

The relationship between Active learning implementation in high schools, and the development of students' critical thinking skills

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Abstract: - *This research seeks to explore whether implementing active learning techniques in Lebanese high school improves the students' cognitive ability. The study deals with investigating the relationship between active learning teaching strategies and the development of students' critical thinking skills. This aims at providing academic benefits on the Lebanese educational institution to encourage active learning. We conducted a quantitative study in analyzing data from a student questionnaire, using an inductive approach, and action research strategy adopted to collecting and interpreting survey data. Meanwhile, the cross-sectional horizons were conveniently chosen for this qualitative study. The results have validated the existence of a relationship between active learning and critical thinking skills. Through studying the relationship between the two variables, this link revealed a noticeable positive relationship between active learning teaching techniques and students critical thinking skills.*

Index Terms: - *Active learning, critical thinking, traditional teaching, elements of active learning, cooperative learning, independent and dependent variables.*

I. INTRODUCTION

Active learning has been an approach to give instructions which involve engaging the learners actively. The course material is given through discussions, case studies, problem solving and many other approaches. This teaching technique has placed a great accountability on the students. It has been shown in the literature review that active learning (AL) has reduced the number of passive learners and converted them into active ones. And of course, the role and the guidance of the instructor are essential in the classroom, because she/he is presumably well trained on how to manage the class while implementing active learning techniques. Also, active learning has helped promoting a higher level of the students' cognitive abilities.

A. Aims and objectives

The aim of this study is to explore the impact of AL on the students' cognitive ability, and to prove that AL tends to be a very effective teaching strategy, that keeps the learners engaged while it is implemented in class. The researcher has built its analysis on AL as being the independent variable and critical thinking (CT) as being the dependent variable.

As it is detailed in the literature review, the research has been done on relevant topics, especially how active learning enables the students to become critical thinkers. Many previous researches have shown the positive impact of the implementation of AL on students' cognitive abilities and academic achievements.

B. Research problem

Being the main two pillars of active learning, collaborative and cooperative learning are an integral part of the learning process. However, the ultimate goal is to help implement all other major AL activities in the classroom as well and study their cumulative effect on the learning process. For instance, role play, discussion, debate, and argument. In this learning environment, the majority of the students work in small groups to achieve a shared learning experience through interaction. In group work, the learners work interdependently, for they are

able to share ideas and do problem-solving activities (Johnson, 2008). In collaborative approach, there are a lot of different learning activities that are carried out in the classroom. The literature review will show that the gap is the lack of full implementation and integration of collaborative learning in the Lebanese program Temsah, L., & Safa, N. (2021).

C. Research questions

The current study aims at answering the following two research questions through a quantitative analysis by surveying high school students from four selected schools in the Mount Lebanon governate.

RQ1 (Research Question 1): Does the implementation of active learning have a positive impact on high school students' class participation in four selected Lebanese schools?

RQ2 (Research Question 2): Does a high level of student's class participation in four selected Lebanese high schools, have a positive impact on the development of their critical thinking skills?

II. LITERATURE REVIEW

This section presents the theoretical framework for the study and develops the topic, by investigating the link between active learning teaching techniques and the students' critical thinking abilities. Some of the aforementioned gaps introduced earlier will require more in-depth investigation, in terms of the links between AL and CT.

D. Active Learning Strategies

During the active learning process, the learners are somehow able to monitor their own understanding and progress. They will become fully aware of their academic progress and could be totally and actively involved in discovering solutions, whenever they struggle with any specific aspect of a task given in the classroom. Moreover, the students' understanding and monitoring of each other, are involved with metacognition. Therefore, metacognition involves the ability of analyzing the method that critical thinking takes place. Metacognition and learning are interrelated, and it is a type of behavior that could be learned, and making it a vital part of the classroom discourse, is the only way to make it credible to occur. In addition, self-awareness improves metacognition, thus, students are in need to acquire some self-awareness capacities to move on in active learning activities. Self-awareness refers to the ability of becoming the main object of attention. For this target, most of the students tend to gain insight into their own skills. This approach has given the opportunity to all the pupils to reflect and be encouraged to say out loud their responses because the teacher listens to all the answers without any judgment and with full objectivity, which constantly keeps students fully engaged till they discover solutions to the problem at hand. (Amanatallah & Safa, 2021).

Several previous research has already suggested that adding active learning activities to traditional college science lectures considerably enhances student's learning. However, there are some courses that have been taught by science education researchers with exceptional teaching expertise, have revealed the relationship between active learning activities and the pupils' performance in the subject area of natural selection. Despite the fact that active learning has the potential to enhance the process of learning, it is not associated with a greater learning gain. It seems that the majority of the biology instructors have lacked the rich and nuanced understanding of learning and teaching that science education developed. Consequently, active learning as designed and carried out by typical college biology teachers might look like active learning used by education observers, but it lacks the constructivist factors and elements that are essential for improving the learning process. (Andrews et al., 2011).

E. Constructivism Theory of Learning

The constructivist learning theory explains that we learn by 'constructing' knowledge in our minds. Constructivism argues that learners have an active role in thinking things through, many times over, and coming to conclusions based on logic and critical thinking.

Prior to the rise of Constructivism, teachers would teach using a behaviorist approach, through hammering ideas into students' heads by getting them to repeat answers over and over again.

Piaget, the most famous constructivist theorist, came up with many of the fundamental ideas in constructivism. According to him, there are six key components to how we learn:

1- *Learning through experience*: Whenever we come across a new experience, we process it in our minds. We will use that experience to understand our worlds. Piaget called learners 'lone scientists' who go out into the world and investigate to learn.

2- *Prior knowledge*: Each new experience is compared to previous experiences we have had. We will look at our new experiences and use them to understand what we're looking at.

3- *Cognitive Schema*: Piaget stated that a cognitive schema is a packet of knowledge that we have in our mind. We can add to a cognitive schema (assimilation) or change it (accommodation).

4- *Assimilation*: Piaget used this term to explain 'adding new knowledge' to our knowledge bank (cognitive schemata). If I come across new knowledge that I can add to my knowledge bank, I'll place it into a cognitive schema. For example, if I see a new breed of dog, I'll recognize it as a dog, so I'll add this new breed of dog to my 'dog' cognitive schema in my mind.

5- *Cognitive disequilibrium*: When we come across a new experience, it may contradict our prior knowledge. A learner will be confused and not understand what they can see. At this point, a learner is in a state of cognitive disequilibrium. We always want to be in a state of *cognitive equilibrium* where everything makes sense.

6- *Accommodation*: To overcome cognitive disequilibrium (confusion), we need to 'fix' old or broken prior knowledge. We will need to recall a cognitive schema and repair it. For example, if I see a horse for the first time, I may think it's a dog because it has four legs. Then, someone will tell me it is a different animal called a 'horse'. Now I need to fix my 'dog' schema by breaking it up so I don't bank all horses into the dog schema. I might create two new schemata: one for dogs and one for horses. I'll try to remember key features of horses (their height, their body shape) so that in the future I can tell the differences between horses and dogs. *I learned through experiences!*

F. Defining Critical Thinking

Critical thinking is the capacity to analyze facts, organize thoughts, take part in debates, defend opinions, make inferences, solve problems, compare and contrast, and appraise arguments. It is considered a disciplined manner of ideas that a student uses to evaluate the validity of a research, an argument or a story. It involves evaluating, identifying and being able to construct controversial topics, and the skills to infer an outcome from one or many premises, in order to examine the logical relationships among statements or data. What is also essential is the productivity process, which is often, the ambiguity and doubt that serve the function of critical thinking. So, when the students become critical thinkers, they are able to judge and ask questions, based on very reliable piece of evidence or source to establish a coherent relationship among their learning skills. (Paul & Elder, 1990).

Many philosophers, from Plato and Socrates to John Dewey, have highlighted the significance of critical thinking and the value of intrinsic instruction that has always reached beyond mere factual recall (McPeck, 19810). Because critical thinking has cut across the majority of all areas of life, enabling students to think critically is an avowed purpose of education. (Kurfiss 1988).

The critical thinking's intellectual roots have been as old as its traceable, etymology, absolutely of probing questioning that most of the people are not able to justify their claims to knowledge. Socrates established a fact that a person could not rely on those in authority to have insight and knowledge. (Elder & Bartell, 1997) He founded the importance of deep inquiry which probe into critical thinking before accepting ideas as worthy of belief. Moreover, he founded the vital importance of the guided discovery which is seeking evidence, closely investigating, analyzing, and reasoning logically. The Socrates questioning tends to be the best critical thinking strategy. Since that time up to now, the agenda has been for the tradition of critical thinking, merely, to reflectively question common explanations and beliefs, carefully examining these beliefs which are reasonable and logical from those which, but appealing they might be to our native egocentrism. However, much they have served our interests.

Critical thinking is major to the civic and personal life of all members of society, for it has allowed all individuals to evaluate many pieces of information presented to them in order to make the most accurate judgments. Also, critical thinking has provided the foundation for the inquiry-based learning strategy. The learner is not able to investigate claims, make inquiry-based, or evaluate the quality of the piece of evidence without thinking critically. (Facione, 1990, p.32). The literature on critical thinking is based on three different fields: education, philosophy, and psychology. These disciplines have reflected many different approaches to defining critical thinking.

G. Cognitive Goal

The necessary components of the lessons designed to encourage critical thinking, are all structured problems, criterion to assess the thinking process, and the students' assessment of their improvement of

thinking. The lessons that are encouraging critical thinking need to be emphasized on well-structured problems. In addition, three types of questions are considered inquiry strategy to enhance the thinking: process: Factual questions, preference questions and the reasoning questions. Moreover, the elements such as interpreting an article, judging a theory, predicting a result, and determining a course, all require logical reasoning. (Paul & Elder, 1990).

Contrasting active learning, the lecture is the oldest teaching technique implemented in universities. Since it has been first carried out in Plato's education institution, lecturing has become an important part of the teaching performances favored in colleges and school curriculum. Recently, this methodology of direct instruction has been attacked, for it is considered an obstacle to foster the cognitive goals. Whereas, active learning gives the learners an opportunity to read, write, interact, and reflect. For example, students from grade II class, should not be told that an orchard is made from soil and rocks. Instead, we could tell that an orchard is used for gardening. In addition, we could take the students outdoor and explain to them, that an orchard is used to grow fruit and vegetables. (Naimule & Corebima, 2018).

The scale of active learning is consisted of components related to cooperative learning and self-guided – learning skills. Those results, are in line with Yew et al, who has discovered that active learning in problem-based learning is a cumulative procedure that has been empowered by cooperative learning and self-guided learning processes. Moreover, the incorporation of critical thinking is one of the sections in the scale which is provided by a piece of evidence to boost the students' cognitive intellectual potential and help them build their knowledge actively, through extension programs. (Chaaban et al., 2020).

All of the elements underpinning critical thinking skills, as remembering, understanding, applying, analyzing, evaluating, and creating, enhance the learners' skills in problem-based learning activities. The students will be able to meet the global community, achieve the learning outcomes, and develop their communicative capacities. The problem-based learning is a student-centered approach of education, where learners learn by doing something in the classrooms. For example, in a science course, students could go to the schools' garden to gain knowledge about the relationship between food and plants. First, determining the types of plants and which the ones that are going to be grown are. Second, mapping the goals of a garden, like providing the cafeteria with some food. Third, planting the seeds and monitoring their growth. This whole process in the garden, will be effective for academic achievement in knowing the importance of our environment and the good nutrition. (Paul & Elder, 1990).

Group work in schools and colleges may be divided into three different categories: Collaborative learning, cooperative learning, and peer tutoring. All these types seem to increase the level of interaction and engagement among the learners (Tolmi et al 2010). Moreover, while students are exchanging ideas and information in class, they are at the same time developing their intellectual growth. Collaborative activities use a self-contained learning task and stresses only on joint activity in order to share understanding. However, cooperative learning solely involves jigsaw methods with a wide variety of learning tasks in order to share outcomes. There are differences in their theoretical background. Cooperative learning originates in a social psychological work in groups that are formed and tasks assigned by the teacher. Meanwhile, collaborative learning structure is a social cognitive network established by students. Collaborative and cooperative learning share a lot of similarities despite the fact that there are differences between them. They are both able to enhance the students' applications of skills and increase the ability of critical thinking.

III. RESEARCH METHODOLOGY

The adopted quantitative research methodology allows for a deeper understanding of the relationship between active learning and critical thinking, and the impact of active learning on students' critical thinking. The study has employed a cross – sectional experimental survey methodology to collect, analyze, interpret, and synthesize quantitative data to answer the research questions (Creswell & Clark ,2011). The justification for this approach was the quantitative data which were comprehensive and adequate to cover all aspects of the topic of the study. Therefore, it provided a way to draw a conclusion from the data in order to understand what motivates the students to be able to implement active learning activities, enhance their class participation, and improve their critical thinking abilities. It is to be noted here, and in order to validate the questionnaire and measure its internal consistency, the researcher piloted the study with two small sized groups of 10 and 14 students, regular BT3 and Developer class. Furthermore, academic performance and critical thinking skills were measured effectively by the validated test of the two groups to assess the impact of the various techniques used in AL activities.

H. Methodology Selected

This quantitative study is correlational in nature, and has used analysis of variance and linear regression to investigate the relationship between the two variables. The survey has been designed to explore if there were a relationship between active learning (IV) and critical thinking skills (DV), in particular identifying the impact of active learning on students’ critical thinking abilities.

I. Study Participants

The researcher used convenient sampling to target all secondary level students’ population from four schools in Mount Lebanon district: Saint Coeur Kfarhabab, Saint Jean Okaibe, College Mon Seigneur Kortbawi, and Antonine Ajaltoun schools. The students were asked to fully answer a specifically designed questionnaire. Our sample consisted of 171 students from all four schools who responded to the survey.

J. Data Collection

This study used a questionnaire as an instrument for collecting data. The questions have been prepared with the intent to gather in depth data on students’ current academic status and their perception of adopted teaching approaches and methodologies, and how well they are benefiting in particular from existing active learning techniques. Moreover, the questionnaire has been framed to have more insight into the implementation of active learning of the participants in order to enhance critical thinking. The collected data showed the personal experiences and opinions of the population represented by the sample.

IV. FINDINGS

This part deals with the data gathering, presentation, and interpretation of the results from the conducted survey. In order to accurately determine the correlation between the two variables and the impact of active learning on students’ critical thinking. This analysis is based on responses of high school students from four Lebanese schools in Mount Lebanon district. It contains the results of the quantitative research design study conducted to test the following hypotheses:

Ha: The implementation of active learning in the classroom has a positive impact on the development of critical thinking skills of high school students in four selected Lebanese high schools.

H0: The implementation of active learning in the classroom has no positive impact on the development of critical thinking skills of high school students in four selected Lebanese high schools.

D. Data Analysis

The following table shows all survey questions divided into three groups A, B, and C. Group A contains all the questions related to student satisfaction and participation, group B encompasses the questions that are relevant to the implementation of active learning in the classroom, while group C questions focus on critical thinking traits and skills. The “Mean” column shows the mean of each question for all of the 171 responses. A coding system has been adopted to quantify ordinal (non-numeric responses). whereby, for binary answers, a value of 0 is assigned for “NO”, and 1 for “YES”. Also, the Likert Scale answers were quantified and coded from 1 (for strongly disagree) till 5 (for strongly agree). The analysis of variance (ANOVA) and linear regression analysis were used to compare the responses’ means of the three groups’ A, B, and C and to find the correlation coefficient *r* along with the *p*-value.

Theme	Survey question	Mean
Satisfaction / Participation Group (A)	9- I pause for clarification during a lecture.	0.5765
	10- I am comfortable with my teacher’s teaching technique.	0.7602
	15- To what extent you agree or disagree on the following statements. [My teacher’s feedback affects me positively.]	3.5789
	19- To what extent you agree or disagree on the following statements. [My teachers think that I cannot do anything correctly.]	4.0000
	20- To what extent you agree or disagree on the following statements. [I don’t understand my teacher’s instructions.]	3.7135

	21- To what extent you agree or disagree on the following statements. [My teacher's verbal comment is important to me.]	3.5965
	22- To what extent you agree or disagree on the following statements. [I am always respected by my teachers whether I answer correctly or not.]	3.6257
	1- My teacher asks me about my opinion towards debatable topics.	0.7024
	5- My teacher asks me about my problems and help me find solutions to solve them.	0.5569
	12- When I participate, the teacher uses my ideas later on as he or she explains the lesson.	0.5858
	13- During discussions, my teacher takes my contributions seriously and elaborate on them.	0.7101
Implementation of Active Learning in the Classroom Group (B)	2- My teacher implements problem-solving techniques.	0.7836
	4- My teacher uses discussions and scaffolding strategy for the subjects I learn.	0.7857
	8- I often take part in group discussions.	0.7706
	16- To what extent you agree or disagree on the following statements. [We sometimes mingle for interactions in the classroom]	3.3567
	17- To what extent you agree or disagree on the following statements. [I share notes with my peers while group activity]	3.6176
	18- To what extent you agree or disagree on the following statements. [My teachers monitor us during learning activities in the classroom]	3.5205
Critical Thinking Skills Group (C)	3 -Are you able to build winning arguments in class?	0.7711
	6- -Can you pick holes in someone's theory if inconsistent with known facts?	0.6706
	7 -Do you possess logical reasoning skills?	0.6959
	11-Are you able to reflect on the biases inherent in your own experiences and assumptions?	0.3787
	14- Do you address problems using a systematic methodology?	0.8765

Regarding Active Learning and critical thinking, the regression analysis shows that the correlation value r is 0.605 which is greater than 0.5, and a p -value of 0.0092 which is less than the critical value of 0.05. These values prove that there is a statistically significant relationship ($r=0.605$, $P=0.009$) between active learning and critical thinking.

In group (B) Q2 with a mean of 0.7836: *My teacher implements problem-solving techniques*, and in group (C) Q14 with a mean value of 0.8765: *Do you address problems using systematic methodology?* This result showed that the adopted teaching technique encouraged learning through exploration and experiments. These problems provided the learner with a broad area of exploration. From the students' answers and the ensuing regression statistics, one can assume that the teacher played the role of the facilitator, but did not provide information to the students. Instead, the students were expected to synthesize and find the necessary pieces of information they need to do the problem-solving activity.

As per the results of AL (group B) and the students' satisfaction and participation (group A), the regression analysis shows the existence of a statistically significant relationship between active learning and student satisfaction and participation ($r=0.505$, $p=0,030$).

Referring to Q1 in Group A: *My teacher asks my opinion towards debatable topics*, with a mean of 0.7024, and Q8 in group B: *I often take part in group discussions*, with a mean of 0.7706, this result indicates that the class was student-centered, and once the student is satisfied with the learning environment in class, he will automatically participate. Therefore, when AL is implemented in the classroom, students exhibit a relatively high level of satisfaction and participation. The teacher in this class aimed to keep the learners involved. With this approach the students do not simply listen

to the teachers. Instead, they get actively involved and learn through group tasks activities or independent learning activities created by the teachers. These learning activities often require the students to take part in group discussions, which expose them to a new learning experience that normally happens through interaction.

Regarding the results of the regression analysis of Students' Satisfaction and participation (A) and Critical Thinking (C) with a value $r=0.605$ and $p=0.027$. These values prove that there is a statistically significant relationship between students' satisfaction and participation, and critical thinking skills.

We considered Q12 from (A) having a mean of 0.5858: *When I participate the teacher uses my ideas later on as she or he uses them when she explains the lesson, and Q7 from (C) with a mean of 0.6959: Do you possess logical reasoning skills?* As per the values it shows that AL has improved the students' satisfaction and participation, and students in group work are more satisfied with the learning process and that in itself will lead to better grades. The students' satisfaction and participation could be determined once the teacher listens to the students' ideas and uses them later on while explaining any learning objective. Also, we notice that satisfaction and class participation have a positive effect on the cognitive capacity of the student who tends to be more objective, better communicator, with much improved logical reasoning skills.

V. CONCLUSION AND RECOMMENDATION

K. Responses to Research Questions

The authors addressed and answered both research questions and presented a summary of the findings. It was found that in response to RQ1, active learning has a positive impact on students' satisfaction and class participation. Meanwhile, and in response to RQ2, it was found that a high level of student's satisfaction and class participation also has a positive impact on the development of their critical thinking skills. At the same time, the statistical analysis led us to reject the null hypothesis and to accept the alternate hypothesis *Ha: The implementation of active learning in the classroom has a positive impact on the development of critical thinking skills of high school students in four selected Lebanese high schools.*

In short, there is a positive correlation between active learning and students' cognitive ability. As such, enhancing active learning teaching strategy will positively impact the students' learning experience. When active learning teaching techniques are integrated into the curriculum and implemented in the classroom, students will learn to construct their own knowledge and become lifelong learners.

L. Recommendations

The Lebanese curriculum necessitates to be updated to fit students' academic needs, as the current teaching techniques are not effective to help students achieve their learning objectives. With updated curricula, adopting active learning methodologies and mandating training of teachers on active learning and inquisitive thinking, will help to shift from an unproductive traditional teacher-based approach, to a more fruitful, student-centered teaching strategy.

In particular, the following recommendations to the ministry of education and educational institutions need to be seriously considered:

First; it is very important that the Ministry of Education reforms the current curriculum to adopt active learning strategies and promote critical thinking skills throughout all programs and education cycles.

Second; it is essential for all educational institutions to invest in technology that facilitates the implementation of most active learning techniques.

Finally; all teachers should be required to participate in mandatory training sessions, seminars, and workshops on active and cooperative learning. All participating instructors will receive certifications essential for their professional development.

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