Lab Rotation Blended Learning Model in Promoting Computational and Critical Thinking: An Assessment of Multiple Stakeholder Needs

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Abstract
Understanding the needs are one of the learning success determinants that can assist in an efficient and targeted learning process. The more parties who participate resulted the more comprehensive understanding of it. We aim to identify multiparty needs for the lab rotation model to fostering computational and critical thinking skills. Participants were 49 students, 3 graduates, 3 instructors, and 1 management representative. Data was gathered through interviews on the use of blended learning at each station of rotation model. While the questionnaire was only for students. We noticed that: (1) statistics learning strategy emphasizes teacher-centered and face-to-face learning. (2) incorporating a range of activities is critical since it keeps students interested, greater than single activities, and less stressful. (3) computational thinking could be improved by using step-by-step instruction, creating connections between each material component, and using a flowchart or mind mapping. Meanwhile, the critical thinking could be improved by conducting spontaneous exams, asking student involvement, rewarding them, etc. While descriptive analysis revealed that students tend to agree, 92% (45) that the lab rotation model activity should be employed, while 4% (2) disagreed. Student expected that needing more learning activities and rewarding. It means, learning activities using the lab rotation model meet the participants needs, which consists of initial learning station (ILS), traditional learning station (TLS), individual practice station (IPS), group learning station (GLS), and final learning station (FLS). In response, the learning process can employ the lab rotation model.

Keywords: Blended Learning, Lab Rotation Model, Computational, Critical Thinking, Needs Assessment

Introduction

One strategy to improve learning effectiveness is to employ the blended learning method. Several prior research have demonstrated that this technique was beneficial as a learning design (Ayob et al., 2020; Govindaraj & Silverajah, 2017). It highlights higher level thinking (Christina et al., 2019; Nederveld & Berge, 2015), as well as demonstrated active learning (Wichadee, 2017). This strategy involves the use of two learning models: traditional or face-to-face learning and online learning.

Students in the online learning can communicate with both their classmates and instructors by a camera, chat, or microphone. They can interact with each other in the same way that they would in a traditional classroom setting. Even while the combination of these two ways was in line with advances in information technology, it still faced several obstacles, notably those related to the learning habit through the online method, which is still relatively new, particularly for students from the city's borders. Interaction with camera assistance cannot be maximized due to unstable internet connections, limited internet quotas, doing something else while studying, and psychological issues such as lack of confidence, feeling uncomfortable while studying, and experiencing anxiety and stress (Alim et al., 2022).

However, virtual involvement cannot perfectly replicate the interaction process of a traditional class. It demands longer to shift the perspective of learning in line with the growth of the times as it is today, and equalization of internet network access must be increased significantly. As a result, this study focuses on the needs among various parties (students, alumni, instructors, and management representatives) to determine whether their thoughts and needs are connected to the use of blended learning methods, particularly in the statistics course. Additionally, we are exploring the viewpoints of instructors and management representatives, particularly in relation to learning approaches that might maximize students' computational and critical thinking. It will then be included into the learning process via the lab rotation blended learning framework.

Need assessments were used to gather detailed information about appropriate learning models. This evaluation involves several parties with varying capacities. At each learning station, they will take part in a series of activities to determine their thoughts about the importance of implementing the lab rotation model in statistical learning.

- Initial Learning Station (ILS): This station emphasizes self-study activities. This station is an out-of-class activity and uses a variety of learning sources, e.g., videos, journals, etc.
- Traditional Learning Station (TLS): Traditional or face-to-face learning approaches.
- Individual Practice Station (IPS): this station stresses on an independent practice, during class time at students' own pace (synchronous learning).
- Group Learning Station (GLS): It is the discussion process by conduct focus group discussions (FGD). This technique will improve students' social skills as well as their capacity to express themselves independently.
- Final Learning Station (FLS): This is the last station that students will experience in a traditional class. This station is led by an instructor. The instructor concludes the session and completes the activity by conducting evaluation process.

The implementation of the lab rotation model can assist students in quickly grasping the content. This method favors higher order thinking over lower-level thinking. As a result, it is intended that this strategy would be able to promote students' computational and critical

thinking, which are two forms of higher order thinking skills. This will then assist students in comprehending the subject offered. Furthermore, it allowed students to engage in several diverse learning experiences, both in terms of learning activities and from the perspectives of various instructors. Further, learning activities based on the lab rotation model approach can accommodate students' diverse learning characteristics. As a result, this technique will serve as a complete learning model.

We would undertake a needs assessment of various stakeholders involved in the educational process. This is essentially required to gain an accurate image of needs for the use of lab rotation model in statistics courses and its relationship to students' computational and critical thinking skill.

Method

Participants were divided into four categories: 49 students, 3 alumni, 3 statistics instructors and 1 management representative. Two methods are used to collect data: questionnaires and interviews. The questionnaire uses a five-point Likert scale. The questionnaire and interview cover the general concept of the lab rotation model. The quantitative approach would be used to investigate the needs of students and concludes with a descriptive analysis. 31 items were used to determine the needs of students for the lab rotation model. The validity analysis revealed that the validity index was in the range of 0.67 - 1.0 with reliability reached 0.90.

The questionnaire would be distributed via Google form for students, using anonymous identity to ensure the participants would be more open in providing the necessary information. While alumni, instructors, and management representative were interviewed. The quantitative data analysis focuses only on identifying the patterns of students' responses to the lab rotation model, which is presented in numerous learning stations.

Meanwhile, qualitative data analysis focuses on the significance of implementing the lab rotation model. Interview focused on: (1) How is the learning model used in current statistics lectures? (2) Is it important to include numerous activities for learning into statistics classes? (3) Is it possible to use blended learning in statistics classes? (4) How do you respond if students are instructed to study independently before joining class? (5) How do you respond when students practice independently after getting a lecture? (6) How are the ways to encourage computational and critical thinking among students during lectures? (7) What is the statistical learning model that you have gone through? (For alumni); (8) What are your expectations for the statistical learning model? (For alumni).

Result

1. Qualitative Approach

The first stage, instructors and management representation were interviewed. They stated that the statistical learning process continues to use the traditional strategy, namely instructor-centered rather than student-centered. Sometimes online by synchronous and giving assistance outside class hours. They are explaining theory first, then practice to the end of the semester. To keep students interested, it needs to include more different learning activities in which students can actively engage, which could reduce feelings of monotony in lectures. The use of blended learning is important demanded because it is in accordance with government recommendations as well as the present situation. Furthermore, individual study

assignments must be completed before students attend class. Students will benefit from this since they will be able to grasp the content more easily.

Meanwhile, individual practice tasks can be completed immediately after the content is presented so that students do not forget the fundamental principles of the content. Moreover, students require gatherings to talk with their classmates to comprehend each other's points of view. Students will compare their views of earlier lessons they have learned. Computational thinking can be encouraged by describing the subject being taught step by step, explaining the relationship between each component, providing crucial questions that encourage them to find solutions to problems, explaining by using a flowchart or mind mapping, focusing on a single aspect before going on to the next. Meanwhile, critical thinking can be stimulated by asking critical questions, requesting student feedback on the content being taught, giving a spontaneous quiz, encouraging students to engage more actively, ask them crucial questions that push them to think, give rewards to stimulate them, etc.

The second stage, alumni were interviewed about their experiences when studying statistics. They mentioned that the statistical learning model that have gone through included tutoring, presentation, the same learning model as previously, etc. While students' expectation included: practicing soon after learning the theory to avoid forgetting, including additional learning activities to avoid bored, discussing in group to exchange understanding with other classmates, providing a great reward to encourage learning motivation.

2. Quantitative Approach

In total, 49 students responded the questionnaire that contained various elements, including the components of the lab rotation model as a learning strategy and the blended learning concept in general – see Table 1.

Needs	Items	5	4	3	2	1
BL	Material presentation, both online and offline, should be tailored to the characteristics of the material.	18 (37%)	31 (63%)	0	0	0
	The main material should be presented offline, but more detailed information can be presented online.	15 (31%)	22 (45%)	7 (15%)	5 (9%)	0
	The combination of online and offline instruction can improve the effectiveness of lectures.	10 (21%)	21 (43%)	13 (26%)	4 (8%)	1 (2%)
	The learning experience will be enhanced if the learning process includes a variety of activities	18 (37%)	22 (45%)	8 (16%)	1 (2%)	0
ILS	I feel it necessary to study independently before attending class.	11 (23%)	30 (61%)	8 (16%)	0	0
	When I have studied the material to be taught, I understand the lesson better.	12 (25%)	29 (60%)	7 (13%)	0	1 (2%)
	I believe it is critical to prepare myself before joining the class.	13 (26%)	29 (60%)	6 (12%)	0	1 (2%)
	Studying prior class allows me to think more critically about the material that will be discussed in the class.	11 (23%)	30 (61%)	7 (14%)	1 (2%)	0
	I understand course material more systematically when I study before attending lectures.	12 (25%)	32 (65%)	5 (10%)	0	0
TLS	I still need the instructor to explain the material that I have studied on my own.	31 (63%)	12 (25%)	6 (12%)	0	0
	Instructors' guidance can help me better understand the material I've already studied.	29 (60%)	19 (38%)	1 (2%)	0	0
	Face-to-face classes are still necessary in today's learning environment.	28 (57%)	17 (35%)	4 (8%)	0	0
	Lecturer's explanation in face-to-face lectures can stimulate my critical thinking skills.	18 (37%)	25 (51%)	6 (12%)	0	0

Needs	Items	5	4	3	2	1
	Face-to-face learning model assists me in systematically understanding the material.	23 (47%)	25 (51%)	1 (2%)	0	0
IPS	There should be a separate time set aside for independent practice activity.	12 (25%)	25 (51%)	11 (22%)	1 (2%)	0
	I need to put into practice what I've learned.	15 (31%)	26 (53%)	8 (16%)	0	0
	Independent practice activities help me better understand the course content.	6 (12%)	26 (53%)	16 (33%)	1 (2%)	0
	Practice is essential as a supplement to the material covered in class.	15 (31%)	26 (53%)	8 (16%)	0	0
	Independent practice can encourage me to be more critical of the material I have learned.	4 (8%)	29 (59%)	15 (31%)	1 (2%)	0
	Independent practice enabled me to establish a step-by-step plan for completing the lecture assignments.	6 (12%)	27 (55%)	12 (24%)	3 (6%)	1 (2%)
GLS	I understand the course material better when I discuss it in groups.	10 (21%)	26 (53%)	12 (24%)	0	1 (2%)
	When I discuss the topic in groups, I can learn a lot of new things.	17 (35%)	25 (51%)	6 (12%)	0	1 (2%)
	Discussion in the group helps me understand my friends' perspectives.	13 (26%)	30 (61%)	5 (10%)	1 (2%)	0
	Group discussions allow me to express myself more directly.	13 (26%)	30 (61%)	5 (10%)	0	1 (2%)
	Group discussions can help me better understand material.	5 (10%)	24 (49%)	18 (37%)	1 (2%)	1 (2%)
FLS	The instructor should provide conclusions on each material that has been taught at the end of the lecture.	21 (43%)	24 (49%)	4 (8%)	0	0
	The instructor should place emphasis on material that is deemed important to know.	20 (41%)	22 (45%)	7 (14%)	0	0
	The instructor's conclusion at the end of the lecture helped me better understand the material that had been studied.	15 (31%)	24 (49%)	10 (20%)	0	0
	The lecturer's conclusions at the end of the lecture helped me see the importance of the lecture material that I had studied.	16 (33%)	26 (53%)	7 (14%)	0	0
	Lecture's conclusion was able to make me see important points related to the material that had been studied.	17 (35%)	26 (53%)	6 (12%)	0	0

Note: 5= Strongly agree, 4= agree, 3= neutral, 2= disagree, 1= strongly disagree.

Table 1: The Distribution of Students Needs

Based on the findings above, it is possible to conclude that learning activities using the lab rotation model (LRM) approach met the needs of the participants, which consists of five components: initial learning station (ILS), traditional learning station (TLS), individual practice station (IPS), group learning station (GLS), and final learning station (FLS).

Discussion

The present statistical learning technique is based on classical learning concepts and is usually performed offline. Learning with a blended approach is still not well implemented due to insufficient infrastructure support and students' learning preferences, which still necessitate face-to-face interactions. Blended learning has been used, particularly during the Covid-19 period. However, the learning process resumed as it had previously. Meanwhile, online learning is only done when it was needed. The use of a blended learning type lab rotation paradigm has occurred, but not in a systematic manner. The instructors only use a combination of online and offline learning without a specific learning structure.

All stakeholders agree that it is critical to incorporate a variety of learning activities into statistics classes. This has never been done before in the prior learning process; thus, it is

novel. It will improve students' understanding, keep them interested, will be more pleasurable and less stressful. As a result, students will not be restricted to boring tasks in the classroom but will be able to learn freely outside of the classroom. Students will benefit from the use of blended learning. They are given the freedom to learn while yet receiving virtual instruction. However, students still need face-to-face contact in offline classrooms, particularly for subjects that require substantial explanation and during the first meeting. It is important to familiarize instructors and students at the first lecture meeting. Online learning can take place after the primary subject matter has been explained that can be monitored by using video camera. The initial meeting is critical for establishing a psychological connection between the instructor and the students (Alim et al., 2023).

Students are also advised to study individually before coming to the class. Students who succeed are more conscious of autonomous study than those who do not. Meanwhile, they can perform a surprise quiz or ask random questions at the beginning of each lecture session to verify they have completed their own learning process. This greatly enhances student understanding of the content that will be presented. Student enthusiasm to actively participate in the independent learning process is a measure of student engagement in the lecture process. Students who have studied independently can be identified by their ability to respond the questions or involve in the class. In addition, they will raise questions or assist their peers who do not comprehend the topic being taught. Following that, students should practice independently after receiving a lecture so that the content may be implemented immediately rather than waiting until the end of semester. This reduces the likelihood of forgetting the content. To support students in carrying out the data analysis process independently, independent practical activities must be overseen by instructors or teaching assistant.

Meanwhile, one technique to stimulate critical thinking among students are to ask them questions that should be addressed scientifically, offering students unexpected quizzes or examinations, comparing multiple viewpoints on a subject and select the most appropriate opinion logically. Instructors might also ask student comments on content presented by instructors or other students. To keep students' critical thinking skills sharply it is vital to recognize students who are critical and actively participate, as well as continuing to push other students to be more involved in the following meeting. Furthermore, stimulating computational thinking may be accomplished by studying in stages, or by focusing on one problem before moving on to the next. This may also be done with the use of mind mapping or graphics to fully comprehend the situation. A problem's execution pattern can also be carried out gradually and systematically. Create a relationship between each content component so that students may grasp the relationship between each subject.

According to students who have attended statistics classes, the learning method so far still prioritizes teacher-centered rather than student-centered learning. This is inextricably linked to a lack of activities that might drive students to carry out activities autonomously and monotonously, as is typical in traditional courses. This may be remedied by introducing various types of learning stations, and it is intended that students would engage in more active learning than lecturers. Meanwhile, students wish to be able to practice soon after learning the theory to prevent forgetting. Students are also expecting including extra learning exercises to minimize boredom, talking in groups to exchange understanding with other students, and delivering a fantastic incentive to promote learning motivation.

The conclusions of the interview session were consistent with the findings of the questionnaire, in which every facet of the lab rotation model was positively addressed. As an

example, consider the importance of integrating blended learning in statistics courses, which is comprised of numerous claims (see table 1). The average student reaction is positive, with the majority agreeing. It suggests that students responded favorably to the use of the blended learning model when paired with the lab rotation model, particularly in statistics courses. This trend can be seen at each lab rotation model learning station, indicating that students are enthusiastic about using this model in statistics. Based on the data presented above, we can infer that using the lab rotation model in statistics learning may meet the needs of students and is supported by stakeholders engaged in the learning process.

Conclusion

The implementation of the lab rotation model in statistics was in acceptance with the needs of the stakeholders. Activities in each station tailored to stakeholders needs, such as studying before class, face-to-face meeting, online individual practicums, focus group discussion, and conclusions. Some of these activities have been implemented, although not consistently. Learning activities using a blended learning approach were only carried out when there was an urgent necessity.

Meanwhile, on the instructor side, instructors continue to promote teacher-centered learning rather than student-centered learning. However, face-to-face interactions were still required by stakeholders rather than fully online learning. Blended learning is supposed to make statistics easier to grasp. This strategy is intended to encourage students to use their computational and critical thinking skills. Future study can use this learning technique for another subject.

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