | 255 | 3.8569 | 1.03867 | .06504 | 3.7288 | 3.9850 | 1.00 | 5.00 |
| RT | | 126 | 4.2540 | .75475 | .06724 | 4.1209 | 4.3870 | 1.67 | 5.00 |
|  | | 129 | 3.5530 | 1.25381 | .11039 | 3.3345 | 3.7714 | 1.00 | 5.00 |
|  | Total | 255 | 3.8993 | 1.09356 | .06848 | 3.7645 | 4.0342 | 1.00 | 5.00 |
| AT | | 126 | 4.1984 | .66289 | .05906 | 4.0815 | 4.3153 | 1.00 | 5.00 |
|  | | 129 | 3.5142 | 1.15471 | .10167 | 3.3130 | 3.7154 | 1.00 | 5.00 |
|  | Total | 255 | 3.8523 | 1.00282 | .06280 | 3.7286 | 3.9760 | 1.00 | 5.00 |
| ADT | | 126 | 4.2778 | .58992 | .05255 | 4.1738 | 4.3818 | 1.67 | 5.00 |
|  | | 129 | 3.5297 | 1.22801 | .10812 | 3.3158 | 3.7437 | 1.00 | 5.00 |
|  | Total | 255 | 3.8993 | 1.03520 | .06483 | 3.7717 | 4.0270 | 1.00 | 5.00 |
| SPE | | 126 | 4.4101 | .65478 | .05833 | 4.2946 | 4.5255 | 1.33 | 5.00 |
|  | | 129 | 3.6072 | 1.24125 | .10929 | 3.3910 | 3.8235 | 1.00 | 5.00 |
|  | Total | 255 | 4.0039 | 1.07199 | .06713 | 3.8717 | 4.1361 | 1.00 | 5.00 |

The differences between comprehensive institutions and professional institutions must be validated using ANOVA tests. Table 6 shows the ANOVA analysis results of this study. All the findings were significant. The difference of student number size in timeliness of task (TT), with significance value of .000, accuracy of task (AT) with significance value of .000, students' perceived engagement (SPE) with significance value of .000, the richness of task (RT) with a significance value of .000, and adaptability of task (ADT) with a significance value of .000, which were smaller than .05, and they were significant.

**Table 5.** ANOVA

|  |  | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
|---|---|---|---|---|---|---|
| TTM | Between Groups | 23.297 | 1 | 23.297 | 23.508 | .000 |
|  | Within Groups | 250.729 | 253 | .991 |  |  |
|  | Total | 274.025 | 254 |  |  |  |
| RTM | Between Groups | 31.322 | 1 | 31.322 | 29.088 | .000 |
|  | Within Groups | 272.428 | 253 | 1.077 |  |  |
|  | Total | 303.750 | 254 |  |  |  |
| ATM | Between Groups | 29.839 | 1 | 29.839 | 33.464 | .000 |
|  | Within Groups | 225.597 | 253 | .892 |  |  |

|  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|
|  | Total | 255.436 | 254 |  |  |  |
| ADTM | Between Groups | 35.669 | 1 | 35.669 | 38.154 | .000 |
|  | Within Groups | 236.525 | 253 | .935 |  |  |
|  | Total | 272.194 | 254 |  |  |  |
| SPEM | Between Groups | 41.082 | 1 | 41.082 | 41.442 | .000 |
|  | Within Groups | 250.803 | 253 | .991 |  |  |
|  | Total | 291.885 | 254 |  |  |  |

**Table 6.** Plots of Student Number Size as Moderator

| Number | Plot | Results |
|---|---|---|
| 1 <br> TT |  | Significant |
| 2 <br> RT |  | Significant |
| 3 <br> AT |  | Significant |
| 4 <br> ADT |  | Significant |
| 5 <br> SPE |  | Significant |

As a whole, with the confirmation of ANOVA test results, table 7 summarizes the major findings on the hypotheses testing of this study.

**Table 7.** Summary of Hypotheses Testing

| Hypothesis | Construct tested | Significance value | Decision |
|---|---|---|---|
| H1 | TT | .000 | Accepted |
| H2 | RT | .000 | Accepted |
| H3 | AT | .000 | Accepted |
| H4 | ADT | .000 | Accepted |
| H5 | SPE | .000 | Accepted |

For hypothesis 1, the significance value is .000, smaller than .05. Hence, hypothesis 1 is accepted. For hypothesis 2, the significance value is .000, smaller than .05. Hence, hypothesis 2 is accepted. For hypothesis 3, the significance value is .000, smaller than. 05. Hence, hypothesis 3 is accepted. For hypothesis 4, the significance value is .000, smaller than .05. Hence, hypothesis 4 is accepted. And lastly, for hypothesis 5, the significance value is .000, smaller than. 05. Thus, hypothesis 5 is accepted.

The study's results highlighted the effects of student size number as Moderator in the effects of four factors on perceived engagement in a blended learning environment. As such, the five hypotheses confirmed in this study were:

- Student size number significantly affects the perceptions of task timeliness (TT) in EFL task-based activities in a blended learning environment.
- Student number size significantly affects students' perceptions of the richness of task (RT) in EFL task-based activities in the blended learning environment.
- Student number size significantly affects the perceptions of the accuracy of task (AT) in EFL task-based activities in the blended learning environment.
- Student number size significantly affects the perceptions of the adaptability of task (ADT) in EFL task-based activities in the blended learning environment.
- Student number size significantly affects the perceptions of the students' perceived engagement (SPE) in EFL task-based activities in the blended learning environment.

## DISCUSSION

The current study intensifies comprehension of the dependent variable of this study, namely students' perceived engagement (SPE) in a blended learning environment by four independent variables, which include timeliness of task (TT), the richness of task (RT), accuracy of task (AT) and adaptability of task (ADT). Findings emphasize the pivotal role of task arrangement of instructors in ensuring student engagement in these tasks in the blended learning environment.

Student number size as one moderator impacts four factors of students' engagement in task-based learning within a blended English learning environment. Classes with smaller size of numbers of students have a more positive view on the Timeliness of Tasks (TT), Richness of Tasks (RT), Accuracy of Tasks (AT), and Adaptability of Tasks (ADT) as compared to classes with bigger size of numbers of students. The study stressed the requirements for elaborately designed tasks with timeliness, richness, accuracy and adaptability. At the same time, timely feedback on the completion of tasks and practical assessment methods to measure students' attributes facilitate the effectiveness of blended learning. Student engagement and learner autonomy also benefit from the blended learning course.

As Rop et al. (2018) pointed out, timely tasks shouldn't include irrelevant information or unsupportive learning materials. Teachers should provide details in guiding the students in completing the tasks. If not, the students would not be positively involved in the tasks assigned by the instructors. Researchers also observed that respondents would engage with tasks with richness in content. As

Prasetya et al. (2020) highlighted, the richness of tasks should encompass the following contents, which have the following main structure: 1. Basic learning tasks, 2. Tasks for revision purposes, 3. Tasks for enrichment, 4. Tasks for remedial purposes, and 5. Interactive learning tasks. By having a richness of tasks, students with various needs will be benefited by carrying the tasks that suit their needs. To ensure active engagement in tasks assigned in the blended learning environment, the accuracy of tasks has to be taken care of. The impact of the tasks with high accuracy will bring about good performance in language learning and allow learner autonomy for self-improvement (Wang, 2021). Therefore, the tasks assigned in a blended learning environment should be able to bring about the results in heightening the knowledge of the course, improving the performance in assessment as well as improving the language skills and not just for the sake of carrying tasks for killing time alone. On top of these, task adaptability in affecting positive engagement has been confirmed vital in this study. The crucial concept in support of students is feedback, as Pardo (2018) mentioned. Instructors must find ways to provide learners feedback on study and learning. The blended learning platform should also include features to ensure the feedback channel is smoothly maintained and carried out.

## CONCLUSION AND IMPLICATIONS

Student number size as one moderator impacts students' engagement in task-based learning within a blended English learning environment. Classes with the smaller size of numbers of students have a more positive view on the Timeliness of Tasks (TT), Richness of tasks (RT), accuracy of tasks (AT), and adaptability of tasks (ADT) as compared to classes in bigger size of numbers of students. Classes with small student numbers facilitate students' engagement in learning tasks more than classes with big numbers. If bigger classes exist, teachers must take some effective measures to promote students' engagement in learning tasks. Some teaching implications on what can be done to enhance engagement are based on and adapted from the SAMR model proposed by Melski (2020) by giving ample attention to the moderator of student size number, as discussed in Table 8.

**Table 8.** Teaching Implications on Steps to Be Taken Care of in Taking Consideration of Effects of Moderators

| | Meaning | Definition | Reflective questions | Activities recommended | Target group |
|---|---|---|---|---|---|
| S | Substitution | Replacement current task with a more suitable one | What will the learners gain by replacing the tasks with supporting materials? | Provide online quizzes or downloadable worksheets that suit the learners' ability and their wants. Access teacher's notes, slides, and instructional materials from any cloud storage to support self-learning and revision purposes. | Learners in bigger classes: Replace with a more detailed description of task completion supporting materials. |
| A | Augmentation | Functionally improves the task by giving proper guidance | Do the tasks with additional features in improving learning? | Suggestions of online tools in completing tasks which the learners are familiar with. Use other learning modalities to enhance the learning experience, such as Audio-visual learning materials, video recordings, etc. | Learners in bigger classes: Additional online applications guidance |

| M | Modifications | The task is redesigned suiting the learner's needs. | Do the tasks significantly improve learning with the modified materials in the blended learning environment? | Combine audio, video, text and relevant multimedia to present supporting learning resources for task completion according to the needs of the learners. | Distant learners in bigger classes with limited online access: Modifications with more face-to-face learning time |
|---|---|---|---|---|---|
| R | Redefinition | Tasks have to be done suiting to the blended learning platform and environments for knowledge creation. | Do the tasks allow the creation of new knowledge concerning previous tasks carried out. | Provide referencing answer keys, previously completed tasks for references and revision after completing tasks and brainstorming online with learners for revision purposes. Create future learning tasks with the ideas of learners. | Learners in bigger classes: Additional face-to-face discussions time upon summarizing task completion |

The results of this study contribute to understanding how student number size can impact students' perceived engagement in blended learning and provide insights for educators to optimize blended learning environments to maximize students' engagement. However, this study has some limitations, and future suggestions are proposed to tackle these limitations. Similar to prior studies, the current study has some limitations.

First, data collected through convenience sampling might restrict the generalizability of results. For future studies, large samples and with stratified sampling method can be employed to increase the generalizability of the findings. Second, there were only four factors involved only in this study. For future studies, more determinants can be added to produce a more fruitful understanding for developing a more comprehensive model, which includes many factors in determining the effectiveness of active engagement in the blended learning environment. Third, the current study took only the effects of four selected independent variables on the dependent variable. Moderators and mediators that will affect the relationships studied in this study should be considered for future studies to yield greater understanding of the effects of these moderators and mediators on the relationships studied. Fourth, this study employed basic method of PLS-SEM in the assessment process. Future study studies should use other more advanced techniques in PLS-SEM analysis, such as assessing the common method variance (construct level correction), PLS-SEM and ANN (a neural network) approach to further verify the results obtained by the PLS-SEM analysis, PLS-SEM and deep learning neural network analysis, and etc. Fifth, this study only included three socio-demographic characteristics as moderators in this study. Future study may include more socio-demographic characteristics in verifying various effects of moderators on the relationships studied. These include emotional factors, functional factors, technological competence factors, cultural dimensions, online learning access, digital divide, and etc.

In conclusion, this study has confirmed that students' perceived engagement (SPE) in blended learning environment can be affected by four independent variables which include timeliness of task (TT), richness of task (RT), accuracy of task (AT) and adaptability of task (ADT). Thus, instructors have to ensure that the tasks assigned to the learners have to be adhered to these four vital factors as to ensure positive engagement in the learning tasks that eventually produce effective learning outcomes.

# DATA AVAILABILITY DECLARATION

The original contributions encompassed within this study are comprehensively documented in the article and accompanying supplementary materials. Should additional inquiries or data-related requests arise, kindly direct them to the attention of the corresponding author.

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# CONFLICT OF INTEREST

The authors herein assert that the research undertaken was executed without the influence of any commercial or financial affiliations, which may be perceived as potential conflicts of interest

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