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Adaptation of AL-TST active learning model in hybrid classroom: Findings from teaching during COVID-19 pandemic in Egypt

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Abstract
Since COVID-19 began, the ways of teaching and learning have changed drastically. Traditional teaching methods are shifted to technology-mediated methodologies such as asynchronous online learning, hybrid learning, blended learning, hy-flex learning, on-demand learning, and competency-based online learning. Due to the COVID-19 pandemic, traditional active learning models, compelling but complex, are assumed not to fit in the hybrid classroom because of the affordance and integration of various distance learning technologies. Hence, in the research, a conceptual active learning model for a hybrid classroom, namely AL-TST (Active Learning-Theory, Strategy, Technology), is used to deliver a STEM course in an Egyptian university. The course was an 8-week-long course designed for 3rd grade (i.e., university junior) students enrolled in the university. At the beginning of the course, the instructor created student-centered lecture contents using the adopted AL-TST model in a hybrid environment. Data (N=76) were collected using the university’s learning management system (LMS). Students’ Course Work Grades, Final Exam Grades and Total Exam Grades are analyzed using a one-sample t-test. The analysis indicated no significant result in students’ Course Work Grades, Final Exam Grades and Total Exam Grades. However, the findings indicated some valuable educational insights, such as improving a conceptual active learning model, the perception of course design, and teaching during the crisis.

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Keywords: Active learning, AL-TST model, Hybrid classroom, Learning interaction, Learning technologies, New normal in education
1. Introduction

1.1. Active learning

According to Vanderbilt University Center for Teaching [1], active learning is defined as activities that students do to construct their own knowledge and understanding. In general, active learning activities vary but require students to do higher order thinking. According to Cambridge Assessment [2], the process of active learning keeps student learning at its center. Hence, active learning focuses on how students learn, not just on what they learn. Typically, students are asked to think hard instead of passively listen to the information given by the teacher in the classroom. Despite the fact that not always explicitly noted, metacognition, and students’ thinking about their own learning are the essential elements that provide the link between activity and learning [2]. On top of that, active learning strategies can help students how to study, share knowledge, think critically, solve problems, and help students to build required skills and knowledge by themselves [3], [4]. Some effective active learning strategies used during and pre-COVID are [5]:

- Large group activities include: line-up, post it parade, debates, dotmocracy, snowball, fishbowl, quescussion, index card pass, think-pair-share, buzz groups, 1-minute paper, and reflections
- Large group activities: case studies, complete turn taking, post it parade, group text reading, peer review, respond, react, reply, pro-con grids, social annotation of text, buzz groups, quescussion, think aloud, round table, and debates
- Individual activities: 1-minute paper, reflections, post it parade, pro-con grids, and case studies

The ultimate objective of using these strategies is to support students to understand the knowledge and skills together with engaging students in practicing the learning activities.

1.2. Hybrid classroom

Since COVID, hybrid environment or hybrid classroom has gained much popularity. The concept of teaching in a hybrid environment or hybrid classroom allows online students and in-class students to attend a classroom simultaneously. In education under COVID, this concept helped significantly reduce the number of face-to-face attendees by offloading some people remotely from their individual locations [6]. A hybrid environment allows students and teachers to move between digital and in-class learning activities. Teachers often use web conferencing tools (i.e., Zoom or WebEx) to connect remote students into a class. Hybrid classrooms or environments could be divided into two types where technological supports could be used:

- Synchronous hybrid: Face-to-face and online lessons are held simultaneously, with lessons for both classroom and online students at the same time. Tools used to support synchronous hybrid classrooms are video conference, conference call, live chat, live streaming etc.
- Asynchronous hybrid: Learn with online content and submit assignments on time, not in real-time, when students are best suited to their schedule. Tools that could be used to support asynchronous hybrid environments are lecture materials, online discussion boards and social media platforms.

Hybrid learning has helped educational institutions to cope with the covid crisis. It is not easy to adapt hybrid classroom as it has several key challenges. For example, 1) students do not become active in the class, and expected learning outcomes may not be achieved to a certain degree; 2) understanding students’ engagement with the teacher and the learning contents could be difficult; 3) potential issues related to technology cannot be overlooked; and 4) providing adequate support to on-site and online students could be challenging.
1.3. Contribution of this paper

This study evaluated AL-TST (Active Learning- Theory, Strategy and Technology) model [7], a conceptual model to support active learning in hybrid classroom. In the context of hybrid classrooms, this conceptual model aims to enhance interaction and learning through online and onsite activities. To evaluate the efficacy of this model, a STEM course was taught at an Egyptian university. Seventy-six students participated in the course for the duration of 07 November, 2020 through 02 January, 2021. Data were collected using the LMS (Learning Management System) of the university and analyzed using one sample statistical method. This paper reports the findings of this 8-weeks-long study.

2. AL-TST model and its components

2.1. The conceptual model

In 2021, Hasnine et al., proposed the AL-TST model (presented in Figure 2) for fostering the interaction and learning through active learning approaches in hybrid classrooms [7]. As reported, the AL-TST model has three main components. First component is, learning theory and planning stage. Second, learning strategies. And third is, appropriate learning and teaching technologies.

The first component is Theory (T) that relies on the constructivist learning theory. Constructivism learning theory is the theory that suggests learners construct knowledge rather than just passively learn information. As people experience the world and reflect upon those experiences, they build their own representations and incorporate new information into their pre-existing knowledge [8]. In addition, social construction reflects the importance of enhancing collaborative learning and supporting students in practicing collaborative learning activities.

The second component, Strategy (S), is an effective method to assist teachers and learners to engage in practicing teaching and learning activities. In active learning practices, several strategies are adapted through hybrid learning environments such as experiential learning, Jigsaw discussion, and role-playing. The conceptual model of AL-TST suggests that teaching can be done through face-to-face interaction in the conventional lecture besides online interaction among teachers and learners in the online interactive lecture. In this regard, instructors are encouraged to practice self-learning of the students.

The third component, Technology (T), plays a key role in this model. An instructor, depending on the institute’s technological affordability, may have access to digital technologies such as digital learning systems, applications, learning management platforms and environments that can be used to enhance active learning.
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2.2. Key aspects of the model for adapting in the hybrid classroom

- Learner-centric content: To adapt the model, instructors are advised to create learner-centric content. Learner-centric contents are more responsive and accessible for any course. It typically brings learners’ own knowledge, past experiences, education, and ideas – and this impacts how they take on board new information and learn. However, in creating this type of content, teachers and students may face a unique set of challenges.
- Design experiential learning: Experiential learning refers to the process of learning by doing. Experiential learning aims to engage students in hands-on experiences and reflections. By doing so, learners are able to connect theories and knowledge learned in the classroom to real-world situations. For instance, Kolb’s experiential learning method could be used in the AL-TST model, which incorporates a learner’s concrete experience, reflective observation, idea development, and active experimentation. Other theories, such as John Dewey’s experiential learning theory, could also be explored within the scope of this model.
- Formative assessment: It is suggested to incorporate formative assessment into a course curriculum as it could improve interactive and collaborative online learning communities and foster equitable education by providing diverse learning opportunities to students with various individual needs.
- Formative feedback: In this model, formative feedback, such as verbal feedback on impromptu questions during class discussion or lecture, working out practice problems for students to watch, or having students work problems on the board, could be supported using the synchronous and asynchronous feedback methods.
- Mapping active learning strategies with technologies: An instructor is expected to be familiar with the common active learning strategies that could be integrated with technologies for adapting the AL-TST model. Figure 3 shows the way each active learning strategy could be guided by technology.
3. Method

This study employed a quasi-experimental research design [10] to understand the efficacy of the AL-TST model in relation to conceptions of teaching in the hybrid classroom during the COVID-19 pandemic. The case in this study was a course taught in a hybrid classroom to keep the students active and engaged during the semester.

3.1. Context and subjects

The model was implemented in a STEM course, namely Instructional Technology (Curriculum and Teaching Methods), at an Egyptian university. The course was designed for university juniors. Initially, the course had 77 students, but one student withdrew from the course. Therefore, data from 76 students (Male=50, Female=26) were collected and analyzed. The average age range of the students was 21.26. It was an 8-weeks-long course taught between 07 November 2020 through 02 January 2021.

3.2. Course contents and teaching method

At the beginning, the teacher created student-centered content. Then, the teacher summarized the main ideas and required knowledge for each lesson in a PowerPoint. The teacher uploaded the PowerPoint to the university’s e-learning platform. Before the class begins, students could review the lecture materials. Students collaborated with their classmates to understand the topic and improved their skills on the topics included in the PowerPoint file during the class. Nevertheless, they had the opportunity to consult with the teacher through a WhatsApp group created for this course.
3.3. Data analysis

Course Work Grades, Final Exam Grades and Total Exam Grades are collected from the LMS and analyzed using one-sample statistics analysis. For Course Work, grading was done based on the reports, answering quizzes and making mind map. The grading for Course Work was done on weekly basis. For Final Exam, pen-and-paper based method was used to grade True/False and Multiple-Choice Questions (MCQs). Final Exam grading was done only once at the end of the course. Total Exam Grades is the summation of Course Work Grades and Final Exam Grades. Table 1 and Table 2 show the results of Course Work Grades. Table 3 and Table 4 present the results of Final Exam Grades. Table 5 and Table 6 present the results of Total Exam Grades which is a summation of Course Work Grades and Final Exam Grades.

| Table 1. One-sample statistics on course work grades. |
|-----------------------------------------------------|
| N | Means | Standard deviation | Std.Error means |
|---|-------|--------------------|-----------------|
| T.IT.CTM.CW.Grades | 76 | 7.6513 | 2.14790 | .24638 |

| Table 2. One-sample test on course work grades. |
|------------------------------------------------|
| t | df | Sig.(2-tailed) | Mean difference | 95% confidence interval of the difference |
|---|----|----------------|-----------------|-----------------------------------------|
| T.IT.CTM.CW.Grades | -1.821 | 75 | .073 | -.44868 | -.9395 | .0421 |

| Table 3. One-sample statistics on final exam grades. |
|-----------------------------------------------------|
| N | Means | Standard deviation | Std.Error means |
|---|-------|--------------------|-----------------|
| T.IT.FinExa.Grades | 76 | 32.6447 | 2.58562 | .29659 |

| Table 4. One-sample test on final exam grades. |
|------------------------------------------------|
| t | df | Sig.(2-tailed) | Mean difference | 95% confidence interval of the difference |
|---|----|----------------|-----------------|-----------------------------------------|
| T.IT.FinExa.Grades | .825 | 75 | .412 | .24474 | -.3461 | .8356 |

| Table 5. One-sample statistics on total exam grades. |
|-----------------------------------------------------|
| N | Means | Standard deviation | Std.Error means |
|---|-------|--------------------|-----------------|
| T.IT.TolExa.Grades | 76 | 40.2961 | 3.45560 | .39638 |
Table 6. One-sample test on total exam grades.

|                       | t   | df | Sig.(2-tailed) | Mean difference | 95% confidence interval of the difference |
|-----------------------|-----|----|----------------|-----------------|------------------------------------------|
| T.IT.TotExa.Grades    | -.515 | 75 | .608           | -2.0395         | Lower -.9936 Upper .5857                 |

4. Results

The improvement in students' performance who studied the Instructional Technology (Curriculum and Teaching Methods) course can be measured by applying the t-test to compare students' performance pre-studying the course and after studying it. The total number of students who registered for the course and finished it was 76. All students answered various methods of assessment in Course Work, Final (Pen & Paper) Exam, and for the Total Exam grades. In the current study, we compared students' scores with the proficiency level in each assessment method. Proficiency level refers to the score of 80.1% of the maximum score that students can achieve in each assessment method. The determination of proficiency level for this study was according to the statistical guideline in [11], which agrees with the cut-off scores determined in previous research in education [12]. Although the students' performance improved while studying the course, students' scores did not increase more than the proficiency level. There is no significant difference between students’ achievement scores in the course works assessment and the proficiency level score (M=7.65, SD=2.15, t = 1.82, p > 0.05). Moreover, there is no significant result in Final Exam scores (M=32.65, SD=2.59, t = 0.82, p > 0.05). Also, no significant result in the Total Exam scores (M=40.30, SD=3.46, t = 0.52, p > 0.05). No significant result was observed in either Course Work Grades, Final Exam Grades or Total Exam Grades. However, we can still argue that the students enjoyed active learning throughout the course. Integrating learning technologies leads students to accept investing the new digital tools in their study. The result suggests that distance learning technologies integrated with active learning strategies support students in finding the required knowledge or skills, which helps improve their self-learning skills.

5. Conclusion

AL-TST (Active Learning- Theory, Strategy, Technology) is a conceptual model of active learning for hybrid classrooms. The model provides teachers and students the flexibility to digital technologies with active learning strategies to deliver a course in hybrid classrooms. This model was used to deliver an 8-week-long course at a university in Egypt. The course was student-centric where the teacher's role was primarily to answer students' inquiries. Moreover, the teacher organized the learning activities that students should practice inside and outside the class. Two assessment methods were used, namely self-assessment and collaborative assessment, for evaluation. Self-assessment was used when students answered quizzes through Google Form, and the instructor shared the model answer using WhatsApp in the classroom. On the other hand, a collaborative assessment was used when the teacher asked the students to make a group of five to seven.

Data were collected using the university’s learning management system. Data representing 76 students’ Course Work Grades, Final Exam Grades and Total Exam Grades were collected and analyzed. The findings indicated no significant result in Course Work Grades, Final Exam Grades, and Total Exam Grades levels when compared students' performance in pre-studying the course and after studying it. However, students enjoyed active learning throughout the course. Students stayed for a long time when the discussion happened. They submitted more extra activities, and searched for more knowledge enthusiastically. Moreover, integrating learning technologies led students to accept investing the new digital tools.

The limitation of this work is that the result presented here is from the perspective of an Instructional Technology (Curriculum and Teaching Methods) course that did not show the statistically significant results in favor of the conceptual model. This could be because of the nature of the course since the course primarily focused on theoretical knowledge rather than practical experiences. However, the AL-TST model emphasizes more on practical experience.
Therefore, in the future, the AL-TST model will be evaluated with experts’ opinions and students’ feedbacks concerning how students enjoyed the course.

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