



# A study that uses Card based learning media to help students' mathematical literacy

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## Abstract

Mathematics learning outcomes assess class performance. Classroom media can affect learning results if it grabs students' attention and makes the material easy to understand. However, field data shows that student learning outcomes, especially in composition function material, need improvement. Using learning media makes helping students enhance learning easier. Media can boost student learning. Card media can be used for education. Card learning media is used to increase math learning in this study. The research uses a Systematic Literature Review Media (SLRM). SLRM involves reviewing Garuda, Google Scholar, Scopus, and Web of Science articles using Harzing's Publish or Perish tool. The review includes 6 pieces. Search articles from 2013 to 2023 using card media and learning outcomes. This research involves planning, reviewing, and documenting. Data analysis provides grouping, analysis, and conclusion. Previous studies increased students' mathematics learning activities and outcomes using PTK, models, and techniques. According to this research, card media can improve student learning outcomes in diverse mathematics resources, educational levels, and learning styles.

**Keywords:** Card Media; Learning Outcomes; SLR.

## Introduction

The evaluation of mathematical learning outcomes measures how students have attained educational goals within the classroom environment (In'am et al., 2023; Laila et al., 2022; Triono et al., 2023). The differentiation between evaluating success in learning outcomes and the realm of science should be emphasized. Mathematics demonstrates a continuous state of progress, propelled by the growing demands of society's technological challenges (Darmayanti, Hidayat et al., 2023; Rachmawati et al., 2023; Rizki et al., 2023). Therefore, mathematics is a subject taught at various educational

levels and is adapted to cater to different learning styles, considering the unique needs of each group and educational setting (Ahmed et al., 2023; Gunawan et al., 2023; Zahroh et al., 2023). Numerous students need help in attaining proficiency in mathematics because it is a topic characterized by significant complexity and the potential to induce stress (da Silva Santiago et al., 2023; Darmayanti, 2023; Usmiyatun et al., 2023).

The difficulties in acquiring mathematical knowledge arise from the educators' imperative to maximize their ability to foster students' innate desire and curiosity toward the subject matter (Herdiansyah et al., 2019; Rahmawati et al., 2023; Sugianto et al., 2022). When students exhibit a keen interest and inclination toward acquiring mathematical knowledge, they will simultaneously facilitate the growth of their mathematical abilities through indirect methods (Baskoro et al., 2008; Cholily et al., 2023; Santoso et al., 2021). However, the discipline's empirical research suggests there is still potential for enhancing student learning outcomes, specifically in composition function material.

The validity of this claim is supported by the results obtained from classroom observations carried out throughout the educational process. Mathematics needs more student participation (Ats-Tsauri et al., 2021; Bača1 et al., 2005; Wicaksono et al., 2021). Maintaining a high level of enthusiasm toward pursuing information continues to be of utmost importance for students (Fatra et al., 2020; Hafiz et al., 2017; S. et al. et al., 2021). The notable issue of student disengagement in mathematics education is particularly salient when considering the constant scheduling of mathematics learning sessions during the final hour of the class curriculum (Dimiyati et al., 2023; Fatra et al., 2022; Zahroh et al., 2022). Therefore, instructors must possess the ability to engage students' attention in the subject of mathematics, mainly by employing instructional resources

Incorporating media in educational environments can engage students' focus and enhance their understanding of academic material, impacting the learning experience's overall outcomes. Learning media can significantly expand the accessibility of initiatives to improve students' learning outcomes. Media utilization can dramatically affect the enhancement of students' academic results. The use of card media as an educational tool has proven to be valuable and feasible.

According to Rahmawati (2017), instructors must include instructional media to enhance their effectiveness and confidence in their teaching methodologies. The potential consequences of this matter may hurt students' holistic educational journey and scholastic accomplishments (Bayharti, 2018; Chen, 2022; Rizany, 2023). Other factors contribute to this problem, including the lack of excitement among teachers in utilizing educational media and their limited creativity in developing instructional aids or learning materials (Smith, 2022; Worth, 2016). According to Audie (2019), procuring instructional press is vital in augmenting pupils' academic accomplishments. Learning outcomes are employed to evaluate the efficacy of learning within an educational context. The incorporation of media in classroom instruction holds the capacity to engage students' focus and enhance their understanding of the subject matter, thus influencing the results of their learning.

According to Atiaturrahmaniah Fajri (2020), student learning outcomes are commonly described as the discernible behavior modifications directly attributable to a student's educational encounters. Therefore, the role of instructors in facilitating the educational process substantially impacts students' academic accomplishments. In the context of education, it is crucial for educators to proficiently incorporate suitable learning activities that possess the capacity to augment student learning results.

Incorporating media, particularly card media, in the educational setting has promise for augmenting the overall efficacy of the learning process and yielding more favorable learning outcomes. Numerous academic investigations have provided evidence to support the notion that using card media can enhance student motivation and deliver good results in terms of academic achievement (Ardyansyah, 2023; Daynasti, 2021). In a study conducted by (Mahmudah, 2023), an investigation was carried out to assess the implementation of card media within the domain of mathematics instruction. The findings of this study indicated a favorable influence on students' academic achievements. Therefore, incorporating tangible visual aids, such as cards, into educational materials can significantly boost academic performance.

The development of learning media has been intricately linked to advancements in technology. The utilization of media in educational settings poses a multitude of issues that have the potential to impede students' academic accomplishments. Education plays a pivotal role in effectively addressing the imminent challenges presented by technology as a platform for knowledge acquisition in the foreseeable future. The implementation of card media as a pedagogical tool in mathematics education has been identified as an innovative technique that shows promise in improving learning outcomes.

The primary aim of this study is to provide a comprehensive portrayal of the utilization of card media within the realm of mathematics education. The direct purposes of this research are threefold. Firstly, it comprehensively overviews the study's objectives, research design, and methodology. Secondly, it seeks to clarify the specific model and type of card media chosen for the study. Lastly, it aims to analyze the current research trends regarding using card media in mathematics education, specifically focusing on its potential to enhance student learning outcomes. Numerous prior investigations have delved into analogous subject matters; nevertheless, this study distinguishes itself by centering on mathematics instruction in secondary educational institutions, emphasizing card media as a pedagogical instrument.

Moreover, the present inquiry has not examined the scholarly literature within the Web of Science Search database. Furthermore, the absence of Harzing's publish or perish program in this study positions it as an update on prior findings. The main aim of this study is to provide a comprehensive portrayal of the application and utilization of card media in mathematics education. The main objective of this study is to clearly define the research objectives, research approach, and the specific type of card medium employed. Moreover, the primary aim of this research is to examine the existing corpus of scholarly works about the use of card media in mathematics education, specifically focusing on its potential to enhance the academic performance of senior high school pupils within this subject area.

## Research Method

The chosen methodology for this research was a comprehensive literature review (Muhammad et al., 2023). The current investigation employed a systematic method to select, evaluate, and analyze particular research discoveries from preexisting scholarly works. The chosen research findings were assessed and analyzed, and deductions were made regarding their significance to the intended research objectives. The ensuing actions were executed in an organized manner, as previously determined. The data utilized in this study is categorized as secondary data, as it was obtained indirectly from previous research endeavors. The study shows the several phases of the Systematic Literature Review Media (SLRM), as seen in Figure 1 (N. Hasanah et al., 2022).

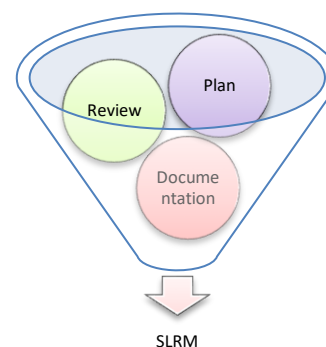


Figure 1. depicts the initial step utilized

Figure 1 depicts the initial step utilized, which encompasses the planning process. The planning process entails the identification of concerns related to learning media, the development of research objectives to be pursued, and the subsequent selection of suitable approaches and strategies. The second component relates to conducting a thorough and analytical review or assessment. This review critically evaluates the scholarly publications or databases relevant to the study's focus and subsequently classifies them based on the research framework. The consideration of documentation represents the third factor. During the third phase, the selected literature is compiled and explained. The results gained form the basis for addressing the identified questions.

By establishing protocols, the researcher performed a comprehensive literature search utilizing the Google Scholar, Garuda, and Willey WOS databases. The inquiry was conducted using the search terms "mathematics cards," "mathematics card media," and "mathematics card learning media." The primary objective of this research is to investigate the efficacy of utilizing mathematics card media as an instructional tool within the context of senior high school mathematics education. This study investigates scholarly works published in international and national journals from 2013 to 2023 (Darmayanti, Milshteyn, et al., 2023). Using Harzing's Publish or Perish service promotes the accessibility of research articles, hence improving the process of conducting literature searches.

Furthermore, it was necessary to set particular criteria in this study to classify the data, differentiating between data that met the requirements and those that did not. The conditions above can be observed in Figure 2.

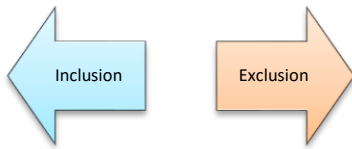


Figure 2. Distinct Criteria

Figure 2 depicts the utilization of two distinct criteria: inclusion and exclusion. Establishing inclusion and exclusion criteria is crucial in assessing the appropriateness of collected data for use in a specific study or analysis. In data analysis, inclusion and exclusion criteria establish the precise parameters for the data that will be included or excluded from the study. The first criterion is exclusion, which pertains to national or international publications that do not relate to using card-based learning materials to improve learning outcomes among senior high school students. The relevance of national or international publications to the title and research subject matter is negligible. The indexing databases of Sinta, Scopus, and Web of Science (Scopus/WOS) encompass articles published before 2013. These databases index reports produced in languages other than Indonesian or English. The second criterion focuses on inclusiveness, specifically addressing national or international issues relevant to using card-based learning media to improve the learning outcomes of senior high school students. This criterion encompasses publications that are by the title and study topic, have been published within the timeframe of 2013 to 2023, and are included in the indexes of Sinta and Scopus/WOS. The permissible languages for these articles

encompass Indonesian and English.

The data analysis methodology encompasses the practice of categorizing data into groups. At this stage, the researcher gathers and indexes pertinent academic literature on using card media in mathematics education. Afterward, the selected information is classified according to the research question (RQ). Formulating research questions (RQs) involves a meticulous alignment with the specific objectives and demands of the chosen topic.

The present study addresses the following research inquiries: Research Question 1: What are the goals, classifications, and methods used in the scholarly article investigating the utilization of card-based learning media to augment the academic accomplishments of senior high school students from 2013 to 2023? Research Question 2: What models and instructional resources are employed for varying educational levels? What is the extant corpus of scholarly literature in the selected articles about the use of card-based learning media to augment the academic accomplishments of senior high school students throughout the timeframe spanning from 2013 to 2023? What is the predominant study direction concerning using card-based learning media to enhance learning outcomes among senior high school students, specifically from 2013 to 2023? During this phase, the researcher thoroughly analyses the selected literature for this research. The researchers were in the process of completing the data analysis. This step encompasses presenting the findings obtained through the defined research methodologies.

### Results and Discussion

The first step in this research is to open Harzing's Publish or Perish program by writing down the keywords for the mathematics card media published from 2013 to 2023, as shown in Figure 3.

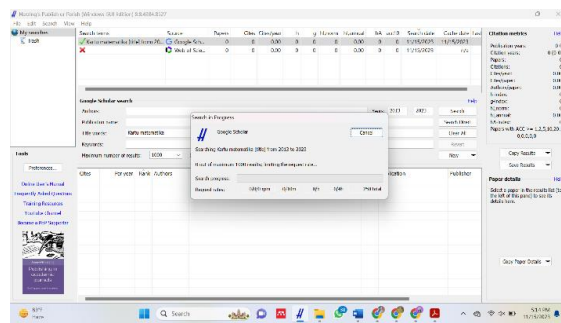


Figure 3. Writing keywords card media in Indonesian

In Figure 3, it can be seen that the search is focused on mathematics learning media using card media. The search was

carried out by writing keywords in Indonesian. Next, an English search was also done, as shown in Figure 4.

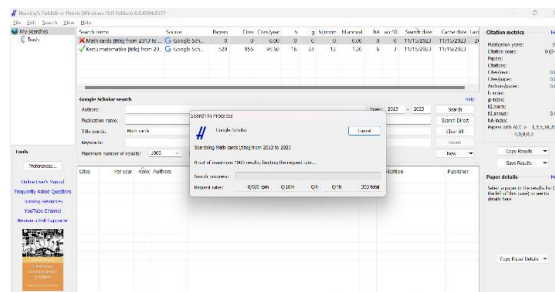


Figure 4. Writing keywords card media in English

From these two searches, 529 articles were obtained using keyword searches in Indonesian, and 700 articles were searched

using keywords in English, which researched the media of mathematics cards. The results can be seen in Figure 5.

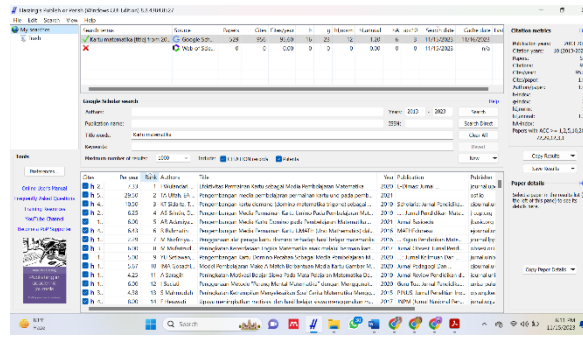


Figure 5. Example of article search results

From the overall data, the next step is to search for keywords in English and Indonesian articles: senior high school, math card,

Mathematics learning, learning outcomes, innovation, and development. The results of this search are shown in Figure 6.

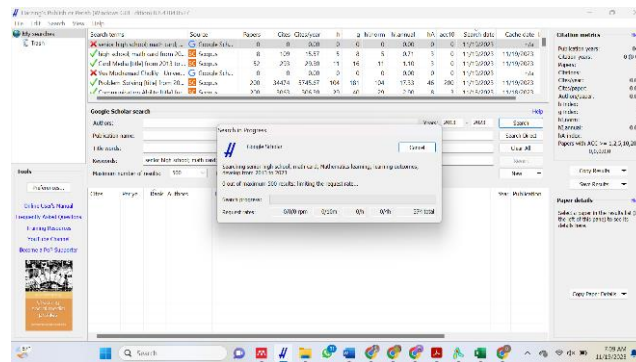


Figure 6. Keyword senior high school mathematics card

Based on the data in Figure 6, it was found that 6 articles were by this research data, where what was determined was the card media used in mathematics learning to help improve student

learning outcomes at the senior high school level. Based on the data found, the teacher's innovation was to develop mathematical card media, as shown in Figure 7.

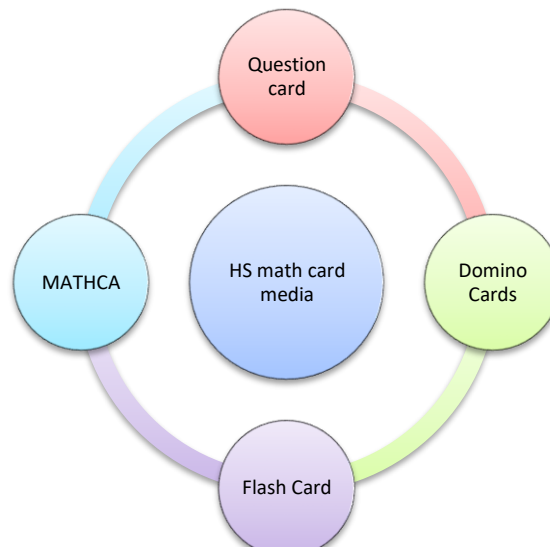


Figure 7. Based on the data found, SLRM

The results of the conducted statistical linear regression model (SLRM) are illustrated in Figure 7. Eight articles were selected for this study, employing specified criteria and keywords about card media, high school mathematics, high school mathematics learning, and high school mathematics learning outcomes. The analysis spanned the time frame from 2013 to 2023. Several types of card media designs exist, including question cards (33.33%), Dominoes (16.67%), MATCHA (16.67%), and flashcards (33.33%). The instructor deliberately chose to incorporate four card-based media innovations into the mathematics teaching of high school students to improve their learning outcomes. The improvements above were developed and executed to enhance the efficiency of the

educational process in high school settings. A lack of comprehensive research has been undertaken in the previous decade about implementing mathematics card media as an innovative tool in high school mathematics instruction to improve student learning outcomes.

The insufficient advancement in the development and incorporation of card-based media in educational environments can be ascribed to the difficulties educators encounter in determining the optimal design for promoting successful learning among secondary school students (Shao et al., 2019; Sharara, 2011; Swanson, 2014). This paper analyses the effects of implementing the

Student-Led Reflective Mathematics (SLRM) approach, specifically focusing on integrating card media into high school mathematics classes. The outcomes of this implementation are discussed in the following subsections:

#### *The process of acquiring mathematical knowledge and skills at the secondary education level.*

There are notable distinctions in mathematics at the high school level. The typical age range for high school pupils is between 15 and 19 years old, corresponding to the middle adolescent stage of development. According to Piaget's theory of cognitive development, individuals in high school are characterized as formal learners. According to (Jitendra et al., 2018), children can utilize tangible procedures to construct more intricate operations, generate hypotheses, integrate ideas and plausible assertions, and engage in reflective thinking, including metacognition. According to (Xin et al., 2017), Piaget contended that individuals in the formal stage of development possess the cognitive ability to approach abstract problems reasonably. This capacity is influenced by brain processing.

High school students must use critical thinking skills by making informed assessments (Doabler & Fien, 2013; Peng et al., 2018), strategizing approaches (Barbieri et al., 2020), identifying key ideas (Hassinger-Das et al., 2015), establishing relationships (Dyson et al., 2013), employing symbolic representations (Hewett, 2015), and effectively communicating their understanding of subjects (Chu, 2018). The Mathematics Curriculum of 2013 places a strong emphasis on the development of decision-making skills through the application of logic and reasoning. Therefore, educators must employ strategies, methodologies, instructional frameworks, pedagogical models, and instructional procedures that encompass the sensory experiences of all students and the dynamic interaction between learning resources.

As illustrated in Figure 7, using card media improves high school students' learning outcomes in acquiring mathematical knowledge and skills in secondary education. Maulida et al. (2017) devised a "Question Cards" media tool to augment students' performance and comprehension of trigonometry concepts in mathematics. The research conducted by (Rahman Amalia, 2019) centered on developing and applying "Domino Cards" as an instructional instrument to augment students' comprehension of mathematical concepts. A study (Komalasari, 2016) examined the impact of using Mathematics Flash Card Media on mathematics learning outcomes. (Astriani & Khairani, 2022) research aims to create a collection of mathematics cards called "MATHCA," incorporating various media formats. The present study was conducted by (Putri & PURWOKETO, 2023), a student from KHSZ PURWOKETO (2023), to investigate the impact of the Logan Avenue Problem Solving Learning Model (LAPS) in conjunction with the "Flash Card" Mathematics Media. The present study examined the potential impact of a specific learning model and media on the development of students' mathematical abilities. The user's text "RS" lacks sufficient information to be rephrased academically. (Bintang Abadi, 2019) utilized the Think Pair Share (TPS) Model in conjunction with Card Math Media in their research. The results derived from the five studies above indicate that the incorporation of card media, in conjunction with diverse methodologies and frameworks such as the Logan Avenue Problem Solving (LAPS)-Heuristic Learning Model, Think Pair Share (TPS) Model, and Intellectual Learning Approach, can be a successful means of enhancing the learning of high school mathematics.

#### *Card media secondary education mathematics research goals.*

The primary focus of this study revolves around investigating the use of card-based media within the realm of mathematics education at the secondary level (Rodriguez-Vasquez, 2020; Tanudjaya & Doorman, 2020; Young, 2017). The investigations undertaken between 2013 and 2023 in secondary education mathematics studies have explored the use of card-based learning

media to improve the learning outcomes of high school pupils. These investigations have exhibited variances in their study emphases. A total of six papers were subjected to analysis, which led to the identification of two main areas of research emphasis. The main aim of this study is to determine the degree to which the use of card-based learning materials contributes to a 33.33% improvement in student learning achievements. In contrast, the subsequent four studies focused on evaluating students' mathematical competence. The primary focus of the research done from 2013 to 2023 revolves around the utilization of card-based learning media as a means to augment student learning results. The primary objective of this study is to identify the optimal model or technique for integrating card-based learning media into high school mathematics instruction to improve students' mathematical proficiency. There exists a necessity for augmentation. The potential favorable impact on learning outcomes can be observed by improving students' mathematical abilities.

#### *The secondary education math research approach uses card media.*

The primary focus of this study revolves around investigating the use of card-based media within the domain of secondary education mathematics. The research undertaken from 2013 to 2023 about using card-based learning media in the context of mathematics education at the secondary level has exhibited divergent research orientations regarding this pedagogical method's effects on high school student's academic achievements. Four different research approaches were utilized to analyze six articles to examine the effectiveness of card-based learning materials in improving student learning outcomes from 2013 to 2023.

The research employed a quantitative methodology, explicitly a Quasi-Experimental Design, with a proportion of 66.67%. Two further studies employed the Research and Development technique. The findings of this study indicate that the utilization of card-based learning media has a higher prevalence in student learning outcomes within the setting of Quasi-Experimental Design research. Furthermore, the study from 2013 to 2023 has predominantly focused on examining the application of card-based learning materials in secondary school mathematics instruction. The primary objective has been ascertaining the optimal model or methodology for augmenting students' mathematical proficiencies. Empirical evidence suggests a positive correlation between the enhancement of pupils' mathematical abilities and the subsequent improvement of their overall academic achievements. Historically, this research has commonly utilized a Quasi-Experimental Design to assess the effects of card-based learning media on students' academic achievements.

The subject of inquiry is the convergence of mathematical principles and card games as depicted in several kinds of media. Implementing the aided question card approach is a pedagogical technique promoting active learning. This pedagogical approach involves instructors actively involving students in immersive and meaningful learning experiences intimately connected to real-world circumstances. Research has demonstrated that involvement in pleasurable educational encounters benefits students' scholastic achievements, learning results, engagement in extracurricular pursuits, and aptitude in mathematics. (Karim et al., 2021; Wu, 2016) Conducted a study in a mathematics classroom to improve the academic performance of high school students by implementing a contextualized instructional approach. From his viewpoint, teaching mathematics in secondary schools requires the implementation of interactive activities that are taken from a pedagogical approach known for their effectiveness (Furuto, 2014; Leonard, 2018; Susanto, 2019). Using a practical methodology enhances student engagement, motivation, and active participation.

Furthermore, it facilitates the formation of linkages between students' preexisting knowledge and its pragmatic application across several domains, encompassing personal, familial, and societal realms. However, given the specific context described, kids persist in lacking self-confidence. Promoting self-assurance in

mathematics classrooms can be enhanced by integrating physical activities into the instructional approach. Research has shown that using the body in the learning process can positively impact the development of cognitive abilities in students. Therefore, it is crucial to integrate a combination of physical and intellectual activities while also stimulating all the senses, as these factors substantially influence the learning process. The achievement of this objective necessitates the utilization of appropriate approaches and models that address the unique attributes and difficulties encountered in mathematics classrooms in different geographical areas. This study highlights the need for further developments in using card media in the context of secondary education. This study highlights the significance of integrating a learning paradigm that combines physical and cognitive activities to boost the academic performance of high school pupils.

## Conclusion

Card-based learning media for 2013-2023 learning outcomes can be used in high school mathematics learning processes, objectives, research types, and designs. Card-based learning media can increase high school mathematics learning outcomes and student abilities in many areas of the learning process, objectives, and research. Based on data, card-based learning medium favors learning outcomes in 2013-2023. Goal tendency study focuses on enhancing learning outcomes through card-based media, specifically in maths. Trends Research on the impact of card-based media on learning outcomes uses a quantitative method with quasi-experimentation. 2013–2023 research uses the Logan Avenue Problem Solving design. This survey shows that secondary education card media needs improvement. This study emphasizes integrating physical and cognitive development to improve high school student's academic performance. Mathematics card media for high schoolers could be researched. It seeks to improve math skills through physical and mental learning.

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