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The critical thinking research trend in Indonesia's language education journals

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Abstract: In the 21st century, education aims to develop research writing skills for critical thinking, emphasizing creative, collaborative, and communicative thinking skills in all programs. The study aims to gather information about a variety of studies discussing critical thinking skills in Indonesia using content analysis in many scientific language education journals published in Indonesia. This study applied content analysis. Data were obtained by collecting papers that had been published in language education publications across Indonesia from 2016 to 2023, carefully read, classified based on the research instrument, and analyzed using the classical content analysis technique. The study resulted in a finding that there have been publications over the last three years that highlighted critical thinking abilities. Quantitative research designs were mostly used. Furthermore, the most targeted subjects and materials were "language acquisition" and senior high school students in their tenth grade. The most widely used data analysis technique and instrument was the t-test and the test sheets. The study suggests future studies to enhance critical thinking skills by expanding research writing options, selecting appropriate data collection instruments, validating findings, and using precise data analysis methods.

Keywords: *writing, research, language, education, thinking*

INTRODUCTION

In the modern world, education is critical to both individual and societal development (Höttecke & Allchin, 2020). Among the principal justifications for the significance of education is that understanding culture, history, and other crucial topics through education is necessary for people to be able to contribute to modern society and help to form a better future (Allen et al., 2021). People with more education are able to make wiser decisions in life, lower their risk of falling into poverty, and enhance society as a whole (Putro et al., 2022). Education fosters social, intellectual, and emotional development, enabling people to advance personally (Schofer et al., 2021). An educated individual can improve society by analyzing circumstances, recognizing issues, and coming up with remedies (Knapp & Wong, 2020). Through education, people can follow their passions and interests, which enriches society and leads to personal fulfillment (Pagis, 2021). People can acquire and hone a variety of talents through education, which increases their value in both the labor market and society at large (Wheelahan & Moodie, 2022). Education promotes a more inclusive and compassionate society by assisting people in understanding and interacting with others without bias (Wamsler & Restoy, 2020). Innovation and advancement are fueled by education in a variety of disciplines, such as science, technology, and politics (Lee & Lim, 2021). A greater number of women are entering the workforce as a result of higher education levels, which is empowering various social groups

and advancing gender equality (R. Ahmed & Hyndman-Rizk, 2020; Cin et al., 2021). To sum up, education is critical in the modern world because it fosters individual progress, societal advancement, and the general welfare of society. It is an effective instrument for influencing the future and building a more affluent, peaceful, and inclusive society (Maheswari et al., 2021).

Numerous research has conclusively shown that critical thinking and education are correlated (Chen et al., 2020). One essential ability that is directly linked to both academic success and cognitive learning outcomes is critical thinking (Peng & Kievit, 2020). Studies have indicated a noteworthy association between critical and creative thinking skills and cognitive learning outcomes. Furthermore, critical thinking abilities have been demonstrated to significantly enhance learning outcomes since they help students solve issues, comprehend material, and arrive at well-informed conclusions (Paulsen & Kolstø, 2022). Research has shown that students' critical thinking skills and their learning results are positively correlated in the context of some disciplines, such as language acquisition and reading comprehension (Din, 2020; Moeiniasl et al., 2022). Thus, fostering critical thinking abilities in students is essential to raising their academic performance and equipping them for success in the modern world.

Education is now considered one of the most crucial tools for building a capable society in the twenty-first century (Desai & Wane, 2022; Reimers & Chung, 2019; Sale, 2020; Tight, 2021). It has been suggested that conceptual mastery is necessary for pupils to thrive in the twenty-first century, not only internalizing each idea that is discussed but also abilities that help kids develop life skills and critical thinking (Choo, 2020; Kumari, 2022). In addition, scientific process abilities are believed to be crucial in the contemporary scientific and technological period (Deta et al., 2020; Trach, 2020; Yongyue & Ruijing, 2021). It is believed that a variety of thinking styles, including metacognitive, creative, and critical thinking, are the most important cognitive abilities for graduates amidst the cutthroat rivalry in the twenty-first century (Purnomo et al., 2021; Samsudin & Hardini, 2019).

Critical thinking is frequently listed as one of the essential competencies for education in the twenty-first century, among all the other competencies described (McMullen et al., 2023). Nearly all educational programs place a strong emphasis on critical thinking in addition to the creative, collaborative, and communicative thinking skills that are closely tied to the 4Cs (Khoiri et al., 2021; Shalehah et al., 2020; Ye & Xu, 2023). Moreover, critical thinking abilities are among the ten primary talents that have been incorporated into the Assessment and Teaching of 21st Century Skills (ACT21S) (González-Salamanca et al., 2020; Kocak et al., 2021). UNESCO's framework for 21st-century skills, the Global Framework of Learning Domains, included critical thinking abilities as a sub-domain, according to LMTF (Gretter & Yadav, 2016). All of the above is essentially the result of favorable traits that will converge with graduates who are ready to be critical thinkers.

Studies have shown that, despite the pressing need for critical thinking skills, pupils' critical thinking abilities remain weaker in many nations. According to studies by Amy Shaw, Rusia pupils' critical thinking abilities were still rated as low or less optimal (Shaw et al., 2020). Consistent with those findings, Liudmila Varenina also noted that Russian prospective instructors lacked a significant degree of critical thinking (Varenina et al., 2021). Critical thinking proficiency among pupils was also found to be low in Malaysia and the Philippines (Fajari, 2021; Mae F. Farillon, 2022). Additionally, research conducted in many Indonesian regions, including on the islands of Sumatra and Java, reported comparable cases (Alhamuddin & Zebua, 2021; Fadhil & Sabic-El-Rayess, 2021; Hidayati & Sinaga, 2019; Rachmatullah & Wiebe, 2022; Suparman et al., 2023; Zein et al., 2020). In certain nations, there may be a lack of emphasis on enhancing critical thinking skills due to educational systems whose structures and methods prevent students from actively participating in discussions, debates, and assessments of their own thought processes (Shaw et al., 2020). However, those kinds of exercises are vital in developing critical thinking.

The growth of education should support the best possible use of students' critical thinking abilities (Rebele & St. Pierre, 2019; Xu & Zhang, 2021). The development itself is inextricably linked to several studies that have fueled extensive conversations regarding maintaining the quality of instructional processes (Johannesson, 2022). Additionally, several studies have made an effort to determine the critical thinking proficiency of students in an effort to optimize the empowerment of critical thinking during educational activities (Sari & Prasetyo, 2021; Teng & Yue, 2023; Lancrin, 2023; Yuan et al., 2022). A wealth of data gathered from those numerous studies is commonly used as the foundation for both government policy and the lesson plans created by lecturers and teachers.

Many studies on critical thinking abilities have also been conducted in Indonesia, particularly in the context of language education. While some studies concentrated on the distribution of students' critical thinking abilities, others addressed the impact of particular instructional designs on students' capacity for critical thought (Marnita et al., 2020; Puspita & Aloysius, 2019; Risnanosanti et al., 2019). A study that addressed the connection between critical thinking ability and other aspects of learning achievement has also been conducted (Anggraeni et al., 2023). However, of all that research, not a single one made an effort to examine the data that has been published in each study.

This current study aims to gather information about a variety of studies discussing critical thinking skills in Indonesia using content analysis in many scientific language education journals published in Indonesia from 2016 to 2023. In more detail, the goals of this study were to respond to the following queries: (1) How did the number of studies on critical thinking abilities trend over the course of the year? (2) How did the various research

approaches applied to investigate critical thinking abilities in Indonesia turn out? (3) Which subject was most frequently examined in order to gauge pupils' capacity for critical thought? (4) What kind of interventions did the researchers use to help students become more adept at critical thinking? (5) What tools did the researchers employ to gauge the participants' ability to think critically? (6) What methods of data analysis did the researchers employ to examine critical thinking abilities? (7) How did the researchers' portrayal of their series of investigations into critical thinking skills turn out?

This study can be distinguished from other studies that also took critical thinking ability as their research focus in a few ways. First, this study focused on all articles accredited to the Science and Technology Index (SINTA) within the publication year of 2016 to 2023. Then, the primary goal of this study was to examine several articles that focused on critical thinking abilities. Lastly, the content analysis in this study was built upon a variety of factors.

METHOD

This research was conducted based on the principles of content analysis, which focuses on the findings of published studies. The research method was adapted from the method Susetyarini & Fauzi (2020) used. Data was obtained from papers published in language education publications across Indonesia from 2016 to 2023. The whole article was taken from language education journals registered at the Science and Technology Index (SINTA), which was a scientific and technology development platform (https://sinta.kemdikbud.go.id) conceived and built by The Indonesian Ministry of Research, Technology, and Higher Education in August 2023. Data was analyzed using the classical content analysis technique. Each paper was classified based on certain categories and aspects. Determining the category refers to the information contained in the paper, precisely in the abstract, method, and discussion. Subsequently, the data that has been collected was presented in the form of tables and graphs.

A set of content analysis guidelines with relevant elements under observation served as the study's instrument (Table 1). In this study, up to seven primary elements must be examined for content analysis. These aspects were as follows: (1) the number of publications per year; (2) types of research; (3) research subjects; (4) language education topics chosen for the studies; (5) treatments; (6) data collection instruments; and (7) data analysis methods. Exceptionally, the categories on aspects (1), (4), and (5) were not decided upon at the outset since there was no prior study that could refer to ascertain what belonged in the categories; there was a chance that overgeneralized categories would emerge from the content analysis of some articles. In addition, prior to data collection, categories on aspects (2), (3), (6), and (7) were established. Table 2 displays the categories taken from a previous study (Susetyarini & Fauzi, 2020). Additionally, aspect (2) was fur-

ther broken down into two sub-aspects: quantitative research design (2b) and generic sorts of study (2a).

Table 1. The Study's Aspects and Categories for Content Analysis

Aspects	Categories	
Types of research (2a)	A.1-Research&Development (R&D) A.2-Classroom Action Research (CAR)	A.3-Qualitative research A.4-Quantitative research
Types of quantitative research (2b)	B.1-Observation Studies (OS) B.2-Correlational Research (CR) B.3-Survey Research (SR) B.4-Pre-experimental Designs (PED)	B.5-True Experimental Designs (TED) B.6-Quasi-experimental Designs (QED) B.7-Ex-Post Facto Designs (EPFD)
Research subject	C.1-VII Grade JHS students C.2-VIII Grade JHS students C.3-IX Grade JHS students C.4-X Grade SHS students C.5-XI Grade SHS students C.6-XII Grade SHS students	C.7-Undergraduate students C.8-Postgraduate students C.9-JHS teacher C.10-SHS teacher C.11-Lecturer
Data collection instruments	D.1-Questionnaire sheet D.2-Observation sheet D.3-Test sheet	D.4-Interview sheet D.5-Unidentified
Data analysis methods	E.1-Mean E.2-Percentage E.3-N-gain E.4-T-test E.5-Analysis of Variance (ANOVA)	E.6-Analysis of Covariance (ANCOVA) E.7-Correlation E.8-Unidentified E.9-Others

RESULTS AND DISCUSSION

Results

Based on the data, it can be inferred that the study of critical thinking in the field of language education had increased from 3.51% in 2016 to 36.84% in 2023, although it was 0% in 2018. Moreover, it can also be stated that quantitative research was mostly used as a research type/design in publications between 2016 and 2023, reaching 54.39%. In contrast, the type of research that had never been used in that time span was qualitative, with a percentage of 0%. The second most used research type was Classroom Action Research or CAR (28.07%). The third most used research type is Research and Development or R&D, which reached 17.54%.

Specifically, the most widely used type of quantitative research from 2016 to 2023 was quasi-experimental design (QED), which reached 52.63%. Meanwhile, Observational Study (OS), Correlation Research (CR), and True Experimental Design (TED), which were other types of quantitative research, had never been used in that time span, with a percentage of 0%. The second most used quantitative research type was Survey Research (SR), which reached 31.58%. The third most used quantitative research type was

Pre-experimental Design (PED), which reached 10.53%. The fourth most used quantitative research type was Ex-Post Facto Design (EPFD), which reached 5.26%.

Regarding the research subject, the majority of the previous studies employed upper-secondary education students (first year of senior high school or X SHS). In contrast, middle or lower-secondary education students (third year of junior high school or IX JHS) were minimally used in those research studies, as the number of research employed them as research subjects was the lowest. A significant number of research studies have employed undergraduate students, although not as many as those with upper-secondary education students. Tests were the most common instruments for data collection, followed by observations. Interviews had not been employed as data instruments, though some research studies even had unidentified data instruments. In terms of methods for data analysis, the data analysis was dominated by the T-test, Analysis of Covariance (ANCOVA), and percentage analysis, highlighting the importance of mean comparison and variable control.

Discussion

Number of Publications

The number of publications published over time demonstrates how frequently research on a particular topic is done. Since 2016, several articles have analyzed critical thinking abilities, as referred to in Table 2 and Figure 1. The number of publications did not appear to be trending upward or downward over the years in the early timeframe of 2016-2019. Nonetheless, quite a significant number of publications have been made since 2019, as seen in Figure 1. A notable increase in the number of scholars motivated to investigate advanced critical thinking skills is indicated by the trend of growing publications about critical thinking skills.

Table 2. The Eight-year Increase Trend in the Number of Research Publications on Education in Indonesia that Emphasize Critical Thinking Abilities

Year	Number of Publications	Percentage
2023	21	36.84%
2022	11	19.30%
2021	9	15.79%
2020	6	10.53%
2019	7	12.28%
2018	0	0%
2017	1	1.75%
2016	2	3.51%

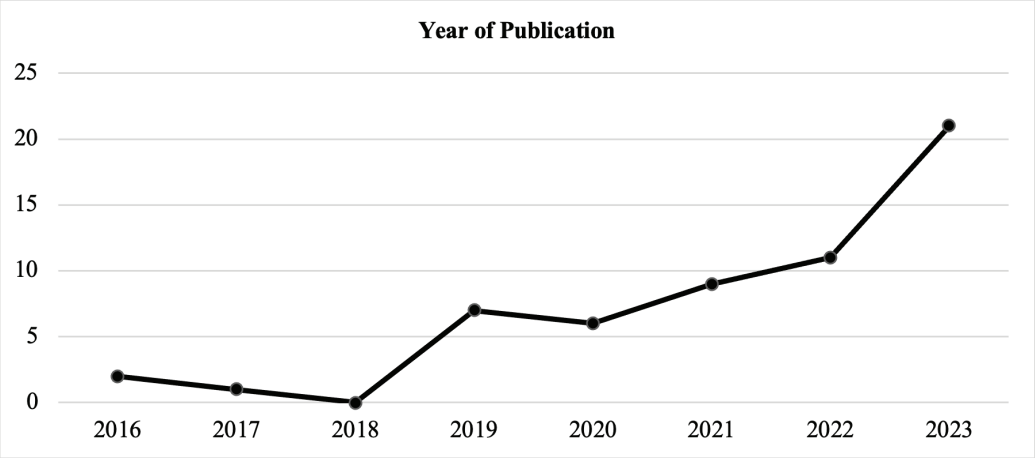

Figure 1. The Eight-year Increase Trend in the Number of Research Publications on Education in Indonesia that Emphasize Critical Thinking Abilities

The majority of the study that has been published stems from the researchers' awareness of challenges that frequently arise in their environment. One of the most prevalent problems is Indonesian pupils' poor critical thinking abilities. Therefore, it is thought that the best approach to solving this issue is to develop a well-thought-out study. Researchers can determine the best learning design or medium that best supports students' critical thinking abilities through well-designed and transparent research designs.

The more clearly written and well-designed study articles that focus on critical thinking abilities, the more beneficial they will be to Indonesia's educational advancement. This premise is predicated on the notion that enhancing educational practice and quality is the primary goal of a research paper's design (Billah et al., 2021; Diyah Nur Rahmawati et al., 2022). Additionally, a study paper will have an impact on educational practice and quality for a number of reasons, including: (1) its conclusions might be referred to as reliable data that educators can use; (2) its conclusions and the development models that are derived from research papers can serve as a crucial foundation for decisions on education made at the local, state, or institutional levels; and (3) its conclusions may have an impact on educators' perspectives. According to the data collected, it can be stated that the study of critical thinking in the field of language education has increased from 3.51% in 2016 to 36.84% in 2023, although it was 0% in 2018.

Types of Research

The focus of the research is determined by the design and type of inquiry. Quantitative research is the most common research design employed to examine critical thinking abilities, as shown in Table 3 and Figure 2. The greater proportion of quantitative research studies compared to other research kinds is consistent with the number of earlier studies that found aca-

demics prefer quantitative research designs over qualitative research when conducting research in education (Fernando & Suryaman, 2022; Firdaus et al., 2021; Rashid et al., 2019). Based on the data collected in the study, it can be stated that quantitative research was mostly used as a research type/design in publications between 2016 and 2023, reaching 54.39%. In contrast, the type of research that had never been used in that time span was qualitative, with a percentage of 0%. The second most used research type was CAR (28.07%). The third most used research type is R&D, which reached 17.54%.

Qualitative methods are still seen as relatively new in the field of educational research (Jefriyanto Saud et al., 2023; Permadi et al., 2022; Suherman, 2022). However, it has been demonstrated that the trend toward qualitative design is growing (Ngoc & Barrot, 2023; Pradana et al., 2022) and has focused on social research, including particular concerns related to education (Bulut-Sahin & Kondakci, 2023; Luo & Zou, 2022; Marzuki et al., 2023; Ramalingam et al., 2022). This has a lot to do with the benefits of using qualitative methods to fully and precisely define a phenomenon. Consequently, future researchers should take advantage of this absence of qualitative research to employ a qualitative design and concentrate on studying critical thinking abilities.

Table 3. The Distribution of Research-by-research Kind, with the Primary Concern Being Critical Thinking Skills

Types of Research	Number of Publications	Percentage
R&D	10	17.54%
CAR	16	28.07%
Qualitative	0	0%
Quantitative	31	54.39%

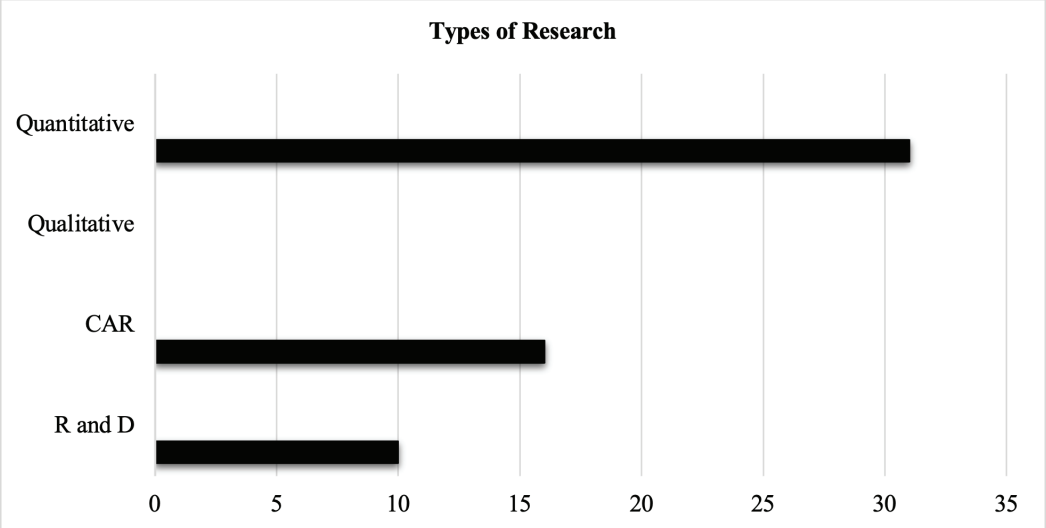

Figure 2. The Distribution of Research-by-research Kind, with the Primary Concern Being Critical Thinking Skills

However, the results of this study, which indicate the absence of R&D research on critical thinking abilities, contradicted the findings of another study. According to their analysis, the most popular category of study to be published in 2017 was R&D research (Hamamah et al., 2023; Zein et al., 2020). One of the newest developments in Indonesian educational research is R&D research. In this type of study, researchers frequently create instructional materials based on the outcomes and methodology of their prior investigations into pure language instruction. The goods may include training materials, books, or modules (Nur Huda et al., 2020). These investigations show that critical thinking abilities are still lacking as a basic building block for the R&D projects carried out by Indonesian researchers.

Table 4. The Diffusion of Quantitative Research Primarily Focuses on Critical Thinking Abilities in Indonesia

Types of Quantitative Research	Number of Publications	Percentage
OS	0	0%
CR	0	0%
SR	18	31.58%
PED	6	10.53%
TED	0	0%
QED	30	52.63%
EPFD	3	5.26%

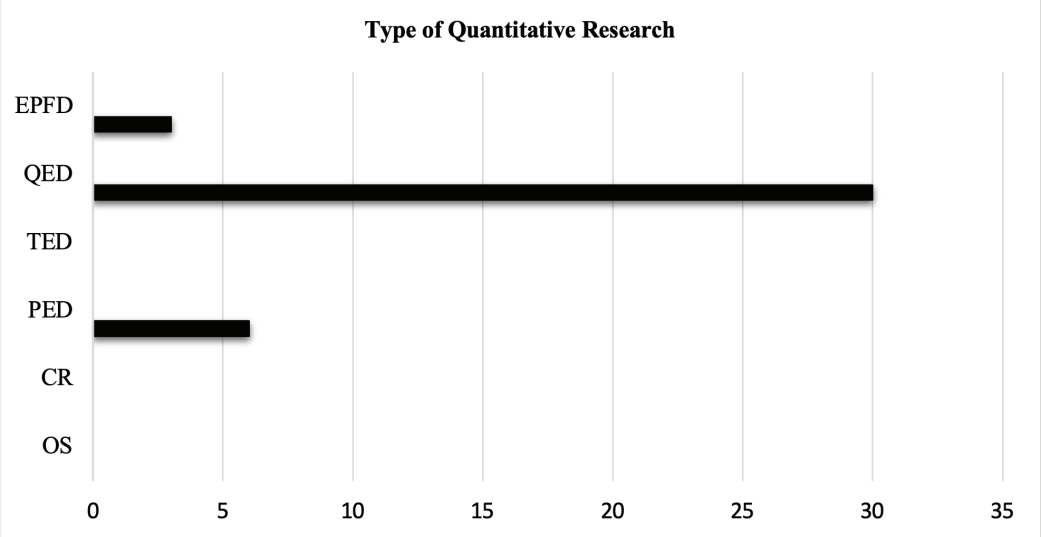

Figure 3. The Diffusion of Quantitative Research Primarily Focuses on Critical Thinking Abilities in Indonesia

In addition to the type of research, this study intends to disclose the distribution of quantitative research that researchers most frequently select. Based on this data, it can be said that the most widely used type of quanti-

tative research from 2016-2023 is QED, which reached 52.63%. Meanwhile, the types of quantitative research that have never been used in that time span are OS, CR, and TED, with a percentage of 0%. The second most used quantitative research type is SR, which reached 31.58%. The third most used quantitative research type is PED, which has reached 10.53%. The fourth most used quantitative research type is EPFD, which reached 5.26%.

Table 4 and Figure 3 indicate that the quasi-experimental approach is the most popular experimental study design in research on critical thinking skills. Researchers ought to choose the design that best fits their educational challenge because, in comparison to other experimental research designs, quasi-experiments are used much more frequently (Fitzgerald et al., 2023; Maulina et al., 2022; Wörner et al., 2022). The pre-experimental design was only discovered in two papers and was the least used experimental design (Novita Indriyati, 2019). However, there was no mention of the true experimental design, which is considered the hardest to apply to educational issues, in any of the papers that highlighted critical thinking abilities.

In quasi-experimental research, scientists examine different treatments to find which best develops critical thinking abilities. This kind of research is particularly notable for allowing researchers to assign a group of students from one or more classes as the experimental group and involve the entire class as the control group. Through the implementation of many interventions and the development of conjectures, researchers are able to determine which intervention best enhances students' critical thinking abilities. Because this type of study has specific requirements—such as randomly selecting and assigning participants—researchers are not required to think about a pure experimental design (Bedewy & Lavicza, 2023; Irwanto, 2023; Novita Indriyati, 2019; Rofiqah et al., 2020; Saputra & Salim, 2020; Saputri et al., 2019). Since most educational institutions have already divided their students into multiple classes, the researcher can only select which classes to include, making the true experimental design unfeasible for this study in particular. Furthermore, the researchers cannot randomly reselect pupils and divide them into multiple classes.

Researchers frequently select surveys in addition to experimental designs. Researchers can benefit from surveys in a number of ways, including cost-effectiveness, time-saving, and abundant data regarding the attitudes, beliefs, thoughts, and skills of the people they will be observing (Butani & Dallaghan, 2022; Parmini et al., 2023). Additionally, observational and correlational research are two quantitative studies that were rarely carried out. In fact, a study that used correlational research to emphasize critical thinking abilities was conducted in Indonesia, although it was not released in Indonesian publications (K. L. Ahmed et al., 2020; Ismawati & Sungkono, 2023). As a result, it is anticipated that the data produced and disseminated by this study will enhance subsequent investigations on critical thinking abilities in Indonesia.

Research Subjects

Students are the target audience for critical thinking skill empowerment. The quasi-experimental design is the one that researchers employ the most, according to the information about the sort of research. This suggests that the research project generally aimed to compare some of the most effective instructional strategies for enhancing students' critical thinking abilities. In order to test their hypotheses, researchers require study volunteers. Figure 4 shows that high school students are the most popular study subjects, followed by college students and junior high school students. This result is consistent with a study by Hafida Hamzaoui, who examined the content of all Indonesian language education studies published in 2023 (Mansouri & Hamzaoui, 2023).

The research by Joshua (S. Iliw-Iliw, 2023) further demonstrated the predominance of high school pupils. According to the research, two of the three subjects that had frequently been selected as the subject of study throughout the last 15 years are students' learning processes and conceptual comprehension. This result is consistent with the findings of Chiu-Lin Lai's (Lai, 2020) study, which showed that the term "students" ranks third in terms of searches for academic research. However, this study differs from the one conducted by Mustafa Uluocak, Süleyman Eroğlu, and Sercan Alabay (2022). According to Mustafa Uluocak, Süleyman Eroğlu, and Sercan Alabay's survey, professors and students in higher education were the most often used research subjects in Turkish education publications.

Table 5 and Figure 4 not only provide data comparisons of high school, college, and junior high school levels, but they also demonstrate that classes with higher levels of education are less likely to be chosen as research subjects. First graders in junior high school were often chosen, but third graders were hardly ever taken into consideration. In a similar vein, first-graders in high school had the highest frequency of inclusion in the study, whereas third-graders had the lowest. This situation is consistent with the trend that, because of the pressure of national tests, most institutions prefer to be selective when allowing researchers to undertake studies in the third grade of junior or senior high school. As seen in the table, the majority of research subjects were first-grade students at the upper secondary education level (first-graders of senior high school or X SHS). The number of research with students at the lower secondary level (third-graders of junior high school or IX JHS) as their subjects was the lowest. There is a significant amount of research with students at the undergraduate level as their subjects, although not as much as those with students at the upper secondary level.

Table 5. Distribution of Research Subjects in Educational Research in Indonesia with Critical Thinking Skills as the Main Concern

Research Subjects	Number of Publications
VII JHS	5
VIII JHS	3
IX JHS	0
X SHS	29
XI SHS	8
XII SHS	2
Undergraduate	10

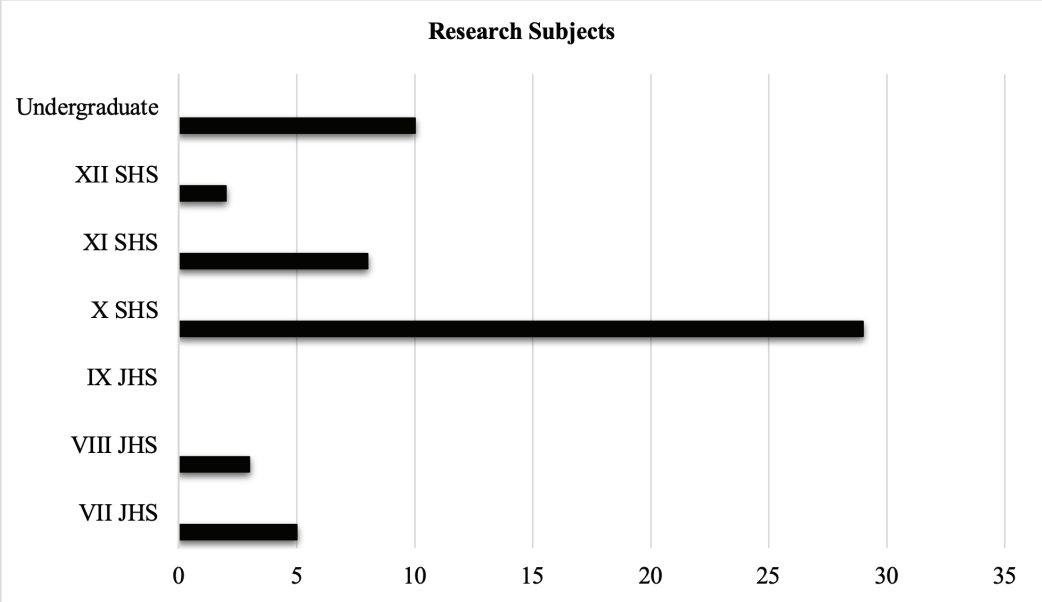

Figure 4. Distribution of Research Subjects in Educational Research in Indonesia with Critical Thinking Skills as the Main Concern

The Selected Language Education Topics When Conducting Research

One of the many sociocultural themes with a wide range of topics is language. Students perceive certain topics as easy and some as challenging (Rymes, 2020; Summer & Steinbock, 2023). Beyond this study, some publications focused on a single issue, while others covered multiple areas. The researchers commonly selected several themes to pilot their studies at the high school and junior high school levels, which are listed in Table 6 and presented in Figure 5. Research on language learning, in particular, was the most frequently selected topic. Thirty-seven papers that focused on language learning examined students' critical thinking abilities. Sadly, none of these papers provided background information on studying the relationships between language learning themes and students' critical thinking abilities.

Citing other studies, we can suggest that language acquisition is a difficult subject for students, as well as a theme in language study that is direct-

ly relevant to the activities being conducted in language education today (Trueswell, 2023). Previous research has highlighted the need to provide students with learning activities that enhance their critical thinking abilities when they are studying language-related subjects (Dhani et al., 2023). For the sake of reader openness, it is crucial to explain in detail why the topic of language learning was selected as the pilot for a study on critical thinking abilities.

Table 6. The Three Subjects in Language Learning that Educational Researchers in Indonesia Have Chosen with an Emphasis on Critical Thinking Abilities

Topics	Number of Publications
Model Language Education	10
English Education	10
Language Learning	37

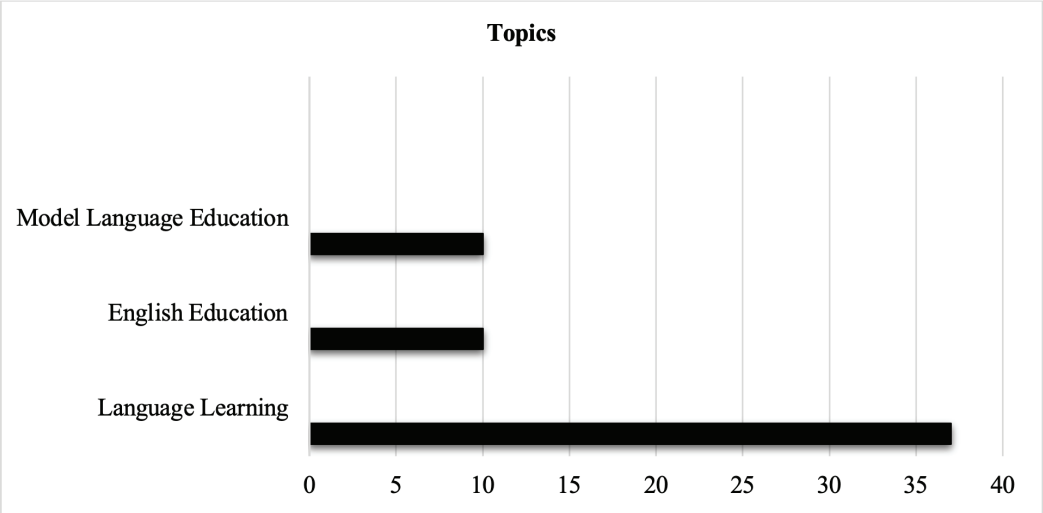

Figure 5. The Three Subjects in Language Learning that Educational Researchers in Indonesia Have Chosen with an Emphasis on Critical Thinking Abilities

Additionally, two other subjects that were frequently chosen as the primary focus of the study were model language methods and language learning (Table 6 and Figure 5). Each of the two was included in 35 publications that addressed critical thinking ability. As many as eleven publications under the heading of English education, like those on the theme of language acquisition, did not fully describe any background information pertaining to the factual state of students' critical thinking abilities. A study by Cong Li and Li Jian (2020) was the only one to provide an explanation for the choice of English education subjects, even if they had nothing to do with critical thinking abilities. The topic, according to the researchers, required a thorough examination of a wide range of English education-related concerns since intricate materials and theories were involved. Nonetheless, thorough research revealed that

language learning and model language methods were related to the subject of language acquisition. The commonality was that each of the ten subjects covered the interactions, functions, and outcomes of learning within a particular language education paradigm. According to this representation, Indonesian scholars were more likely to provide an answer for teaching language learners how to think critically and solve problems.

Treatments

Treatment was given to verify the researcher's hypothesis or determine the importance of particular conditions for each studied parameter. The most popular approaches in researching critical thinking skills are inquiry-based learning (IBL) and problem-based learning (PBL), as seen in Table 7 and Figure 6. As many as 49 publications employed PBL, while there were six that used IBL. The scientific approach was the third-most popular option after these two. In some ways, PBL is, in fact, similar to IBL. It is claimed that the latter serves as the former's primary basis. Furthermore, both fall within the scientific method. Fundamentally, PBL, IBL, and the scientific approach all rest on the same tenet: assisting students in carrying out a range of scientific tasks (El-Hani et al., 2020). A crucial aspect of science is critical thinking (Alam, 2022). As a result, educational initiatives that focus on scientific subjects have the best chance of fostering students' critical thinking abilities.

Table 7. Three Types of Treatments or Independent Variables Frequently Chosen in Indonesian Language Education Research, with Critical Thinking Skills as the Main Focus

Treatments/Independent Variables	Number of Publications
Problem-based learning	49
Inquiry-based learning	6
Scientific approach	2

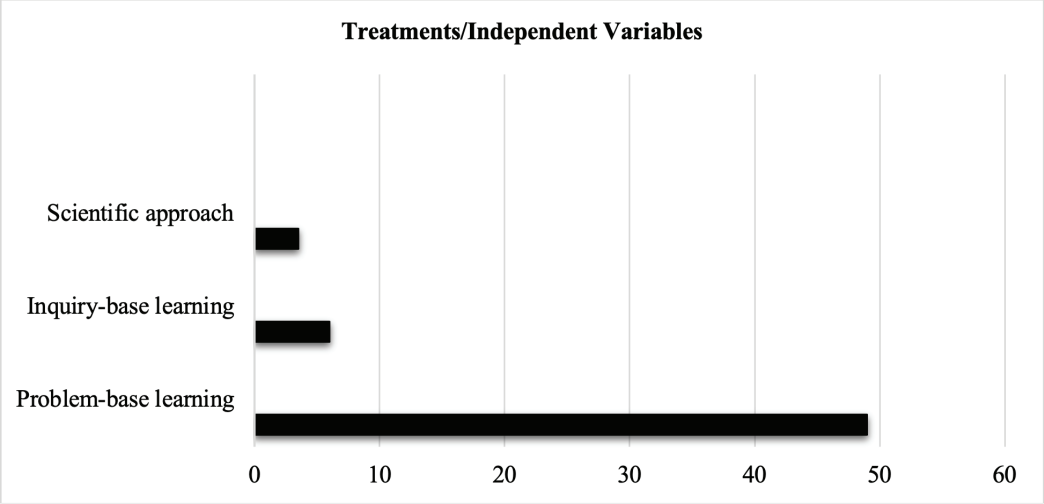

Figure 6. Three Types of Treatments or Independent Variables Frequently Chosen in Indonesian Language Education Research, with Critical Thinking Skills as the Main Focus

The results of this study also inform us that most researchers like to use a certain instructional design as the independent variable or treatment in their studies. However, despite the fact that demography is one of the deciding elements that is directly associated with student learning accomplishment, research on the influence of demographic factors is still uncommon in articles published in Indonesia. A number of studies have produced varying conclusions regarding the impact of demographic variables on students' critical thinking abilities. According to certain research, demographic factors have little bearing on pupils' critical thinking abilities (Ugwuozor et al., 2020). Furthermore, other research demonstrates that pupils' critical thinking abilities are highly influenced by their demographics (Ren et al., 2020). Thus, further research is required to determine how demographics affect students' critical thinking abilities.

Data Collection Instruments

Researchers need equipment to aid in the collection of data during the study. A number of tools that have been established by earlier scholars can be used to test students' critical thinking abilities. Tests are the most widely utilized instrument to gather information on critical thinking abilities, according to the statistics and graphs in Table 8 and Figure 7. In essence, students' responses to challenging questions can be used to assess or evaluate their critical thinking abilities. Furthermore, tests are thought to be a more objective data gathering than surveys and in-person inspections.

The ability of students to think critically can be assessed using a variety of examinations. The Cornell Critical Thinking Tests (CCTT) and the essays created by Zubaidah, Corebima, and Mistianah to evaluate critical thinking abilities are the most widely used ones in Indonesian publications (Himmatussolihah et al., 2020). Unfortunately, a number of researchers failed to disclose in their publications which instruments were employed to gather data on critical thinking abilities. Those particular researchers who employed tests as their primary method of collecting data also failed to disclose whether the validity and reliability of the instruments they used had been examined. It is crucial to remember that instruments' validity and reliability should be examined prior to utilization (Verawati et al., 2020). In other words, data validity and dependability are seen as significant in persuading the intended audience.

Table 8. Distribution of Instrument Selection for Data Collection in Several Educational Research Studies in Indonesia

Data Collection Instruments	Number of Publications
Questionnaire	3
Observation sheet	7
Test sheet	44
Interview sheet	0
Unidentified	3

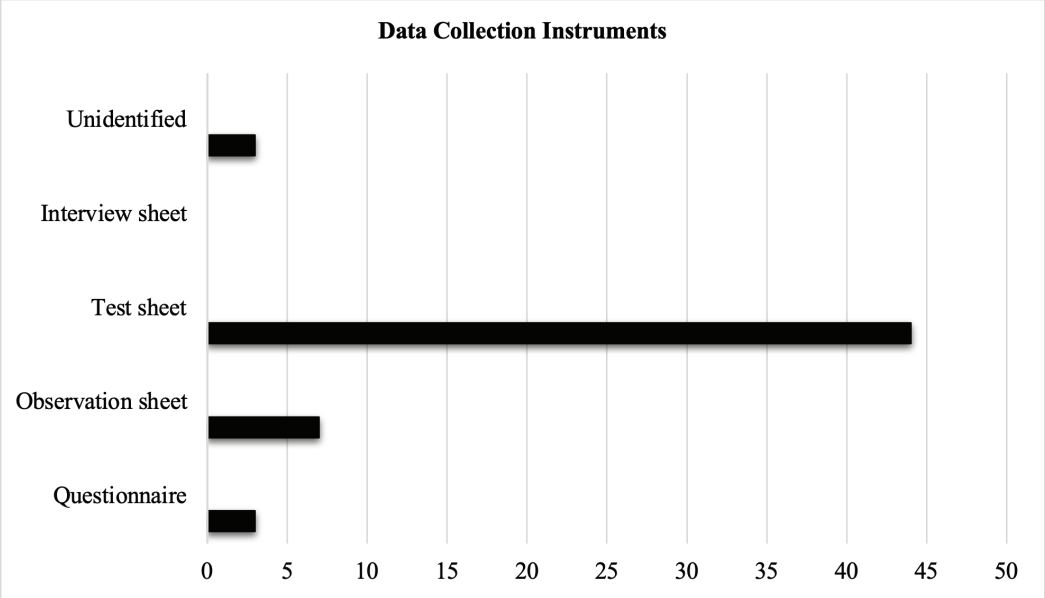

Figure 7. Distribution of Instrument Selection for Data Collection in Several Educational Research Studies in Indonesia

The instrument with the highest number of samples was the test sheet, which was used by 44 out of a total of 57 samples, indicating that tests are the most common method used in data collection. Observation sheets were used by 7 samples, indicating that observation is also fairly common. Questionnaires and unidentified instruments were each employed on 3 samples. However, since unidentified instruments are hardly defined, it is hard to draw further analysis on their use. No research in the samples used the interview sheet, indicating that interviews were not used as a data collection method in those research studies.

Data Analysis Methods

The degree of validity of a study will depend on how well the methods for data analysis are chosen. Referring to the data and graphs presented in Tables 2 and 5, we can observe that 34 studies employed quasi-experimental designs (Tables 4 and 3), and only seven of those studies employed ANCOVA as a method of data analysis (Table 9 and Figure 8). Additionally, Table 9 and Figure 8 demonstrate that the most popular data analysis technique was the t-test. The following explanation can explain why academics frequently use t-tests to compare the performance of two groups or classes. When the researchers use the t-test to evaluate the hypothesis, they find two general tendencies. In the first tendency, researchers had to take the post-test data from every class and use the t-test to analyze it. In the second tendency, the researchers consulted the pre-test and post-test data before determining the N-gain of the two datasets. After that, the t-test was used to investigate the N-gains for both classes. This tendency will reduce the validity of the research. The results of the research conducted by N. Badriyah, Anik

Anekawati, and Lutfiana Fazat Azizah (Badriyah et al., 2020) are consistent with the inaccuracy in applying data analysis techniques.

Table 9. Distribution of Data Analysis Method Selection in Several Education Research Projects in Indonesia

Data Analysis Methods	Number of Publications
Mean	5
Percentage	7
N-gain	6
T-test	20
ANOVA	3
ANCOVA	7
Mann-Whitney (MW)	3
Regression	3
Unidentified	3

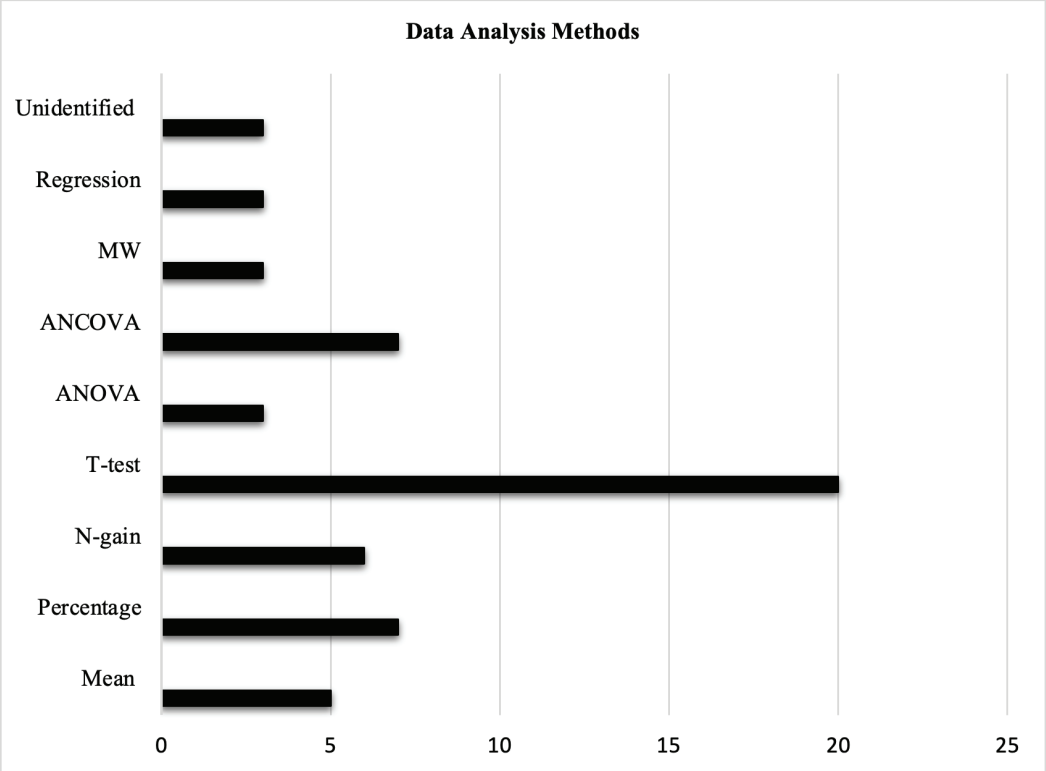

Figure 8. Distribution of Data Analysis Method Selection in Several Education Research Projects in Indonesia

It is highly advised that researchers employ ANCOVA, particularly when attempting to use a quasi-experimental design in which they are unable to choose individual students to be the participants of their study (only students in a designated class are eligible to be selected). Under these circumstances, researchers can manipulate external factors that could im-

pact the correlation between the independent and dependent variables by utilizing ANCOVA. Additionally, ANCOVA can be used to find changes in the corrected mean between groups depending on the pre-test data's representation of the study participants' characteristics (Huitema, 2020; Y.-F. Lee et al., 2022). In conclusion, ANCOVA is advised for quasi-experimental research involving pre-test and post-test data.

As mentioned before, the T-test was the most commonly used analysis, which had been performed 20 times, indicating that comparison of means was paramount in data analysis. In addition, ANCOVA was also used significantly (7 times), indicating that the study also involved significant variable control. Percentage analysis was also conducted frequently (7 times), indicating the possibility of analyzing data based on percentages of the total or certain parts. Meanwhile, means and N-gains were used 5 and 6 times, respectively, indicating that the study also involved analyzing the mean and change in values in the pre-intervention and post-intervention measurements. ANOVA, MW, Regression, and unidentified data analysis methods were used 3 times each. However, it is hard to draw further conclusions about the applications of unidentified data analysis methods.

CONCLUSION

This study analyzed papers highlighting critical thinking abilities published in Indonesian language education journals between 2016 and 2023. Since the last three years, there has been a rise in the number of publications highlighting critical thinking abilities. The majority of the hundreds of papers are quantitative studies. Furthermore, language learning was the most chosen topic, and the majority of the research subjects were first-graders in senior high schools. Test sheets and t-tests were the most often employed instruments for data collection and analysis, whereas PBL was the most commonly administered treatment. Several suggestions for more research have been offered in light of the study's findings. First, it is necessary to do more qualitative studies on the growth of critical thinking abilities regularly. Second, research and development for educational materials should be aimed at raising pupils' still-poor critical thinking abilities. Third, it is imperative that researchers possess comprehensive knowledge regarding their research instruments, including their validity and reliability. Lastly, it is advised that researchers select the test that best fits the hypothesis and research design when conducting research.

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