



Study of Analytical Thinking Skills Research Trends: from Design Perspective to Data Analysis Techniques

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Abstract: The development of analytical thinking skills is one of the various competencies that 21st-century education aims to achieve. The purpose of this study is to analyze trends in analytical thinking skills research, reviewed from the aspects of research design to data analysis methods. This study uses content analysis on a number of articles published in Scopus-indexed international journals between 2015 and 2024, with analytical thinking skills as the main focus of the research. This review study shows that in the last eight years, the number of publications focusing on analytical thinking skills has increased. The peak was in 2022. After this year, the trend declined. Among these publications, quantitative research was the most dominant, with survey studies being the most frequently conducted compared to other quantitative research. In addition, high school students were the most targeted subjects. Tests and proportion analysis were the most frequently used instruments and data analysis methods. In light of these findings, recommendations for future research include the need for studies on analytical thinking skills as the main focus, as well as an increase in the variety of research and the selection of more appropriate data analysis techniques.

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INTRODUCTION

Analytical thinking skills (ATS) are one of the key competencies in 21st-century education. Analytical thinking skills refer to a person's ability to identify problems, analyze information, evaluate evidence, and draw logical and rational conclusions. With the rapid development of technology and access to information, mastery of analytical thinking skills is becoming increasingly important, both in academic and professional contexts. Therefore, research on the development and

application of analytical thinking skills has become an urgent need.

In recent years, interest in research on analytical thinking skills has increased significantly. This study aims to analyze trends in the development of analytical thinking skills, from research design to the data analysis methods used. By understanding these aspects, it is hoped that patterns can be found that are useful for further research development in this field. (Jung et al., 2024; Munibi et al., 2024) A study of articles published in Scopus-indexed international journals

from 2015 to 2024 shows a sharp increase in the number of publications focusing on analytical thinking skills. The peak occurred in 2022, although the trend declined thereafter. This indicates a high level of interest in this topic at a certain point in time, but also points to challenges that need to be overcome to ensure the sustainability of research in the future. (Bayani et al., 2025; Misbah et al., 2024)

One interesting finding from this study is the dominance of quantitative research, with survey studies being the most frequently used approach. This reflects a general trend in educational research, where quantitative data collection is considered easier and more efficient. However, quantitative research is often limited to descriptive data, so it does not always provide an in-depth understanding of the factors that influence analytical thinking skills (Cheng et al., 2021).

The most frequently studied research subjects were high school students. This shows the importance of developing analytical thinking skills at this crucial stage of education, where students face various academic challenges that require critical thinking skills. By understanding how analytical thinking skills develop in high school students, it is hoped that more effective approaches to improving these skills among students can be found (Punto Aji & Nugraheni, 2023).

In terms of instruments and data analysis methods, this study shows that tests and proportion analysis are the most frequently used techniques. These methods are considered effective for measuring the extent to which students can apply analytical thinking skills in various contexts. However, there are limitations to the use of these methods, especially in exploring the thought processes underlying the results obtained (Fauzi & Pradipta, 2018; Tabuena & Hilario, 2021). Therefore, this study provides recommendations for further research, with the aim of increasing the diversity of research types and selecting more appropriate data analysis techniques. Researchers are expected to further explore qualitative research, which can provide a deeper understanding of the dynamics of analytical thinking skill development. In addition, the use of more diverse data analysis methods, such as qualitative or mixed analysis, is expected to provide a more comprehensive picture of the factors that influence analytical thinking

skills. (Goodwin, 2019) In the context of educational development, it is important for educators and policymakers to pay attention to these research trends when designing curricula and teaching strategies.

The development of analytical thinking skills is not only important in formal education, but also in equipping the younger generation with the skills needed to face future global challenges (Tokanov et al., 2024). Thus, this article aims to provide deeper insights into research trends on analytical thinking skills, with a focus on research design and the data analysis methods used. This analysis is expected to contribute significantly to the understanding and development of analytical thinking skills among students, as well as serve as a guide for further research in this field. In closing, it is important to note that this research not only focuses on the development of analytical thinking skills in schools, but also provides a broader picture of how these skills can be integrated into everyday life.

Analytical thinking skills will be a valuable asset for individuals in facing increasingly complex challenges in this fast-paced world. In developing analytical thinking skills, it is important to note that this process involves not only gathering information, but also critically processing and evaluating it. This requires a holistic and in-depth approach, which enables individuals to not only identify problems, but also find rational and effective solutions. Education that focuses on developing analytical thinking skills will create individuals who are not only academically intelligent, but also capable of dealing with various situations with a broader perspective and logical thinking. (Baisova, 2024; Guo et al., 2024b). Research focusing on analytical thinking skills tends to explore various aspects, such as effective teaching methods, factors that influence the development of these skills, and the relationship between analytical thinking skills and academic achievement.

The various approaches used in this research provide a more complete picture of how analytical thinking skills can be developed and applied in various contexts. Therefore, the results of this study can serve as a strong basis for designing more structured and focused analytical thinking skills development programs (Al- Mayyahi, 2024;

Bhijakkanarin & Kenaphoom, 2024; Brenes Maltez et al., 2024). In addition, it is also important to understand that although quantitative research using survey methods dominates, qualitative research also has a very important role in exploring more deeply the experiences and perceptions of individuals in developing analytical thinking skills. The qualitative approach allows researchers to understand more complex thinking processes, including how social, cultural, and emotional factors influence the way a person analyzes information and makes decisions. Therefore, qualitative research can complement quantitative research by providing deeper insights (Aryal, 2024; Kittur & Tuti, 2024).

Data analysis methods also play a key role in determining research results. Although tests and proportion analysis are often used, there are various other methods that can be applied to obtain more accurate and representative results. For example, regression analysis can be used to model the relationship between different variables, while thematic analysis can help researchers identify deeper patterns in qualitative data. By using a variety of appropriate analysis techniques, researchers can make a more meaningful contribution to the understanding of analytical thinking skills. (Kim et al., 2024; Zhao & Li, 2022) Finally, to ensure the sustainability and positive impact of research in the development of analytical thinking skills, it is important for researchers, educators, and policymakers to collaborate and share their research findings. This collaboration can encourage the application of these findings in broader teaching practices and curricula. Thus, the development of analytical thinking skills can become an integral part of a sustainable education system, equipping future generations with the ability to think critically and rationally in the face of increasingly complex global challenges (Guo et al., 2024a; Khan et al., 2024).

METHOD

This study uses content analysis on a number of articles published in Scopus-indexed international journals from 2015 to 2024. The research method in this study uses a content analysis approach to explore and analyze trends in analytical

thinking ability research (Khusna et al., 2024). Content analysis is a research technique used to identify, classify, and evaluate patterns or themes that emerge in written texts. (Atiya, 2024; Pieniążek-Niemczuk, 2024; Wijaya et al., 2023) In the context of this study, articles published in Scopus-indexed international journals during the period 2015 to 2024 were the objects of analysis. This method was chosen because it allows researchers to systematically and objectively explore the information contained in various articles and provides a deeper understanding of research trends and developments in specific topics (Gilbert & Kelley, 2024; Szabó et al., 2025).

The first step in applying content analysis is the selection of relevant articles (Sean Palicki et al., 2023). The articles selected for analysis are those published in Scopus-indexed international journals that focus on analytical thinking skills. Article selection was based on strict inclusion criteria, such as topic relevance, year of publication, and indexing in Scopus. The researchers also ensured that the selected articles covered various types of research, using quantitative, qualitative, and mixed methods, in order to obtain a more comprehensive picture of research trends in this field. After selecting relevant articles, the next stage was data extraction. At this stage, the researchers identified important variables to be analyzed, such as the type of research design, data analysis methods used, and research subjects (Gürbüz & Uluyol, 2023).

This data is then recorded in a structured format, which facilitates further analysis. Content analysis in this study involves categorizing data based on themes or patterns that emerge from the reviewed articles. This aims to identify major trends in research on analytical thinking skills, as well as to understand how this research has developed over time. To ensure the validity and reliability of the analysis results, this study also used triangulation techniques. Triangulation is the process of combining various data sources or approaches to ensure that the research results are accountable and not influenced by bias or inaccuracy. In this study, triangulation was carried out by comparing the results of content analysis with findings from similar studies that had been conducted previously (Marlina et al., 2024; Treur et al., 2024). In this way, researchers can evaluate the suitability and

consistency of the findings obtained, as well as ensure that the conclusions drawn are based on valid and reliable data.

The next stage in this methodology is thematic analysis. Thematic analysis is used to explore patterns or themes that frequently appear in the articles analyzed (Naudé, 2024; Lomas, 2024). In the context of this study, the researchers focused on identifying the main themes related to research design, data analysis methods, and dominant research subjects. These themes are then used to formulate conclusions about ongoing research trends and to provide recommendations for future research. Thematic analysis helps researchers to develop a clearer picture of how research on analytical thinking skills is developing and what its role is in the context of education.

Finally, to ensure the accuracy and richness of the analysis results, researchers critically reflect on the data obtained. This process involves assessing possible biases in article selection, data interpretation, and conclusions drawn. The researchers also evaluated the limitations of the methods used, such as potential limitations in the representation of articles or limitations in the content analysis approach itself. By conducting critical reflection, researchers can improve the credibility and validity of research results and ensure that the findings obtained can make a meaningful contribution to the development of research on analytical thinking skills.

RESULT AND DISCUSSION

The trend in publications on analytical thinking skills from 2015 to 2024 shows a significant increase after 2016, peaking in 2022, with 9 publications recorded. This increase in the number of publications indicates a growing interest in research in this field, with relatively lower numbers in previous years, such as in 2016, when only 1 publication was recorded. This may reflect the development of the topic and awareness of the importance of analytical thinking skills in education and self-development. However, after peaking in 2022, the graph shows a slight decline in the number of publications in the following years, namely 2023 and 2024, with 7 articles recorded in each year. Nevertheless, the number of publications in 2023

and 2024 remains fairly stable, indicating that this topic remains relevant and of interest to researchers despite a slight decline. This could be influenced by external factors such as changes in research policy, a shift in focus to other areas, or even challenges in conducting research under certain conditions.

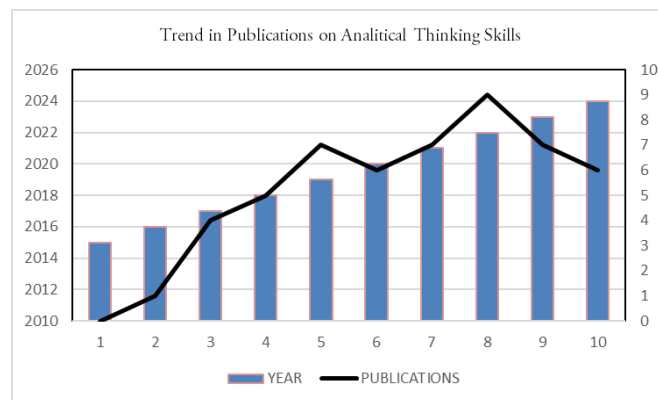


Figure 1. Trend in publications on analytical thinking skills from 2015 to 2024

Despite a slight decline in the number of publications in 2023 and 2024, the overall trend shows that research on analytical thinking skills continues to experience positive development. This decline may be due to factors such as the time needed to apply research results in practice or the transition to new research topics that are more specific or related to the needs of society and industry. Nevertheless, with a consistent increase in publications from 2016 to 2022, it is clear that interest in this topic remains high and is likely to continue to grow in line with the need to improve analytical thinking skills in various aspects of life, especially in education and the professional world (Toleva-Stoimenova & Rasheva-Yordanova 2023).

Furthermore, based on the available data, the most widely used type of research in the literature on analytical thinking skills is quantitative research with a survey study approach, which accounts for 8 articles or approximately 27.59% of the total 29 articles analyzed.

This research generally uses standard and structured measurement instruments, such as questionnaires or tests, to collect data that can be analyzed statistically. This survey research provides a broad picture of individuals' views, attitudes, or behaviors in the context of analytical thinking skills. In addition, pre- experimental research also shows

significant numbers, with 6 articles or about 20.69%. This type of research is often used to

conduct trials under controlled conditions but cannot fully control all variables involved.

Table 1. Type of research

Research Type	Type of Research	Number	%
B.1 Development (R & D)		6	20.7
B.2 Qualitative		4	13.8
B.3 Quantitative	B3.1 Observational study	0	0
	B3.2 Survey study	8	27.6
	B3.3 Correlation studies	1	3.45
	B3.4 Ex post facto study	0	0
	B3.5 Pre experimental studies	6	20.7
	B3.6 Quasi-experimental study	4	13.8
	B3.7 Ture experimental	0	0
Total		29	100

In addition to quantitative research, qualitative research also plays a role, although to a lesser extent, with 4 articles or around 13.79%. Qualitative research focuses more on a deep understanding of the phenomenon being studied, often through interviews, observations, or narrative analysis to explore analytical thinking skills. This type of research provides more comprehensive insights into individual perspectives and social contexts in the development of analytical

thinking skills, which cannot be achieved with quantitative data alone. On the other hand, research using observational studies, ex post facto studies, and true experiments showed lower numbers, with no articles using these types of research, possibly due to methodological limitations or an undeveloped research context in these areas. In the research subject data used, the research subjects were divided into several groups, with high school students being the most dominant group.

Table 2. Number of publications per school level

Research Subject	Number	Percent
C.1 Elementary School Students	2	6.67
C.2 Junior high school students	3	10
C.3 High school students	13	43.33
C.4 College Students	9	30
C5 Teachers	2	6.67
C6 Lecturer	1	3.33
Total	30	100

A total of 13 out of 30 articles, or about 43.33%, focused on research involving high school students. This shows that analytical thinking skills are often studied at the upper secondary education level, which may be related to the more mature development of critical thinking skills at this age. Furthermore, the university student group also showed a significant proportion, namely 9 articles or around 30%, which indicates that analytical

thinking skills continue to be studied at the higher education level.

Research involving elementary and junior high school students recorded lower numbers, namely 2 articles (6.67%) and 3 articles (10%). This may be due to differences in the complexity of the material that can be taught and understood by children of that age. Meanwhile, research with teachers and lecturers as subjects recorded only 2

articles (6.67%) and 1 article (3.33%), respectively, which may indicate that research on analytical

thinking skills among educators is not as extensive as that among students.

Table 3. Percentage of Instrument Types

Research Instruments	Number	Percent
D.1 Questionnaire	11	28.2051
D.2 Observation sheets	4	10.2564
D.3 Test sheet	18	46.1538
D.4 Interview sheet	6	15.3846
	39	100

This limitation may reflect the main focus on developing analytical thinking skills among students and university students, with the view that teaching these skills is more intended for students and university students. In terms of the instruments used, the most widely used research instrument was the test sheet, which accounted for 18 (46.15%) of the total instruments used in the research. This

shows that this instrument is the primary choice for measuring analytical thinking skills, given that test sheets can provide objective and easily measurable results. The use of test sheets reflects the importance of measuring cognitive abilities through structured questions, which allow researchers to obtain clearer quantitative data related to student achievement.

Table 4. Percentage Data Analysis Method

Data Analysis Methods	Number	%
E.1 Mean	17	33.33
E.2 Percentage (proportion)	18	35.2941
E.3 N-Gain	3	5.88235
E.4 t-test	4	7.84314
E.5 ANOVA	0	0
E.6 ANCOVA	2	3.92157
E.7 Correlation	4	7.84314
E.8 Others	3	5.88235
	51	100

In addition, several other data analysis methods such as t-tests and correlations were used in 4 (7.84%) studies. T-tests were used to test the difference in means between two groups, while correlations were used to examine the relationship between two variables. The N-Gain method, which was applied in 3 (5.88%) studies, was used to measure skill improvement from pretest to posttest. On the other hand, ANCOVA was used in 2 (3.92%) studies, which is useful for controlling confounding variables when testing differences between groups. Interestingly, ANOVA was not applied in this study, possibly because fewer studies required testing variances between more than two groups.

Based on the data presented, there are several interesting and positive points, as well as areas that need improvement in articles published on analytical thinking skills during the period 2015 to 2024. In general, the quality and quantity of publications appear to be fairly stable, but there are findings that provide an overview of the direction of research and recommendations for the future. One positive point to note is the consistency in the number of publications, which shows that the topic of analytical thinking skills continues to receive attention in academic literature. Although there are variations in the types of research used, the dominance of quantitative research suggests that

many researchers are attempting to measure and analyze analytical thinking skills using a more objective and measurable approach. These studies generally use appropriate instruments, such as questionnaires and tests, which allow for more systematic and accountable results.

However, one thing to note is the dominance of instruments such as test sheets and questionnaires, which prioritize the measurement of analytical skills in a theoretical context, but do not explore the application of these skills in a practical context. Although this provides a clear picture of a person's level of analytical ability, it is important for future research to introduce more practical or situational methods that can describe how analytical thinking skills are applied in real life. Based on the type of research data used, it appears that most researchers use quantitative research methods, with a focus on survey and pre-experimental studies. This shows that a numeric data-based approach is more commonly applied, allowing researchers to draw conclusions that are more easily understood by a wider audience. However, there is room to increase the use of qualitative methods, such as interviews or case studies, which can provide deeper insights into the dynamics of analytical thinking skill development in individuals.

One interesting point is that although statistical methods such as t-tests and correlation analysis have been used, more complex methods such as ANOVA or ANCOVA have hardly been applied. This indicates a lag in the use of more sophisticated analytical techniques, which could deepen our understanding of the relationships between variables that influence analytical thinking skills. Therefore, future researchers are advised to introduce more diverse analytical techniques in order to obtain more comprehensive results. Although the available data shows progress in the types of research used, it is crucial for future research to focus more on longitudinal research methods.

Longitudinal research allows for a better understanding of how analytical thinking skills develop over time. This is particularly important because analytical thinking skills are not only influenced by factors that exist at a given time, but also by the dynamics and changes in an individual's learning process and life experiences. In addition,

more attention needs to be paid to the higher education sector, because at the university level, analytical thinking skills are very important for students in developing more complex research and problem-solving abilities. Further research on the application of analytical thinking skills among students and lecturers can provide a more comprehensive picture of how these skills are used in the academic world.

One of the shortcomings of this study is the limited use of technology in teaching analytical thinking skills. Technology, particularly digital devices and AI-based learning applications, offers great opportunities to improve how analytical thinking skills can be learned and applied. Therefore, it is important for future research to explore how technology can be applied to develop these skills in a more efficient and interactive way. From the available data, it appears that there is still an opportunity to introduce more diverse research instruments. Although questionnaires, observation sheets, and tests are often used, further research could incorporate various other types of instruments, such as digital platforms, educational games, or simulations that test analytical thinking skills in a more lively context. This would not only introduce more modern methods but also attract more participation from students.

One recommendation that emerged is the importance of more research involving collaboration between various disciplines. This collaboration can enrich insights and produce more holistic and applicable research. For example, researchers working with experts in technology, education, and psychology can create more innovative approaches to teaching analytical thinking skills by utilizing technology and more effective pedagogical methods. In addition, future researchers need to explore more advanced data analysis techniques, such as ANOVA or ANCOVA, to identify more complex relationships in the development of analytical thinking skills. This will help broaden our understanding of the factors that influence the development of these skills in various contexts. By using more sophisticated techniques, research can produce more in-depth findings that can be implemented more effectively in education. In terms of research instruments, researchers are advised to continue developing and introducing

various tools that are more relevant to current needs, such as technology-based applications or interactive learning media. This will enrich existing methods and facilitate the measurement and monitoring of analytical thinking skills in a more dynamic way that is accessible to various groups. Thus, future research can have a more significant impact on the development of analytical thinking skills in general.

Overall, although many aspects of research on analytical thinking skills are already good, there is still room for improvement, both in terms of the methods used, the instruments applied, and collaboration between disciplines. By following these recommendations, more diverse and comprehensive research can be realized, and the results can be applied to improve the quality of education and the development of analytical thinking skills in the future.

CONCLUSIONS

This study analyzes publication trends related to analytical thinking skills in Scopus-indexed international journal articles during the period 2015–2024. The results of the analysis show that the number of publications increased significantly, reaching its peak in 2022, before declining in 2023–2024, indicating high interest in this topic, although efforts are needed to maintain its sustainability. Quantitative studies dominated the research with survey methods (27.59%) and pre-experiments (20.69%), while qualitative research was still minimal (13.79%), even though it has the potential to provide in-depth insights. High school students were the most common research subjects (43.33%), followed by university students (30%), while research on educators remains limited. The most widely used instruments were test sheets (46.15%) and questionnaires (28.21%), with proportion (35.29%) and average (33.33%) analysis methods, while complex statistical techniques such as ANOVA were not used. Therefore, further research needs to increase the diversification of methods, adopt more sophisticated analysis techniques, and expand the scope of research subjects to produce more comprehensive findings.

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The authors declare no conflict of interest

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