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Analysis of Mathematical Beliefs of Madrasah Tsanawiyah Students After Using the Geometry Transformation Digibook

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Abstract

Mathematical belief is students' belief in mathematics which can construct their cognitive domain in the mathematics learning process. This research aims to analyze and describe students' mathematical beliefs after using the geometric transformation digibook. The subjects in this study were 32 students of class IX-B MTs Negeri 3 Ciamis. The method used in this research is descriptive qualitative method. The data collection technique in this study is through observation and a mathematical belief questionnaire. The instruments used in this research were the geometric transformation digibook and the mathematical belief questionnaire. Based on the results of the study and discussion, it can be concluded that after learning mathematics using the geometric transformation digibook, students' mathematical beliefs in each of the main dimensions of mathematical belief, namely: about mathematics education are in the high category, about themselves are in the high category and about the social context are in the high category.

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INTRODUCTION

The current paradigm of learning activities requires teachers to be able to apply various learning strategies, master and utilize various learning media so that the learning process and objectives can be achieved as expected (Komara & Ratnaningsih, 2022). There are many learning media that can be used by teachers in the learning process, but the learning media used is not necessarily suitable for the learning material delivered to students (Komara, Supratman & Lestari, 2023). Therefore, teachers must be able to choose and use appropriate and effective learning media in the learning process, especially learning media that are able to facilitate the development of affective abilities, namely students' mathematical beliefs. One of the interactive learning media that can be used by teachers to motivate and make it easier for students to understand learning material that is considered difficult is digibook (digital book) (Watin & Kustijono, 2017; Khoerunnisa, Ratnaningsih & Lestari, 2021; Fauzi, Ratnaningsih & Lestari, 2022; Komara, Supratman & Lestari, 2023).

In learning mathematics at school, apart from aiming to develop their cognitive abilities, students are also directed to develop their affective abilities. One of the affective abilities of students that has received much attention in the development of the world of mathematics education is mathematical beliefs

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(Lestari, 2016; Isharyadi, 2017; Lestari, 2018). In the Oxford dictionary, belief is defined as: (1) Acceptance that something exists or is true, especially without evidence, (2) A strong feeling about the existence of something, (3) Believing that something is good or true. In everyday language, belief is often confused with the terms attitude, disposition, opinion, philosophy or value. Belief is a very important element in the cognitive and affective development process of students in learning mathematics. Mathematics beliefs construct students in a stable and personal way in influencing students' self-views about mathematics discipline or matters related to mathematics learning. Students who have poor beliefs about learning mathematics will be passive students and tend to memorize lessons to understand the lesson topic (Wijayanti & Permana, 2018).

Firmansyah (2017) states that mathematical beliefs are a person's encouragement to initiate their cognitive process in mathematics learning activities. Himmah (2017) defines belief as an individual's subjective knowledge about themselves, mathematics, problem solving, and topics related to problems. Madawistama (2019) states that students' mathematical beliefs are students' beliefs in mathematical concepts which influence students' responses in responding to mathematical problems. Furthermore, Lau (2022) states that mathematical beliefs are domain-specific epistemological beliefs related to the characteristic of mathematics. From these opinions, it can be concluded that mathematical beliefs are students' beliefs about mathematics which can construct their cognitive domain in the mathematics learning process.

Mathematical beliefs have an important role in mathematics learning and are closely correlated with students' mathematical abilities (Syarifah, 2016; Pitsia, Biggart & Karakolidis, 2017; Liviananda & Ekawati, 2019; Satyam, Bae, Smith & Levin, 2022; Robbani & Sumartini, 2023; Lestari, Supratman & Komara, 2023). Mathematical beliefs can influence students' self-views regarding mathematics learning and by having mathematical beliefs, students can have the ability to evaluate themselves and can more easily accept learning material and carry out the mathematics tasks given (Wijayanti & Permana, 2018).

Specifically, Collier (in Lau, 2022) suggests two categories of mathematical beliefs, namely (1) formal mathematics based on fixed, established forms and (2) informal mathematics with original and creative elements. Meanwhile, Ernest (in Lau, 2022) put forward three categories of mathematical beliefs, namely (1) mathematics as a collection of facts, rules and skills used to achieve certain goals (instrumentalist view); (2) mathematics as a static but integrated collection of knowledge with interrelated structures and truths to be discovered (Platonic view); and (3) mathematics as an ever-evolving field of human discovery subject to revision (problem-solving view). In line with this opinion, Stipek, Givvin, Salmon and MacGyvers (2001) introduced two categories similar to Collier's, namely (1) traditional mathematics and (2) inquiry-oriented mathematics. Individuals with traditional views of mathematics tend to view mathematics as knowledge that involves the use of a set of rules and procedures to obtain the correct answer to a problem. Those who hold an inquiry-oriented view of mathematics conceptualize mathematics as a discipline that is constantly changing as a means for problem solving.

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Op't Eynde, De Corte and Verschaffel (2002) stated that students' beliefs related to mathematics are formulated as students' subjective conceptions that are considered correct, either implicitly or explicitly, which influence students' mathematics learning and problem solving. Eynde categorizes students' mathematical beliefs into three things, namely: (1) beliefs about mathematics education, (2) beliefs about themselves, and (3) beliefs about the social context (class) as described in the following main dimensions of students' mathematical belief systems:

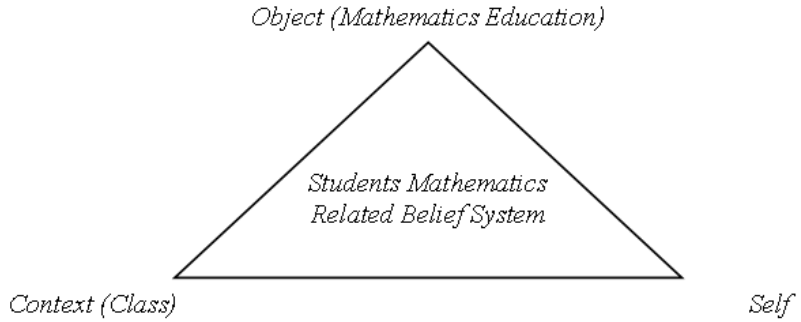

Figure 1. Main dimensions of students' mathematical belief system

Several research results have been carried out related to students' mathematical beliefs, including research by Himmah (2017) which examined the influence of students' mathematical beliefs on problem solving abilities with the results of the research stating that mathematical beliefs have an influence on problem solving abilities but have different mathematical beliefs so that teachers need to identify and pay attention to mathematical beliefs so that students' mathematical beliefs can increase. Livianandа and Ekawati (2019) research revealed that there is a significant relationship between students' beliefs in mathematics, the learning process and students' mathematical abilities. Thus, students' mathematical beliefs are the result of the mathematics learning process. In line with these two studies, Tanzila and Nasution (2022) stated the results of their research that mathematical anxiety and mathematical beliefs influence students' mathematics learning outcomes so that to obtain optimal mathematics learning outcomes, students must reduce their mathematical anxiety and must increase their mathematical beliefs. From the three research results, it can be seen that mathematical beliefs have an influence on students' problem-solving abilities and mathematics learning outcomes. Meanwhile, Drijvers (2019) and Lestari, Supratman and Komara (2023) stated that digibook is a digital learning media which, if developed according to the characteristics and needs of students and with the implementation of appropriate strategies, can significantly influence and strengthen students' mathematical beliefs, especially in the context of independent and interactive learning.

Based on this description, the aim of this research is to analyze and describe students' mathematical beliefs after using the geometric transformation digibook. Analysis of students' mathematical beliefs after using learning media, especially geometric transformation digibooks, is very important and necessary to become a new basis and theory in improving student learning outcomes.

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RESEARCH METHOD

The method used in this research is descriptive qualitative method. The subjects in this research were 32 students in class IX-B MTs Negeri 3 Ciamis. Data collection techniques in this research are through observation and a mathematical belief questionnaire. This research stage begins with learning geometric transformations using digibooks, then after that students are given a validated mathematical belief questionnaire. The instruments used in this research were a geometric transformation digibook was designed and developed by the researcher according to the characteristics and needs of students and integrated aspects of mathematical beliefs using the flip pdf professional application and can be accessed by students online via a link provided by the researcher and a mathematical belief questionnaire consisting of 40 statements with a total score of 200. This mathematical belief questionnaire has been validated (face validation and content validation) by two people, namely a professional psychologist and a senior guidance and counseling teacher. The mathematical belief questionnaire was given to students after learning geometric transformation using a digibook to be filled in within 40 minutes.

The following are aspects and indicators of mathematical beliefs that researchers modified from Op't Eynde (2002) and Himmah (2017) as the basis for compiling a mathematical belief questionnaire:

Table 1. Aspects and indicators of mathematical beliefs

No	Aspects	Indicators
1	Beliefs about mathematics learning	Students have beliefs about mathematics as a subject
		Students have beliefs about mathematics learning and problem solving
		Students have beliefs about learning mathematics in general
2	Beliefs about themselves	Students have beliefs about self-efficacy for mathematics
		Students have beliefs regarding control over mathematics
		Students have beliefs about the value of tasks in mathematics
		Studets have beliefs about goal orientation towards mathematics
3	Beliefs about social context	Students have beliefs about social norms in learning mathematics in the classroom, namely regarding the role and function of teachers as well as the roles and functions of students
		Learners have beliefs about social norms of mathematics in the classroom

The students' mathematical belief questionnaire was measured using a Likert scale with five answer choices and each answer score, namely:

Table 2. Categories of Students' Mathematical Belief Questionnaire Scores

Scores	Categories
5	Strongly agree
4	Agree
3	Less Agree
2	Disagree
1	Strongly Disagree

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Based on students questionnaire score, to determine the interpretation the following steps are taken (Sundayana, 2016):

a. Determine the maximum score (S_{max})
   S_{max} = *number of questionnaire items x respondents x 5*
b. Determine the minimum score (S_{min})
   S_{min} = *number of questionnaire items x respondents x 1*
c. Determine the range
   Range = maximum score – minimum score
d. Determines the class length (p)

$$p = \frac{Range}{lots\ of\ categories}$$

e. Determine the response scale

Table 3. Interpretation of Response Scale

Total Score (TS)	Interpretation
$S_{min} \leq TS < S_{min} + p$	Very Low
$S_{min} + p \leq TS < S_{min} + 2p$	Low
$S_{min} + 2p \leq TS < S_{min} + 3p$	Medium
$S_{min} + 3p \leq TS < S_{min} + 4p$	High
$S_{min} + 4p \leq TS < S_{max}$	Very High

RESULTS AND DISCUSSION

In accordance with the research stages carried out, after carrying out learning using the geometric transformation digibook, students fill out a mathematical belief questionnaire. The students' mathematical belief questionnaire refers to 3 main dimensions of mathematical belief, namely (1) beliefs about mathematics learning, (2) beliefs about themselves and (3) beliefs about the social context. The following is a graph of students' mathematical belief scores:

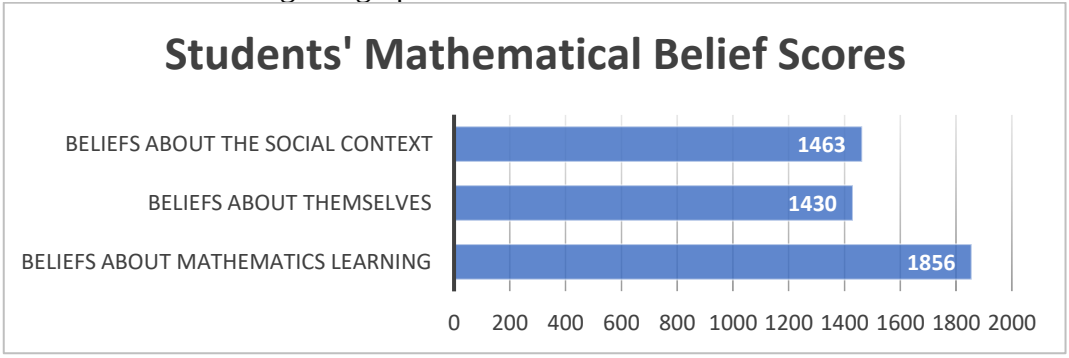

Figure 2. Graph of Students' Mathematical Belief Scores

From Figure 2, it can be seen that the belief score about mathematics education is 1856. The categories and ranges of belief scores about mathematics education are: very low (480-863), low (864-1247), moderate (1248-1631), high (1632-2015) and very high (2016-2400). Referring to the categories and ranges of scores, 1856 is in the range between 1623-2015 which means that students' mathematical beliefs on the main dimensions of beliefs about mathematics education are in the "High" category. The belief score about themselves is 1430. The categories and ranges of belief scores about themselves are: very low (416-748,7), low (748,8-1081,5), medium (1081,6-1414,3), high (1414,4-1747,1) and

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very high (1747,2-2080). Referring to the category and range of scores, 1430 is in the range between 1414,4-1747,1 which means that students' mathematical beliefs in the main dimensions of beliefs about themselves are in the "High" category. The belief score about the social context is 1463. The categories and ranges of belief scores about the social context are: very low (384-691,1), low (691,2-998,3), medium (998,4-1305,5), high (1305,6-1612,7) and very high (1612,8-1920). Referring to the category and range of scores, 1463 is in the range between 1305,6-1612,7 which means that students' mathematical beliefs in the main dimensions of beliefs about the social context are in the "High" category.

The high level of the three main dimensions of students' mathematical beliefs after learning using geometric transformation digibooks which was designed and developed according to the characteristics and needs of students and integrated aspects of mathematical beliefs is a positive impact from the good understanding and mastery of mathematical concepts as well as the positive learning environment/social interactions of students in the classroom, thereby encouraging students' own mathematical beliefs and abilities. This is in line with the results of research by Muhtarom, Juniati, Siswono and Rahmatica (2018) which states that the process of forming a student's mathematical beliefs is influenced by mastery of learning materials that encourage students' mathematical abilities, as well as students' interactions with the social system, especially the classroom environment during learning activities.

The achievement of students' high levels of mathematical belief is also in accordance with constructivist learning theory which gives students the freedom to build their own knowledge based on the design of learning activities created by the teacher (Sopiany & Rahayu, 2019). When learning mathematics using geometric transformation digibooks, students are more active in learning to understand and organize concepts and give meaning to the things they learn from the learning media used both personally and socially in the learning/classroom environment. Meanwhile, the teacher acts as a facilitator who helps provide interesting and interactive learning media and prepares a good learning environment so that students' construction can develop well. This is in accordance with the research results of Maula, Su'aida and Salvia (2023) which stated that learning by applying constructivist principles can increase students' mathematical beliefs.

Students' beliefs about math play a critical role in how they approach learning and perform in the subject. Based on observations, several key insights can be shared: (1) Connection between beliefs and achievement: Students who hold positive beliefs about their math abilities tend to perform better. They are more motivated, confident in facing challenges, and persistent when encountering difficulties; (2) Self-Perception in math: Students who believe in their capacity to understand math are typically more engaged in the learning process. They are less afraid of making mistakes, viewing errors as an integral part of learning; (3) Impact of the learning environment: A supportive learning environment, including encouragement from teachers and parents, can strengthen students' math beliefs. When students feel valued and supported, their confidence in their math abilities is likely to grow; (4) Influence of past experiences: Previous experiences with math, whether positive or negative, significantly shape students' beliefs. Students who have faced repeated difficulties may develop negative beliefs, which can hinder

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further learning; (5) Teacher's role in shaping beliefs: Teachers play a crucial role in shaping students' beliefs about math. Through inclusive and motivating teaching approaches, teachers can help students build positive beliefs about their abilities; (6) Impact of stereotypes: Stereotypes about math, such as the notion that math is only for "smart" students, can affect beliefs. Students who feel they do not fit this stereotype may develop negative attitudes toward math. These observations highlight the importance of addressing students' beliefs in math education. By understanding and nurturing positive math beliefs, educators can create a more inclusive and effective learning environment, helping all students succeed regardless of their initial beliefs.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the use of appropriate learning media can optimize students' mathematical beliefs in learning mathematics. This is proven that after learning mathematics using the geometric transformation digibook, students' mathematical beliefs in each of the main dimensions of mathematical beliefs, namely: about mathematics learning are in the high category, about themselves are in the high category and about the social context are in the high category.

REFERENCES

Drijvers, P. (2019). Embodied instrumentation: combining different views on using digital technology in mathematics education. Eleventh Congress of the European Society for Research in Mathematics Education. https://hal.science/hal-02436279/

Fauzi, F. A., Ratnaningsih, N., & Lestari, P. (2022). Pengembangan Digibook Barisan dan Deret Berbasis Anyflip untuk Mengeksplor Kemampuan Berpikir Komputasional Peserta Didik. Jurnal Cendekia : Jurnal Pendidikan Matematika, 6(1), 191–203. https://doi.org/10.31004/cendekia.v6i1.1089

Firmansyah, M. A. (2017). Peran Kemampuan Awal Matematika Dan Belief Matematika terhadap Hasil Belajar. Prima: Jurnal Pendidikan Matematika, 1(1), 55. https://doi.org/10.31000/prima.v1i1.255

Himmah, W. I. (2017). Analisis Belief Matematik Siswa Tingkat SMP. Journal of Medives : Journal of Mathematics Education IKIP Veteran Semarang, 1(1), 49–58. https://e-journal.ivet.ac.id/index.php/matematika/article/view/457

Isharyadi, R. (2017). Pengaruh Mathematical Beliefs terhadap Prestasi Belajar Matematika Siswa SMA. PYTHAGORAS: Jurnal Program Studi Pendidikan Matematika, 6(1). https://doi.org/10.33373/pythagoras.v6i1.596

Khoerunnisa, S. N., Ratnaningsih, N., & Lestari, P. (2021). Pengembangan Digibook Trigonometri Berbasis Flip PDF untuk Mengeksplor Kemampuan Koneksi Matematis Peserta Didik. Jurnal Cendekia : Jurnal Pendidikan Matematika, 5(3), 3082–3096. https://doi.org/10.31004/cendekia.v5i3.995

Komara, K., Supratman, S., & Lestari, P. (2023). Pengembangan Digibook Transformasi Geometri Berbantuan Geogebra untuk Mengoptimalkan Kemampuan Representasi Gambar. Jurnal Cendekia : Jurnal Pendidikan Matematika, 7(2), 1451–1468. https://doi.org/10.31004/cendekia.v7i2.2227

ISSN : 2579-5724
ISSN : 2579-5260 (Online)
http://ejournal.umm.ac.id/index.php/MEJ

Komara, & Ratnaningsih, N. (2022). Dampak Pelaksanaan Pembelajaran Daring Terhadap Hasil Penilaian Kognitif Peserta Didik Dalam Pembelajaran Matematika Selama Pandemi Covid-19. Journal of Authentic Research on Mathematics Education (JARME), 4(2), 152–171. https://doi.org/10.37058/jarme.v4i2.4048

Lau, W. W. F. (2022). Predicting Pre-service Mathematics Teachers' Teaching and Learning Conceptions: The Role of Mathematical Beliefs, Mathematics Self-efficacy, and Mathematics Teaching Efficacy. International Journal of Science and Mathematics Education, 20(6), 1141–1160. https://doi.org/10.1007/s10763-021-10204-y

Lestari, P. (2016). Belief Matematis Mahasiswa Calon Guru Melalui Model Pembelajaran Aktivitas Investigasi Autentik. JPPM (Jurnal Penelitian Dan Pembelajaran Matematika), 9(2), 194–200. https://doi.org/10.30870/jppm.v9i2.997

Lestari, P. (2018). Peningkatan Kemampuan Penalaran Proporsional, Representasi Gambar Dan Belief Matematis Calon Guru Melalui Pembelajaran Model Aktivitas Investigasi Autentik [Universitas Pendidikan Indonesia]. http://repository.upi.edu/34948/4/D_MTK_1201507_Chapter1.pdf

Lestari, P., Supratman, & Komara. (2023). Digibook Media and Novice Teacher Mathematical Beliefs. Mosharafa: Jurnal Pendidikan Matematika, 12(3), 545–556. https://doi.org/10.31980/mosharafa.v12i3.2760

Liviananda, F., & Ekawati, R. (2019). Hubungan Keyakinan Siswa Tentang Matematika dan Pembelajarannya dengan Kemampuan Matematika. MATHEdunesa, 8(2), 357–364. https://doi.org/10.26740/mathedunesa.v8n2.p357-364

Madawistama, S. T. (2019). Peningkatan Kemampuan Berpikir Matematis Tingkat Lanjut Dan Keyakinan Matematis Mahasiswa Calon Guru Matematika Melalui Pembelajaran Berdasarkan Teori Valsiner [Universitas Pendidikan Indonesia]. http://repository.upi.edu/40807/

Maula, I., Su'aida, A. H., & Salvia, N. Z. (2023). Penguatan Matematika Belief Melalui Model Konstruktivisme Guna Meningkatkan Prestasi Belajar Siswa Di Era Society 5.0. ProSANDIKA UNIKAL (Prosiding Seminar Nasional Pendidikan Matematika Universitas Pekalongan), 559–564. https://proceeding.unikal.ac.id/index.php/sandika/article/view/1259

Muhtarom, M., Juniati, D., Siswono, T. Y. E., & Rahmatika, I. (2018). Teachers' and students' beliefs in mathematics at State Senior High School 5 Semarang. Jurnal Riset Pendidikan Matematika, 5(1), 64–72. https://doi.org/10.21831/jrpm.v5i1.18734

Op't Eynde, P., De Corte, E., & Verschaffel, L. (2002). Framing Students' Mathematics-Related Beliefs. In Beliefs: A Hidden Variable in Mathematics Education? (pp. 13–37). Springer Netherlands. https://doi.org/10.1007/0-306-47958-3_2

Pitsia, V., Biggart, A., & Karakolidis, A. (2017). The role of students' self-beliefs, motivation and attitudes in predicting mathematics achievement: A multilevel analysis of the Programme for International Student Assessment data. Learning and Individual Differences, 55, 163–173. https://doi.org/10.1016/j.lindif.2017.03.014

ISSN : 2579-5724
ISSN : 2579-5260 (Online)
http://ejournal.umm.ac.id/index.php/MEJ

Robbani, I. A., & Sumartini, T. S. (2023). Kemampuan Pemecahan Masalah Matematis Ditinjau dari Motivasi Belajar Siswa Sekolah Dasar. Jurnal Inovasi Pembelajaran Matematika: PowerMathEdu, 2(2), 185–192. https://doi.org/10.31980/powermathedu.v2i2.3049

Satyam, V. R., Bae, Y., Smith, J. P., & Levin, M. (2022). Affect graphing: leveraging graphical representations in the study of students' affect in mathematics. Educational Studies in Mathematics, 110(3), 481–501. https://doi.org/10.1007/s10649-021-10131-3

Sopiany, H. N., & Rahayu, W. (2019). Analisis Miskonsepsi Siswa Ditinjau Dari Teori Kontruktivisme Pada Materi Segiempat. Jurnal Pendidikan Matematika, 13(2), 185–200. https://doi.org/10.22342/jpm.13.2.6773.185-200

Stipek, D. J., Givvin, K. B., Salmon, J. M., & MacGyvers, V. L. (2001). Teachers' beliefs and practices related to mathematics instruction. Teaching and Teacher Education, 17(2), 213–226. https://doi.org/10.1016/S0742-051X(00)00052-4

Sundayana, R. (2016). Statistika Penelitian Pendidikan. Alfabeta.

Syarifah, L. L. (2016). Pengaruh Model Pembelajaran Dan Belief Matematika Terhadap Kemampuan Komunikasi Matematis. Alphamath : Journal Of Mathematics Education, 2(2), 35–46. https://doi.org/10.30595/alphamath.v2i2.1226

Tanzila, S., & Nasution, H. A. (2022). Pengaruh Kecemasan Matematis dan Belief Matematika Terhadap Hasil Belajar Matematika Siswa. Jurnal MathEducation Nusantara, 5(2), 21. https://doi.org/10.54314/jmn.v5i2.233

Watin, E., & Kustijono, R. (2017). Efektivitas penggunaan E-book dengan Flip PDF Professional untuk melatihkan keterampilan proses sains. Prosiding Seminar Nasional Fisika (SNF), 124–129. https://fisika.fmipa.unesa.ac.id/proceedings/index.php/snf/article/view/25

Wijayanti, D. A., & Permana, A. A. (2018). Pengaruh Pendekatan Metode Pembelajaran dan Belief Matematika Terhadap Hasil Belajar Matematika Siswa. Jurnal Riset Pembelajaran Matematika Sekolah, 2(1), 17–23. https://doi.org/10.21009/jrpms.021.03