

DEVELOPMENT OF LOGICAL THINKING AMONG SECONDARY LEVEL STUDENTS

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Abstract

Education refers to the discipline that is concerned with methods of teaching and learning in educational environments. Logical thinking is having the potential to analyze mutually, various concepts by knowing their meaning to link with other related aspects and to have a sequential thinking.

The researcher in this current study developed and executed modules to enhance Logical thinking of Secondary School Students. Single Group Pre -test or Post-Test design was adopted in the current study. 50 sample were chosen based on the pre-test score and executed the Logical thinking module. Modules on number series, Analogies, Verbal Classification, Matching Definitions, Logical Reasoning, Logical Games, Statement and Assumption, Statement and Conclusion, Cause and Effect, Logical Deduction, Letter and Symbol Series, Essential Part and its Relationship was developed to enhance the logical thinking ability among secondary school students.

The samples chosen were trained through modules. On evaluation post-test scores were better than pre-test scores. This indicates the impact of the module in improving the logical thinking of secondary level students. The samples were subjected to module and were found to have improved.

The collected data was subjected to 't' test to find the difference in pre-test and post-test scores, and significant difference between pre-test and post-test score was found indicating the effectiveness of the module in developing logical skills.

Keywords: *Logical thinking*

Introduction

Education refers to the act or process of imparting or acquiring knowledge, developing thought and judgment, and preparing intellectually for a mature life. It also means helping people learn how to do things and helping them think about what they have learned. It is also important for educators to teach how to find and use information. Education needs research to figure out how to improve it. Education is usually a lifelong constant, energetic, and constantly adapting practice. Education is the next need of people, right after food, clothing, and shelter. Through education, knowledge about society, the country and the

world is passed down from generation to generation. Education can help individuals and lead them from one class to another. Educated individuals and groups, for example, can help and encourage less educated people to become educated. Thinking cannot be separated from the individual thought process. To overcome the hurdles, it is important to approach the problem logically. Logical thinking is the ability to reach a rational conclusion by analyzing a situation. Well-developed logical thinking skills also promote analytical thinking, reasoning, problem solving, and many other skills.

Logical thinking enables learners to understand what they have read or been shown and to build on that knowledge without being guided. Logical thinking teaches students that knowledge is fluid and builds upon itself. Logical thinking is also an important foundation for problem solving.

Defining logical thinking in relation to the classroom from different perspectives, teaching methods best suited to develop the skills, reasons why reasoning skills are critical to students' educational success. The research draws on previous studies that are conducive to teaching; however, it is clear that the underlying factor in developing a unified idea of what reasoning is the problem.

Logical thinking helps one to come to a concert conclusion by undertaking skills like analyzing, understanding and evaluating. One who is completely developed in logical thinking will lead to analytical thinking, creativity, problem solving, handling real life situations and many more.

Logical thinking teaches students that knowledge in not a single dimensional path. It builds a strong foundation to solve the hurdles they would encounter in future too.

Review of Related Literature

Developing consensus on what logical thinking is in terms of curriculum and standards set by state and federal departments of education, and how a teacher defines it using an established rubric, can vary astronomically. Krupat et al. (2011) examined how reasoning is defined and used by medical school students. They pursued three objectives: The first was to determine the parameters of the definition of logical thinking. To measure logical thinking, it is important to have a common definition of what it is and how it is defined depending on the task, assignment, or challenge. Even a rubric that sets expectations for students can be open to interpretation if teachers have different definitions of reasoning or how it applies to their class. Without a full understanding of what is expected and how it is graded, there is no way to clearly develop, build, or improve reasoning skills.

Papinczak et al. (2009) examined the situation from the students' perspective. The study referred to the teaching method used by tutors and how it was received by students. It was found that learning stopped when tutors did not follow the guidelines provided and that, in fact, any attempt to develop logical thinking skills fell apartment.

The study found that when tutors reviewed their teaching methods, which many did, they were able to scale them back to the required level so that reasoning skills could flourish. Without consistency, learning expectations decrease while experiences lay the foundation for students' preconceived notions and expectations when working with teachers. The open-ended questions asked of students provided a wealth of information. The main problem with this study is the researcher's interpretation of the students' comments.

Logical reasoning theory allowed **Baez (2007)** to add another level of understanding in the pursuit of logical reasoning by conducting a quantitative study on the understanding of the term logical and the importance of answering logical questions. The term "logical" has come to mean more than just judging something. As with any research, it is open to interpretation, and the study conducted by Baez (2007) demonstrates this truth about the difficulty of research. Without a clear definition of what is being researched or expected, it is nearly impossible for a research team to even begin to decipher what it means in general for a particular industry or academic field. Breaking the research down to a central concept, e.g., logical thinking, and what exactly is being measured, e.g., the development of logical thinking skills, an understanding of the implications can begin; on the other hand, Stage notes that answering the logical questions pushes the boundaries of what is common. These two studies together analyze how research is conducted, and their focus on research questions is intriguing. However, without a full understanding of what is being studied, there is little hope that a study will yield accurate results. Studies that focus heavily on the "what" of the research rather than the "how" may be inaccurate and may not embody the research questions that were the focus of the research or achieve the end goal that prompted the study. Accuracy could be questioned, rendering the results or interpretations of the results null and void.

Arsita Wahyuningsih (2023) 1) Analyzing the feasibility of interactive e-books on units of time to improve the reasoning skills of second grade students at Muhammadiyah 1 Elementary School Candi, 2) Analyzing the effectiveness of interactive e-books on units of time to improve the reasoning skills of second grade students at Muhammadiyah 1 Elementary School Candi. The product of this research is an interactive e-book with material on units of time for grade II of elementary school. The result of this development research is that the interactive e-book has a very good quality, with the results of validity of material experts at 96.15%, design experts at 96.05% and linguists at 90%. From the obtained results, it can be concluded that the interactive e-book on units of time can be used very well at Muhammadiyah 1 Elementary School Candi and improve students' reasoning skills. Based on the results of the above discussion, it can be concluded that the interactive e-book has a high quality, very good and very feasible because there are no criticisms or suggestions from experts, accompanied by the results of validity of material experts is 96.15%, design experts are 96.05% and language experts are 90% and interactive e-books

has an impact on improving the logical thinking skills of students in SD Muhammadiyah 1 Candi seen from the results of paired sample t-test obtained a sig.(2-tailed) probability value of 0.001.

Horanska (2022) examined the effects of research on students' level of verbal and logical reasoning. The researcher studied the effects of research work through an experimental test. The results of the educational experiment allowed to conclude that the level of verbal and logical thinking increased in the subjects of the experimental group as a result of the special experimental work.

Ambusaidi and Abdullah (2022) determined the level of scientific reasoning skills in chemistry among 11th grade Omani students and the effects of their reasoning skills and gender on this level. The sample of the study consisted of (400) male and female students intentionally selected from an educational region in Oman. The instruments of the study consisted of "Scientific Argumentation Skills Test" and "Logical Thinking Test" The results of the study showed that the level of 11th grade students was moderate in argumentation skills and low in logical thinking. The study is important for Omani chemistry teachers because it provides an overview of the level of scientific reasoning skills and logical thinking of their students, which helps teachers determine the next steps of the learning process by applying appropriate teaching strategies.

Monterola and Sheryl Lyn C. (2022) investigated the effects of collaborative scripting in computer-supported collaborative learning CSCL on student reasoning. They used a quasi-experimental design with three groups (pretest - posttest) and two delayed posttests involving grade 7 students. The results showed that CSCL approaches significantly improved students' reasoning ability. In addition, the delayed posttests consistently showed that CSCL with scripting significantly affected the development of reasoning. This innovation catalysed learning and offered significant implications that provided opportunities for future research directions.

Baserer and Dilek (2020) determined the level of reasoning in university students. To determine the level of reasoning in the study, the researcher-developed reasoning scale (MDI) was applied to a total of 525 students at Kazim Karabekir Education Faculty of Ataturk University. The relationship between the personal information form and the total scores obtained on the scale was investigated. As a result of the study, it was found that students who read books daily had a higher level of logical thinking. Students studying Education and Turkish and Social Sciences have higher levels of logical thinking than students studying in other disciplines.

From the extensive literature collected in the field of logical reasoning, it appears that the knowledge of logical reasoning is necessary to overcome the hurdles they will encounter during their educational journey.

Gurcay and Etna (2018) examined the relationships between high school students' learning approaches and reasoning skills and their understanding of the concepts of heat, temperature, and internal energy. All data collection instruments were administered to 120 Anatolian high school students. The data collected with these instruments were analysed using descriptive statistics and stepwise multiple regression analysis. The results of this study show that the variable that best predicts high school students' understanding of heat, temperature, and internal energy is their reasoning ability. Logical reasoning skills and alignment with meaningful and memorized knowledge predicted 41% of the variance in understanding of heat, temperature, and internal energy. Research findings indicate the importance of reasoning skills and orientation to meaningful learning in understanding concepts related to heat, temperature, and internal energy.

Methods

The present study was executed adopting single group pre-test, post – test design. Samples of 50 students were screened based on pre-test score and were subjected to intervention.

On Completion of interrelations session the chosen samples were administrated with post – test to check the impact of module on enhancing logical skill of secondary level students.

Module on Logical Thinking

A module was developed on the following areas of logical thinking such as such as number series, verbal classification, analogies, matching definitions, logical reasoning, logical games, statement and assumption, statement and conclusion, cause and effect, logical deduction, letter and symbol series, essential part and relationship. The module was used to train students on logical thinking and was spread across 20 sessions.

Objectives of the Study

- To determine the impact of module on developing logical thinking.
- To find significant difference in logical thinking of Secondary school students based on their gender.

Statistical Analysis

In the current study, the researcher used the random sampling method to select the samples. By this method 50 secondary level students of Central Board from Chennai district were selected.

Hypotheses of the Study

- There is significant impact of the module on enhancing the logical thinking of students.
- There exists no significant difference between the pre test scores and the post test scores of the students based on gender.

Analysis

The researcher collected the data from the secondary school students and analyzed it. The researcher calculated the statistics. It was found that there was no significant difference in logically thinking among the boys and girls.

Table 1 Showing Significance of Means Difference between Pre-Test and Post Test Score

	N	Mean	Standard Deviation	t	Sig. (2-tailed)
Pre-test	50	16.8	2.58725	45.91	0.01
Post-test	50	37.2	2.01018		

It can be inferred from the above table that there exists significant difference between pre-test and the post-test scores. This shows the positive impact of the module prepared by the investigator in developing logical thinking of Secondary School Students. It is evident from the mean value that 37.20 obtained after Post – test is significantly more than the scores obtained from mean value of Pre-test score of 16.80. This difference significant at 0.01 level indicate the impact of the module in developing the logical thinking skill among the Secondary School Students.

Table 2 Showing Significance of Mean Difference in Pre-Test Score based on Gender

Gender	Mean	Standard deviation	t	Level of Signification
Female	17.0000	2.95401	0.521	No significance
Male	16.6154	2.16695		

It can be inferred from the above table that there exists no significant difference between boys and girls in their logical thinking on the pre-test scores. Both the boys and girls are treated equally and no discrimination is discharged in facilities provided to students. Thus, they are found to be similar in their logical thinking based on pre-test scores.

Table 3 Showing Significance of Mean Difference in Post-Test Score based on Gender

Gender	Mean	Standard Deviation	t	Level of Signification
Female	36.7692	2.14117	1.60	No significance
Male	37.6667	1.78561		

On inferring based on gender it is found evident that there is no difference between the boys and girls in their logical thinking post-test scores. Analysis on the account of treatment given to the students shows that there is no significant difference among them based on their gender.

Findings

It could be found that the existence of significant difference in the pre-test and post-test scores of students in their logical thinking.

There was no difference between the boys and girls in their pre-test and post-test scores.

The treatment given to them equally. Thus, no significant difference was found in the post-test scores based on gender.

Implications

In this current study, the researcher develops the logical thinking level of secondary level students with the help of prepared module.

The teacher and educator should focus on helping the students think sequentially to solve any situation they would encounter. The parents or the guardian should facilitate the students in solving day-to-day hurdle on their own by thinking sequentially in a wider range rather than pampering and solving the hurdles faced by students. Thus, the current study throws light on modules prepared to develop logical thinking of students.

Conclusion

This research shows that the Logical Thinking is developed among the secondary school students. The prepared modules helped the secondary school students in developing their logical thinking. This helps the students to think logically to find many dimensions in all the aspects to solve any situation. As a result of this research, the researcher has found that the modules prepared has enhanced the logical thinking ability among secondary school student.

References

1. Al-Ajmi, B., & Ambusaidi, A. (2022). The Level of Scientific Argumentation Skills in Chemistry Subject among Grade 11th Students: The Role of Logical Thinking. *Science Education International*, 33(1), 66-74.
2. Baserer, D. (2020). Logical Thinking Levels of Teacher Candidates. *Educational Policy Analysis and Strategic Research*, 15(4), 176-190.
3. Gurcay, D., & Gulbas, E. (2018). Determination of Factors Related to Students' Understandings of Heat, Temperature and Internal Energy Concepts. *Journal of Education and Training Studies*, 6(2), 65-72.

4. Horanska, T. V., Bakumenko, T. K., Polishchuk, V. L., Atamanchuk, I. M., & Turchyn, T. M. (2022). Development of Students' Verbal and Logical Thinking in the Course of Research Work. *Journal of Curriculum and Teaching*, 11(1), 185-194.
5. Hsu, C. C., & Wang, T. I. (2018). Applying Game Mechanics and Student-Generated Questions to an Online Puzzle-Based Game Learning System to Promote Algorithmic Thinking Skills. *Computers & Education*, 12(1), 73-88.
6. Kaklauskas, A., Kuzminskė, A., Zavadskas, E. K., Daniunas, A., Kaklauskas, G., Seniut, M., & Cerkauskienė, R. (2015). Affective Tutoring System for Built Environment Management. *Computers & Education*, 82, 202-216.
7. Ramirez, H. J. M., & Monterola, S. L. C. (2022). Co-creating scripts in computer-supported collaborative learning and its effects on students' logical thinking in earth science. *Interactive Learning Environments*, 30(5), 908-921.
8. Wahyuningsih, A., & Nurdyansyah, N. (2023). Time Unit Interactive Ebook to Improve Logical Thinking Skills for Grade 2 Elementary School Students. *Journal of Islamic and Muhammadiyah Studies*, 4, 10-21.