The Effects of Learning Stations on Socioeconomically Disadvantaged Students' Achievement and Self-Regulated Learning

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Abstract

The aim of this study was to investigate the effects of learning station strategies on developing academic achievement and self-regulated learning among middle school students of low socioeconomic status. The sample group consisted of 68 female Saudi students. We applied a quasi-experimental design with an experimental and control group and a pretest and posttest. We examined the correlation between academic achievement and self-regulated learning. The data collection instruments included an academic achievement test and self-regulated learning questionnaire. The results revealed a statistically significant difference between the mean scores of both instruments in favor of the experimental group. Additionally, there was a positive relationship between development of academic achievement and self-regulated learning among the students for the experimental group. The study's findings suggest that the learning stations created a dynamic classroom, which prompted students to engage in self-regulatory behaviors and develop their knowledge and understanding.

Keywords: learning stations, achievement, self-regulated learning, low socioeconomic status

Considering the importance of sustainable education for the future of all students, including students who come from socioeconomically disadvantaged backgrounds, investigating instructional strategies that may support and amplify their learning experiences becomes a necessary intervention to address their educational needs. Additionally, students of low socioeconomic status are often identified as students with low educational achievement and from low-income households who are at risk of inadequate academic preparation and weak parental or family support (Dietrichson et al., 2017; Rubin et al., 2014). As such, strengthening the focus on teaching quality and students' learning abilities becomes central to providing students from socioeconomically disadvantaged backgrounds with appropriate and sustainable education for their future.

Previous research has established that students of low socioeconomic status, on average, have lower academic achievement levels than students of high socioeconomic status (e.g., Acar, 2019; Hernstein & Murray, 1994; Hertert & Teague, 2003). Although it is unrealistic to believe that school-based strategies alone can eliminate disparities in academic achievement between socioeconomically advantaged and disadvantaged students, teachers with effective instructional strategies can help narrow the achievement gap (Reardon, 2013). Many studies have found that the role of teachers is a key factor in making a significant difference in students' achievement. For example, Haycock (1998) stressed that teachers have a more powerful influence on students' achievement than students' socioeconomic status and parent education. Similarly, Marzano et al. (2001) indicated that even in low-performing schools, teachers could affect achievement in students and help them attain their fullest capacities. Collectively, students may face socioeconomic and academic challenges during their educational journey, but effective teaching strategies can address their achievement needs (Wronowski, 2017).

Furthermore, existing research recognizes the critical role that self-regulated learning plays in students' academic achievement. Drawn from social cognitive theory, self-regulated learning mainly involves cognitive strategies, metacognitive strategies, and resource-management strategies, which are known within self-regulation literature to support students' learning and academic achievement (e.g., Graham & Harris, 2009; Zimmerman & Schunk, 2011). Additionally, adept self-regulated learning is correlated with satisfactory levels of achievement, and high-performing students implement self-regulated learning more often and more successfully than their lower-performing peers (Dent & Koenka, 2016).

However, a crucial question is what instructional strategies should be targeted by teachers and encouraged by educational decision makers that have the potential to narrow the achievement gap and foster self-regulated learning among students from socioeconomically disadvantaged backgrounds. Nevertheless, adopting an instructional strategy to address academic achievement is a decisive and challenging decision because not all established instructional strategies maximize achievement levels, and they may unintentionally increase the achievement gap (Atlay et al., 2019). Moreover, learning stations (also known as stations or scientific stations) are part of an instructional strategy that provides an alternative way to guide instruction for diverse learners, differentiate instruction, and foster a positive learning environment (Tomlinson, 2014). Learning stations are essentially different physical locations in the classroom where students work on various tasks simultaneously (Jones, 2007). Several sources provide key characteristics that support the selection of learning stations as an instructional strategy to use with struggling students from socioeconomically disadvantaged backgrounds (e.g., Aydogmus & Senturk, 2019; Jones, 2007; Tomlinson, 2014). One main characteristic is that the teacher can creatively design and methodically build each station to address the students' academic needs. Learning stations also encourage small group instruction and facilitate interactions among peers, which decreases student to teacher ratios. Therefore, students are in charge of executing their own problem-solving and consequent learning, which builds students' interest in the content area and allows for more inquiry and discovery. Additionally, rotating students through learning stations that address their academic weaknesses can minimize their frustration. As such, students adjust or modify their learning strategies based on their current station and the intended goal, which may influence them to practice self-regulated learning.

Although cooperative learning, feedback, and tutoring seem like promising approaches, providing the most suitable teaching interventions for students from socioeconomically disadvantaged households is still a conundrum (Dietrichson et al., 2017). Therefore, the purpose of the study is to investigate the effects of learning station utilization on the development of academic achievement and self-regulated learning among middle school students from socioeconomically disadvantaged backgrounds. The following questions guided the current study:

1. How effective is the learning stations strategy in the development of academic achievement among second-year middle school students?
2. How effective is the learning stations strategy in the development of self-regulated learning among second-year middle school students?
3. What is the relationship between academic achievement and self-regulated learning among second-year middle school students?

Literature Review

Learning Stations

Learning stations are part of an instructional strategy that supports differentiation (Tomlinson, 2014). Learning stations are distinguished locations (e.g., distinguished by signs, symbols, or colors) in the classroom where groups of students collaboratively work on different tasks simultaneously to learn content and develop skills related to a topic. The groups rotate from station to station until each group of students has completed all the tasks. Additionally, designing learning stations and setting up the classroom can take different forms. Two to four learning stations are ideal for most classrooms, and student groups should range from four to six members. Furthermore, each learning station is recommended to have simple instructions that students can quickly read and spend approximately 10–15 minutes accomplishing at each learning station (Jarrett, 2010). Moreover, there are varying arrangements for learning stations that are premeditated based on the nature of the subject, available class time, and student's grade level, such as exploration stations, reading stations, yes-or-no stations, visual stations, acting stations, electronic stations, and art stations.

In the context of middle school education, the learning stations strategy has been examined in several subject areas. For example, Suoed and Taha (2020) investigated the effect of using learning stations on student achievement in a computer course. Suoed and Taha employed a quasi-experimental design using 72 second-year male middle school students who were divided into an experimental and control group. This study included four learning stations: an electronic station, exploration station, reading station, and visual station. Using a multiple-choice achievement test, the results revealed a significant difference between the mean scores of both groups in favor of the experimental group. The researchers elaborated that the learning stations strategy created a positive learning environment for the students to engage with each other, ask questions, and actively interact with the lesson and its materials.

Allihaibi (2015) conducted a study that revealed the impact of learning stations on developing achievement and positive attitudes toward the subject of physics. The sample was composed of 60 second-year male middle school students who were divided equally into the experimental group and in the control group. This study used three learning stations: an exploration station, a reading station, and a yes-or-no station. The researchers used a multiple-choice achievement test and a three-point Likert scale to gauge participants' attitudes toward physics and collect data from them. The results showed significant differences in favor of the experimental group between the mean scores in the post-application of the achievement test and the attitude toward the physics questionnaire. The researchers concluded that the learning stations provided students with an opportunity to constructively build their own knowledge by gradually developing their understanding of physics at each station. Additionally, the researchers indicated that the learning stations allowed students to engage in meaningful science discourse that may have influenced their positive attitudes toward physics.

Another example is Al-Hafidh's (2020) study that aimed to explore the effect of learning stations on developing deductive thinking in science among first-year middle school students. The sample was composed of 65 students divided into an experimental (30 students) and control (35 students) group. This study had four learning stations: an electronic station, exploratory station, imaginary station, reading station, audio station, and a yes-or-no station. The researchers developed a 20-item deductive reasoning test. The findings showed significant differences between the mean scores of both groups in the post-application of the deductive reasoning test in favor of the experimental group. The researcher stressed that the learning station approach allowed students to interact with various educational stations that helped them construct their own knowledge and work with their peers to create a sound cognitive structure. Overall, these studies highlight that the number and type of learning stations should be chosen based on the nature of the subject and content being taught. Additionally, hardly any studies have investigated the effects of learning stations on developing academic achievement and self-regulated learning among middle school students from socioeconomically disadvantaged backgrounds.

Self-Regulated Learning

Self-regulated learning can be defined as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (Zimmerman, 2000, p. 14). As such, self-regulated learning centers around the individual's active and constructive processes of planning, monitoring, implementing, and reflecting to attain academic achievement (Pintrich, 2000). Additionally, self-regulated learners are active agents in their learning process by planning, setting goals, and engaging in strategies to enhance their progress toward academic achievement (Zimmerman, 1986). Furthermore, self-regulated learning strategies are systematically directed toward the achievement of learning goals. As such, self-regulation is a multidimensional construct that can be categorized into the following strategies: cognitive, metacognitive, and resource management (Pintrich et al., 1991; Pintrich, 2004; Zimmerman, 1990). Based on the studies mentioned above, we used the following definitions of self-regulated learning in the current study. *Cognitive strategies* refer to methods and techniques the learner uses to integrate new knowledge with prior knowledge, which also involves contribution strategies that help them recall, elaborate on, and organize ideas. *Metacognitive strategies* refer to the learner's self-awareness about their cognitive processes and the strategies they employ to set goals and monitor, plan, and regulate their learning. *Resource management* refers to the learner's ability to manage and control their learning environment to achieve their goals using tools such as time and effort, management, help-seeking, and peer-learning. Overall, many studies have highlighted that self-regulated students adopt strategies that align with the cognitive demands of tasks and activities to better reach their goals of high academic achievement (e.g., Broekkamp & Van Hout-Wolters, 2007; Komarraju & Nadler, 2013).

Methodology and Methods

Population and Sample

General education in Saudi Arabia consists of three stages: six years in elementary school, three years in middle school, and three years in high school. The population in this study was composed of second-year middle school female students from public middle schools in the city of Khobar, Saudi Arabia. Of the 20 public middle schools in Khobar, two schools contain students of low socioeconomic status due to low income and education achievement in their family's households. Random sampling was not possible because selection of the middle schools had to be disclosed to the Department of Planning and Development in the Eastern Province Branch of the Ministry of Education so that ethical approval could be obtained. Thus, we purposefully approached one of the two middle schools that were willing to participate in the study.

Research Design

A quasi-experimental design with an experimental and control group and a pretest and posttest was used to investigate the study's research questions. The chosen middle school consisted of five second-year classes. Two classes were randomly selected. Thirty-three students comprised the experimental group, and 35 students comprised the control group. The experimental group received the pretest, the treatment (learning stations), and the posttest. The control group received a pretest followed by a posttest. All students in both groups were of low socioeconomic status (i.e., from households with low income and educational achievement). Additionally, there were no differences between the two groups regarding the following extraneous variables: gender, age, educational content, or previous academic achievement. Furthermore, the subject of science was chosen because both the school's principal and academic counselor indicated that science was a challenging subject for their second-year students, and the students were at risk of having a significant achievement gap in science. Furthermore, the following two units from the science textbook were used for this study: "Support, Locomotion, and Response" and "Reproduction and Development." The first unit included two lessons, which were "Skin and Muscles" and "The Skeleton and Nervous Systems." The second unit included two lessons, which were "The Endocrine and Reproductive Systems" and "Stages of Human Life."

Research Tools

The development of the academic achievement test. The academic achievement test was developed to measure students' level of understanding related to the "Support, Locomotion, and Response" unit and the "Reproduction and Development" unit (see Appendix A). Together with an expert teacher from the middle school, we examined several resources when drafting the academic achievement test, which included the learning objectives of each lesson, the scientific concepts in each unit, previous academic achievement tests carried out in the school, and samples of academic achievement tests supplied by the Saudi Education and Training Evaluation Commission. The academic achievement test included 28 multiple-choice questions designed to test different cognitive levels – remembering, understanding, applying, and analyzing (Anderson & Krathwohl, 2001).

Moreover, content validity was established by having the test reviewed by two curriculum and instruction professors at the researchers' university. They were asked to review the test's degree of representation in the content, the clarity of the questions, the suitability of the alternatives for each of the questions, and the suitability of the questions for the corresponding cognitive level and give any other necessary feedback. Accordingly, changes were made based on the reviewers' feedback, which included minor wording editing and the cognitive difficulty of some questions. Then, the researchers piloted the test on 58 third-year male middle school students who were not participants in the study. The internal consistency was assessed by calculating Pearson correlation coefficients between each question and the total mark for the cognitive level under which the question falls, as shown in the following table:

Table 1
Pearson Correlation Coefficients for the Academic Achievement Test

Remember		Understand		Apply		Analyze	
Pearson Correlation	Question	Pearson Correlation	Question	Pearson Correlation	Question	Pearson Correlation	Question
0.693*	1	0.630*	3	0.782*	2	0.749*	5
0.732*	7	0.559*	9	0.862*	4	0.813*	6
0.580*	8	0.683*	10	0.724*	12	0.665*	13
0.744*	14	0.584*	18	0.854*	28	0.629*	11
0.661*	15	0.614*	19			0.762*	23
0.595*	16	0.519*	20			0.641*	24
0.503*	17	0.638*	21				
0.579*	25	0.660*	22				
0.727*	27	0.629*	26				

* Correlation is significant at the 0.01 level.

Table 1 shows that all correlation coefficients between each question and the total mark for a cognitive level under which the question falls are statistically significant at 0.01, which means that the academic achievement demonstrated internal consistency. Additionally, the internal consistency was calculated for each cognitive level individually with overall test scores. The value of coefficients for remembering, understanding, applying, and analyzing were 0.722, 0.665, 0.603, and 0.648, respectively. Thus, all coefficients were statistically significant correlations at 0.01, indicating an existing strong internal consistency of the test. Furthermore, the reliability of the test was verified through two methods Cronbach's alpha and split-half reliability (Spearman–Brown). We calculated the results of both methods to be 0.865 and 0.867, respectively. This indicates high reliability and thus confirms the appropriateness of the test for application.

Furthermore, the difficulty and discrimination coefficients were examined for each question. The difficulty coefficients ranged from 0.38 to 0.76 with an average of 0.58, and the discrimination coefficients ranged from 0.31 to 0.69 with an average of 0.54. Accordingly, the academic achievement questions have appropriate difficulty and discrimination coefficients, and thus they are considered suitable. Finally, the academic achievement test took approximately 40 minutes to complete.

Development of the self-regulated learning questionnaire. The self-regulated-learning questionnaire consisted of the following three components of learning strategies, each of which includes three skills as follows: (1) cognitive strategies: recalling information, organizing, and elaborating; (2) metacognitive strategies: planning, regulating, and monitoring; and (3) resource management strategies: time managing, peer learning, and help-seeking. These specific self-regulated-learning strategies and associated skills were chosen because of their suitability for the abilities of the study participants, and the items were taken from literature in the context of middle school education (e.g., Al-Shammari, 2019; Muhammad, 2017). The questionnaire consisted of 36 statements, with each skill having four statements. Negative phrases were considered in the development of the questionnaire, and negative statements were included in items 8, 16, and 36. The questionnaire included a three-point Likert scale: rarely (score 1), sometimes (score 2), and always (score 3). Two experts in educational psychology reviewed the questionnaire to confirm content validity. They were asked to evaluate each item for clarity, readability, and relevance. All necessary changes recommended by the reviewers were addressed, which mostly involved wording and minor grammatical changes to avoid misinterpretation and ensure clarity. Then, the questionnaire was pilot tested on 58 middle school students who were not participants in the study. The internal consistency was assessed by calculating Pearson correlation coefficients (refer to Table 2).

Table 2
Pearson Correlation Coefficients for the Self-Regulated Learning Questionnaire

Recalling information		Organizing		Elaborating	
No.	Pearson Correlation	No.	Pearson Correlation	No.	Pearson Correlation
1	0.803*	5	0.738*	9	0.783*
2	0.769*	6	0.758*	10	0.843*
3	0.792*	7	0.837*	11	0.827*
4	0.749*	8	0.733*	12	0.775*
Planning		Regulating		Monitoring	
No.	Pearson Correlation	No.	Pearson Correlation	No.	Pearson Correlation
13	0.778*	17	0.837*	21	0.866*
14	0.805*	18	0.775*	22	0.815*
15	0.798*	19	0.773*	23	0.828*
16	0.774*	20	0.859*	24	0.842*
Time managing		Peer learning		Help-seeking	
No.	Pearson Correlation	No.	Pearson Correlation	No.	Pearson Correlation
25	0.882*	29	0.804*	33	0.811*
26	0.768*	30	0.796*	34	0.747*
27	0.847*	31	0.784*	35	0.802*
28	0.805*	32	0.825*	36	0.826*

* Correlation is significant at the 0.01 level.

Table 2 shows that all correlation coefficients between each statement and the total mark for the habit of mind under which the statements fall are statistically significant at 0.01 and 0.05, indicating that the questionnaire is internally consistent. Additionally, we calculated the internal consistency of each skill with overall questionnaire scores. The values of the coefficients were as follows: recalling information (0.646), organizing (0.589), elaborating (0.752), planning (0.661), regulating (0.679), monitoring (0.699), time managing (0.662), peer learning (0.768), and help-seeking (0.575). The values of the coefficients were statistically significant at 0.01. The reliability of the questionnaire was tested by using Cronbach's alpha, which was calculated as 0.925, and split-half reliability (Spearman–Brown), which was estimated as 0.872, both of which are acceptable degrees of reliability. The questionnaire took approximately 20 minutes to complete (see Appendix).

Teachers' guide to learning stations. In Saudi middle schools, science is generally taught four times per week, and each class is 45 minutes long. In this study, we used three learning stations: an exploration station, visual station, and reading station. At the exploration station, students were engaged in hands-on activities where they carried out and explored a specific concept from their lesson. Then, students moved to the visual station, where a computer screen was set up for them to watch a video clip related to the lesson content. Finally, the students proceeded to the reading station, where they interacted with a scientific text related to the lesson. At this station, the students linked and extracted information included in the reading text with previous knowledge gained from the exploration and visual stations. They also engaged in reading activities, such as identifying main ideas, underlining key concepts, and expressing meaning in their own words. At each station, the students were asked to take notes and answer questions on the accompanying worksheets.

Furthermore, we developed a teacher's guide to learning stations for the "Support, Locomotion, and Response" and "Reproduction and Development" units. The guide includes the following sections: introduction to learning stations strategy, lesson objectives, scientific concepts included in each lesson, lesson plans according to learning stations, using learning stations in larger classes, and worksheets for each learning station. The teacher's guide was reviewed by two science education professors and by an experienced middle school teacher. Necessary changes were made upon receiving their written feedback and verbal suggestions.

Procedures

Before carrying out the study, we sought approval from the Eastern Province Office of the Ministry of Education, which issued a letter to the targeted middle school allowing us to conduct the study with second-year female middle school students. All participating students, their parents, and the classroom teacher agreed to voluntarily participate in the study. Moreover, we applied descriptive statistics to analyze the data of this study, which included calculating the mean, standard deviation (SD), and degrees of freedom (df) values for both the academic achievement test and self-regulated learning questionnaire. Additionally, we used Pearson correlation coefficients to investigate the connection between the two dependent variables. Initially, the normality in each group was estimated using a Shapiro–Wilk's test, the results of which showed that each had nonsignificant readings and followed a normal distribution. As a result, we employed inferential statistics, which included a *t*-test for independent samples to identify differences between the experimental and control groups in developing the academic achievement test and self-regulated learning questionnaire and the eta-squared (η2) coefficient to calculate the effects of the size of learning stations on academic achievement and self-regulated learning.

Furthermore, we administered the pretest using the test and questionnaire on the chosen experimental and control group to verify their equivalence. We examined the equivalence of the two groups by using an independent sample *t*-test. Table 3 illustrates the results.

Table 3
T-Test Results for the Pretest Academic Achievement Test

Group	N	Mean	SD	df	T value	Significance level
Experimental	33	7.39	2.16	67	0.597	0.553
Control	35	7.71	2.26			

Table 4
T-Test Results for the Pretest Self-Regulated Learning Questionnaire

Group	N	Mean	SD	df	T value	Significance level
Experimental	33	56.52	7.55	67	0.944	0.348
Control	35	54.69	8.37			

Tables 3 and 4 show that the test significance level is above 0.05, which indicates that there are no statistically significant differences between the experimental and control groups. Therefore, there is equivalence between both groups. Finally, after the four-week treatment was completed, we conducted the posttest by using both instruments for the experimental and control groups.

Results

Research Question One

To answer the first research question, we tested the following hypothesis: "There are no statistically significant differences at ($\alpha \leq 0.05$) between the posttest mean scores of the experimental and control groups in the academic achievement test." Table 5 shows the summary statistics for testing this hypothesis, which corresponds to the first research question.

Table 5
Posttest Summary Statistics for the Academic Achievement Test

Group	N	Mean	SD	*df*	*T*-test	η^2	Significance level
Experimental	33	25.36	1.85	67	11.44	0.665	0.00
Control	35	18.17	3.13				

Table 5 reveals that the significance level is less than 0.05. Therefore, the null hypothesis is rejected, which means that the use of learning stations made a difference in the posttest in favor of the experimental group. Additionally, eta squared (η2) is calculated at 0.665, revealing a large effect size. This indicates that learning stations had a significant and effective impact on the students' performance on the academic achievement test.

Research Question Two

To answer the second research question, we tested the following hypothesis: "There are no statistically significant differences at ($\alpha \leq 0.05$) between the posttest mean scores of the experimental and control groups in the self-regulated learning questionnaire." Table 6 shows the summary statistics for testing this hypothesis, which corresponds to the second research question.

Table 6
Posttest Summary Statistics for the Self-Regulated Learning Questionnaire

Group	N	Mean	SD	*df*	*T*-test	η^2	Significance level
Experimental	33	100.12	5.59	67	17.81	0.828	0.00
Control	35	65.77	9.65				

Table 6 shows that the significance level is less than 0.05. Therefore, the null hypothesis is rejected, which means that the use of learning stations made a difference in the posttest in favor of the experimental group. Additionally, eta squared (η2) is calculated at 0.828, which is a large effect size. This indicates that learning stations had a significant and effective impact on the development of students' self-regulated learning.

Research Question Three
To answer the third research question, we tested the following hypothesis: "There are no statistically significant correlations at ($\alpha \leq 0.05$) between academic achievement and self-regulated learning among middle-school students." Table 7 shows the summary statistics for testing the third hypothesis, which corresponds to the third research question.

Table 7
Pearson's Correlation Coefficients Between Academic Achievement and Self-Regulated Learning

Group	N	Pearson Correlation	Significance level
Experimental	33	0.534	0.001
Control	35	0.125	0.474

Table 7 shows that the correlation coefficient in the case of the experimental group reached 0.534, which is greater than that of the control group 0.125. The significance level for the experimental group is less than 0.05; therefore, the null hypothesis is rejected. Additionally, there is a positive correlation for the experimental group between students' achievement on the test and their development of self-regulated learning when using learning stations.

Discussion

Regarding the learning stations strategy making a difference in the post academic achievement test in favor of the experimental group, a possible explanation could be the collective effect of the three learning stations on the students' achievement on the test. In the exploration station, students were given the opportunity to learn through their own interactions with tangible experiences. The activities in this station stimulated students' curiosity, established a desire to learn, and raised questions. As students progressed, spontaneous processes of exploring new ideas were triggered to address questions or problems they encountered during the explanation activities. Ocak (2010) stressed that exploration stations are active and dynamic, which provides students with the opportunities for experimentation to develop their personal knowledge and meaning.

Furthermore, considerable empirical evidence reveals that students of low socioeconomic status are more likely to have poor reading and writing skills (e.g., Ming & Powell 2010;

Wamba, 2010). As such, the visual station may have helped the students who are weaker in these areas by maximizing their cognitive and emotional awareness. Additionally, the visual station worked to bring scientific concepts of the lessons closer to the students' minds and helped to embody verbal meanings that the students could easily perceive by watching the video clips. Berk (2009) explained how educational video clips are processed in students' brains. Berk concluded that educational video clips have the potential to tap into students' core intelligence and interpersonal emotions. Similarly, Choudhury (2011) indicated that video clips could support students' retentive memory and help them recall what was taught in class. Moreover, the reading station set the final stage to address the concepts of the lesson. This station provided the students with more formal instruction by having them read texts that were oriented toward the lessons' concepts. Because the students engaged in both experimentation and visual activities, the reading station encouraged an active search for meaning rather than mechanical memorization and a lack of meaningful connection when learning the scientific concepts. Overall, comparisons of our findings with those of other studies confirm that using learning stations significantly affects students' academic achievement levels compared to using conventional educational methods (Al-Hafidh, 2020; Allihaibi, 2015; Suoed & Taha, 2020).

With respect to the learning stations making a difference in the post-self-regulated-learning questionnaire in favor of the experimental group, a possible explanation is that each learning station created a cooperative and engaging context for solving problems and fostered the development of students' self-regulated learning. The exploration station's activities emphasized the continuity of self-learning and pushed the student toward researching and employing their ideas in problem-solving, which enhanced their self-regulated learning skills. Additionally, the exploratory nature of the learning station's activities may have assisted the students in remembering and retrieving information, which in turn facilitated the process of retaining and organizing the lesson's content and concepts in the student's cognitive structure to improve long-term retrieval. Previous researchers indicated that practicing activities that allow students to adopt cognitive strategies (i.e., planning, elaboration, and organization) deepens their engagement with the lesson content, which aids them in remembering and retrieving information (Pintrich, 2003).

The learning stations also provided the students with the opportunity to employ metacognitive strategies. Across the stations, students took responsibility when dealing with the activities and identifying their strengths and weaknesses while learning, which prompted them to employ metacognitive strategies such as planning, regulating, and monitoring their learning. Additionally, with each station having a specific time limit, students would search for effective ways to increase their awareness and understanding at each station using self-regulated learning (i.e., resource-management). Collectively, the study's results suggest that the systematic and exploratory nature of the learning station provided the students with a greater awareness of their self-regulated learning skills. Additionally, the study's findings align with those of previous studies, which indicated that students with varying backgrounds and abilities could develop self-regulated learning strategies (Lichtinger & Kaplan, 2011; Nilson, 2013).
Furthermore, using the learning stations, we were able to show a positive correlation between academic achievement and self-regulated learning. Several studies indicated that students of low socioeconomic status face unfavorable odds in attaining academic success and narrowing the achievement gap (Johnson et al., 2011; Sirin, 2005; Thomson, 2018). Additionally, classroom context has been recognized as a significant contributor to students' development of self-regulated learning (e.g., Paris & Paris, 2001; Turner & Meyer, 2000). As such, a possible explanation for this result may be that the learning stations created a dynamic classroom context where students in each station were required to be active learners by working toward

successfully completing the station's activity (e.g., the station's worksheets), as well as deliberate planning and monitoring the accomplishment of the station's task. The instructional settings of the learning station allowed students to deepen and manipulate the associated content of the lessons. That is, each station played a role in encouraging students to employ various cognitive approaches to acquire the content knowledge of the lesson and develop processes by which they could exercise control over their thinking, affect, and behavior (i.e., self-regulated learning).

Conclusion

The purpose of this study was to investigate the effects of learning stations on developing academic achievement and self-regulated learning among students from socioeconomically disadvantaged backgrounds. Results from the current study suggest that teachers can use learning stations to benefit students of low socioeconomic status and develop their academic achievement and self-regulated learning. The academic achievement growth seen in the experimental group might be explained by considering the multiple opportunities students had to address the content of the lesson at each station (i.e., exploration, visual, and reading stations). The continued exposure to the lesson content and information may have been sufficient for acquiring knowledge. Furthermore, it is important to note that classroom activities that are easy to complete might make students lose interest, and activities that are too challenging are likely to make them feel frustrated or lost (Gilliam, 2015). As such, findings from the current study suggest that the learning stations created a classroom context that offered a reasonable amount of challenge, which prompted students to engage in self-regulatory behaviors, such as organizing, monitoring, peer-learning, time-managing, and help-seeking.

Our purposeful sampling may be viewed as a potential limitation. However, the Saudi educational system is centralized, so it is likely that little variation in the results will be present when similar studies are conducted in the region. Moreover, further research could explore students' attitudes toward the use of learning stations strategy and the use of observation sheets to investigate pre-service or in-service teachers' skills when using the strategy. Teacher education programs and professional development workshops should include experiences and instructional strategies that adequately meet the needs of students of low socioeconomic status. Considering the importance of sustainable education in improving the futures of students of low socioeconomic status, further research is needed to evaluate other instructional strategies that have the potential to narrow the achievement gap and develop students' learning abilities.

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Appendix A: Academic Achievement Test (Example)

1. The chemical produced by epidermis cells that protects the skin from the sun's rays and gives it its color is called: (*Remember*)
   a. Hemoglobin
   b. Hormones
   c. Melanin
   d. Sweat glands

6. Ligaments differ in their function from the tendon in that they: (*Understand*)
   a. Connect the bones together in the joint
   b. Move the limb bones
   c. Move cartilage
   d. Help the spongy bone to move

9. The structure and basic function in the nervous system that conveys nerve impulses in one direction is called: (*Apply*)
   a. Neuron
   b. Synaptic cleft
   c. Spinal cord
   d. Brain

12. Ahmed fell while playing football. The doctor diagnosed him with a knee joint injury. This joint type is: (*Analyze*)
   a. Hinge
   b. Axial
   c. Spherical
   d. Sliding

Appendix B: Self-Regulated Learning Questionnaire

1. I repeat difficult concepts when studying science until I memorize them.
2. I recite important concepts for myself many times so that I will not forget them.
3. I read definitions aloud several times so that they stick in my mind.
4. I write down important points several times while studying so that I can remember them.
5. I use symbols and shapes to help me organize my studies in science.
6. I create drawings and maps of the concepts in the lessons.
7. I compare scientific concepts when I study science topics.
8. I lack the ability to organize new information into tables and charts.
9. I relate new ideas to what I previously learned while studying science.
10. I underline important phrases to facilitate understanding and review.
11. I summarize the most important things I learned in the lesson in simple paragraphs.
12. I create a hierarchy of lesson ideas.
13. I set goals for myself before I start studying.
14. I make a schedule of my daily activities.
15. I create an action plan before or during my study.
16. I study directly without prioritizing, remembering, or revising lessons.
17. I ask myself questions while studying science to assess my understanding.
18. I compare my answers with those of the teacher in the classroom.
19. I compare my academic progress with that of my classmates.

20. I can spot my mistakes when doing science activities.
21. I mark points that I did not understand while studying.
22. I follow my way of doing the homework.
23. I spot the parts where I made mistakes for review.
24. When I study, I pause from time to time to make sure I understand the material.
25. I organize my time when studying science lessons.
26. I complete my science assignments on time.
27. Before I start studying, I specify times to rest and eat.
28. I prepare for the test well in advance.
29. I exchange notes with my classmates while learning.
30. I enjoy practicing teamwork with my classmates to help one another.
31. When I understand the lesson well, I explain it to my classmates.
32. I participate with classmates to simplify difficult-to-understand scientific concepts.
33. I seek help from others when it is difficult for me to complete my homework.
34. If there is something that I cannot understand, I ask my teacher to explain it to me.
35. I ask my classmates about concepts that I did not understand well in science.
36. I feel embarrassed when I seek help from my classmates to do science activities.