

## STUDENTS' LEARNING OBSTACLES IN SOCIAL ARITHMETIC

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### Abstract

Social arithmetic is one of the essential subjects for 7th-grade students because it is related to everyday life. However, the facts show that many students still have learning problems about the application of social arithmetic. The obstacle experienced by students is due to the students' obstacle in learning social arithmetic. This study aimed to obtain previous research on junior high school students' learning obstacles on social arithmetic. This study method is a systematic literature review (SLR), a descriptive-based survey in the form of an analysis of 23 articles from the Google Scholar database, with the keywords learning obstacle, analysis error, and difficulties in social arithmetic. The results showed that three types of learning obstacles, namely didactical obstacles, ontogenic obstacles, and epistemological obstacles. In addition, obstacles occur in concepts (profit, loss, discount), procedures (modeling and concluding), operational techniques (multiplication of percentage and division), and textbooks used because of the language that is difficult to understand and does not fit the context recognized by students. The research implies providing information on the obstacles experienced by students and research gaps from the results of this review for future research, namely research on analyzing textbooks.

**Keywords:** Learning obstacle; social arithmetic; systematic literature review (SLR); textbooks.

### Abstract

Aritmetika sosial salah satu mata pelajaran yang penting bagi siswa kelas 7 karena berhubungan dengan kehidupan sehari-hari. Namun, fakta menunjukkan bahwa masih banyak siswa memiliki permasalahan dalam mempelajari aritmetika sosial. Permasalahan yang dialami siswa, salah satunya dikarenakan adanya learning obstacle yang dialami siswa. Tujuan penelitian untuk memperoleh informasi tentang learning obstacle yang dialami siswa SMP pada materi aritmetika sosial dari penelitian yang telah dilaksanakan sebelumnya. Metode penelitian ini menggunakan Systematic Literature Review (SLR) dengan menggunakan pendekatan deskriptif berbasis survei melalui analisis terhadap 23 artikel yang terdapat pada database google scholar dan sejenisnya, dengan kata kunci learning obstacle, analisis kesalahan dan kesulitan pada materi aritmetika sosial. Berdasarkan hasil review dan analisis 23 jurnal tadi menunjukkan, bahwa learning obstacle yang terjadi terdapat tiga jenis, yaitu didactical obstacle, ontogenic obstacle, dan epistemological obstacle. Selain itu, obstacle terjadi pada konsep (untung, rugi, diskon), prosedur (pemodelan dan penarikan kesimpulan), teknik operasional (perkalian persen dan pembagian), dan buku teks yang digunakan karena bahasa yang sulit dipahami dan tidak sesuai konteks yang dikenali siswa. Implikasi pada penelitian ini menjadi memberikan informasi obstacle yang dialami siswa, serta gap penelitian dari hasil review ini untuk penelitian di masa depan pada materi aritmatika sosial, yaitu penelitian analisis buku teks.

**Kata kunci:** Aritmatika sosial; buku teks; learning obstacle; systematic literature review (SLR).



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### INTRODUCTION

Mathematics is one of the knowledge that is useful for humans

because it teaches humans to recognize and explain phenomena that occur in everyday life. This opinion is in line

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with Hashmi et al. (2018), when students can apply the application of the relationship between mathematical concepts and everyday situations, students will develop abilities. Mathematics education should prepare students to apply mathematics in all types of work, such as viewing mathematical ability as a basis for employability (Gravemeijer et al., 2017). Therefore, mathematics is helpful in everyday life

It is essential to realize the relationship between mathematics and students' lives to have competence in solving problems in life, for example, OECD (2014) report that financial literacy competencies can support the development of mathematics and reading skills. As for financial literacy, such as using an everyday context shopping for groceries, this item addresses the basic concept of value for money (e.i, questions about buying goods) (OECD, 2021). This will provide an authentic context in solving math problems. Therefore, Partnership for 21st Century Skills (2012) expects students who have graduated from school to be better prepared to face today's global economy, thus enabling schools to prepare early by including financial literacy, economics, business and entrepreneurship as core subjects.

These subjects may have started to run in Indonesia, even though they are only at the high school level equivalent to entrepreneurship subjects. In line with the objectives of the 2013 curriculum, which will be more achieved when students have the entrepreneurial spirit (Kemendikbud, 2019). Therefore, at the junior high school level, the subject that allows supporting this is social arithmetic.

In general, social arithmetic comes from social situations where

students interact directly, as human understanding in the modern era (Gaukroger, 2016; Wheat, 1946). Specifically in the educational process, social arithmetic is a subject that is taught in grade 7 even semesters and discusses mathematical calculations in social activities and their aspects in daily life, such as trading (sales and purchase prices, discounts, profit and loss, tare, gross, net), banking (single interest) (Bela et al., 2021; Winata et al., 2020). Thus, social arithmetic is a subject that discusses trade, banking, etc.

Social arithmetic is closely related to modeling mathematical situations from contextual problems. However, many students still have problems in learning social arithmetic. In Indonesia, about 1% of students score at level 5 or higher in mathematics (OECD average: 11%), one of which students can model complex mathematical situations (OECD, 2019). This shows that Indonesia's modeling difficulty mathematical problems level is still in the low category, only 1%. Meanwhile, social arithmetic material is closely related to making mathematical models. Based on data from Puspendik, social arithmetic on the National Examination at the junior high school level in Serang City, Banten province decreased from 2018 to 2019 by 33.12% to 31.92% ((Puspendik, 2018) and (Puspendik, 2019)).

Data from OECD and National Examination have shown that students in junior high schools have difficulty finding solutions to social arithmetic problems. Therefore, considering the importance of mastering social arithmetic, it is necessary to explore whether there are problems that occur in the social arithmetic learning process. Based on previous research, it was

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found that students had obstacles or difficulties in learning social arithmetic and its causes.

Based on previous research, the experience by students in social arithmetic problems is learning process carried out emphasizes memorizing concepts or formulas, which is social arithmetic (Asih et al., 2018). Its value in calculating discounts on final prices (concept errors), miscalculations of operations, and linking the context of word problems to students' own experiences in mathematical form (Allen, 2007; Ana & Nusantara, 2021; Barwell, 2005). Besides that, the obstacle is students' errors in solving algebraic problems, for example, calculating the initial price by applying a discount to the final price (sales price after discount) whose value is already known, not to the unknown initial price.

Errors, obstacles, and difficulties experienced by students in finding solutions to social arithmetic problems may indicate that there are fundamental problems related to the construction of knowledge and the meaning of the concept of social arithmetic itself. According to Makonye and Fakude (2016) although teaching strategies that maximize students' participation in mathematics classes help students learn and resolve their errors or obstacles, knowledge must be re-created by students. Therefore, in the learning process, including social arithmetic, you will find the phenomenon of difficulties, errors, or obstacles experienced by students, and this is due to one of the reasons for learning obstacles. Obstacles that occur can detect from the actual situation of students with the environment, cognitive barriers in thinking activities to complete mathematical task procedures

(Antonijević, 2016; Bernardo, 1999; Skovsmose, 2005)

Based on the problems that exist above, it is necessary to have several studies that have the result about detecting learning obstacles, especially in social arithmetic, as consideration for developing learning designs (didactic) so that the quality of learning carried out by students runs optimally, especially on social arithmetic. Thus, the author is interested in conducting a literature review study by collecting several studies from several journals by searching using Google Scholar. The keywords learning obstacle in social arithmetic, error and difficulty analysis in social arithmetic. The purpose of analyzing several articles using literature review is to find out what types of obstacles often occur in students' experiences from previous studies in articles.

## **METHOD**

The method in this study used a systematic literature review (SLR) with a survey-based descriptive approach. The sample in this study used 23 articles. Twenty-three journals have been selected because they fulfill the explanation of obstacles in social arithmetic material. The articles are in the Google Scholar database and the like in the 2011-2021 period, with the keywords learning obstacle, error analysis, and difficulty in social arithmetic. The first step in this research is collecting articles discussing the learning obstacle in social arithmetic. Then, classifying the articles based on the year, title, research topic, context, method journal. This study aimed to obtain information about the learning obstacles experienced by junior high school students on social arithmetic from previous research. Furthermore,

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analyzing the articles that had been selected and grouped, including the types of obstacles, so that the types of obstacles that students often experienced and their causes became conclusions, new ideas, and recommendations for further research.

**RESULTS AND DISCUSSION**

In this study, 23 articles were selected and discussed learning obstacles, error analysis and difficulties in social arithmetic. Based on 23 articles, they are from 14 national and four international journals.

After finding the titles of articles from journals, classifying the articles based on the year of their publication. Thus, the articles' classification by year is as Figure 1:

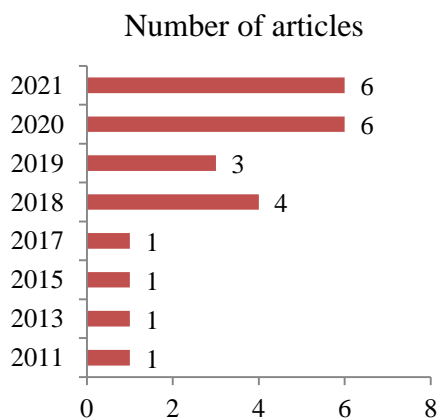


Figure 1. Classification by year

Figure 1 shows that in 2020 and 2021 has, many articles related to the learning obstacle of social arithmetic.

After that, classifying articles based on their research methodology. The results of this classification are shown in Figure 2.

Research Methodology

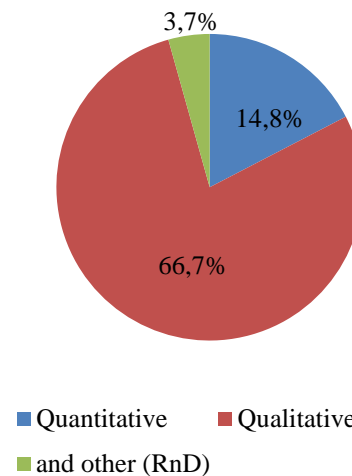


Figure 2. Classification based on the method

Figure 2 shows that research on learning obstacles, analysis of errors, and difficulties in social arithmetic used qualitative research methods. In line with the opinion of Creswell (2012) that this qualitative research process starts with philosophical assumptions and the use of an interpretive/theoretical framework, continues with an interpretive approach to the procedures involved, to inform the study of research problems that deal with meanings that are considered individuals or groups to come from social or human issues. In other words, research related to analyzing articles about learning obstacles begins with a problem and is interpreted by the researcher.

Furthermore, the researcher classified 23 articles based on the obstacles experienced by students in social arithmetic, according to Brousseau (2002), there are three types of learning obstacles, namely ontogenic obstacles, didactical obstacles, and epistemological obstacles. The ontogenic obstacle is learning due to personal limitations in mental readiness

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and age development. The didactical obstacle comes from the misrepresentation of knowledge in the learning process and usually comes from the method used by a teacher. Epistemological obstacle occurs because the knowledge possessed by

students is not complete in a specific context. Hence, students' knowledge (knowledge epistemization) is incomplete and comprehensive. The following analysis is obtained in Table 1.

Table 1. Results of classification article according to Brousseau

No	Type of Obstacles	Detail	References	Percent. (%)
1	Didactical obstacle	Students are learning methods that are not yet creative, such as still fixated on textbooks less varied teaching materials, so that the role of the teacher still dominates.	(Inayah, 2018; Utami, 2013; Winata et al., 2020; Yeh et al., 2019)	16%
2	Ontogenic obstacle	Lack of interest, awareness, and attention in students learning mathematics, lazy to read long questions, difficulty in interpreting every word in the questions, learning methods that only memorize material, the hasty attitude carried out by students in working on questions, students' understanding of the price problem proposed to students was not following the context that students had known.	(Ana & Nusantara, 2021; Astutik & Kurniawan, 2015; Davies, 2011; Intansari, 2019; Sari et al., 2018; Dila & Zanthly, 2020; Marlina & Setiawan, 2021)	28%
3	Epistemological obstacle	Do not understand the concept and terms (cost, profit, price, loss, profit percentage), lack of accuracy in reading questions (don't understand what is known and asked), difficulty determining formulas so that answers are incorrect, performing calculations without writing down the formulas used in advance to shorten	(Amalia, 2017; Ana & Nusantara, 2021; Chanisah et al., 2019; Ferdianto, 2021; Karadeniz & Karahan, 2020; Intansari, 2019; Ningsih et al., 2021; Nuraeni et al., 2020; Parawansa & Siswanto, 2021; Sawatzki & Goos, 2018; Wahyuni, 2020; Yunia & Zanthly, 2020)	48%

No	Type of Obstacles	Detail	References	Percent. (%)
		processing time, procedural obstacles (e.i, processing errors, concluding the final solution, modeling into mathematization about writing symbols, arithmetic operations errors, such as subtraction, division, multiplication by percentage). Most obstacles occur because of the lack of prior knowledge, such as poor reading skills and the 'Ratio and Proportion' concept in 'Percentage'.		
4	Epistemological obstacle (based on textbooks)	The textbook does not hone students' spatial abilities (imagination), the contents of the book have no explanation of how the origin of getting a way to solve the problem, so students cannot solve varied problems, and the examples of questions given are also still lacking for independent study.	(Rangkuti & Khairani, 2018; Bela et al., 2021)	8%

Based on table 1 have several learning obstacles in social arithmetic. According to Brousseau, based on the category of learning obstacles: (1) The didactical obstacle that occurs is in stark contrast to the mandate of the curriculum in Indonesia, that a teacher should have understood the characteristics and objectives of implementing each learning model to be achieved by students so that this is expected to overcome student boredom and make students active. Kemendikbud tells recommended learning model, especially during the current pandemic conditions (Pusdatin Kemendikbud,

2020), namely the Discovery-Inquiry Model, Project Based Learning Model, Blended Learning Model, etc. Thus, the learning obstacle can be indicated because of the lack of didactic anticipation reflected in learning planning, impacting each student's less optimal learning process. This is because some of the student responses to didactic situations are beyond the teachers' thinking or are not explored. The various learning obstacle that arises is not responded to by the teacher appropriately or even not responded to. As a result, the learning process may not occur (Suryadi, 2013). We need an

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approach in teaching that refers to designing simple tasks for students who are by student's prior knowledge so that students will benefit from the learning process and be more involved in learning (Dong et al., 2020).

Then another obstacle, namely (2) ontogenic obstacle, concerns teachers to make mathematics learning meaningful and fun for students, starting from the beginning to the end of learning. This is because mathematics is one of the subjects that causes a lot of negative emotions (hate) for students (Gafoor & Kurukkan, 2015). Most students do not like mathematics, especially social arithmetic, because the material is not understood. Therefore, the students know the importance of the content, context, and theme because those also show substantial individual variations in the students' like or dislike (Løhre et al., 2021). In fact, in understanding the economics contained in social arithmetic, students must be able to observe their way of thinking, the structure of their understanding, about certain phenomena (such as prices) so that they can relate the context of these social-based problems to students' own experiences, as well as the role of the language conveyed, understood by students in solving financial issues (Barwell, 2005; Bayaga et al., 2021; Butler, 2013; Davies, 2011; Van Rinsveld et al., 2016). Therefore, teachers must also describe how the mathematics teacher knows the topics that the teacher teaches about the mathematical content (e.g., concepts, rules, theorems, facts, and procedures) and their meanings (Carrillo-yañez et al., 2018).

Finally, another obstacle, namely (3) epistemological obstacle. Based on Table 1, it can be shown that students most often experience obstacles in

social arithmetic, namely in epistemological obstacles. Epistemological obstacle has 52% (include based on textbook 8%), that is greater than didactical obstacle(16%) and ontogenic obstacle(28%). Thus, in this study, it can be seen that the epistemological obstacle that is thought to be most often experienced by students is through articles that have been collected and analyzed, but of course, this study has limitations. This is the solution to the epistemological obstacle that has not been described. Another limitation is that the articles analyzed in this study focus more on teachers and students, even though there are elements that support the knowledge construction process, namely textbooks. Although several studies discuss the factors of textbooks owned by students influence the learning process, especially social arithmetic, as listed in Table 1. As a result, the material given to students is only accepted without being interpreted and understood by the students themselves, thus allowing obstacles to arise from aspects of the textbooks used.

It is known that textbooks play an essential role for students in acquiring and constructing knowledge. Previous research concluded that students' quality of books plays a vital role in mathematics instruction. In the student aspect, textbooks are considered to have the potential to be a powerful tool to help students develop ideas and understanding of mathematical concepts so that reading textbooks, provides opportunities for students to be involved in tasks that require a high level of understanding, which students are expected to have high scores. higher (Hadar, 2017; Weinberg & Wiesner, 2011).

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In the teacher aspect, textbooks emerged as 'tools' and pedagogical guidelines for teachers to be adapted to students' age-appropriate in certain classes (Gene et al., 2018). It can be said that all teachers feel responsible for the teaching and learning of students, including the selection of textbooks that accommodate the existing learning management system to match the criteria and use in the classroom (Ardiansyah et al., 2018). There must be coherence between the National Curriculum, teaching approaches in schools with textbooks to provide detailed knowledge implicit in curriculum programs and contain brief explanations of the material that needs to be taught (Oates, 2014). According to (Kemendikbud, 2016) in Permendikbud Nomor 8 Tahun 2016, Pasal 1 Ayat 1, textbooks are the primary learning source to develop Basic and Core Competencies. Therefore, this shows that textbooks play an important role in determining the success of the students' learning and teaching process. However, the facts show that teachers rely too much on textbooks (Wijayanti, 2019). The data shows that 70% of teachers use thematic books from publishers, while 30% of teachers design their own (Ain & Kurniawati, 2012), meaning that teachers prefer ready-made books rather than making their own. In several studies, many the context in mathematics about obstacles that focus on student learning and teaching innovation, meanwhile the modules (textbooks) adapted to the curriculum are rarely questioned (Bosch et al., 2021).

Textbooks give rise to the construction of knowledge, i.e., Students are faced with the condition to understand previous material that is not under prior knowledge, so students will

try to assimilate knowledge into their existing framework, or what is called a synthetic mode (Kajander & Lovric, 2009). Although sometimes, students connect assignments with examples and find it difficult, students are also expected to reason using other information in the textbook so that students do not just imitate the solutions from the examples (Jäder et al., 2020). Thus, textbooks do contain material subjects and include the learning process and the expected competencies, which have a structure that seeks to help students construct their knowledge through presentations and questions (Sugandi & Delice, 2014). In line with Glasnovic Gracin (2018), the tasks and examples listed in the textbook are the most important element.

Therefore, an analysis of the tasks in the textbooks can be done for further research, where there is one theory recommended as a tool in analyzing textbooks, especially focusing on questions/tasks, namely the praxeological theory initiated by Yves Chevallard. The idea of this praxeological reference model explains in analyzing the mathematical core of the textbook in a reasonably objective and detailed manner (Wijayanti & Winslow, 2017). In some dictionaries define praxeology as the study of human actions and behavior. However (Chevallard, 2006) in the study of praxeology it is about what people do and how they do it and what they think and how they do it. Therefore, analyzing textbooks with praxeology theory find out the indications from tasks, especially in constructing student knowledge (epistemological obstacles). Praxeology can explain the comparison of textbooks and communication in mathematics class so that textbooks become sources for a teacher to find out



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why mathematics should be taught and how (Pansell & Boistrup, 2018).

### CONCLUSION AND SUGGESTION

Each of the previous researchers identified the obstacles, errors, and difficulties, experienced by students in solving social arithmetic problems. The obstacles that have been summarized are classified into three parts, according to Brousseau, namely didactical obstacle (teachers' teaching method), ontogenic obstacle (student mental processes), and epistemological obstacle (knowledge formation process), and textbooks used because of the language that is difficult to understand and does not fit the context recognized by students. However, the discussion of obstacles focuses more on students, while research on textbooks only has a few that analyze more deeply. Therefore, it can suggest future research in analyzing related textbooks. The suitability of the task (tasks) in the textbook with existing knowledge (prior knowledge) is aimed at the indicators that students want to achieve. One way to analyze textbooks is by using the praxeological theory initiated by Yves Chevallard.

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