Plagiarism Check

by Muhammad Fayakuun

Submission date: 13-May-2023 05:21AM (UTC-0400)
Submission ID: 2092032338
File name: Bismillah_Ya_Allah_ACCEPTED_1.docx (441.71K)
Word count: 4916
Character count: 30505

Jurnal Elemen, 9(1), 1-10, January 2023
https:/doi.org/10.29408/jel.v9i1.XXXX

e- ISSN: 2442 - 4226

Check for updates

Content analysis: Flipped Classroom of Mathematics Creative Thinking, Critical Thinking, and Problem-Solving skills

Muhammad Fayakuun [1 *], Arief Agoestanto [2]

[1, 2] Department of Mathematics, Universitas Negeri Semarang, Central Java, Indonesia

[*] Correspondence: correspondingauthor@university.ac.id (11-point)

Abstract (12-point, bold)

Studies on mathematics education research methodologies should advise future researchers on best practices. Unfortunately, this study is scarce. This study examined the diversity of research types, research subject, mathematics topics, research variable, data collection tools, test design, data analysis method, and learning media in articles published in Scopus, ERIC, and Garuda databases of mathematics educational journals in 2018. 22 articles were evaluated in this content analysis study. The results showed that the most type, quantitative, research subject, topic chosen in mathematics, research variable, data collecting tools, type of design, data analysis techniques, and learning media were quasi-experimental design, VIII junior high school students, three-dimensional shape, problem-solving, test sheet, pretest-posttest, t-test, video. In conclusion, flipped classroom mathematics research papers have grown, with the maximum number in 2022. Based on this study's results, several suggestions have been made for further research on flipped classrooms of creative, critical, and problem-solving abilities. These include diversifying study types and using more accurate data analysis methods.

Keywords: mathematics educational journals; flipped classroom; creative thinking skills; critical thinking skills, problem-solving skills

How to cite: Author One, Author Two, & Author Three. (2023). The title should be written in sentence case with 14 words maximum and using times new roman. *Jurnal Elemen, 9*(1), 1-10. https://doi.org/10.29408/jel.v9i1.XXXX

Received: Date Month Year | Revised: Date Month Year
Accepted: Date Month Year | Published: Date Month Year

Introduction

Technology had grown rapidly in recent years (Duan et al., 2019; Garrido, 2012; Paschen et al., 2019; Prakash et al., 2013; Soc et al., 2020). Technology allows computers to learn from experience and perform tasks which previously only humans could do that (Riedl, 2019; Zanzotto, 2019). In many industries, technology had brought higher efficiency and productivity, as well as improved service quality for customers (Li et al., 2022; Ostrom et al., 2019; Xu et al., 2020). As a human being, we need the ability to survive in technology era (Ormerod, 2021). Individuals with strong psychosocial competence are more likely to enhance their chances of survival (Bhat & Aminabhavi, 2011; Sukenti et al., 2021). According to WHO in (Joynes et al., 2019), creative thinking, critical thinking, and problem-solving were skills needed to have psychosocial competence. The United Kingdom's teacher and elsewhere are being urged to encourage student's creativity in all course material subjects, including mathematics, because creativity is that personal activity aim on producing a new thing and unpredictable, thus fostering creativity with guidance could help to raise the learner's character growth (Sriwongchai, 2015). The innate ability to think critically is not inherent in students, and their previous educational encounters may not have necessitated such thinking, so it means that educators who aim to incorporate this skill into their instructional practices must first exemplify the behaviour thus students must acquire the ability to think critically before they can effectively employ it in various content scenarios (Ebiendele Ebosele Peter, 2012). Colombia University students may arrange multi-assignment projects in computer design, business networking, and mathematical function systems using critical thinking (Facione, 2011). Students may use their multi-disciplinary skills to problem-solving in these multi-projects (Yanuarto & Hapsari, 2022). Individuals must master mathematics creative thinking(MCeT), critical thinking(MCiT), and problem-solving(MPS) skills to compete in the worldwide competition of the twenty-first century (Setiana et al., 2021).

Improving in creative thinking (Alkhatib, 2019; Maharani, 2014; Sari et al., 2018; Yayuk et al., 2020), critical thinking (Aizikovitsh-Udi & Amit, 2011; Alkhatib, 2019; Ebiendele Ebosele Peter, 2012), and problem-solving (Alkhatib, 2019) skills in mathematics was needed effective learning models (Sanders, 2016; Simanjuntak et al., 2021). One of effective learning models is flipped classroom because it can improve MCeT, MCiT, and MPS skills in mathematics (Al-Zoubi & Suleiman, 2021; Atwa et al., 2022; Azizah et al., 2022; Puspitasari et al., 2020; Ramadhani et al., 2020; Wei et al., 2020). The learning sessions are broken up into two different types under the flipped classroom model: individual learning sessions and face-to-face sessions with the teacher (Bergmann, J., & Sams, 2012). Students have a greater degree of flexibility in terms of the rate at which they study and how they use their time when they participate in independent learning sessions, which provide them the ability to make their own use of learning materials (Horn & Staker, 2012; Vogelsang et al., 2019).

In international and national research, several studies on flipped classroom of MCeT, MCiT, and MPS skills are founded, notably in the context of mathematical education. Studies that examine the effects of media learning (Ariani et al., 2022; Tabieh & Hamzeh, 2022), another study discuss about learning challenges in flipped classroom to improve critical thinking

(Yuliana et al., 2022). The correlation between flipped classroom of MCeT, MCiT, and MPS and other measures of academic success has also been investigated (Chang et al., 2020; Widya Pratama, 2019). However, none of the studies reviewed the research information that has been conducted.

The use of content analysis on many scientific journals data in Scopus, The Education Resources Information Centre (ERIC), and *Garba Rujukan Digital* (Garuda) databases which was published from 2018 to 2023, the purpose of the present research was to gather data on several papers that discussed flipped classroom of MCeT, MCiT, and MPS skills. The following topics were specifically addressed by this study: (1) How was the trend of the number of research on flipped classroom of creative thinking, critical thinking, and problem- solving skills from year to year? (2) How were the various study methods used to examine flipped classroom of MCeT, MCiT, and MPS skills? (3) What was the utilization of diverse research designs in quantitative research to explore flipped classroom of MCeT, MCiT, and MPS skills? (4) Who was the most frequent to be subject in the research flipped classroom of MCeT, MCiT, and MPS skills? (5) What was the subject matter employed to examine the academic performance of students on flipped classroom of MCeT, MCiT, and MPS skills? (6) What were the data collecting tools used by the researchers to measure flipped classroom of MCeT, MCiT, and MPS skills? (7) What was the most frequent type of test design and learning media used to investigate flipped classroom of MCeT, MCiT, and MPS skills? (8) What were types of test design usually used on flipped classroom of MCeT, MCiT, and MPS skills? (9) What data analysis techniques did the researchers employ to analyze the flipped classroom of MCeT, MCiT, and MPS skills? (10) What was the most frequently learning media that used on flipped classroom of MCeT, MCiT, and MPS skills? (11) What is the accuracy of researchers in using good data analysis methods and techniques on flipped classroom of MCeT, MCiT, and MPS skills?

This study differs from previous ones that focused on the skills of MCeT, MCiT, and MPS in mathematics due to the utilization of the flipped classroom treatment in certain components. The present investigation centered on comprehensive articles that were published between 2018 and 2023, inclusive of Scopus, ERIC, and Garuda databases. The present study was dedicated to examining several articles that centered on the implementation of the flipped classroom approach in the context of developing MCeT, MCiT, and MPS skills. Thirdly, diverse parameters were employed as the basis for conducting content analysis.

Methods

The study utilized content analysis as its primary methodology, with a specific focus on analysing findings from various scientific journals that were indexed in Scopus, ERIC, and Garuda. The research method employed was comparable to the ones utilized by Fauzi & Pradipta, 2018; Susetyarini & Fauzi, 2020; Turmuzi et al., 2023.

Data Sources

The data was collected through a content analysis of articles related to mathematics education, utilizing a specific keyword: (1) flipped classroom; and (2) mathematics critical thinking skill or mathematics creative thinking skill or mathematics problem-solving skill in Scopus, ERIC, and Garuda databases on April 2023 which was published from 2018 to 2023. Scopus is one of credible database in the world. ERIC is an internet-based repository of educational research and information, supported by the Institute of Education Sciences (IES) within the United States Department of Education. Garuda is the database that created by Indonesian Central Government.

Inclusion & Exclusion

All the literature acquired during the identification phase was reviewed and chosen as the main research using two criteria, namely inclusion and exclusion. The inclusion criteria in this review are: (1) journal or academic proceeding; (2) related to flipped classroom and mathematics critical thinking or creative thinking or problem-solving skills; (3) published in January 2018 to April 2023; (4) in mathematics education scope. The exclusion criteria in this review are: (1) not journal and academic proceeding; (2) not related to flipped classroom and mathematics critical thinking or creative thinking or problem-solving skills; (3) not published from January 2018 to April 2023; (5) not mathematics education scope.

Study Selection Process

By using keyword TITLE-ABS-KEY("flipped classroom") AND TITLE-ABS-KEY("mathematics" or "mathematical) AND TITLE-ABS-KEY("critical thinking" or "creative thinking" or "problem-solving") in Scopus, there was 44 papers. Then, by using keyword "flipped classroom" AND (mathematics OR mathematical) AND ("creative thinking" OR "critical thinking" or "problem-solving") in ERIC, there was 70 papers. By using keyword related to flipped classroom and mathematics critical thinking skill or mathematics creative thinking skill or mathematics problem-solving skill in English term and Indonesian term, in Garuda, there was 15 papers. After removing duplicate articles, unavailable articles, and papers that did not match the inclusion criteria, twenty-two papers were acquired for content analysis.

Research Instruments

The research employed a content analysis guide to examine relevant features (refer to Table 1). This study involved the assessment of up to nine distinct elements for the purpose of conducting content analysis. The aforementioned factors encompassed various aspects such as the annual publication count, research types, quantitative research types, research subjects, mathematical topics chosen for the studies, research variables, data collection instruments, test design types, data analysis methods, and learning media. The categories for components (1), (5), and (10) were not selected initially due to the absence of prior studies that could have served as a reference point for determining the constituents of these categories. Additionally, there was a possibility of the emergence of excessively broad categories following the content analysis of certain articles. Furthermore, the establishment of component categories (2), (3), (4), (6), (7),

(8), and (9) preceded the process of data collection. Table 1 displays the categories, which have been derived from previous studies by Fauzi and Pradipta (2018), Susetyarini and Fauzi (2020), and Turmuzi et al. (2023), with certain alterations. **Data Analysis**

Each data from the articles that have been collected will be included in the analysis component. Abstract, methods, and discussion parts will be the main considerations in this selection. Then, the results will be entered in the form of a bar chart.

Table 1. The Components and Categories used for Content Analysis in the Study

Component	Categories	
Type of research	A1-Quantitative A2-Qualitative A3-Research and Development (R&D)	A4-Class Action Research (CAR) A5-Mixed Method A6-Literature Study
Type of Quantitative Research	B1-Observation studies (OS) B2-Correlational research (CR) B3-Survey research (SR) B4-Pre-experimental designs (PED)	B5-True experimental designs (TED) B6-Quasi-experimental designs (QED) B7-Ex post facto designs (EPFD)
Research subject	C1-VII grade junior high school (JHS) students (VII) C2-VIII grade JHS students (VIII) C3-IX grade JHS students (IX) C4-X grade senior high school (SHS) students (X)	C5-XI grade SHS students (XI) C6-XII grade SHS students (XII) C7-Undergraduate/pre-service teacher C8-Others
Research Variable	D1-Creative thinking skill D2-Critical thinking skill	D3-Problem-solving skill
Data Collection Instruments	E1-Questionnaire sheet E2-Observation sheet E3-Test sheet	E4-Interview sheet E5-Unidentified
Type of Test Design	F1-Pretest-posttest F2-Posttest Only	
Data Analysis Techniques	G1-Mean/SD G2-Frequency/Percentage G3-Gain score/N-Gain G4-T-test G6-ANOVA G7-ANCOVA	G8-MANOVA G9-MANCOVA G10-Correlation G11-Regression G12-Factor analysis G13-Non-parametric tests G14-Others

Results

Trend of Publications

The trend of publications that were published throughout a certain time period provided an indication of the amount of relevant research that was carried out during that time. Based on the graphical representation in Figure 1, it can be inferred that scholarly articles pertaining to the evaluation of flipped classroom with MCeT, MCiT, and MPS research have been accessible since 2018.

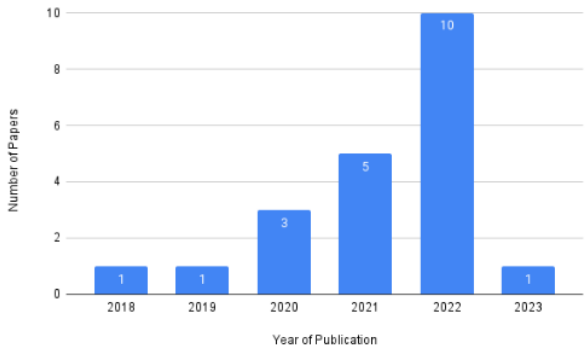

Figure 1. Flipped Classroom Trend in the Quantity of Educational Studies in MCeT, MCiT, and MPS Skills

There was a certain shift pattern that occurs in the number of annual publications, which continues to increase from 2019 to 2022. The observed trend of a rising number of publications on flipped classrooms that incorporate creative thinking skills, critical thinking, and problem-solving skills indicates a notable increase in the number of researchers who are actively exploring higher-order flipped classrooms with these skills. However, the research of flipped classrooms with these skills was decreasing in 2023 inferred that researchers are not yet of flipped classrooms with these skills have been published in scientific journals before April 2023.

Types of Research

The various approaches that might be used in the research are referred to as "types of research.". Based on the chart in Figure 2, most of the types of research used were quantitative with 16 articles, followed by literature study and mixed method with two articles, and one research and development article. No one has done qualitative research and classroom action research on this topic.

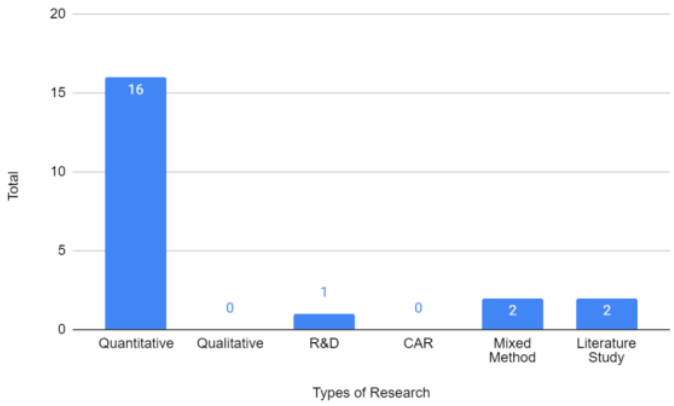

Figure 2. The Distribution of Research Types that Used on Articles of Flipped Classroom of Mathematics MCeT, MCiT, and MPS Skills.

Types of Quantitative Research

Quantitative research involves the systematic collection and analysis of numerical data in order to test a hypothesis or identify patterns and correlations within the data. Quantitative Research is most of the types of research used on this topic. There are several types of quantitative research. Figure 3 shown that a quasi-experimental design is the most widely used type of quantitative research, as many as 15 times. Followed by pre-experimental design three times and true-experimental design once. While other types of research do not yet exist.

Research Subjects

The empowerment of flipped classroom in MCeT, MCiT, and MPS skills was students to be target from junior high school to highest educational levels.

Figure 4 depicts the variety of study subjects in the research articles that were analyzed for this study. According to the graph in Figure 4, the research subjects most commonly utilized in the 22 publications evaluated were VIII junior high school students (27.27%). After VIII junior high school students, the second most common study subjects were VII junior high school students (18.18%). The third most common study subject, there were three study subjects as follows: X senior high school students, XI senior high school students, and undergraduate (13.64%).

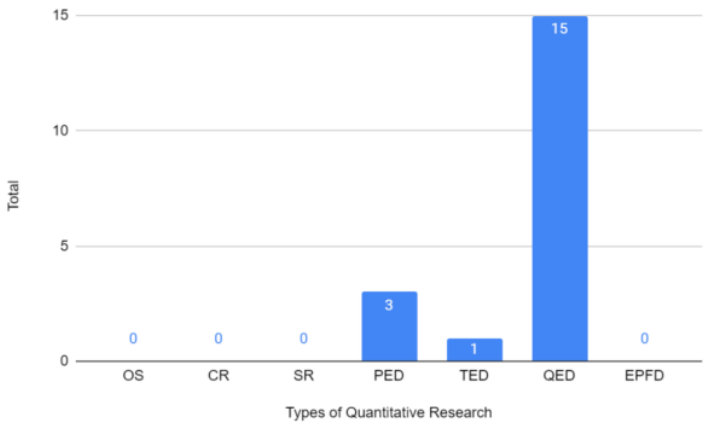

Figure 3. The Distribution of Quantitative Research Types that Used on Articles of Flipped Classroom of Mathematics MCeT, MCiT, and MPS Skills.

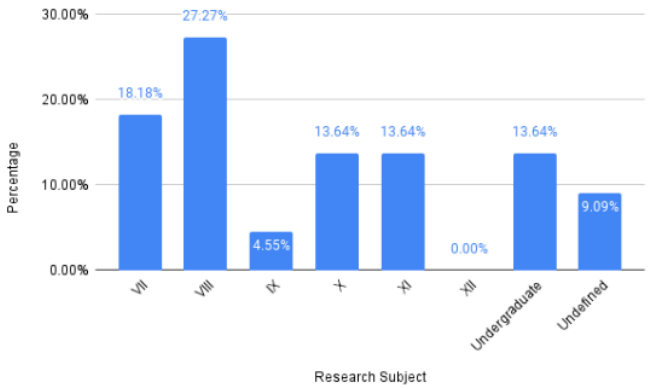

Figure 4. Research Subject in Select Educational Studies with A Primary Focus on Flipped Classroom of MCeT, MCiT, and MPS Skills.

Research Discussion Material

Mathematics is one of scientific disciplines with various subjects. Some topics are deemed simple while others remain challenging for students. Several publications deviated from the analysis by focusing on a single topic, whereas other sources highlighted multiple topics.

Based on Figure 5, multiple topics in mathematics were chosen to pilot the researcher in the school with the superior topics in mathematics was three-dimensional shape (21.43%) to know the effectiveness flipped classroom of MCeT, MCiT, and MPS skills. By researcher, to

pilot the research based on Figure 5 can use to be reference in research study. The frequent mathematics topics were Three-dimensional shape (21.43%), Algebra (14.29%), and Integral (14.29%) to assess students in flipped classroom of MCeT, MCiT, and MPS skills.

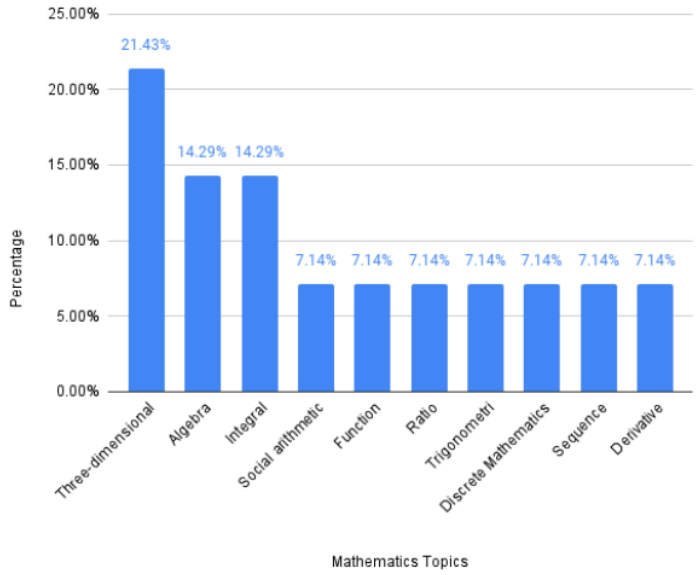

Figure 5. Mathematics Topics in Educational Researches in Flipped Classroom of MCeT, MCiT, and MPS Skills

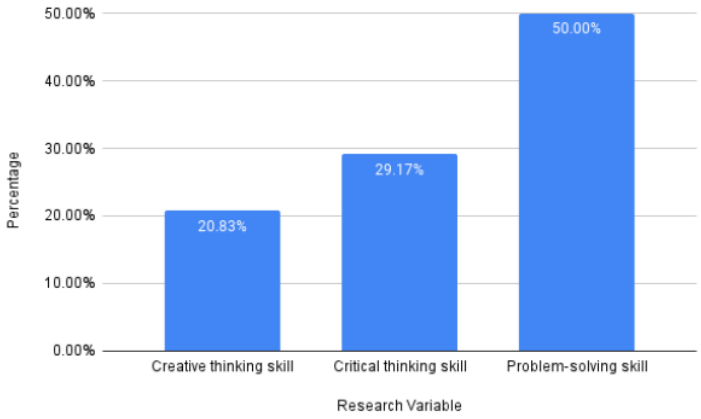

Figure 6. Research Variables of Flipped Classroom as Main Concern

Research Variables

A number of studies, each of which was used a different set of factors in researcher investigations. The diversity research variables are presented in Figure 6. According to the trend in Figure 6, studies that investigated problem-solving skill (50%) in flipped classroom were the most prevalent. The second and the third skills to be the research variables are critical thinking skill (29.17%) and creative thinking skill (20.83%), respectively.

Data Collection Instruments

Data collection instruments mean tool to gather information on substantially identical items. Because there are only 2 literature studies, then test sheet is the most chosen tool on this topic, as many as 19 times. Questionnaire sheet and observation sheet was used once. Also, interview sheet was used 2 times and there were 2 articles that wasn't tell what instrument to use. This information shown in Figure 7.

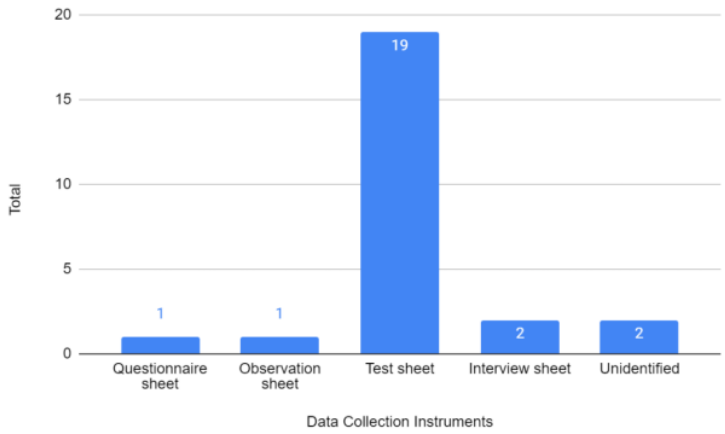

Figure 7. The Distribution of Data Collection Instrument that Used Articles of on Flipped Classroom of Mathematics MCeT, MCiT, and MPS Skills

Type of Test Design

Based on Figure 8, there were only 2 types of test designs used, namely pretest-posttest (15) and posttest only (4). It was indicate that pretest-posttest was commonly used in the research of articles reviewed.

Data Analysis Techniques

Data analysis techniques is the process of extracting useful information by analysing data. In Figure 9, data analysis techniques that used on article of flipped classroom of mathematics MCeT, MCiT, and MPS skills was shown. The most utilized data analysis techniques were t-test (8), N-gain (4), ANOVA (4), and MANCOVA (4). Besides that, percentage, correlation, regression, and factor analysis were not found in any articles.

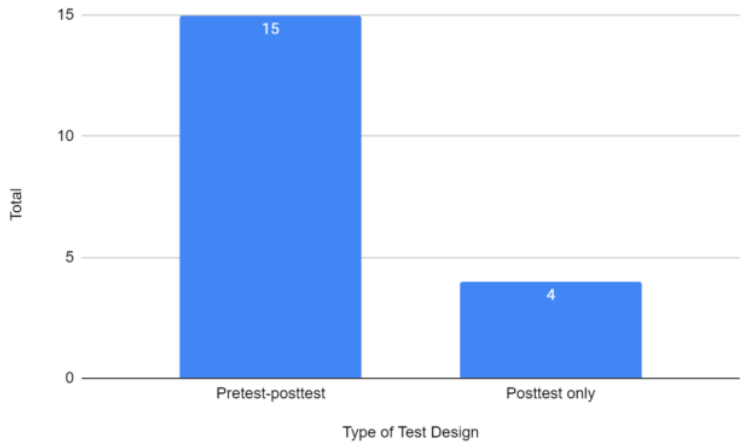

Figure 8. The Distribution of Test Design Type that Used on Articles of Flipped Classroom of Mathematics MCeT, MCiT, and MPS Skills

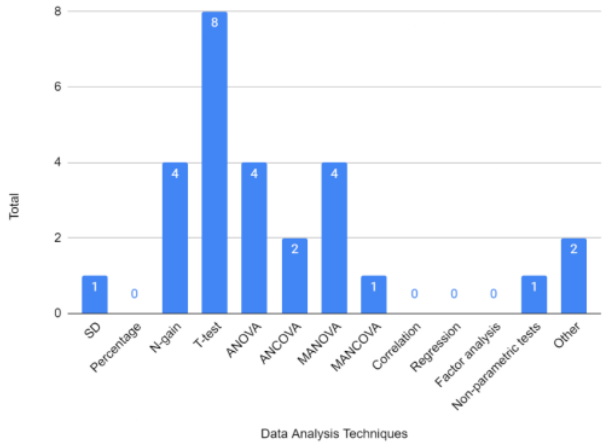

Figure 9. The Distribution of Data Analysis Techniques that Used on Articles of Flipped Classroom of Mathematics MCeT, MCiT, and MPS Skills.

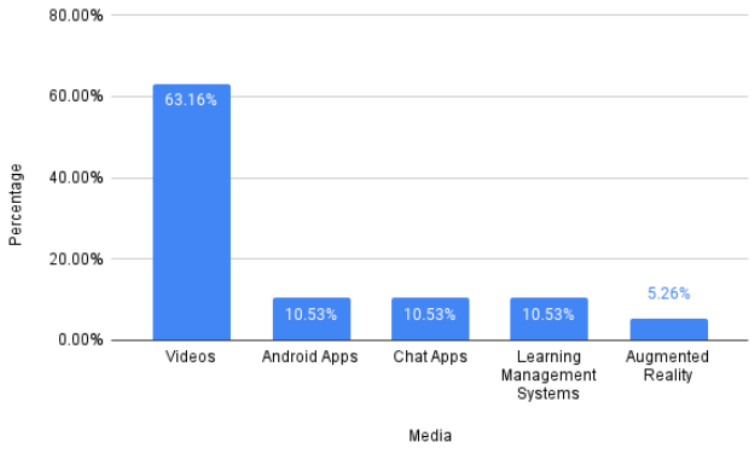

Figure 10. Learning Media Used

Learning Media

Learning media to assess students' MCeT, MCiT, and MPS in flipped classroom shown in Figure 10. Based on Figure 10, the most frequent used to be learning media was videos (63.16%). The second learning media of this focus study is Android Apps (10.53%), Chat Apps (10.53%), and Learning Management Systems (10.53%). In addition, Augmented Reality (5.26%) is the most rarely founded in research study throughout 2018.

Discussion

Data Analysis Techniques

This study showed positive results in the selection of test designs conducted by the researchers because quasi-experiments using the post-test only design were not recommended. According to Krishnan (2019), quasi-experiments using a post-test only design have low inference power, easily threatened internal validity, and uncontrollable external variables. Unfortunately, in the selection of data analysis techniques, it shows negative things. According to Susetyarini & Fauzi (2020), ANCOVA is strongly recommended than t-test for quasi-experiments using the pretest-posttest design. In this study, it shows that the t-test is the one that is widely used than ANCOVA or MANCOVA. ANCOVA is very useful in eliminating uncontrolled external variables. Based on this study, the recommendation for the next researcher is using ANCOVA if using quasi-experimental design in a pretest-posttest .

Media – Type of Research

Flipped classroom of mathematics MCeT, MCiT, and MPS really needs media, especially video because it is used the most for media learning (see Figure 10), but it was contrary with type research used rarely (see Figure 2) is Research and Development (R and D). Making video to use in flipped classroom of mathematics MCeT, MCiT, and MPS is very challenging (Voogt et

al., 2013) such as the content quality, easier to understand, etc. In other hand, to make video learning firstly researchers have to do R and D. According to Fatahillah et al., 2020 R and D is needed in effective and valid learning media. In this study, the recommendation for the next research uses R and D on the type of research in the flipped classroom of creative, critical thinking, and problem-solving skills.

Conclusion (14-point, bold)

Research articles in the subject of mathematical education that were published in Scopus, ERIC, and Garuda were used for the content analysis research in this study. The publications trend in flipped classroom of creative thinking, critical thinking, and problem solving skills since 2018 has the highest number appeared in 2022. There was a diversity of research types, research subject, topics in mathematics, research variable, data collecting tools, type of test design, data analysis method, learning media used in the various articles. The quantitative method of research was the one that appeared in published publications the most often. Quasi-experimental design, VIII junior high school students, three-dimensional shape, problem-solving, test sheet, pretest-posttest, t-test, video were the most research in quantitative, research subject, topic chosen in mathematics, research variable, data collecting tools, type of design, data analysis techniques, learning media respectively that often be chosen.

Acknowledgment (13-point, bold)

The authors wish to express their gratitude to those who contributed to the writing of this article,

Conflicts of Interest (13-point, bold)

The authors assert that there are no conflicts of interest pertaining to the publication of this manuscript. Furthermore, the authors have addressed the ethical concerns pertaining to plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies.

Funding Statement (13-point, bold)

This work received no specific grant from any public, commercial, or not-for-profit funding agency.

Author Contributions (13-point, bold)

Muhammad Fayakuun: Conceptualization, writing - original draft, investigation, methodology and visualization; **Arief Agoestanto:** Writing - review & editing, formal analysis, and validation.

References

Aizikovitsh-Udi, E., & Amit, M. (2011). Developing the skills of critical and creative thinking by probability teaching. *Procedia - Social and Behavioral Sciences*, *15*, 1087–1091. https://doi.org/10.1016/j.sbspro.2011.03.243

Al-Zoubi, A. M., & Suleiman, L. M. (2021). Flipped classroom strategy based on critical thinking skills: Helping fresh female students acquiring derivative concept. *International Journal of Instruction*, *14*(2), 791–810. https://doi.org/10.29333/iji.2021.14244a

Alkhatib, O. J. (2019). A Framework for Implementing Higher-Order Thinking Skills (Problem-Solving, Critical Thinking, Creative Thinking, and Decision-Making) in Engineering Humanities. *2019 Advances in Science and Engineering Technology International Conferences, ASET 2019*, 1–8. https://doi.org/10.1109/ICASET.2019.8714232

Ariani, D. N., Sumantri, M. S., & Wibowo, F. C. (2022). The Impact of Android Module-Based Inquiry Flipped Classroom Learning on Mathematics Problem Solving and Creative Thinking Ability. *International Journal of Interactive Mobile Technologies*, *16*(24), 32–46. https://doi.org/10.3991/ijim.v16i24.35749

Atwa, Z., Sulayeh, Y., Abdelhadi, A., Jazar, H. A., & Eriqat, S. (2022). Flipped Classroom Effects on Grade 9 Students' Critical Thinking Skills, Psychological Stress, and Academic Achievement. *International Journal of Instruction*, *15*(2), 737–750. https://doi.org/10.29333/iji.2022.15240a

Azizah, T., Fauzan, A., & Harisman, Y. (2022). "Flipped Classroom Type Peer Instruction-Based Learning" Based on a Website To Improve Student'S Problem Solving. *Infinity Journal*, *11*(2), 325. https://doi.org/10.22460/infinity.v11i2.p325-348

Bergmann, J., & Sams, A. (2012). Flip your classroom: reach every student in every class every day. In *Eugene, Or. : Alexandria, Va. : International Society for Technology in Education*.

Bhat, A., & Aminabhavi, V. (2011). Home Environment and Psychosocial Competence of Adolescents. *Journal of Psychology*, *2*(1), 57–63. https://doi.org/10.1080/09764224.2011.11885464

Chang, C.-Y., Kao, C.-H., & Hwang, G.-J. (2020). Facilitating Students' Critical Thinking and Decision Making Performances. *Educational Technology & Society*, *23*(2), 32–46. https://www.jstor.org/stable/26921132

Duan, Y., Edwards, J. S., & Dwivedi, Y. K. (2019). Artificial intelligence for decision making in the era of Big Data – evolution, challenges and research agenda. *International Journal of Information Management*, *48*(January), 63–71. https://doi.org/10.1016/j.ijinfomgt.2019.01.021

Ebiendele Ebosele Peter. (2012). Critical thinking: Essence for teaching mathematics and mathematics problem solving skills. *African Journal of Mathematics and Computer Science Research*, *5*(3), 39–43. https://doi.org/10.5897/AJMCSR11.161

Facione, P. a. (2011). Critical Thinking : What It Is and Why It Counts. In *Insight assessment* (Issue ISBN 13: 978-1-891557-07-1.). https://www.insightassessment.com/CT-Resources/Teaching-For-and-About-Critical-Thinking/Critical-Thinking-What-It-Is-and-Why-It-Counts/Critical-Thinking-What-It-Is-and-Why-It-Counts-PDF

Fatahillah, A., Puspitasari, I. D., & Hussen, S. (2020). The development of Schoology web-based learning media with GeoGebra to improve the ICT literacy on quadratic functions. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*, *5*(3), 304–316. https://doi.org/10.23917/jramathedu.v5i3.10692

Fauzi, A., & Pradipta, I. W. (2018). Research methods and data analysis techniques in education articles published by Indonesian biology educational journals. *JPBI (Jurnal*

Pendidikan Biologi Indonesia), *4*(2), 123–134. https://doi.org/10.22219/jpbi.v4i2.5889

Garrido, A. (2012). Ai and mathematical education. *Education Sciences*, *2*(1), 22–32. https://doi.org/10.3390/educ2010022

Horn, M. B., & Staker, H. C. (2012). Classifying K – 12 Blended Learning. *INNOSIGHT Institute*, *May*, 1–22. https://www.christenseninstitute.org/wp-content/uploads/2013/04/Classifying-K-12-blended-learning.pdf

Joynes, C., Rossignoli, S., & Amonoo-Kuofi, E. F. (2019). 21st Century Skills: Evidence of Issues in Definition, Demand and Delivery for Development Contexts. Connected Learning Alliance, Digital Media and Learning Research Hub. Irvine, CA. *Brighton, UK: Institute of Development Studies.*, *August*, 1–75. https://opendocs.ids.ac.uk/opendocs/handle/20.500.12413/14674

Krishnan, P. (2019). A review of the non-equivalent control group post-test-only design. *Nurse Researcher*, *26*(2), 37–40. https://doi.org/10.7748/nr.2018.e1582

Li, M., Yin, D., Qiu, H., & Bai, B. (2022). Examining the effects of AI contactless services on customer psychological safety, perceived value, and hospitality service quality during the COVID-19 pandemic. *Journal of Hospitality Marketing and Management*, *31*(1), 24–48. https://doi.org/10.1080/19368623.2021.1934932

Maharani, H. R. (2014). CREATIVE THINKING IN MATHEMATICS : ARE WE ABLE TO SOLVE MATHEMATICAL PROBLEMS IN A VARIETY OF WAY ? Hevy Risqi Maharani Sultan Agung Islamic University Semarang , Indonesia Csikszentmihalyi (1997) define c reative thinking is generating new ideas within. *International Conference on Mathematics, Science, and Education 2014*, *2014*(Icmse).

Ormerod, R. (2021). The fitness and survival of the OR profession in the age of artificial intelligence. *Journal of the Operational Research Society*, *72*(1), 4–22. https://doi.org/10.1080/01605682.2019.1650619

Ostrom, A. L., Fotheringham, D., & Bitner, M. J. (2019). *Customer Acceptance of AI in Service Encounters: Understanding Antecedents and Consequences*. *II*, 77–103. https://doi.org/10.1007/978-3-319-98512-1_5

Paschen, J., Kietzmann, J., & Kietzmann, T. C. (2019). Artificial intelligence (AI) and its implications for market knowledge in B2B marketing. *Journal of Business and Industrial Marketing*, *34*(7), 1410–1419. https://doi.org/10.1108/JBIM-10-2018-0295

Prakash, D., Mageshwari T, U., Prabakaran, K., & Suguna, A. (2013). Detection of Heart Diseases by Mathematical Artificial Intelligence Algorithm Using Phonocardiogram Signals. *International Journal of Innovation and Applied Studies*, *3*(1), 145–150.

Puspitasari, R. D., Herlina, K., & Suyatna, A. (2020). A Need Analysis of STEM-integrated Flipped Classroom E-module to Improve Critical Thinking Skills. *Indonesian Journal of Science and Mathematics Education*, *3*(2), 178–184. https://doi.org/10.24042/ijsme.v3i2.6121

Ramadhani, R., Bina, N. S., Sihotang, S. F., Narpila, S. D., & Mazaly, M. R. (2020). Students' critical mathematical thinking abilities through flip-problem based learning model based on LMS-google classroom. *Journal of Physics: Conference Series*, *1657*(1). https://doi.org/10.1088/1742-6596/1657/1/012025

Riedl, M. O. (2019). Human-centered artificial intelligence and machine learning. *Human Behavior and Emerging Technologies*, *1*(1), 33–36. https://doi.org/10.1002/hbe2.117

Sanders, S. (2016). Critical and Creative Thinkers in Mathematics Classrooms. *Journal of Student Engagement: Education Matters*, *6*(1), 19.

Sari, D. M., Ikhsan, M., & Abidin, Z. (2018). The development of learning instruments using the creative problem-solving learning model to improve students' creative thinking skills in mathematics. *Journal of Physics: Conference Series*, *1088*. https://doi.org/10.1088/1742-6596/1088/1/012018

Setiana, D. S., Purwoko, R. Y., & Sugiman. (2021). The application of mathematics learning model to stimulate mathematical critical thinking skills of senior high school students. *European Journal of Educational Research*, *10*(1), 509–523. https://doi.org/10.12973/EU-JER.10.1.509

Simanjuntak, M. P., Hutahaean, J., Marpaung, N., & Ramadhani, D. (2021). Effectiveness of problem-based learning combined with computer simulation on students' problem-solving and creative thinking skills. *International Journal of Instruction*, *14*(3), 519–534. https://doi.org/10.29333/iji.2021.14330a

Soc, K., Vol, M. E., & Data, B. (2020). *인공지능(Artificial Intelligence)과 대학수학교육 1). 2017*, 354–359.

Sriwongchai, A. (2015). Developing the Mathematics Learning Management Model for Improving Creative Thinking In Thailand. *International Education Studies*, *8*(11), 77. https://doi.org/10.5539/ies.v8n11p77

Sukenti, D., Tambak, S., & Siregar, E. (2021). Learning Assessment for Madrasah Teacher: Strengthening Islamic Psychosocial and Emotional Intelligence. *AL-ISHLAH: Jurnal Pendidikan*, *13*(1), 725–740. https://doi.org/10.35445/alishlah.v13i1.552

Susetyarini, E., & Fauzi, A. (2020). Trend of critical thinking skill researches in biology education journals across Indonesia: From research design to data analysis. *International Journal of Instruction*, *13*(1), 535–550. https://doi.org/10.29333/iji.2020.13135a

Tabieh, A. A. S., & Hamzeh, M. (2022). the Impact of Blended-Flipped Learning on Mathematical Creative Thinking Skills. *Journal of Educators Online*, *19*(3). https://doi.org/10.9743/JEO.2022.19.3.15

Turmuzi, M., Suharta, I. G. P., & Suparta, I. N. (2023). Ethnomathematical research in mathematics education journals in Indonesia: A case study of data design and analysis. *Eurasia Journal of Mathematics, Science and Technology Education*, *19*(1), em2220. https://doi.org/10.29333/ejmste/12836

Vogelsang, K., Droit, A., & Liere-Netheler, K. (2019). *Designing a Flipped Classroom Course-A Process Model Classroom*. *14*(4), 1–23. https://doi.org/10.18417/emisa.14.4

Voogt, J., Erstad, O., Dede, C., & Mishra, P. (2013). Challenges to learning and schooling in the digital networked world of the 21st century. *Journal of Computer Assisted Learning*, *29*(5), 403–413. https://doi.org/10.1111/jcal.12029

Wei, X., Cheng, I. L., Chen, N. S., Yang, X., Liu, Y., Dong, Y., Zhai, X., & Kinshuk. (2020). Effect of the flipped classroom on the mathematics performance of middle school students. *Educational Technology Research and Development*, *68*(3), 1461–1484. https://doi.org/10.1007/s11423-020-09752-x

Widya Pratama, R. (2019). The Development Of Attention, Relevance, Confidence, And Satisfaction (ARCS) Model Based on Active Learning to Improve Students'learning Motivation. In *Jurnal Pendidikan Matematika* (Vol. 10, Issue 1).

Xu, Y., Shieh, C. H., van Esch, P., & Ling, I. L. (2020). AI customer service: Task complexity, problem-solving ability, and usage intention. *Australasian Marketing Journal*, *28*(4), 189–199. https://doi.org/10.1016/j.ausmj.2020.03.005

Yanuarto, W. N., & Hapsari, I. (2022). The Model of Creative Thinking , Critical Thinking , and Entrepreneurial Skills Among University Students. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *6*(2), 411–424. https://doi.org/10.31764/jtam.v6i2.7467

Yayuk, E., Purwanto, As'Ari, A. R., & Subanji. (2020). Primary school students' creative thinking skills in mathematics problem solving. *European Journal of Educational Research*, *9*(3), 1281–1295. https://doi.org/10.12973/eu-jer.9.3.1281

Yuliana, Wijayanti, S., & Yuwono, M. R. (2022). Tantangan pembelajaran matematika mobile problem based learning (mpbl) pada flipped classroom untuk membangun kemampuan berpikir kritis siswa A . Pendahuluan Kondisi pandemi mewabah sangat

lama sejak dari tahun 2019 hingga sekarang , serta kemajuan ilmu. *AKSIOMA: Jurnal Matematika Dan Pendidikan Matematika*, *13*(1), 101–118.

Zanzotto, F. M. (2019). *Viewpoint: Human-in-the-loop artificial intelligence*. *64*, 243–252. https://doi.org/https://doi.org/10.1613/jair.1.11345

Plagiarism Check

ORIGINALITY REPORT

12%	11%	7%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	e-journal.hamzanwadi.ac.id Internet Source	3%
2	files.eric.ed.gov Internet Source	1%
3	www.ejmste.com Internet Source	1%
4	Submitted to Indiana University Student Paper	1%
5	www.researchgate.net Internet Source	1%
6	www.e-iji.net Internet Source	1%
7	researcharchive.wintec.ac.nz Internet Source	1%
8	Abdul Rahman, Siti Masitoh, Andi Mariono. "Collaborative Learning to Improve Creative and Critical Thinking Skills: From Research Design to Data Analysis", International Journal of Educational Review, 2022 Publication	<1%

9	ijournalse.org Internet Source	<1 %
10	www.scribd.com Internet Source	<1 %
11	journals.iugaza.edu.ps Internet Source	<1 %
12	docplayer.net Internet Source	<1 %
13	rjsh.rsu.ac.th Internet Source	<1 %
14	www.tandfonline.com Internet Source	<1 %
15	Laubacher, Matthew; Navarre-Jackson, Layana C.; Williams, Amanda N.; Dillard, Dana; Pate, Jennifer;Choi, Kunsoo Paul. "An Introduction to Social Science: Individuals, Society, and Culture", UAGC, 2022 Publication	<1 %
16	Submitted to WHU - Otto Beisheim School of Management Student Paper	<1 %
17	www.jsod-cieo.net Internet Source	<1 %
18	www.tmp.ca Internet Source	<1 %

19	msocialsciences.com Internet Source	<1%
20	D. Seprilia, P.W. Handayani, A.A. Pinem. "User acceptance factors affecting the usage of mobile learning in enriching outside classroom learning at high school level", 2017 Second International Conference on Informatics and Computing (ICIC), 2017 Publication	<1%
21	www.biorxiv.org Internet Source	<1%
22	www.scitepress.org Internet Source	<1%

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	On		