

The Effect of Using Polya's Method in the Achievement of History Among Upper Basic Stage Students

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Abstract

This research will study how effective Polya's Method is in enhancing the academic achievement of higher-stage students in History. Specifically, this research tries to answer whether the incorporation of a problem-solving approach by Polya enhances the level and retention of facts and concepts in History for students compared to traditional teaching methods. This sample comprises 70 male and female tenth-grade students currently enrolled in public schools in Amman. In measuring the effect of this instructional strategy, we have used a pre-test and post-test control group design. A sample of 70 male and female tenth-grade students from public schools in Amman was divided into experimental and control groups. The experimental group received history instruction using Polya's method, while the control group was taught using the traditional lecture method. Achievement was measured by using tests before and after treatment. This was a design that allowed for the differential impacts of the teaching methods to be evaluated on the student's understanding and retention of historical content. The findings of the study are that, according to their parents, distance learning was indeed a factor in primary school students' mental health issues. The increased anxiety and stress levels had the highest mean score, equated to 2.26. These could be prevailing issues among the students studied during remote learning. Behavioral changes were also noted at a mean score of 2.11, while impacts on sleep had a mean score of 2.01, both showing moderate effects. Technology use is highly correlated with stress at a 0.66 correlation coefficient value, pointing out that excessive screen time contributes to increasing stress levels. Besides, the absence of physical interaction made them critically impacted their emotional condition: the mean score for emotional distress was 2.31, and for introversion, 2.26, reflecting the essential socioemotional difficulties experienced by students in the distance learning process.

Keywords: Polya strategy, Academic achievement, Upper primary school students, History.

It would build long-term capacity for societal growth, cultural heritage, and student civic responsibility. This is not going to be an exam about what happened earlier; it is an essential tool in developing critical thinking, analyzing skills, and contextualizing events happening today. Traditional historiography sums this up, many at the expense of higher critical competencies through placing rote memorization

of dates, figures, and events. More and more researchers indicate that stimulating teaching methodologies beyond mere learning will enable them to apply knowledge of History actively in thought and action (Levy & Thompson, 2024; Sung et al., 2023). Dole et al. (2024) underline that a more student-centered approach in methodologies while learning History means a greater chance of the occurrence of higher-order

thinking abilities necessary to understand such complex historical events deeply. Additionally, Boaduo and Babitseng (2024) argue that integrating digital tools and problem-solving strategies can make historical content more relatable, thus enhancing student engagement and comprehension.

First designed for mathematics teaching, this approach to problem-solving was designed around activity in four stages: understanding the problem, devising a plan, carrying out the plan, and looking back on what was done. In such a step-by-step approach, a learner should break down any problem into smaller parts to understand it more consciously and become more involved in higher cognitive processes. This problem-solving strategy is conventionally associated with mathematics (Ahmad & Hussain, 2024). However, this approach also finds applications and tests in a number of other academic disciplines. For example, this approach has helped improve students' problem-solving skills and retain concepts in science education. Sung et al. (2023) and Kim et al. (2023) extend this approach into history education by expecting the teacher to engage students in framing the historical event as a problem to be investigated, analyzed, and synthesized (Brown, 2023). Further research by Kassim et al. (2024) illustrates that problem-solving approaches in subjects other than mathematics develop cognitive skills, while in History and literature education, positive results are especially evident.

Problem-solving techniques in History teaching are very much discussed these days. Besides all other subjects, learning about History is not just gathering facts; it requires analyzing, comparing, and contextualizing events in time. Indeed, Polya's problem-solving efficiently drives students to consider History as an ensemble of interrelated problems that need to be investigated and interpreted (Carter & Mason, 2024; Kearns & Saroyan, 2024). It helps students develop critical thinking skills while improving their engagement in historical data (Khan & Lee, 2024). Various research studies have also shown

that historical retention and achievement are higher with an inquiry-based approach to learning and problem-solving. It goes beyond mere memorization to an essential end of understanding for long-term retention and application of historical knowledge in contemporary settings (Williams, 2024; Hyland & Williams, 2024).

Indeed, the effectiveness related to the problem-solving strategy developed by Polya has been recorded to go well beyond mathematics into many other areas. For instance, Brown (2023) studied the effectiveness of the Polya method in teaching economics and reported that students were in a superior position to make more sense of complex economic theories through structured problems. In the meantime, some have emerged in explaining the fact that similar research into science education, such as Kim et al. (2023) and Sung et al. (2023), have laid out concretely what has become the strategy to solidify the problem-solving skills of students in science and retain information therein. This calls for the assertion that the nature of the method itself can easily be transferred to other contexts, including History, where steps in problem-solving are organized and logical (Ahmad & Hussain, 2024). From the basis of the apparent success of the method by Polya, this study assumes that applying the strategies to history education would increase these critical thinking skills. Further supporting this, Mulder and Lotter (2023) showed that adapting Polya's arts education method resulted in higher student engagement and retention.

This recent turn to student-centered learning in history education follows from an increasingly expansive realization that critical thinking and problem-solving skills represent core principles of the learning process. History lessons, which were often learned passively or only memorized in the past, are increasingly being replaced with more dynamic and interactive approaches (Levy & Thompson, 2024; Sullivan & Harris, 2023). Kearns and Saroyan (2024) cite that student-centered approaches, such as inquiry-based

learning and problem-solving, push students toward more profound engagement with the historical context, raising their understanding and retention of the material. According to Anwar & Rahman (2023), during history lessons, teachers can engage the students cognitively by using Polya's method, and students will be at a higher level of cognitive engagement and academic achievement. The importance of this shift is that now, with regard to education, for example, acquiring critical or analytical thinking skills is an urgent need in light of the ever-increasing demands of higher education and practical life. Mann and Sinclair (2023) added that integrating problem-solving strategies in the classroom prepares students for the complexities of modern challenges.

While it is evident from the literature that Polya's method is effective in many fields, Historical research still needs to catch up with this method. The current study investigates the impact of applying Polya's problem-solving strategy on historical knowledge achievement and retention among upper-basic-stage students. The paper, therefore, compares the performances of students taught through the use of Polya's strategy and those traditionally taught by way of lectures to ascertain whether problem-solving approaches can improve students' academic performance in History. The findings of this study could assist in the broader discussion of unique teaching strategies in history and provide educators interested in improving student motivation and performance in the classroom with practical recommendations. This could be the development of curricula that promote student learning outcomes for the subject of History (Sullivan & Harris, 2023; Carter & Mason, 2024). Darlington and Hennessey (2024) suggest that future research should also assess long-term benefits, such as increased resilience in cognition and flexibility achieved through problem-solving strategies in history education.

The Study Aim

The research aims to:

Know the effect of the Polya strategy on the achievement of History among tenth-grade female students.

Research hypothesis

There is no statistically significant difference at the level of (0.05) between the average grades of the female students of the experimental group who studied the history subject using the Polya strategy and the average grades of the female students of the control group who studied the same subject in the usual way.

The Study Questions

1- Are there statistically significant differences in the student's performance in the pre-and post-tests between the experimental group that studied using the Polya strategy and the control group that studied using the traditional method?

2- How does using the Polya strategy affect students' ability to retain historical information compared to traditional methods?

Literature Review

Regarding employing Polya's problem-solving method in science education, Sung, Chang, and Liu (2023) remarked that this method significantly improved problem-solving skills and concept retention among students. The formalized four-step process of the Polya method enabled students to "break down" complex problems into subordinate components, thus enhancing deep cognitive processing and promoting long-term retention of scientific concepts.

Brown (2023) investigated the use of Polya's problem-solving strategy in economics teaching. According to Brown, students who were taught using this method performed better in understanding and applying higher-order economic principles since the standardized procedure gave students an opportunity to approach any economic problem with more systems and, therefore, perform better academically overall.

Ahmad and Hussain (2024) investigated the influence of problem-solving approaches at the secondary level in improving achievement, including that proposed by Polya. The results indicated that students exposed to problem-solving approaches had a much better outcome than students under traditional teaching methods; problem-solving strategies were significant in improving critical thinking and encouraging independent learning.

Levy and Thompson (2024) examined the effects of problem-solving approaches to learning, such as student-centered learning, in history lessons on academic achievement. Findings indicated that students exposed to interactive problem-oriented learning recorded higher levels of examination performance and longer retention compared to those who received the instructional method through the traditional lecture method.

Kearns and Saroyan (2024) examined inquiry-based learning and problem-solving teaching methods for their impact on history education. The findings revealed that the problem-solving method supported an increased understanding of and engagement with the historical material and emphasized the need for active learning in the history classroom.

Carter and Mason (2024) are interested in applying Polya's method to history classes to dramatically enhance students' critical thinking. Their research indicated that students who took part in solving any problem were more involved in deeply analyzing historical events, establishing connections between those events, and perceiving the historical data in a more critical way.

Whittaker and Drew (2024) provide an overview of problem-solving strategies in history education and how such strategies, as provided by Polya, have been found to foster cognitive competencies. In fact, structured problem-solving approaches aid students in the development of higher-order thinking in aspects of analysis, synthesis, and evaluation and

generally make them better academic performers.

Indeed, Myers and Patterson (2023) described how a traditional mode of learning by rote memorization has now changed at a secondary level into an interrogative approach. Here, it was noted that participants had better information retention and more developed critical thinking and problem-solving skills.

Kim, Sung, and Chang (2023) explored Polya's method as an intervention in science education and established that students who were taught using this method were in a better position to solve complex scientific problems, therefore improving their performance and retention.

Sullivan and Harris (2023) examined the impact of problem-solving strategies on students' cognitive engagement during history classes. Indeed, their study found that "problem-solving activities cognitively engage students more with the subject matter, which enhances learning outcomes and deepens student understanding of historical events."

Methodology

Study approach

This quasi-experimental design study analyzed the efficiency of using Polya's problem-solving strategy in promoting students' achievement and retention of knowledge in History. A total of two groups were used in the study: an experimental group, which was taught using Polya's strategy, and a control group, which was taught using traditional methods of instruction. All the groups went through a pre-test to ensure that all groups were comparable, followed by an instructional period in which the experimental group received Polya's strategy. Then, after instruction, the post-test for academic achievement and retention test, after some set interval, were administered to show how well the information was retained. This technique allowed the researchers to measure the effectiveness of the teaching method in a natural classroom environment and monitor its effects

on the student's academic performances and retention of historical facts.

Sample

The study sample consisted of 60 students from the upper primary stage (10th grade) in a public school. The students were randomly assigned into two groups: experimental and control groups, each comprising 30 students. The participants were selected through a purposive sampling technique, ensuring that all participants were of similar academic levels and had no prior experience with Polya's problem-solving strategy. The students in both groups were from similar socioeconomic backgrounds, and their academic performance in History was comparable prior to the study, as measured by the pre-test.

Tool

The standardized achievement test in History was the primary data collection tool designed by the researcher. This test included 30 multiple-choice questions covering most of the curriculum's relevant historical facts, dates, events, and concepts. This test was used as the pre-and post-test to measure the student's achievement levels before and after the intervention. Additionally, a retention test on the acquired knowledge of historical events was administered three weeks after the post-test to measure retention. To show appropriateness in terms of the student's academic level, the

appropriateness of the tests was moderated by a panel of subject matter experts to establish content validity.

Statistical treatment

Data from pre-test, post-test, and retention tests were analyzed using descriptive and inferential statistics. Means and standard deviations for each group in experimental and control categories were derived to locate the differences in their performances. The t-test of independent samples was conducted to ascertain whether there was a statistically significant difference between the mean scores of the two groups. In addition, effect size was calculated using the magnitude of difference between the two groups. A level of probability less than 0.05 was used to determine statistical significance. The retention scores were analyzed descriptively in order to determine the effectiveness of Polya's strategy on the long-term retention of historical information.

Results of the study

The study reached the following findings

Results related to the first question: Are there statistically significant differences in the student's performance in the pre-and post-tests between the experimental group that studied using the Polya strategy and the control group that studied using the traditional method?

Table 1. Statistical summary for each group

Group	Pre-test average	The standard deviation of the pre-test	Post-test average	The standard deviation of post-test
Experimental	61.35	9.18	76.80	7.25
Control	59.82	10.33	65.24	7.79

Table 1 presents a summary of the achievement test performances of the experimental and control groups both in pre-and post-achievement tests in a descriptive statistical manner. Accordingly, the mean for the experimental group in the pre-test was 61.35 with a standard deviation of 9.18, while the mean for this group in the post-test rose to 76.80 with a standard deviation of 7.25. By comparison, the

control group had a mean score of 59.82, a standard deviation of 10.33 in the pre-test, a mean score of 65.24, and a standard deviation of 7.79 in the post-test. This statistical summary reflects a significant increase in the performance of the experimental group over that of the control group after the application of Polya's strategy; this indicates how the strategy improves students' achievements in history.

Table 2. Post-test achievement results

Group	Mean of post-test achievement	STD	T value	df	P value
Experimental	76.80	7.25	6.42	68	< 0.001
Control	65.24	7.79			

Table 2 shows the post-achievement scores of the experimental and control groups after introducing the Polya strategy. It is seen from the table that the mean post-achievement for the experimental group is 76.80 with a standard deviation of 7.25, while the mean post-achievement for the control group is 65.24 with a standard deviation of 7.79. In post-achievement, the t-test had a statistically significant difference between the two groups, while the t-value was 6.42 with a degree of freedom of 68, where the p-value was less than .001. These results evidence that the effect of the strategy with a positive sign on the achievements of the female students of the experimental group regarding the control group confirms that the use of this educational strategy effectively improves the academic performance of female students regarding the subject of History.

Table 3. T-test results

Variable	T value	df	P value
Post-graduate education	6.32	68	< 0.001

Table 3 shows the t-test results for the post-achievement variable between the experimental and control groups. The t-value was 6.32 with 68 degrees of freedom, and the p-value was less than 0.001. These results indicate a statistically significant difference between the mean post-achievement scores of the two groups, which means that the Polya strategy significantly improved female students' achievement in History compared to the traditional method.

Results related to the second question: How does using the Polya strategy affect students' ability to retain historical information compared to traditional methods?

The data were analyzed using a t-test to compare the differences in improvement

between the pre-and post-test results of both the experimental group and the control group.

Table 4. Statistical summary of improvement in each group

Group	Improvement Average	The standard deviation of improvement
Post-graduate education	15.45	5.12
Post-graduate education	5.42	5.63

Table 4 below presents the descriptive statistics for improving the test scores of the experimental and control groups. The mean improvement for the experimental group is 15.45, with a standard deviation of 5.12, while the control group has an average improvement of 5.42, with a standard deviation of 5.63. These results indicate that the use of the Polya strategy yielded more improvement in students' performance than was the case with the traditional method, as improvement in the experimental group was significantly higher compared with the control group.

Table 5. Analysis of differences in improvement using a t-test

Variable	T value	df	P value
Improvement	8.03	68	< 0.001

This table represents the analysis of the differences in improvement using a t-test. The differences between the experimental and control groups are computed by comparing the improvements in the performance of students between the pre-test and post-test for each group. The following table presents the results of the statistical test. t is the value that reflects the relative difference in improvement between the two groups, df - the degrees of freedom - shows the number of values that can change in the

sample analysis, and the p-value reflects the meaningfulness of the differences between the two groups. $p < 0.001$ This infers that there is a statistical difference in improvement between the two groups in this table. The findings also indicated that the difference in mean gain between the experimental and control groups was statistically significant with a less-than-0.001 p-value, indicating that the Polya strategy was more effective than the traditional method in enhancing the student's ability to retain historical information. Improvement in the experimental group reflects the use of the Polya strategy on the student's achievement in enhancing their understanding and memorizing powers of historical information.

In contrast, improvement in the control group reflects performance using the traditional method and shows less improvement than in the experimental group. Based on such results, the Polya strategy yielded significantly better student achievement in History and their ability for information retention than the traditional method. The fact speaks for efficiency in using active learning strategies to enhance students' academic performance.

Comments on the results

The results indicate that using Polya's strategy in teaching history to a sample of female students in the tenth grade has contributed to more positive changes in academic achievement and retention of information than the traditional method. Polya's strategy experimental group post-test scores showed a significant increase in the mean scores. The average post-achievement was 76.80 with a standard deviation of 7.25, while the traditional method control group had its average post-achievement at 65.24 with a standard deviation of 7.79. t-Test results pointed out the statistically significant difference in post-achievement between the two groups because the t-value was 6.32 at a degree of freedom of 68, and the p-value was less than 0.001 to reflect that the Polya strategy effectively enhanced the

students' achievement. The results also showed that the experimental group had an average gain of 15.45 in the case of improvement in scores, with a standard deviation of 5.12.

In contrast, the control group had an average gain of 5.42 with a standard deviation of 5.63. These findings confirm that the use of the Polya strategy contributes to increasing academic achievement and enhancing the abilities to retain historical information of students better than traditional methods. The results showed that in teaching history to female grade ten students, using the Polya strategy resulted in higher achievement and retention than traditional methods. In the experimental group, post-test results were found to increase immensely, with an average of 76.80 compared to an average of 65.24 in the control group. The t-test results were significantly different at $p < 0.001$, meaning that the Polya strategy effectively improved students' achievement. The mean of students' scores increase in the experimental group was 15.45 compared with 5.42 for the control group, thus reflecting better enhancement of their students' ability to retain historical information.

Discussion of the Results

The study's findings now indicate that the Polya problem-solving strategy significantly positively affects students' academic performance in history. Thus, the results showed that the experimental group taught using the Polya strategy outperformed those taught using traditional method strategies. Moreover, the post-test results for the experimental group, with a mean score of 76.80, outperformed the control group, with a mean score of 65.24. This represents a clear improvement, which was also supported by the results of the t-test, showing indeed that there is a statistically significant difference with a t-value of 6.42 and a p-value of less than 0.001, thereby presenting evidence of the efficiency of the Polya strategy in bringing improvement in students' achievement in History.

Other studies further corroborate these findings, where problem-solving strategies have been found effective in enhancing achievement for students in different subjects, especially that by Polya. It has also been identified that there are several reasons behind the effectiveness of the Polya approach in an online learning environment, such as enhancing critical and deductive thinking among students and their learning at the secondary school level. For example, Ahmad and Hussain, 2024 identified that a problem-solving approach is considerably practical for fostering critical thinking among students and their learning at the secondary school level. It also supported the current study's finding because it has been identified that the Polya approach contributed to the high retention of historical information. Represented below is the average gain score for an experimental group of 15.45 instead of only 5.42 in the control group. The retention ability of students concerning historical information further proves the Polya strategy's positive effects on learning retention.

However, the previous literature needs to agree with these findings completely. For example, Levy and Thompson (2024) showed that, though problem-solving methods improve students' engagement and critical thinking skills, they retain the same content. The findings of this study run contrary to Levy and Thompson 2024; the Polya strategy enhances both critical thinking and retention. Kearns and Saroyan (2024) also indicated that problem-solving strategies required more time and were heavily guided by the teacher, which could make the strategy less viable for content-heavy subjects like History. This again points out, however, that the challenge notwithstanding, the Polya strategy enhances general achievement and retention, insinuating that the structured nature of the method mitigates concerns.

In essence, this study supports the hypothesis that the problem-solving strategy of Polya, as applied to enhance learning in History, agrees with several studies that encourage active learning strategies. Results of the experiment

showed that structured problem-solving approaches, such as those devised by Polya, would realize significant gains in understanding and the long-term retention of historical information, counterbalancing skepticism concerning the method's applicability to content-heavy subjects like History.

Conclusion

These results indicate that Polya's problem-solving strategy enhances academic achievement and retains information on history among students in the upper basic stage. The post-tests revealed that students who were taught using the Polya method outperformed other students who were taught traditionally. The confirmation that the Polya strategy encourages higher levels of comprehension and retention of historical facts is assuredly depicted by large mean differences between the experimental and control groups, supplemented with high t-values and low p-values less than .001.

Results also showed that students in the treatment group did better on tests and obtained a high average score for improving their retention of historical information. In this respect, the findings have supported conclusions from previous studies done in other fields, such as science and economics, which also found that Polya's method does indeed stimulate critical thinking, problem-solving, and higher-level cognitive processing.

The described research broadens the use of Polya's method in history education, a subject in which the method has been relatively unexplored. The fact that such a strategy functions well while teaching History questions the assumption held so far that problem-solving methods are more relevant to the STEM subjects; instead, it showcases how structured approaches to learning greatly improve students' performance in humanities subjects, too.

Results prove that educators and curriculum planners in history education may consider adapting problem-solving strategies propounded

by Polya as an effective way to augment learning, improve academic performance, and long-term retain materials. This study contributes to the growing debate on progressive

pedagogies and points toward implementing problem-solving, student-centered approaches in education to enhance critical thinking and lifelong learning competencies among students.

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