

THE EFFECT OF A COMPUTERIZED EDUCATIONAL PROGRAM ON ACADEMIC ACHIEVEMENT AND DEVELOPING CRITICAL THINKING SKILLS AMONG STUDENTS

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Abstract

Structured educational plans enhance student academic accomplishments to a considerable extent. Educational programs that enable students to pause regularly while doing active work and applying visual tools deliver substantial benefits. Children from various backgrounds benefit substantially from educational programs because they examine unique student conditions to modify teaching tactics appropriately. The purpose of this investigation is to explore how sixth-grade mathematics students' achievement and critical thinking development, including prediction, interpretation, evaluation, deduction, and induction, would react to computerized educational programs. A total of fifty students participated in the experimental group as they received their education through computerized programs, yet the fifty students in the control group followed traditional learning methods. The sixth-grade students received an experimental design for the academic year 2022/2023 into two separate learning groups before researchers distributed validity and reliability-validated tests for critical thinking skills and academic achievement assessment. These instruments passed both validity and reliability checks. The main research goal is to evaluate which instructional methods would influence sixth graders' mathematical skills along with their analytical abilities. The study included two groups where the "experiment" received healthy nourishment and the "control" received an inadequate diet. The experimental group scored 20,763 on average after adjustment, while the control group maintained an average of 17,037 for academic performance. Results indicated that the experimental group exceeded the control group by substantial amounts in critical thinking assessment (domain effect size at 37.8% with specific effect sizes between 16.4% and 56.4%). The experimental group that used computer-based education achieved superior results compared to traditional methods for teaching sixth graders both mathematics and critical thinking skills. According to research findings, academic success demonstrates a direct link to what students eat. The research emphasizes how educational curricula developers should incorporate student nutritional health considerations during their work. Student performance in mathematics and critical thinking tests improves significantly when well-nourished students experience computerized educational programs. Teachers can enhance learning results by including nutritional information about their students in both classroom processes and educational programs. Educational institutions, as well as teaching staff, must prioritize nutrition-aware approaches alongside technological teaching tools because they fulfill the diverse needs of students while creating conducive learning environments.

Keywords: Educational program, students' performance, achievement test, academic achievement

INTRODUCTION

Nations encounter mounting economic and social difficulties because technology advances quickly, and globalization affects the world. The accumulation of knowledge and complex skills from education creates opportunities for economic growth as well as additional opportunities (The Organization for Economic Cooperation and Development (OECD) (2019)). Electronic technology has led to the development of various innovative teaching approaches through its wide distribution of quality educational materials in modern classrooms (Ertmer et al., 2012). Some children face difficulties with their education because their homes lack easy computer and internet access, and they need support from their parents to succeed. The pandemic holds dual potential to either elevate e-learning and intellectual development in the developing world or cause permanent damage to these areas. The essential requirement surpasses technological accessibility because strong family-teacher relationships need to be established (The Organization for Economic Cooperation and Development (OECD) (2020)).

The education and training sector launches active solutions and tasks to develop ICT infrastructure for administration and instruction, evaluation, and investigation (Acosta et al., 2018; Diabat & Aljallad, 2020).

Education and training professionals suggest combining online teaching through the Internet with television-based "face-to-face" remote instruction to ensure effective student learning during COVID-19 times (Pham et al., 2021; Stahl, 2021).

Students can enhance their learning through three activities which combine computers as supplemental tools: written work composition and online research and the use of specialized programs for mathematical calculations (Owusu et al. 2010).

The term "academic performance" refers to a student's level of responsibility and success in school. Various elements control the learning pace and progression of children. Ability describes either natural talents or developed competencies and achieved expertise. Education under ideal circumstances allows students to achieve such goals. People typically recognize how much information they possess only when they show it through various educational settings. According to Singh (2016), students represent the most essential component within the educational system. Academic success holds great importance because it decides what type of leaders and workers will lead a country's political and economic development in the future. Academic success among pupils has been investigated extensively throughout previous studies. Academic achievement studies in the past analyzed teacher development alongside student household dynamics and student origins, gender variations, and socioeconomic status. Human resource development includes education as its essential part, according to Shakeel and Peterson (Shakeel, 2020). Students achieve educational success in school based on their academic results.

The researchers conducted this study to evaluate how educational programs using computers affect achievement outcomes and critical thinking ability across prediction and interpretation and evaluation and deduction and conclusion among sixth-grade students.

Study Problem

The problem of the study lies in the nature of some of the materials that appear in the form of rigid texts that generated aversion among students, the signs of which were evident in the low achievement that the two researchers observed through the grade record, and also in observing the effect of some other factors on achievement.

Computerized educational programs play a role in teaching thinking and helping the student practice critical thinking skills such as prediction, interpretation, evaluation, deduction, and conclusion, which are considered in need of a modern method in order to teach and simplify them in the light of which scientific knowledge is delivered to the student. Therefore, the problem of the study lies in identifying the effect of a computerized educational program on academic achievement and developing critical thinking skills among sixth-grade students in mathematics.

Study Question

The study seeks to answer the following questions:

1. Are there statistically significant differences ($\alpha = 0.05$) in the academic achievement of sixth-grade students in mathematics between the two groups due to the teaching method (computerized educational program, the regular method)?
2. Are there statistically significant differences ($\alpha = 0.05$) in developing critical thinking skills of sixth-grade students in mathematics between the two groups due to the teaching method (computerized educational program, the regular method)?

Study Objectives

The study aims to:

1. The study aims to develop a computerized educational program and benefit from it in teaching mathematics to sixth grade students and developing critical thinking skills between students.
2. Studying the effect of a computerized educational program and benefiting from it in teaching mathematics to seventh-grade students on academic achievement.

Previous Studies

The study by Babajani et al. (2023) evaluated an educational program built from previous academic research about student academic progress perceptions. The research design included assessment procedures before implementing the intervention and followed up with an evaluation of the study. All participating students in this study belonged to female high school second-year students at Sanandaj schools during the academic period of 2022-2023. Forty students underwent random selection based on poor academic satisfaction levels, which led to the establishment of two groups with twenty participants each. A 90-minute time frame served to deliver the program through academic engagement to all participants within the experimental group. Both groups of participants used Lent et al.'s academic satisfaction questionnaire to respond. SPSS-25 served to evaluate the data through mixed variance analysis.

The research by Zhussupbayev et al. (2023) examined how computer-assisted instruction methods affect student achievement, subject attitude, and long-term memory in the "History of World Civilizations" High School Second History Lesson. The research used an experimental design supported by data acquisition through the researchers' achievement test and their attitude scale on classroom instruction. An experimental design model was used in the study to determine how students' academic achievement and attitude, along with their recall level, would be affected by both computer-assisted teaching and traditional teaching methods within a high school second-year history class. Researchers assembled the results by using tests that included a pretest and a posttest as well as a retention (recall) test together with their custom-made scale. The achievement test results for "History of World Civilizations" showed a statistically relevant difference between students who learned from different educational teaching approaches. These research findings indicate that technology-based history education surpasses traditional teaching methods regarding second-year history students' educational success and attitude toward the "History of world civilizations" unit and its associated subject matter.

Albarico et al. (2023) studied the academic underachievement factors affecting senior students at San Ildefonso National High School Población in San Ildefonso Bulacan. Two research methods were integrated in the study to identify the underlying factors. Standardized questionnaires, together with researcher-designed open-ended queries, functioned as the research methodology to collect data. A random selection procedure allowed the researcher to select one hundred senior students for its study. The research utilized mean analysis and thematic analysis with frequency and percentage analysis as its data interpretation approach. Students fail to reach adequate results because of school-based factors and domestic and self-generated factors. Children face particular obstacles when learning in their environments. The analysis revealed dissimilar findings that originated from the research data.

Alkhaldeh and Khasawneh (2023) conducted research to understand if tenth-grade students would achieve better academic results when learning biology through online programs. The research utilized a quasi-experimental design method to study (80) male and female students as participants. The study separated its participants into two distinct groups that included (40) students in each division. The assessment developers engineered a special exam for assessing biology subject knowledge. Academic achievement pretests conducted on experimental and control groups did not result in statistically significant differences. Results from the experimental group's biology posttest evaluation exceeded those of the control group. Women outperformed men according to the academic achievement assessment results in biology, which was conducted after the measurement.

Deng et al. (2023) performed research on educational computer games through the selection of 74 female third-year students from two Zanjan state high schools using a two-stage cluster random selection process. Each of the classes contained 37 total students. The experimental group students received specialized training on ECGs created by researchers for this particular program. Research instruments were given to all participants after their training was finished. The research data collection ran for approximately five months and ten days. Computers demonstrate their ability to enhance AR, ASR, and AA by addressing the research questions.

According to Lin & Yu (2023), computer-based academic reading aids provide multiple benefits to students studying in colleges. The research uses structural equation modeling approaches to analyze results. Students perceive digital academic reading tools on computers favorably when lecturers provide positive feedback, and the tools are both easy to use and provide practical value. Students' effectiveness rating of these tools depends on their perceived ease of use and lecturers' positive feedback, as well as their academic success goals. Students develop positive academic success expectations and favorable attitudes through their optimistic intentions to use educational resources, yet previous academic experience remains the primary predictor of negative tool attitudes (4). Additionally, students perceive their ability to use these tools based on their collaborative learning ease perceptions and self-efficacy levels (5, 6). This model demonstrates strong explanatory capabilities ($R^2 = 64.70-84.20\%$), which implies the study findings can provide valuable insights to researchers, teachers, students, and technology designers who aim to better understand student behavior regarding digital academic reading tools on computers.

According to Lewis et al. (2023), a technological method is evaluated to enhance first-year college students' involvement and success in business numeracy studies. The purpose of this paper is to present readers with new educational methods that integrate technological resources. The research investigates how video-based learning (VBL) strategies affect first-year undergraduate achievement profiles in modern business education through 11 years (2006-2017) of longitudinal study at a contemporary UK institution. A VBL instructional approach employed in this research boosts academic performance among all student groups from basic pass levels to advanced business mathematics achievement. The VBL teaching method demonstrates features that maintain student interest in learning throughout their academic year. The research findings have multiple usages for students and teachers but also establish a new learning model that will become the focus of upcoming investigations.

López et al. (2023) performed a research investigation to find out whether university-level critical thinking enhancement approaches would work effectively for K-12 education. A total of 149 first-year engineering students received an intervention during their "Basic Communication Skills" compulsory course spanning one semester. The authors created a fresh critical thinking definition after combining the course targets with its essential abilities.

Students received multiple engagement enhancement techniques as part of the implemented system. The proposed educational method led to substantial improvements in critical thinking abilities compared to conventional teaching methods. The educational environment of technical and vocational schools uses interactive methods with energetic approaches to boost student learning and teaching quality.

Simões et al. (2022) conducted research to determine if student computer usage relates to academic performance. The researchers presented a model to depict the relationship between children's academic performance, mother's education level and father's education level and marital status and family size (AA). The conceptual model for accuracy tests used survey results from 286 teenagers who responded to questionnaires through an online platform. The combination of adequate computer access and maternal education with job orientation serves as primary factors for improving academic achievement. The combination of pleasure attitudes and a dull school atmosphere with a lack of interest, motivation, and isolation produces negative effects on AA. Academic success in school experiences moderation through computer use and remains under the influence of computer self-efficacy and family size.

Hamdan and Amorri (2022) investigated changes in student academic performance in research practices and Internet information preferences, as well as library resource evaluation and classmate collaboration under online education. The research adopts descriptive and parametric analytics as research methods to examine the impact of new elements on student academic performance. E-learning materials usage on the Internet by students determines their e-learning capability development and subsequent academic performance effects. Students from University College (UAEU) enrolled either in Spring 2019 or Fall 2020 classes made up the research participant group.

The goal of Tong et al. (2022) was to evaluate whether the flex model of blended learning serves effectively as a student instruction method for mathematical plane coordinate content. A quasi-experimental study measured academic results and self-study aptitudes and learning attitudes between 44 experimental students who studied with blended learning and 46 control students who received traditional teaching instruction. The research gathered data through pretest and posttest scores, classroom observations, and student survey data, which received numerical analysis through SPSS and qualitative assessment. The experimental group achieved better results than the control group based on independent t-test results (Sig (2-tailed) = 0.001 and SMD = 0.6717). Student interaction with teachers increased significantly while learning attitudes and, academic performance and self-study abilities showed improvement according to both survey and observational data from students. Some participants running out of time prevented them from making any progress through the experiment. The study conclusions demonstrated partial population typicality because the research featured a small sample size. Research expansion should examine how to enlarge the sample size, and study blended learning effects across different subjects while developing effective teaching practices under various blended learning methods.

The study by Mao et al. (2022) integrated 21 effect sizes extracted from 20 empirical research which included 1,947 participants, to verify the general effect of game-based learning on critical thinking capacities while assessing various moderating variables because earlier studies generated incongruous results. Studies revealed substantial variations in effect sizes yet demonstrated positive outcomes for game-based learning toward students' critical thinking abilities ($g = 0.863$, $k = 21$). Role-playing games stood as the game category with the most substantial average effect size at $g = 1.828$ ($k = 5$). Students demonstrated better critical thinking attitudes ($g = 1.774$, $k = 4$) during game-based learning than they did regarding critical thinking abilities ($g = 0.661$, $k = 17$). Students in collectivistic societies achieved better results from game-based learning with an average effect size of 1.282 ($k=10$) compared to students in individualistic countries who achieved 0.432 ($k = 10$). The influence measured in this study expanded with each new year that passed after the initial publication. Journal articles that examined game-based learning presented a larger effect on critical thinking than thesis studies ($g = 1.154$, $k = 13$ vs. $g = 0.378$, $k = 8$).

Spitzer & Musslick (2021). This paper examines how German school closures in 2020 influenced students' proficiency in math curriculum-based online learning software. The evaluation of more than 2,500 K-12 pupils who computed over 124,000 mathematical problem sets before and during the shutdown revealed better student performance compared to the previous year. The data revealed that the achievement difference between low-achieving and high-achieving pupils became smaller after low-achievers showed greater improvement than high-achievers. Virtual classrooms demonstrate the capacity to prevent educational regression that results from school closures and could continue letting students learn effectively in the present and upcoming educational periods.

Musa (2020) conducted research to study how critical thinking abilities affect student performance within the sports science department. The research includes 1170 participants who are students at the Faculty of Sport Sciences at Usak University throughout the 2019-2020 academic period. The study selected its sample group from university students through random selection and received participation from 334 individuals.

Gbollie and Keamu (2017) conducted research to determine the motivational beliefs and learning strategies used by junior and senior high school students in Liberia. Students need to think about their education challenges before their studies can continue. The study involved three hundred twenty-three participants from two different counties through the use of a cross-sectional quantitative research design. A total of twelve learning obstacles were recognized, so researchers adapted the Motivated Strategies for Learning Questionnaire (MSLQ) to address these barriers. SPSS 17.0

functioned as the statistical analysis program. The study findings demonstrated that test anxiety was the least common motivating belief, while the belief in extrinsic goals' significance was the dominant preference among respondents. The research revealed practice as the preferred method, but students displayed minimal use of seeking help from others. The statistical analysis validated the existence of significant relationships between these two concepts. Education faced specific challenges during the research. The study has produced various conclusions that lead to proposed recommendations to boost student academic outcomes.

MATERIALS AND METHODS

Study Approach

This study was built on a quasi-experimental approach, where the experimental group of sixth-grade students was subjected to the computerized educational program prepared by the two researchers, while the results of another control group who received regular education.

The study sample

A public school was intentionally chosen that has Internet service and has more than one class for the sixth grade. In a random manner, the subjects were assigned so that one of them would be an experimental group consisting of (50) students taught through the computerized educational program, and the second would be a control group of students consisting of (50) students taught in the usual way.

Study tools

1. Achievement test

This test measured the students' achievement in mathematics for the sixth grade, as this test represented the various educational objectives for the three units that are intended to be achieved by the students' study of the educational material using the computerized educational program method and the regular method. The test was prepared according to a table of specifications that arranges the content according to the levels set by Bloom for cognitive objectives, and the number of lesson pages was divided by the total number of pages for the unit, to know the relative importance of each part (for each lesson). As well as the relative importance of each level of the (15) goals, and knowing the relative importance of each cell (the relative importance of each lesson x the relative importance of each level).

Test validity

The researcher verified the veracity of the achievement test by relying on the veracity of the arbitrators. The test was distributed in its initial form to a group of arbitrators with experience and specialization in Jordanian universities in the field of curricula, teaching methods, measurement and evaluation. Their number reached (9) arbitrators. They were asked to express their opinions and observations on the test items in terms of content and linguistic formulation, and any comments they deemed appropriate. The arbitrators made some comments on some of the test items and they were considered, and amending it, with the researcher relying on the criterion of an agreement rate of 80% or more to keep the paragraph, and less than that to delete or modify it. Such procedures are considered evidence of the validity of the achievement test.

Test reliability

To verify the stability of the achievement test, the researcher used the method of test/retest by applying the achievement test to a sample consisting of (30) individuals from the study population and from outside its sample, After two weeks had passed from the time of the first application, the researcher re-administered the achievement test on the same group members again, and the stability of the achievement test was verified by extracting the Pearson correlation coefficient between the two times of application. The researcher also used the Cronbach Alpha equation to verify the stability of the achievement test, and Table No. (1) shows the results of that.

Table 1 The reliability of the achievement test

| Achievement test | Dimensions | Reliability coefficient | |
|------------------|------------|-------------------------|-------------|
| | | Cronbach alpha | Test-retest |
| | Total | 0.90 | 0.93 |

It is clear from Table No. (1) that the reliability coefficient of the achievement test according to the test method reached (0.93) and with the Cronbach alpha method (0.90). These values are good for this type of test, which indicates that the test has an appropriate degree of reliability.

Difficulty and discrimination coefficients for the achievement test items:

Difficulty and discrimination coefficients were extracted for each item of the achievement test, and Table No. (2) shows the results.

Table 2 Difficulty and ease coefficients for achievement test items

| Item N | Difficulty coefficient | Discrimination coefficient | Item N | Difficulty coefficient | Discrimination coefficient | Item N | Difficulty coefficient | Discrimination coefficient | Item N | Difficulty coefficient | Discrimination coefficient |
|--------|------------------------|----------------------------|--------|------------------------|----------------------------|--------|------------------------|----------------------------|--------|------------------------|----------------------------|
| 1 | 0.70 | 0.38 | 8 | 0.40 | 0.49 | 15 | 0.50 | 0.55 | 22 | 0.62 | 0.44 |
| 2 | 0.66 | 0.31 | 9 | 0.60 | 0.37 | 16 | 0.70 | 0.73 | 23 | 0.55 | 0.37 |
| 3 | 0.53 | 0.55 | 10 | 0.55 | 0.50 | 17 | 0.76 | 0.53 | 24 | 0.73 | 0.33 |
| 4 | 0.84 | 0.68 | 11 | 0.40 | 0.48 | 18 | 0.54 | 0.49 | 25 | 0.70 | 0.40 |
| 5 | 0.71 | 0.29 | 12 | 0.80 | 0.44 | 19 | 0.61 | 0.32 | 26 | 0.66 | 0.41 |
| 6 | 0.62 | 0.61 | 13 | 0.66 | 0.36 | 20 | 0.70 | 0.41 | 27 | 0.80 | 0.50 |
| 7 | 0.50 | 0.55 | 14 | 0.53 | 0.30 | 21 | 0.83 | 0.50 | 28 | 0.45 | 0.33 |

The data presented in Table 2 indicate that the difficulty coefficients of the achievement test items ranged between 0.40 - 0.83. This indicates that the levels of difficulty of the test items are wide, and this is an indicator of the quality of the test items and their suitability to the purpose of the test for which it was prepared in this study. The data also show that the discrimination coefficients of the items ranged between (0.29 - 0.73), they are all positive discrimination coefficients, confirming that the achievement test has a good discrimination coefficient. These coefficients also give us evidence of the validity of the test, as the paragraph discrimination coefficient or its ability to discriminate is evidence of the validity of the test.

2. Critical thinking skill test:

This test measures students' critical thinking skills in the content of the mathematics course for the sixth grade. This test will represent the various critical thinking skills that are to be achieved after students study the educational material using the computerized educational program and the regular method, the test will be prepared by the researcher according to a table of specifications that arranges the content according to levels of critical thinking skills.

STUDY RESULTS AND DISCUSSION

Results related to the first question: Are there statistically significant differences ($\alpha = 0.05$) in the academic achievement of sixth grade students in mathematics between the two groups due to the teaching method (computerized educational program, the regular method)?

To answer this question, the researcher extracted the arithmetic averages and adjusted means, considering that the pre-measurement is the associated variable (control variable), and Table (3) shows the results of that.

Table 3 Arithmetic averages for the level of sixth grade students in the achievement test

| Group | Pretest | | Posttest | | Adjusted arithmetic mean |
|--------------|---------|------|----------|------|--------------------------|
| | Mean | STD | Mean | STD | |
| Experimental | 13.20 | 2.55 | 20.76 | 2.22 | 20.763 |
| Control | 11.12 | 2.44 | 17.04 | 3.23 | 17.037 |

The adjusted arithmetic means obtained from Table (3) indicate notable differences exist between achievement test scores of the control and experimental groups after application. Statistical significance of differences required the use of a one-way analysis of variance (ANCOVA) between control and experimental groups as the pre-measurement achievement level functioned as the control variable. Table (4) shows the results of this

Table 4 One-way analysis of variance (ANCOVA) to examine differences between groups in the level of achievement of sixth grade students in the post-measurement

| Source of variance | Sum of squares | df | Mean of squares | F value | Sig | Effect size (ITA square) |
|--------------------|----------------|----|-----------------|---------|--------|--------------------------|
| Between groups | 173.557 | 1 | 173.557 | 22.829 | *0.000 | 0.33 |
| ERROR | 357.313 | 47 | 7.602 | | | |
| Total | 18403.000 | 50 | | | | |
| Corrected total | 542.500 | 49 | | | | |

*Statistically significant at the significance level ($\alpha=0.05$)

The data presented in Table No. (4) indicate that there are statistically significant differences at the significance level ($\alpha=0.05$) between the means of the post-measurement of the achievement test according to the group variable (control, experimental) after controlling for pre-performance. Referring to the adjusted arithmetic averages in Table 3, it appears that the average performance of the experimental group members reached (20.763) and the average performance of the control group reached (17.037), which indicates that the differences are in favor of the experimental group, and this result reinforces the effect of teaching using a computerized educational program in developing the academic achievement of sixth grade students in mathematics. It also confirms the size of the calculated effect, which amounted to (33%). These values indicate, according to Cohen's classification, the existence of a significant effect of teaching using a computerized educational program in developing the academic achievement of sixth grade students in mathematics. The superiority of the computerized educational program over the traditional method may be attributed to the fact that the computerized educational program represents a good tool for representing the cognitive relationships between the concepts present in the students' cognitive structure, as through it the concepts are arranged and relationships are built in them. The computerized educational program is a modern method of teaching for students, and the student by nature accepts to deal with every innovation in the educational environment with some positivity, which has improved the students' performance.

Results related to the second question: Are there statistically significant differences ($\alpha = 0.05$) in developing critical thinking skills of sixth grade students in mathematics between the two groups due to the teaching method (computerized educational program, the regular method)?

To answer this question, the researcher extracted the arithmetic means, and the adjusted means based on the pre-measurement are the associated variable (the control variable), and Tables No. (5) show the results of that.

Table 5 Arithmetic means and standard deviations for the level of critical thinking among seventh grade students

| Dimensions | Group | Pre/test | | Post/test | | Modified mean |
|-------------------------|--------------|----------|-------|-----------|-------|---------------|
| | | Mean | STD | Mean | STD | |
| Know the assumptions | Experimental | 11.16 | 1.68 | 14.12 | 1.86 | 14.081 |
| | Control | 11.64 | 2.41 | 11.20 | 2.50 | 11.239 |
| Deduction | Experimental | 12.00 | 1.63 | 14.44 | 1.04 | 14.466 |
| | Control | 11.60 | 2.20 | 10.68 | 2.19 | 10.654 |
| Inference | Experimental | 10.12 | 2.96 | 13.08 | 2.38 | 13.080 |
| | Control | 10.12 | 3.07 | 10.76 | 3.39 | 10.760 |
| Interpretation | Experimental | 10.12 | 3.07 | 12.92 | 2.63 | 12.887 |
| | Control | 9.96 | 3.09 | 10.44 | 3.62 | 10.473 |
| Evaluation of arguments | Experimental | 10.20 | 3.03 | 13.64 | 2.43 | 13.606 |
| | Control | 10.00 | 3.24 | 10.40 | 3.66 | 10.434 |
| Total | Experimental | 53.60 | 10.11 | 68.20 | 6.31 | 68.165 |
| | Control | 53.32 | 11.72 | 53.48 | 12.59 | 53.515 |

The data in Table (5) show that there are apparent differences in the adjusted arithmetic means for the post-application between the control group and the experimental group at the level of critical thinking, at the level of each of the dimensions as well as the overall level of the scale. To reveal whether the differences are statistically significant, A one-way analysis of variance (ANCOVA) was used between the two groups (control and experimental), and Table No. (6) shows the results of this.

Table 6 One-way analysis of variance (ANCOVA) to examine differences in the level of critical thinking among sixth grade students in the post-measurement according to the group variable (control, experimental)

| Dimensions | Source of variance | Sum of squares | df | Mean of squares | F value | Sig | Effect size (ITA squared) |
|-------------------------|--------------------|----------------|----|-----------------|---------|--------|---------------------------|
| Know the assumptions | Between groups | 99.574 | 1 | 99.574 | 20.602 | *000.0 | 0.305 |
| | Error | 227.163 | 47 | 4.833 | | | |
| | Total | 8353.000 | 50 | | | | |
| | Corrected total | 339.220 | 49 | | | | |
| Deduction | Between groups | 179.604 | 1 | 179.604 | 60.900 | *000.0 | 0.564 |
| | Error | 138.610 | 47 | 2.949 | | | |
| | Total | 8206.000 | 50 | | | | |
| | Corrected total | 318.320 | 49 | | | | |
| Inference | Between groups | 67.280 | 1 | 67.280 | 9.204 | *400.0 | 0.164 |
| | Error | 343.576 | 47 | 7.310 | | | |
| | Total | 7584.000 | 50 | | | | |
| | Corrected total | 479.680 | 49 | | | | |
| Interpretation | Between groups | 72.754 | 1 | 72.754 | 8.527 | *500.0 | 0.154 |
| | Error | 401.031 | 47 | 8.533 | | | |
| | Total | 7378.000 | 50 | | | | |
| | Corrected total | 556.880 | 49 | | | | |
| Evaluation of arguments | Between groups | 125.592 | 1 | 125.592 | 14.457 | *000.0 | 0.235 |
| | Error | 408.296 | 47 | 8.687 | | | |
| | Total | 7819.000 | 50 | | | | |
| | Corrected total | 594.980 | 49 | | | | |
| Total | Between groups | 2682.649 | 1 | 2682.649 | 28.578 | *000.0 | 0.378 |
| | Error | 4411.942 | 47 | 93.871 | | | |
| | Total | 192546.000 | 50 | | | | |
| | Corrected total | 7470.720 | 49 | | | | |

*Statistically significant at the significance level ($\alpha=0.05$)

The data presented in Table (6) indicate that there are statistically significant differences at the significance level ($\alpha=0.05$) between the means of the post-measurement of the dimensions of the critical thinking scale, as well as the

total level according to the group variable (control, experimental), after controlling for pre-performance. Referring to the modified arithmetic means in Table 6, the means of the experimental group are higher than the means of the control group at the level of each dimension of the critical thinking scale. The differences are in favor of the experimental group, this result reinforces the existence of an effect of teaching using a computerized educational program in developing critical thinking skills among sixth grade students in mathematics.

It also confirms the calculated effect size, whose values ranged between (16.14% - 56.4%) and for the overall domain (37.8%). These values indicate, according to Cohen's classification, there is a significant impact of teaching using a computerized educational program in developing critical thinking skills among sixth grade students in mathematics.

This may be attributed to the clear difference between the strategy of the computerized educational program and the strategy of the regular method. The computerized educational program in teaching has raised students' motivation through the element of suspense and educational opportunities rich in information and knowledge.

And the experiences caused by the computerized educational program among students. The computerized educational program also provides opportunities to consider individual differences, due to the audio clips, video clips, and still and moving images it provides. In addition to giving students the opportunity to be self-reliant in obtaining information, knowledge and experiences through the Internet, and transferring experience from the abstract to the tangible. Because the computerized educational program and films support classroom situations in a regular and sequential manner, it works to improve students' ability to make connections between the image and the idea, which has had a clear impact on developing critical thinking skills. This led students to create mental images of concepts that helped them advance their memory towards creativity and coming up with new ideas

DISCUSSION OF THE RESULTS

The main focus of this research evaluated how sixth-grade students responded to a computer-based program about mathematics while tracking their critical thinking development. The research data demonstrates beyond doubt that the digital curriculum achieved its targets in both domains. Student performance in mathematics and critical thinking developed more strongly when they used the computerized educational method instead of traditional classroom instruction.

The research findings presented by Zhussupbayev et al. validate the positive effects of technological teaching approaches within the experimental group which used the computerized educational program. The outlined teaching approaches deliver successful results in enhancing educational achievement and securing improved memory function. Student critical thinking skills received substantial improvement through participation in the online course according to research results. Participating in the program seems beneficial because it presents multiple educational choices which deliver detailed information alongside flexible learning options tailored for individual needs. The implementation of technology requires students to actively process content through critical analysis and information evaluation and relationship building which develops their critical thinking abilities. The results documented by López et al. about critical thinking enhancement through interventions match the current advancement of engineering student critical thinking abilities.

The research of Lin and Yu validates student engagement with digital tools because it depends on their academic achievement ambitions and subjective tool usability ratings. The research by Deng et al. revealed that instructional computer games effectively enhance learning outcomes similar to their influence on developing visual-to-ideology connections. The online course establishes a deeper effect than the technological platform used for content delivery because it alters the core educational content. The authors Spitzer and Musslick S. argue that technology transforms abstract knowledge into concrete information which boosts memory function and supports innovative thinking. The research findings regarding how technology helps diminish academic setbacks match the conclusions presented by these authors.

The computerized educational approach produced positive benefits which extended past academic achievement by helping students develop important skills in critical thinking. The online course delivered positive impacts by raising student grades while enhancing their critical thinking abilities thus proving its multiple beneficial aspects.

The research outcomes match those previously reported by other investigations. The computer-based program demonstrates superior educational advantages over traditional methods since it yields enhanced test results alongside superior critical thinking abilities. The research results from this study and those in its included studies prove that technology integration in education creates significant value by enabling effective information distribution while developing essential soft skills.

CONCLUSION

In recent years, there has been a great deal of discussion and reflection on the impact of technology on the educational process. The findings of this study provide strong evidence in favour of incorporating computer-based educational

program into the curriculum, particularly with regard to improving students' academic performance and encouraging the development of their critical thinking skills in mathematics at the sixth-grade level. Students' critical thinking, analysis, and capacity to apply theoretical concepts were all shown to have significantly increased in the data, not only their mathematical proficiency. In my opinion, the online course is more than just a cutting-edge method of instruction; it has the ability to completely revamp the educational experience for students. Its promise is shown by the myriad benefits it provides, from adapting to different learning styles to concretizing intangible ideas. The educational requirements of the 21st century is changing at a dizzying rate, and traditional techniques, while essential, may not be enough on their own. Results from this study's computerized program are persuasive evidence that traditional teaching methods need updating to keep up with the times.

Moreover, I think the true worth of such program goes far beyond students' grades. These initiatives are helping to raise the next generation of problem-solvers, creators, and leaders by encouraging analytic thinking. Being able to think critically is an invaluable skill in all aspect of life, not just academia.

In light of the results, I believe that while conventional classroom techniques certainly have their place, the future of education lies in the widespread implementation of technologically enhanced approaches to education. These responses do more than just meet the immediate needs of the classroom; they also equip students to meet the challenges and seize the opportunities of the twenty-first century. In order to guarantee a generation that is intelligent, well-informed, and able to think critically, the success of the computerized educational program in this study should serve as a rallying cry for teachers, legislators, and other stakeholders to invest more heavily in such creative teaching approaches.

An extensive debate and contemplation about the influence of technology on educational methods took place during the past several years. Research data demonstrates that computer-based educational programs should become part of the curriculum because they enhance academic results and help sixth-graders build critical mathematics thinking capabilities. Students demonstrated major improvements in critical thinking together with analysis abilities and theoretical concept application capacity according to all data points in addition to their math performance. The online course represents more than modern teaching methods because it has potential to transform student education completely. The platform delivers an array of advantages that include supporting students with learning in ways that match their individual styles while making abstract concepts clear. The educational standards of this century transform rapidly and classroom methodologies though important will no longer suffice independently. Computerized program results demonstrate traditional teaching needs modernization to match current educational needs.

I believe this program holds greater value than student grading performance demonstrates. Through these initiatives the future generation can develop into problem-solving creators and leaders by building their analytical capabilities. Critical thinking enables students to succeed across every life aspect beyond their studies.

Modern educational practices should embrace technologically advanced approaches because such techniques offer the best outlook for achieving widespread educational success. The responses developed in this study provide students with tools to confront twenty-first-century challenges and exploit its opportunities beyond classroom needs. The computerized educational program's successful outcome from this study needs to become a call to action for teachers, legislators and other stakeholders to dedicate greater resources toward such innovative educational methods which will produce a generation of smart learners who are both informed and critically thinking.

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