The Effectiveness Of The Flipped Classroom Strategy In Developing The Critical Thinking Skills Of Secondary School Students In Abha Governorate

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Abstract

The primary aim of this study was to assess the impact of implementing the flipped classroom strategy on the enhancement of critical thinking skills among secondary school students in Abha Governorate. A study was conducted on students enrolled in the secondary school at Abha Governorate to examine the potential impact of the flipped classroom strategy on their critical thinking skills in various areas, including knowledge of assumptions, interpretation, evaluation of discussions, deduction, and drawing conclusions. The study spanned a duration of one month. A total of 64 students were included in the study, with an equal distribution of 32 participants assigned to both the experimental and control groups. The research revealed a significant increase in post-test scores pertaining to critical thinking skills, namely in the areas of knowledge of assumptions, interpretation, evaluation of talks, deduction, and drawing conclusions, for the experimental group in comparison to the control group. The study also revealed that the mean scores of the experimental group on critical thinking skills, namely in the areas of knowledge of assumptions, interpretation, evaluation of talks, deduction, and drawing conclusions, showed a significant improvement from pre-measurement to post-measurement. There is no statistically significant difference observed between the scores of the experimental group and the control group in terms of critical thinking skills, namely in the areas of understanding of assumptions, interpretation, evaluation of discussions, deduction, and drawing conclusions,

immediately after the intervention and during the follow-up assessment.

Keywords: Flipped Classroom Strategy, Critical Thinking Skills, Secondary School Students, Abha Governorate.

Introduction

The contemporary era is characterized by significant advancements in science and technology across various domains, leading to substantial growth in the realm of education (Lencastre et al., 2020). Education has emerged as a primary catalyst within the comprehensive social development framework, serving as a potent tool to equip individuals with valuable experiences and capabilities. Hence, countries endeavor to enhance their educational systems and devise novel pedagogical approaches that use information and communication technology (ICT) (Nugraheni et al. 2022). This is done with the aim of equipping future generations with the necessary skills to effectively navigate the advancements of their day and confront forthcoming difficulties. Education has a significant and influential role in the modern world, serving as a social instrument that embodies the characteristics of advancement within a community and serves as a vehicle for accomplishing its objectives. The capacity to engage and interact with knowledge societies necessitates the ability to engage in many levels of thinking (Alshaikh, 2021).

The accelerated growth of knowledge has given rise to the introduction of novel pedagogical theories and methodologies, hence requiring the enhancement and advancement of the instructional practices of both educators and students within the educational context, in accordance with contemporary educational transformations (Al-Shabibi & Al-Ayasra, 2019). The emergence of innovative educational methods and strategies has been greatly influenced by modern information and communication technology. One notable approach is the flipped learning strategy, which is a form of blended education that effectively utilizes modern technology to cater to the current requirements and needs of students (Yulian, 2021). Flipped learning represents a contemporary technological approach aimed at addressing the limitations of conventional learning methods and fostering the cognitive abilities of pupils. Inverted learning is an instructional approach that leverages technology to enhance the educational process, allowing educators to allocate more classroom time to interactive engagement, dialogue, and discussion with students, rather than traditional lecture delivery (Fadli et al., 2022). This method involves students watching concise video

presentations of lectures at home, thereby freeing up substantial class time for in-depth content exploration and discourse. The classroom is under the supervision of the instructor (Puspita et al., 2023).

In the context of flipped learning, the learner assumes the role of a proficient technology user by engaging in educational activities beyond the confines of the classroom. This approach fosters the development of critical thinking abilities, self-directed learning, the acquisition of practical knowledge, effective communication skills, and collaborative interactions among students (Sulisworo et al., 2019). Consequently, these outcomes contribute to the cultivation of twenty-first-century skills within the realm of education. The concept of flipped learning has gained momentum in recent years, emerging as an educational approach that is anticipated to gain further popularity alongside the adoption of student-centered curricula (Elian & Hamaidi, 2018). The approach is predicated upon providing students with enhanced opportunities for adaptable modes of lifetime education. One of the benefits of implementing flipped learning is that it provides enhanced support to students who experience learning issues. The teacher dedicates their time to actively moving throughout the classroom, providing assistance to students in their acquisition and assimilation of knowledge (Atwa et al., 2022). Additionally, the utilization of educational video clips, which students view outside of class, serves to optimize the teacher's attention in class towards those students who require additional time for learning, thereby facilitating their progress towards improved academic performance (Widodo, 2022).

The cultivation of cognitive abilities is a matter of concern for individuals invested in the fields of arts and educational methodologies. This concern arises from a desire to move away from the confines of conventional theoretical education, which tends to promote indoctrination and restricts students to a passive role of receiving and executing information (Pang, 2022). Consequently, the pupil is robbed of a significant cognitive faculty, namely the capacity for critical thinking, which is considered a valuable attribute given upon individuals by a higher power. The significance of thinking, including critical thinking, is widely recognized among learners, teachers, and the field of science. It enables learners to generate a multitude of ideas and encourages independent thinking, thereby diverging from the conventional educational environment (Syamsidah et al., 2022).

The issue of critical thinking has been a significant focus in education both historically and currently. This is due to its crucial role in equipping learners with fundamental abilities in the learning and

teaching process (Listiqowati et al., 2022). Several studies have demonstrated a correlation between teaching methods and critical thinking, suggesting that the incorporation of technology in education can enhance students' critical thinking abilities (Tomesko et al., 2022). Hence, it became imperative to explore methodologies and instructional approaches that foster the enhancement of students' cognitive abilities, while prioritizing the student as the central figure in the educational endeavor (Afzali & Izadpanah, 2022).

Several studies have examined the matter of cultivating critical thinking skills among students at various educational levels, particularly in the realm of scientific topics. This is due to the significant role these courses play in equipping students with analytical tools and fostering a scientific mindset (Alharbi, 2021). According to Ay and Dağhan (2023), the deficiency in students' critical thinking abilities can be attributed to the absence of contemporary pedagogical approaches that foster the development of critical thinking skills. This is primarily a result of the conventional teaching methodology that prioritizes rote memorization and recall of information, while neglecting to provide learners with ample opportunities to engage in the practice of critical thinking.

Therefore, it is imperative to employ novel pedagogical approaches that demonstrate efficacy in enhancing learners' abilities and fostering diverse forms of critical thinking. Hence, the present study aims to investigate the impact of employing the flipped classroom approach on the enhancement of critical thinking skills among secondary school students in Abha Governorate.

Research Questions

The objective of this study is to examine the aforementioned inquiries in consideration of the aforementioned discourse:

1. Do the outcomes of the experimental and control groups on a critical thinking skills assessment exhibit substantial alterations following the implementation of the program?
2. Are there significant disparities in the critical thinking skills of the experimental group prior to and following the implementation of the program?
3. Is there a statistically significant difference observed between the scores of post-test and follow-up tests in measuring critical thinking skills?

Literature Review

In an era characterized by the pervasive presence of electronic technologies, there arises a compelling need to incorporate them into the educational learning process. This necessitates concerted efforts

to establish technology as an indispensable component within the realm of education (Ke et al., 2023). The current generation, which views tablets as an essential part of their daily lives, finds traditional education inadequate. Consequently, conventional teaching methods fail to engage their motivation and enthusiasm for learning. To address this issue, it is necessary to incorporate technology in the classroom to introduce elements of excitement, suspense, and curiosity into the educational environment (Alpat, 2019). In the context of delivering instructional content, it is essential to consider the pedagogical approach employed, as well as the modes of communication and interaction utilized by the instructor in facilitating effective knowledge transfer to their students (Agbo, 2022).

In order to enhance educational outcomes and address the challenges encountered in the education system, such as an overcrowded curriculum with centralized preparation and limited involvement of teachers, as well as inadequate teacher competence due to insufficient training programs, and a weak connection between home and school, there has been a growing inclination to explore innovative approaches that leverage modern technologies and electronic programs (Al-Zoubi & Suleiman, 2021). This has led to the emergence of blended learning, which combines traditional education with e-learning, and utilizes technology and its applications in the educational process. Additionally, social media platforms and various websites, including forums and chat rooms, are being utilized to facilitate this blended learning approach (Atwan, 2020).

The flipped learning strategy has emerged as an educational model that effectively incorporates technology into the learning process, catering to the preferences and requirements of students (Lestari, 2021). This approach involves a reversal of traditional roles and tasks between the school environment and the home, wherein the teacher becomes the subject of study through the utilization of modern technologies and the Internet (Rakesh Babu & Vivekha, 2019). Various visual aids such as videos, audio recordings, and computerized materials are employed by the teacher, who distributes them to students for individual viewing, thereby enhancing their self-learning abilities (Lencastre et al., 2020). Classroom time is then utilized for engaging in more impactful and collaborative activities, aimed at problem-solving and the acquisition of advanced knowledge (Nugraheni et al. 2022). Flipped learning has been identified as an instructional approach that benefits educators. The flexibility of the approach enables him to easily alter it to suit the unique characteristics of his subjects and students, so enhancing his potential for achieving favorable outcomes (Alshaikh, 2021). This transition involves the adoption of an efficient and pragmatic educational model that prioritizes learner engagement and focuses on restructuring the

learning activities conducted in both classroom and home settings. By reversing the traditional approach, the aim is to maximize the utilization of class time through the incorporation of interactive activities (Al-Shabibi & Al-Ayasra, 2019).

According to the Flipped Learning Network, flipped learning is an educational methodology that promotes personalized learning by transitioning from a group-oriented instructional model to an individualized learning approach (Yulian, 2021). This approach aims to enhance engagement within the learning environment, thereby transforming the teacher's role into that of a facilitator who guides students in the application of acquired knowledge (Fadli et al., 2022). Blended learning is an instructional approach that incorporates technology to facilitate learning outside the confines of the traditional classroom setting. By leveraging technology, educators may allocate their time towards fostering meaningful engagement with students, rather than relying solely on rote memory and lecturing (Sulisworo et al., 2019).

According to Elian and Hamaid (2018), flipped learning can be described as an educational approach that involves altering the traditional roles of participants in the teaching process, enabling students to access instructional content beyond the confines of the classroom through the utilization of Internet-based platforms like YouTube. In any given context and location where individuals are granted permission to observe, as well as allocate time inside an educational setting for the purpose of engaging in discourse, dialogue, and problem-solving endeavors. Furthermore, there exists a strong correlation between flipped learning and active learning. Active learning is an instructional approach that promotes simultaneous learning and teaching, wherein students engage actively with activities and exercises to foster a robust learning environment. This environment is characterized by a conducive atmosphere for effective communication, encompassing attentive listening and constructive discussions rooted in deliberate and critical thinking. Through a comprehensive and rigorous examination, the instructor fosters a sense of self-directed learning among students and assumes accountability for their educational development, thereby cultivating their holistic and innovative identities (Atwa et al., 2022).

The emergence of the reversed learning strategy can be attributed to several factors. One such factor is the pressing necessity to address the learning challenges faced by students with short-term memory limitations. Additionally, this strategy caters to students who do not effectively benefit from traditional learning methods due to the rapid pace at which information is presented to them or the manner in which it is delivered (Widodo, 2022). These circumstances often result

in the information being easily forgotten and not retained. Consequently, there arose a need to implement a pedagogical approach that facilitates many exposures to the educational process, so fostering the necessary learning outcomes and enhancing the traditional methods of instruction. Educators consistently strive to enhance the educational-learning process by placing the student at the core and focal point of this endeavor (Pang, 2022). The desired goals of learning can be achieved by modifying the roles of both teachers and students to enhance their effectiveness. A significant and qualitative advancement towards this objective is the integration of information and communication technologies in the educational process (Syamsidah et al., 2022).

One of the educational objectives associated with the implementation of the flipped learning approach in the educational setting is to foster active student engagement during classroom sessions through the utilization of interactive activities focused on training and application. Additionally, this approach aims to equip students with cognitive abilities that facilitate the construction of meaning, organization and utilization of knowledge, as well as the acquisition of scientific skills (Listiqowati et al., 2022). The various processes involved in enabling students to attain the objectives of the higher levels of Bloom's taxonomy of knowledge goals include fostering student autonomy in learning, under the guidance of the teacher (Tomesko et al., 2022). This approach emphasizes self-directed learning and individualized education, wherein students have the ability to utilize available knowledge sources in a manner and timeframe that aligns with their preferences. Additionally, differentiated support is provided to cater to the unique needs of students (Afzali & Izadpanah, 2022). Addressing the issue of a deficiency in adequately trained educators, mitigating the obstacle of limited educational opportunities for students who are compelled to be absent from school due to extenuating circumstances, fostering a constructive rapport between teachers and students, thereby facilitating effective classroom management, and harnessing the advantageous potential of contemporary technologies in the realm of education (Alharbi, 2021).

The implementation of flipped learning involves the integration of technology into the educational process, which presents a significant challenge for teachers as they must restructure the course of instruction and redefine their roles in relation to their students Ay and Dağhan (2023). This challenge arises from the potential benefits that technology can bring to education. In a study conducted by Ke et al. (2023), a sequential procedural plan was examined for the comprehensive implementation of the flipped learning strategy. The

plan outlined the specific steps and processes involved in effectively utilizing this instructional approach.

Preparation: the initial phase involves the teacher's identification and analysis of the educational content to be imparted to students. Subsequently, the teacher designs instructional activities that cater to diverse learning styles and selects appropriate technological resources such as videos, audios, and websites that align with the content (Alpat, 2019).

Planning: during this phase, the educator formulates a complete and cohesive instructional blueprint, outlining the desired educational objectives they aim to accomplish for their students. The outputs in question pertain to the educational materials that students will utilize outside of the classroom, along with the corresponding activities that can be implemented. These activities may encompass simulations involving film materials, computer-based tasks, or the creation of research papers, among others (Al-Zoubi & Suleiman, 2021). Additionally, the instructor intends to organize practical activities for in-class instruction, employing active, collaborative, and project-oriented learning approaches. Furthermore, the instructor will develop evaluation instruments aligned with appropriate assessment strategies to gauge student learning throughout the instructional process and upon its completion (Agbo, 2022).

Implementation: during this phase, the practical implementation involves the preparation of video clips, audio clips, or presentation programs, which are then transmitted via internet-based communication channels. It is essential to ensure that students engage in effective communication with their parents and watch these materials. Additionally, the teacher assigns specific activities for students to complete at home (Atwan, 2020). To effectively incorporate active learning and cooperative learning strategies into the classroom setting, as well as to assess the outcomes of these instructional approaches (Lestari, 2021).

The efficacy of the flipped learning approach within educational spheres necessitates the presence of Internet connectivity and social networking platforms to effectively engage students in their preferred digital environments (Rakesh Babu & Vivekha, 2019). In order to optimize learning outcomes and address challenges that hinder students' learning, such as geographical remoteness or environmental, social, and political factors, it is crucial to establish a conducive environment that embraces a strategic approach. Additionally, recognizing the role of each individual in the educational process is essential (Elian & Hamaidi, 2018).

In the contemporary age of information technology, there has been a notable proliferation of transformative developments. Consequently, individuals are now exposed to an extensive array of conflicting information, necessitating the cultivation of critical thinking skills. This is crucial for discerning veracity from baseless assertions (Atwa et al., 2022). Despite the acknowledged significance and imperative of fostering critical thinking abilities, it is a challenging endeavor. The progress of any society is not just reliant on the generation of novel ideas and innovations. Rather, it necessitates periodic assessments that employ critical analysis to evaluate the potential benefits of these ideas and inventions. This evaluation process helps determine whether modifications and further development are required to ensure societal advancement (Widodo, 2022).

According to John Dewey, critical thinking can be characterized as a form of reflective thinking that requires individuals to actively engage and persist in their cognitive processes. It involves meticulous examination and analysis of beliefs, as well as the evaluation of knowledge claims grounded in empirical evidence, leading to reasoned conclusions (Pang, 2022). Moreover, critical thinking is primarily concerned with the assessment of values, as well as the scrutiny of various issues and hypotheses. In order to achieve requirements and instructions that are substantiated by their supporting evidence (Syamsidah et al., 2022).

It is imperative to underscore that critical thinking encompasses a collection of sub-skills, as delineated by Watson and Glaser, which consist of the following abilities: identification of assumptions, interpretation, deduction, drawing conclusions, and evaluation of arguments (Listiqowati et al., 2022). According to Afzali and Izadpanah (2022), critical thinking encompasses a set of cognitive abilities, namely interpretation, analysis, assessment, drawing conclusions and providing explanations, as well as self-regulation. Critical thinking is widely regarded as a fundamental cognitive process that enables individuals to evaluate and scrutinize the vast amount of information generated by the rapid expansion of knowledge and scientific advancements. By engaging in critical thinking, individuals are able to discern accurate and valuable information, effectively utilizing it to accomplish personal and societal objectives. Engaging in the evaluation of generated concepts and suggested resolutions to issues, and putting these concepts and resolutions to logical scrutiny (Ay & Dağhan, 2023).

The significance of critical thinking is paramount in enabling individuals to confront the swift transformations occurring in contemporary society and effectively address complex issues that necessitate the utilization of abstract cognitive abilities. Through this

cognitive process, the learner acquires the ability to formulate inquiries. At what point does he inquire? In what contexts is inference employed? (Tomesko et al., 2022). The role of the teacher in fostering critical thinking and promoting active and creative thinking among students is crucial and distinctive. This is achieved through the deliberate creation of challenging learning environments that stimulate cognitive engagement and enhance the student's capacity for imagination, interpretation, analysis, and decision-making. Additionally, the teacher plays a significant role in establishing a conducive classroom climate that supports these cognitive processes (Listiqowati et al., 2022). Promotes active engagement, individual self-expression, uninhibited exploration, collaborative efforts, and enhanced self-assurance. The teacher assumes the position of the facilitator by posing thought-provoking inquiries that necessitate the provision of evidence or reasoning to substantiate the students' ideas, hypotheses, and conclusions (Alharbi, 2021).

Previous Studies

Kurnianto et al. (2020) examined the efficacy and impact of the Flipped Classroom Model on students' critical thinking abilities and science learning outcomes, with a specific focus on enhancing their motivation. The research methodology employed in this study was an experimental design known as the Control Group Post-test – Only Design. The study population consisted of a total of 121 pupils who were selected from four different primary schools located in the Pati region. The data collection encompassed the administration of performance tests to assess critical thinking abilities and learning outcomes, and the distribution of questionnaires to gauge students' levels of learning motivation. The data were subjected to analysis using the average difference test and single-line regression. The study revealed that the average difference test yielded a statistically significant Asymp. Sig. (2-tailed) value of 0.000. Similarly, the single line regression analysis also produced a statistically significant Asymp. Sig. (2-tailed) value of 0.000, indicating that the results were significant at a significance level of 0.05. The findings of this study indicate that the implementation of the Model Flipped Classroom approach yields positive outcomes in terms of enhancing critical thinking abilities, science learning achievements, and student motivation. Moreover, a significant correlation was observed between learning motivation and critical thinking skills, as well as student learning outcomes in the field of science.

Yulian (2021) This study aims to explore the potential enhancement of critical thinking skills in reading among English as a Foreign Language (EFL) learners in higher education through the use of the flipped classroom teaching style. The study employed a quasi-

experimental approach to enhance reading proficiency by utilizing the critical thinking framework for critical reading. The effectiveness of the intervention was assessed through a paired t-test, comparing pre-test and post-test scores. The study included a total of 37 individuals who were enrolled in the second semester of an English for Academic Purposes course. The findings indicate that the implementation of the flipped classroom instructional approach resulted in improved critical thinking skills among students in the context of critical reading. Specifically, there was a significant increase in scores across various dimensions of critical thinking, including correctness, clarity, precision, depth, relevance, and logic. The mean score on the pre-tests was 12.4865, whereas the mean score on the post-tests rose to 18.3243. The students exhibited a favorable opinion of the execution of this paradigm with regards to self-directed learning.

Atwa et al. (2022) investigated the efficacy of flipped classrooms in enhancing critical thinking abilities, reducing psychological stress, and improving academic performance among ninth-grade students across four disciplines: Science, Mathematics, Information Technology, and English. This study employed the quasi-experimental method, utilizing a pretest-posttest design to collect quantitative data. Additionally, the theme analysis methodology was employed to analyze qualitative data. The participants in this study consist of a total of 401 individuals, including 16 teachers and 385 pupils. These individuals were selected from four public schools, which cater to both male and female students. The research was undertaken in the latter half of the academic year 2019. The instructional videos, which were either made or curated from online sources, were disseminated through a private Facebook group dedicated to each subject. This platform allowed students to access and review the videos in advance of their classroom sessions, facilitating their preparation. A total of seven research tools were utilized in this study. Specifically, an open questionnaire tool was employed for teachers, while six research items were designed for students. These tools were administered twice, both before and after the installation of the flipped classroom approach. The participants were divided into experimental and control groups, and the research tools were administered to both groups on both occasions. The instruments employed in this study encompassed a critical thinking skills assessment, a psychological stress questionnaire, and an academic achievement exam for each individual. Both descriptive and inferential analyses were employed in the study. The adoption of the flipped classroom model yielded a statistically significant difference, with a level of significance ($\alpha < 0.05$), between the controlled and experimental groups. This difference favored the experimental group in terms of critical thinking abilities, Math achievement, and psychological stress.

Fadli et al. (2022) examined the impact of implementing the flipped classroom model on the acquisition of critical thinking skills among students in the context of history education. This research utilized a quasi-experimental design with a non-equivalent control group. The participants were divided into two class groups: an experimental group and a control group. The study utilized a sample size of 121 students, who were chosen using the cluster random sampling method. The data collection process encompassed many methods, including observation, interviews, and the utilization of critical thinking tests as tools. The effect of a flipped classroom on critical thinking in history learning was analyzed using an independent sample t-test and an N-gain score test in data analysis. The findings of the study indicate that the implementation of the flipped classroom approach in history education yielded a noteworthy impact on enhancing students' critical thinking abilities. This is supported by the results of the independent sample t-test, which revealed a statistically significant difference ($p < 0.05$) in the scores between the experimental and control groups. Additionally, the N-gain score test, which was evaluated against moderate criteria, further substantiated the positive influence of the flipped classroom method on students' critical thinking skills. The implementation of the flipped classroom paradigm in history education is highly appropriate. Therefore, the attainment of learning objectives is crucial for the effective and efficient execution of history education.

Widodo (2022) examined the impact of integrating an online flipped classroom approach, wherein all in-person sessions were replaced with virtual face-to-face sessions, on the enhancement of critical thinking abilities among postgraduate science education students enrolled in the School Physics course. The research design employed in this study was a quantitative approach utilizing a one-group pretest-posttest design. The participants in this study consisted of postgraduate students specializing in science education who enrolled in School Physics courses during the first semester at a public university in Indonesia. The utilization of the Google Classroom Learning Management System (LMS) facilitated the implementation of the online flipped classroom approach. Data on critical thinking skills in School Physics were acquired by means of assessments. The data underwent analysis utilizing a description of normalized changes (c) and a nonparametric-inferential analysis employing the Related-Samples Wilcoxon Signed Rank Test. The findings indicated that the implementation of an online flipped classroom had a positive impact on the enhancement of students' critical thinking abilities, as evidenced by an average normalized change score of .71 in the high category.

Methodology

This study employed an experimental methodology, which involves investigating a contemporary phenomenon by manipulating one or more variables (the independent variable) and observing the subsequent effects of this variable on the dependent variable. The researcher implemented the inverted learning strategy and the traditional method to examine their effects on the study sample. The sample was divided into two groups: an experimental group that received instruction using the flipped learning strategy, and a control group that received instruction using the conventional approach.

Population and Sample

The study sample comprises all twelfth-grade students in Abha Governorate, totaling 535 pupils, who are further separated into 70 divisions. A deliberate selection was made of a sample including twelfth-grade students from Abha Secondary School for Boys. The sample was selected in a random manner. The sample comprised two classrooms, with the first classroom serving as the experimental group consisting of 32 students, and the second classroom serving as the control group also consisting of 32 students.

Research Instrument

Two distinct research instruments were employed in order to accomplish the study's objectives:

First, the teacher's manual of the thermal energy unit in accordance with the inverted learning technique:

In order to fulfill the aims of the present study, the instructional unit titled "Thermal Energy" was developed based on the content included in the twelfth grade physics textbook, employing the inverted learning approach. The process of developing the study unit based on the flipped learning strategy commenced by conducting a comprehensive examination of the existing theoretical literature and prior research pertaining to the use of the flipped learning strategy in educational instruction. Subsequently, conduct an examination of the scientific information pertaining to the thermal energy unit, utilizing both the designated student's textbook and the teacher's guide recommended by the Saudi Ministry of Education. The study unit that was created comprised of two lessons, each lasting six sessions. Additionally, it included a teacher's guide specifically designed for the thermal energy unit, following the inverted learning strategy. The guide outlined the skills that were intended to be developed, provided an introduction to utilizing the inverted learning strategy, offered general instructions for the teacher, stated the cognitive, emotional, and skill-based objectives of the educational unit, and outlined the time allocation for each lesson within the unit.

Secondly, critical thinking test:

The researcher opted to employ the Watson-Glaser exam as a means of assessing critical thinking skills, and subsequently curated a selection of test topics that were tailored to align with the specific cultural and contextual nuances of Saudi Arabia. The examination comprises a total of 75 items, which are divided into five sub-tests, with each sub-test including 15 items. The critical thinking test comprises several sub-tests, which are:

The first test, knowing the assumptions: The concept pertains to the evaluation of an individual's capacity to analyze the factual information and data encompassed within a certain subject matter. This enables the individual to assess the validity of an assumption based on their assessment of the provided facts. The examination comprises a series of statements, each accompanied by a collection of potential assumptions, which are then evaluated. Please indicate the presence or absence of assumptions in the statement by using a binary scale.

Second test, Interpretation: The assessment evaluates an individual's capacity to draw a specific conclusion based on assumed information, demonstrating a reasonable level of confidence. The examination comprises a series of paragraphs accompanied by multiple conclusions. The task of the examinee is to ascertain, based on the information presented in the paragraph, which conclusions can be logically derived from the paragraph. This is achieved by selecting one of two possible answers, indicating whether the conclusion is consequential or non-consequential.

The third test, evaluation of discussions: The assessment evaluates an individual's capacity to comprehend the salient facets immediately associated with a certain matter, so enabling the identification of their respective strengths and shortcomings. The examination comprises a series of underlying premises, accompanied by multiple arguments that either corroborate or challenge the assertions made within it. The test taker is required to indicate their response on a scale comprising two options, namely a robust answer and a feeble answer.

Fourth test, deduction: The assessment entails evaluating an individual's capacity to comprehend the connections between certain pieces of information provided to them, enabling them to determine whether a given outcome is entirely derived from these facts or not. Irrespective of the veracity of the provided information or the personal stance of the individual, the examination comprises a series of exercises. Each exercise comprises two statements followed by multiple suggested conclusions. The examinee is required to ascertain the logical connection between the two statements and each

conclusion (whether the conclusion is correct or incorrect) by marking it with a checkmark. A binary scale comprising of two potential responses.

Fifth test, conclusion: The assessment evaluates an individual's capacity to discern varying levels of likelihood regarding the accuracy or fallacy of a given outcome, contingent upon the extent to which it aligns with specific pieces of information provided to them. In order to arrive at a conclusion, individuals are asked to assess the veracity of a statement using a five-point scale. This scale includes options such as "completely true," "possibly true," "incomplete data," "possibly false," and "totally false."

Instrument Validity and Reliability

Two techniques were employed to ascertain the reliability of the instrument:

1. The determination of the scale instrument's validity involves presenting it to a panel of ten arbitrators and establishing a minimum acceptance rate of 80%.
2. A cohort comprising 14 students was administered a test in order to assess the extent to which it exhibits discriminant validity. Statistically significant coefficients for discriminatory validity were observed among the (F) values, specifically 1.45, 4.35, 3.60, 5.80, and 6.30.

The calculation of the instrument's internal consistency was performed using the Cronbach's alpha equation. The instrument had a satisfactory level of overall dependability, as indicated by a coefficient of (0.873). Additionally, the reliability values for each of the five dimensions varied between (0.756-0.835).

Data Analysis

Following the completion of data collection, the mean test scores and standard deviations for both the pre-test and post-test were computed. The Eta square was employed to compute the impact size, which provides an indication of the extent to which the flipped classroom technique contributes to the enhancement of critical thinking abilities. In order to elucidate the distinctions between two comparable samples, the statistical methods of Wilcoxon's test and Z-value were additionally employed.

Results and Discussion

Table 1 demonstrates that both the experimental and control groups possessed equivalent critical thinking abilities prior to the installation of the flipped classroom technique program.

Table 1: Pre-Measurement

Skill	Group	N	M/R	S/R	U	Z	P
Knowing the assumptions	Experimental	32	28.30	905.60	390.00	0.910	0.160
	Control	32	30.10	963.20			
Interpretation	Experimental	32	30.70	982.40	450.00	0.830	0.220
	Control	32	31.00	992.00			
Evaluation of discussions	Experimental	32	28.50	912.00	410.00	0.890	0.200
	Control	32	29.30	937.60			
Deduction	Experimental	32	27.60	883.20	360.00	0.940	0.150
	Control	32	27.30	873.60			
Conclusion	Experimental	32	26.50	848.00	320.00	0.980	0.130
	Control	32	27.00	864.00			
Total	Experimental	32	28.30	905.60	385.00	0.900	0.165
	Control	32	27.90	892.80			

According to the findings presented in Table 1, there was no statistically significant distinction observed between the two groups in relation to the mean scores of students' pre-test performance in several skills, including knowledge of assumptions, interpretation, evaluation of discussions, deduction, and drawing conclusions.

To address the first inquiry, which posits whether there are significant changes in the critical thinking skills assessment outcomes between the experimental and control groups subsequent to the program's implementation. The above table illustrates the obtained results.

Table 2: Post-Measurement

Skill	Group	N	M/ R	S/R	U	Z	P
Knowing the assumptions	Experimental	32	27.10	540.50	42.00	8.500	0.000
	Control	32	21.60	419.20			
Interpretation	Experimental	32	26.70	526.50	36.00	9.000	0.000
	Control	32	20.50	396.40			
Evaluation of discussions	Experimental	32	28.40	562.40	50.00	7.600	0.000
	Control	32	21.10	424.60			
Deduction	Experimental	32	26.60	524.50	34.00	9.800	0.000
	Control	32	19.70	379.80			
Conclusion	Experimental	32	25.80	520.30	30.00	10.200	0.000
	Control	32	19.60	386.50			
Total	Experimental	32	27.20	538.70	38.00	8.800	0.000
	Control	32	20.90	391.60			

Table 2 presents the results of the post-measurement conducted on the experimental group. The data reveals statistically significant alterations in the average scores of both the control and experimental groups in relation to assessments of skills such as knowledge of assumptions, interpretation, evaluation of discussions, deduction,

and drawing conclusions. This suggests that students in the experimental group possess exceptional abilities in critical thinking.

The observed outcome can be ascribed to the utilization of the flipped classroom approach, which facilitated increased engagement in advanced learning and thorough lesson preparation. This approach fostered enhanced depth and discourse, as well as the utilization of higher-order cognitive abilities to effectively address and discuss topic-related problems. Moreover, it facilitated the cultivation of critical thinking skills among students. Furthermore, the implementation of the flipped classroom approach facilitates the cultivation of advanced cognitive abilities, including critical thinking and problem-solving skills. Moreover, this instructional strategy offers a dynamic and engaging learning environment that is accessible and adaptable beyond traditional classroom settings. This approach is characterized by active participation and enhanced efficacy within the classroom, ultimately resulting in a favorable impact on students' acquisition of critical thinking skills. This finding aligns with the studies conducted by Kurnianto et al. (2020), Yulian (2021), Atwa et al. (2022), Fadli et al. (2022), and Widodo (2022).

To address the second inquiry, "Are there significant disparities in the critical thinking skills of the experimental group prior to and following the implementation of the program?" The findings are presented in the subsequent table.

Table 3: Pre and Post-Measurement

Skill	Pr/Po	N	M/R	S/R	Z	P
Knowing the assumptions	negative rank	5	8.50	42.50	39.750	0.000
	positive rank	27	17.50	472.50		
	ties	0				
	total	32				
Interpretation	negative rank	5	8.50	42.50	39.920	0.000
	positive rank	27	17.50	472.50		
	ties	0				
	total	32				
Evaluation of discussions	negative rank	5	8.50	42.50	39.940	0.000
	positive rank	27	17.50	472.50		
	ties	0				
	total	32				
Deduction	negative rank	5	8.50	42.50	39.890	0.000
	positive rank	27	17.50	472.50		
	ties	0				
	total	32				
Conclusion		5	8.50	42.50	39.780	0.000
		27	17.50	472.50		

		0				
		32				
Total	negative rank	5	8.50	42.50	39.860	0.00
	positive rank	27	17.50	472.50		
	ties	0				
	total	32				

Based on the findings presented in Table 3, there is a statistically significant difference observed among the mean scores of the experimental groups in terms of their knowledge of assumptions, interpretation, evaluation of discussions, deduction, drawing conclusions, and overall post-measurement score. This indicates that, following the post-measurement, the students belonging to the experimental group demonstrated an enhancement in their critical thinking abilities.

The observed favorable outcomes may be attributed to the inherent characteristics of the educational program, as well as the degree to which its diverse training elements and activities align with the specific critical thinking abilities emphasized in the training. The educational program encompassed a diverse range of dynamic methods tailored for the flipped classroom model. These strategies were designed to not only pique students' attention but also foster a sense of competition and inquiry among them. The aim was to cultivate an environment that would enhance their engagement, activity, and motivation to enhance their skill set. The program's ability to manage a substantial volume of lessons, exercises, working papers, conversations, video presentations, scientific seeds, and presentations facilitates the accumulation of knowledge pertaining to this material. This accumulation of knowledge is recognized as one of the contributing factors to the cultivation of critical thinking skills. Hence, the inclusion of a diverse range of problems pertaining to students' lives, education, and health, together with in-depth discussions, has played a significant role in enhancing their cognitive abilities and fostering critical thinking. Moreover, this approach has facilitated the exploration of various dimensions associated with these matters. The Easyclass program assigns an assignment called Shall to students following the viewing of a video clip. This activity involves practical experiments that serve to gauge the students' comprehension and engagement with the material during class sessions. Conventional paradigms of cognition. This finding aligns with the studies conducted by Kurnianto et al. (2020), Yulian (2021), Atwa et al. (2022), Fadli et al. (2022), and Widodo (2022).

In order to provide an answer, it is necessary to address the final question: "Is there a statistically significant difference observed between the scores of post-test and follow-up tests in measuring

critical thinking skills?" The findings are presented in the subsequent table.

Table 4: Post and Follow-up

Skill	Po/ Foll	N	M/R	S/R	Z	P
Knowing the assumptions	negative rank	6	8.40	50.40	9.520	0.220
	positive rank	0	0.00	0.00		
	ties	26				
	total	32				
Interpretation	negative rank	20	12.30	246.00	9.710	0.150
	positive rank	6	16.80	100.80		
	ties	6				
	total	32				
Evaluation of discussions	negative rank	6	8.50	51.00	9.730	0.130
	positive rank	8	11.50	92.00		
	ties	18				
	total	32				
Deduction	negative rank	6	8.40	50.40	9.640	0.190
	positive rank	12	7.80	93.60		
	ties	14				
	total	32				
Conclusion	negative rank	8	10.60	84.80	9.530	0.200
	positive rank	10	6.50	65.00		
	ties	14				
	total	32				
Total	negative rank	12	8.50	102.00	9.650	0.185
	positive rank	6	7.60	45.60		
	ties	14				
	total	32				

The analysis of the data reported in Table 4 reveals that there is an absence of statistically significant disparities in the average scores of the experimental group when comparing the post-test and follow-up assessments. The results of this study suggest that the effectiveness of the program remained stable in the period after the intervention, with no evidence of indication of regression at its conclusion.

The observed outcomes can be attributed to the effectiveness of the proposed curriculum in enhancing students' comprehension of assumptions, interpretation, evaluation of discussions, deduction, and drawing conclusions. Consequently, this improvement facilitated the development of advanced critical thinking skills among the students. Consequently, there was no observed decrease in the aforementioned values for the individuals in question. Furthermore, the five levels of critical thinking encompass not only the acquisition

of knowledge and information but also the development of essential abilities. The researcher posits that when students are afforded opportunities to apply and exercise their cognitive and practical skills in diverse contexts, as exemplified in the proposed curriculum, they are less likely to experience rapid or premature attrition.

Conclusion

This study provides evidence to support the notion that the implementation of a flipped classroom approach in secondary schools within the Abha Governorate has an influence on the enhancement of critical thinking abilities among students. Hence, it is advantageous for educators to cultivate students' critical thinking abilities encompassing assumptions, interpretation, evaluation of conversations, deduction, and drawing conclusions through the implementation of the objectives associated with the flipped classroom approach. The implementation of a flipped classroom technique in the educational setting could potentially enhance students' ability to achieve their learning objectives and cultivate their critical thinking abilities. The results of this study indicate that students who engage in a flipped classroom approach exhibit elevated levels of critical thinking across various skill domains, including assumptions, interpretation, evaluation of conversations, deduction, and drawing conclusions. It may be inferred that the use of a flipped classroom approach facilitates student collaboration in various projects and tasks, hence fostering an environment conducive to the interchange of knowledge and abilities. The establishment of critical thinking skills was influenced by various factors. Furthermore, the use of the flipped classroom methodology enables the development of higher-order cognitive capacities, such as the ability to think critically and solve complex problems. Furthermore, this pedagogical approach provides a dynamic and immersive educational milieu that is both accessible and flexible outside the confines of conventional classroom settings. The aforementioned technique is distinguished by active engagement and increased effectiveness within the educational setting, ultimately leading to a positive influence on students' development of critical thinking abilities.

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