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Phenomena of Understanding and the Need for Psychological Indicators of Mathematics Learning Outcomes in Establishing Pedagogic Contracts

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ABSTRACT

This paper aims to describe the need for psychomotor domain indicators for elementary school (SD) mathematics learning outcomes as a form of pedagogic contract between education units and the community in Bantul district, Yogyakarta, Indonesia. This study uses a qualitative descriptive method with a phenomenological approach. Data collection techniques were carried out by interviews and observation. Research subjects were determined by purposive sampling technique. The validity of the human instrument was measured by the researchers themselves. Data were analyzed through stages: data reduction, data presentation, and drawing conclusions. The results showed that: 37 out of 40 teachers (92.5%) stated that the psychomotor domain indicators had not been understood, the community's focus was on the cognitive domain; 3 out of 40 teachers (7.5%) understand the psychomotor domain indicators but have not been able to describe the form of the skills; 40 out of 40 parents of students (100%) did not understand the indicators of the psychomotor domain and the forms of follow-up in helping their children. The conclusion of this study is that teachers do not understand psychomotor indicators so that the pedagogic contract between the education unit and the community has not been realized properly.

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INTRODUCTION

Learning is a learning process designed and implemented by the teacher in order to develop the cognitive, affective, and psychomotor domains. The 2022 curriculum or independent curriculum implies that each subject makes a balanced contribution to the development of the three domains. This means that balanced development also applies to learning mathematics in elementary schools (SD). Balanced development through learning mathematics can be said to be successful or not, it is necessary to have measurable indicators. These indicators already exist in operational verbs (KKO) which are formulated in Bloom's Taxonomy.

Mathematics as knowledge that is deductive, formal, and abstract, emphasizes as knowledge that tends to develop the cognitive domain and develop towards the affective domain. The results of the analysis of learning implementation plans (RPP) and teaching modules for independent curriculum implementers, the writing of mathematics learning objectives tends to use KKO which is dominant from the cognitive domain. For example: Students can calculate the results of multiplication of fractional numbers. While the affective domain will be written if learning mathematics uses a contextual approach. For example: Students can discuss the results of observing data searches.

The results of observations and interviews of 40 elementary school teachers in the sub-districts of Imogiri and Srandakan, Bantul district, Yogyakarta, Indonesia, stated that 37 out of 40 teachers (92.5%) stated that learning mathematics is to develop logical, critical and creative thinking skills. This can be seen from the KKO which is written in the learning objectives in lesson plans and teaching modules, such as: matching, comparing, completing, making diagrams, evaluating, and making patterns, are KKO which tend to develop students' mindsets. Nigar, Nashid (2020) states that students can be said to be successful or not in achieving their mathematics learning goals will be seen from the test results. If the test results exceed or equal to the set minimum completeness criteria (KKM), students are considered to have completed the mathematics material. However, it will be the other way around if the test results are below the KKM then students can be said to have failed.

Kalpokaite, Neringa, and Ivana Radivojevic (2019) explained that the KKO from the affective domain will be written in lesson plans and teaching modules, if mathematics learning is associated with the socio-cultural environment that exists in students and uses the group model. The KKO written in lesson plans and teaching modules, such as: following, helping, showing, adjusting, and acting, are verbs that tend to measure the development of

the affective domain. Thus, the teacher will pay attention to the solidity of group members by giving marks in the form of criteria from an attitude perspective. For example: an A score for group members who have a solid attitude with very good criteria; score B for a group that has a solid attitude with good criteria; value C for the group that has a solid attitude with sufficient criteria.

3 out of 40 teachers (7.5%) realized that learning mathematics also develops the psychomotor domain, but the teacher cannot describe the form of the skills. For example, in the subject of dancing, the teacher will be able to describe the development of the psychomotor domain by writing KKO in the learning objectives in lesson plans and teaching modules. Mimicking, performing, playing, developing, and producing works are examples of verbs in the psychomotor domain. Echeverria, Jon, and Olga C. Santos (2021) state that the art of dancing can be seen concretely from its physical movements. While learning mathematics, physical movements that can be seen are the fingers of the students. Dance movements are the result of coordination between the right brain and nerves that move physically through the muscles. Meanwhile, learning mathematics is the result of coordination between the left brain and the nerves that move the fingers. The two subjects have similarities in the system, namely the result of coordination between the brain and the nerves that move the body. This statement implies that there is a phenomenon regarding the psychomotor domain of mathematics learning outcomes.

Kenedi, Ary Kiswanto, Yullys Helsa, Yetti Ariani, Melva Zainil, and Sherlyane Hendri (2019) explain that 6/18 is equivalent to 30/90 and 6/18 in its simple form 1/3, is a basic skill in associating with mathematical operations. Another example, every time around Ali's field he drank Vitamin 3 capsules. if Ali circled the field 5 times, determine the mathematical model. The answer is 5 x 3 = ⋯. This is a mathematical modeling skill. These two examples have different indicators because they have different quality of development. The phenomenon of understanding the indicators of the psychomotor domain of mathematics learning outcomes is a current demand. This is because, parents of students need a specific explanation of the ability to learn mathematics. The results of observations of 40 parents of students regarding the teacher's answers to learning difficulties in mathematics, namely: 12 out of 40 parents (30%) stated that they did not pay attention during learning, 10 out of 40 parents (25%) stated that they did not memorize formulas, 18 out of 40 parents (45%) stated that they lacked practice questions.

The specification of the psychomotor domain indicators is an illustration of the ability to learn mathematics. The need for psychomotor domain indicators is a phenomenon in learning mathematics. This is because, the need for specification of psychomotor domain indicators can create pedagogic contracts between teachers and students and between educational units and parents (community). Cowan, Michelle (2020) states that the pedagogic contract is one of the functions of the KKM. For this reason, this study describes the phenomenon of understanding the indicators of the psychomotor domain and the needs of students' parents for psychomotor indicators.

RESEARCH METHODS

This research method is descriptive qualitative with a phenomenological approach. Sugiyono (2018) states that research is called qualitative if the researcher is the object under study, the key instrument, and in natural conditions. Marambang Daulay (2010) explains that the phenomenological approach is research on the experiences experienced by individuals in their life experiences subjectively and have meaning. Badil, Dildar Muhammad Dildar Muhammad, Zeenaf Aslam Zeenaf Aslam, Kashif Khan Kashif Khan, Anny Ashiq Anny Ashiq, and Uzma Bibi Uzma Bibi (2023) state that phenomenology is a qualitative methodology that allows researchers to apply subjectivity and interpersonal skills in exploring data. Taking into account the above understanding, this qualitative research aims to describe the phenomenon of understanding and the need for psychomotor indicators of elementary school (SD) mathematics learning outcomes in realizing pedagogic contracts. The research will be carried out from January to April 2023.

The research was conducted in two sub-districts, namely: Imogiri and Srandakan, Bantul district, Yogyakarta, Indonesia. Determination of the location and subject in this study consisted of 40 teachers and 40 parents of students. The subjects represented 23 public elementary schools and 17 private elementary schools which were inclusive schools and had been designated as friendly schools for students. In the implications of the independent curriculum, 40 elementary schools in the 2022/2023 academic year use two curricula, namely the 2013 curriculum and the 2022 curriculum by choosing independent learning.

Alam, Md Kausar (2021) states that data collection techniques are procedures for obtaining research data. In this study, the data collection was through: in-depth interviews, observation, and documentation. Kriyantono (2020) states that interviews are active two-way communication between researchers (information seekers) and informants (someone who

has information on a particular object). In this study, the researcher chose free interviews so that informants could provide detailed information so that a meaningful conclusion was drawn. Sutrisno Hadi (2016) says that observation is a complex or collaborative process between biological and psychological domains with a focus on the process of observing and remembering. Observations were carried out when the subject carried out the teacher activity group (KKG). The results of observations in the form of diary notes. Arikunto (2016) explains the notion of documentation as a collection of data about things in the form of notes, transcripts, books, newspapers, minutes, report cards, agendas and so on. In this study, the documentation in question is the lesson plan (RPP) and teaching modules.

The data that has been entered will then be validated. Rukminingsih, Gunawan Adnan, Muhammad Adnan (2020) explained that Validation is the honesty and truth of the results of research reports that can be described, interpreted, explained, and drawn conclusions. Validation in this study uses triangulation of data sources. Moleong (2023) explains the meaning of data source triangulation is the activity of using various data sources, such as: diaries, interviews, observations, and documents, or interviewing more than one subject who has different views to seek the truth of the data that has been obtained. Triangulation of data sources in this study by interviewing two peer teachers and school principals from each research subject.

After the data is collected, it needs to be analyzed. Asapi, Lili Sururi, Utami Rosalina, and Dwi Nopiyadi (2022) state that data analysis is an activity for inspection, discarding data that is inconsistent with research, data modeling, with the aim of obtaining useful information, providing information about conclusions to support decision making. Data analysis in this study uses the theory of Miles and Huberman (Tjetjep Rohendi, 2014) whose stages are: data reduction, data presentation, and drawing conclusions. Data reduction is an activity of classifying, directing, sharpening data according to the research focus and removing irrelevant data. Presentation of data is the activity of compiling data that allows for conclusions to be drawn. The data in this study were texts from interviews, field notes, and lesson plan documents and teaching modules. Meanwhile, drawing conclusions are the results used for decision making. The results obtained in this study are a description of the phenomenon of understanding and the need for psychomotor indicators of mathematics learning outcomes in realizing pedagogic contracts.

RESULTS AND DISCUSSION

The results of the study can be described that the psychomotor domain is understood as development related to the body or physique, concrete motor, and kinesthetic, and requires continuous training, such as subjects: sports, dancing, singing, painting, experiments or demonstrations in science. Efendi, Defi, Renny Wulan Apriliyasari, Juliana Gracia Eka Prihartami Massie, Cho Lee Wong, Regina Natalia, Bejo Utomo, Chiyar Edison Sunarya, Efa Apriyanti, and Kee Hsin Chen (2023) explain the emergence of the assumption that understanding psychomotor indicators is not related to learning mathematics. The emergence of the elementary teacher's assumptions is due to the fact that learning mathematics is related to things that exist in the human mind and develops logical, critical, and creative thinking. Meanwhile, the psychomotor domain deals with development that focuses on imitating, manipulating, and precision. This statement is in accordance with psychologist Dave (in Dewi Amaliah Nafiati, 2021) who states that psychomotor abilities are divided into five tiered groups (from low to high), namely: imitation, manipulation, precision, articulation, and naturalization.

From the results of observations and interviews, the following data were obtained:

a) There were 3 out of 40 teachers (7.5%) who stated that teachers understood psychomotor indicators to describe concrete physical activities but had not been able to describe abstract forms of skills in learning mathematics.

    1) The word imitating in the psychomotor domain is defined by Hima, Lina Rihatul, Toto Nusantara, Erry Hidayanto, and Swasono Rahardjo (2019) as an activity following the physical movement of objects that are the focus of learning but not yet meaningful and concrete. For example, students imitate dance movements from the dance teacher's demonstration results. But the movement is still not flexible because it is still in the imitating stage. At this stage, the teacher is able to describe the criteria that students are able or not able to imitate dance movements. This is because the dance movement can be observed (concrete). Understanding of indicators of the psychomotor domain of teachers is able to understand concrete meanings, but has not been able to describe abstract forms in learning mathematics. Lidyasari, Aprilia Tina, Indriyana Rachmawati, Augusto Da Costa, and Poh Wanyi. 2022 explains that the inability to describe the imitation stages which are abstract in nature, is indicated by the inability to give examples of skills in mathematics.

Teacher Activities	Student Activities
The teacher explains the operational competence of multiplication of fractions: $\frac{a}{b}+\frac{c}{d}=\frac{axd}{bxd}+\frac{cxb}{dxb}$ $=\frac{axd+cxb}{bxd}$	Students copy the steps explained by the teacher: $\frac{a}{b}+\frac{c}{d}=\frac{axd}{bxd}+\frac{cxb}{dxb}$ $=\frac{axd+cxb}{bxd}$ It is an abstract skill, i.e. copying and does not have meaning

2) The stages of manipulation are described by Jakhongir, Fozilov, and Abduraxmonova Mohinur. (2022) namely as the ability to imitate the object being studied but there are additions to show a different impression. In physical movement the teacher is able to describe the stages of manipulation and is able to give examples. For example, dance movements, which at a certain stage are dominant with hand movements, are then added with facial movements. Mat Isa, C. M, N. K Mustaffa, E. O Joseph, and C. N Preece (2020) explained that the teacher's ability to describe the stages of manipulation is because the teacher can pay attention to every movement displayed by students. However, teachers have not been able to describe the meaning of this manipulation in learning mathematics.

Teacher Activities	Student Activities
The teacher explains the operational competence of multiplication of fractions: $\frac{a}{b}+\frac{c}{d}=\frac{axd}{bxd}+\frac{cxb}{dxb}$ $=\frac{axd+cxb}{bxd}$	Learners manipulate the completion steps. $\frac{a}{b}+\frac{c}{d}=\cdots$ (this step is omitted) $=\frac{axd+cxb}{bxd}$ It is an abstract skill, namely manipulating by eliminating one stage of a step, so that meaningfulness begins to appear, namely students are able to operate multiplication of fractions

3) Having the stages of precision or accuracy is understood by elementary school teachers as activities of carrying out physical movements and behaviors without

examples that can be seen or noticed, and are carried out smoothly, in a balanced manner, have precise movements, and have high accuracy. Kawuri, Maria Yosephien Retna Tinon, Ishafit Ishafit, and Suritno Fayanto (2019) state that for concrete activities, the teacher is able to provide examples, namely dancing movements followed by musical accompaniment. The teacher is able to describe the smoothness of the movements, the flexibility of the movements, and the movements that match the rhythm of the music. All of these indicators can be described by the teacher because the activities displayed by students can be observed. However, the precision stages for learning mathematics have not been able to describe and give examples of teachers. This is because the precision stages which are abstract in nature have not been properly understood.

Teacher Activities	Student Activities
The teacher explains the operational competence of multiplication of fractions: $\frac{a}{b}+\frac{c}{d}=\frac{axd}{bxd}+\frac{cxb}{dxb}$ $=\frac{axd+cxb}{bxd}$	Students at the precision stage of the completion step produce the correct truth value. $\frac{a}{b}+\frac{c}{d}=\frac{axd+cxb}{bxd}$ $= k$ (result is true) This abstract skill is shown by having the meaning "can operate multiplication of fractions" and the value of the operation result is correct.

b) 37 out of 40 teachers (92.5%) stated that psychomotor indicators regarding abilities were not well understood, such as: perception, readiness, and imitation. These three indicators are stages before students begin the development of the psychomotor domain. On the other hand, the focus of teachers and parents of students (community) on learning mathematics is only on the development of the cognitive domain. The psychomotor indicators referred to are related to or related to physical activity and coordination between nerves and muscles to bring about movement. Simpson (in Dewi Amaliah Nafiati, 2021) explains that psychomotor abilities are related to physique, the result of coordination between nerves and muscles, and the utilization of areas of motor skills that need continuous training and can be measured both in terms of: precision, distance, speed, procedures and execution techniques.

Simpson (in Dewi Amaliah Nafiati, 2021) explains that there are seven activities in categorizing psychomotor abilities, namely: perception, readiness, imitating, habituation, proficient, natural, and original. Three things that become the basic phenomenon of teachers do not understand to uncover and describe the development of the psychomotor domain, namely they do not understand the meaning of indicators:

1) Perception. The definition of perception in the psychomotor domain is the ability to utilize sensory nerves to interpret an estimate. For example, the teacher brings a watermelon when teaching the definition of volume or the content of a spherical shape. The operational verbs are: choosing, detecting, preparing, connecting, describing, selecting, identifying, isolating, and differentiating.
2) Readiness. The definition of readiness in the psychomotor domain is the ability to

   repare mentally, physically, and emotionally for learning. Suppose students work on math problems according to the right steps and the results are correct. The operational verbs used are: helping, showing, initiating, initiating,showing, preparing, and demonstrating.
3) Mimic. The meaning of imitation in the psychomotor domain is defined as the ability to start performing a broader skill by imitating and trying out. Imitating the instructor's movements for something concrete and copying what the teacher explains on the blackboard. The operational verbs used are try, do, respond, follow, practice, make, show, install, and react.

The results of learning mathematics in the form of semester results reports, for parents of students provide relatively the same input and interpretation. The results of the interviews stated that students who experienced difficulties in learning mathematics were due to:

1) less memorizing math formulas. Mathematics is identified with a collection of formulas that have no meaning for students. This is because the semester results report is a collection of failures from each material to the next material. Matusov, Eugene, and Paul Sullivan (2020) explained that the difficulties at the beginning of the math material were not specifically explained by the teacher, why students were not ready or did not understand mathematical concepts for a long time.
2) lack of practice questions. Providing practice questions and homework becomes a source of problems if students do not have a companion when learning mathematics.

The questions given at the beginning of the subject matter are still classified as cognitive domains of stage 1 or 2, but giving practice questions or homework is cognitive stage 5 or 6.

3) do not pay serious attention when learning mathematics. The psychological situation and condition of students or not ready to accept the next subject matter is often not noticed by the teacher. Demands for completion of the curriculum or in accordance with the lesson plan and teaching modules that have been made, are a source of additional problems for students.

4) be passive when learning. Nurlaily, Vivi Astuti, Heribertus Soegiyanto, and Budi Usodo (2019) state that the character of students in elementary school is not controlled by the teacher. Likes in groups, playing, and in concrete stages, are some of the characteristics of the psychological development of students in elementary school. This condition is less noticed by the teacher as evidenced by the data, namely: teachers in mathematics learning always go from abstract to abstract.

The statement above is in accordance with the results of the study which stated that 40 out of 40 parents of students (100%) did not understand psychomotor indicators and follow-up forms in helping their children. Students experiencing math problems are not specifically detected at which stage when the material is explained by the teacher. Zorluoğlu, Seraceddin Levent, and Çağrı Güven (2020) explained that the lack of understanding was due to teachers not being able to understand indicators from the psychomotor domain, so explanations to parents could not be specific. The teacher's inability to explain specifically results in the parents of students being unable to assist individually and go straight to the source of the problem.

Psychomotor domain indicators for learning mathematics are not so focused on by the teacher. Hayashi, Paulo, Gustavo Abib, and Norberto Hoppen (2019) explain that the mindset of elementary school teachers, mathematics is knowledge to develop critical, logical and creative thinking. Thus, they do not understand the need for indicators from the psychomotor domain. Dyer (in Olapane, Elias C, 2021) states that psychomotor abilities are not only concrete in nature which involve kinesthetic, physical, motor, but also abstract ones involving innovation, abstraction, and creativity, such as: counting, writing, reading, drawing, and composing in the fields of language, social, and religion. The understanding of the existence of psychomotor domain indicators is a phenomenon to provide assistance at which stages students experience difficulties in learning mathematics.

Dyer (in Nofrialdi and Reski, 2022) states that the taxonomy of the abstract psychomotor domain consists of the stages: observing or observing, asking questions, conducting experiments, using reason, and communicating. The taxonomy is a source for teachers to be able to provide descriptions of the development of students in learning mathematics. This is because these stages reflect the level of ability shown by students in learning mathematics. That is, if students are still in the observing stage, it is better if the mathematical concept given is to build mathematical concepts with concrete stages, for example: using manipulative materials, giving geometric models, and connecting mathematical material with the environment around students.

Simpson, Dave, and Dyer (in Poluakan, Cosmas, Anetha F Tilaar, Philoteus Tuerah, and Aswin Mondolang. 2019) state that the level of ability in the abstract psychomotor domain, each stage has an operational verb. Olson-Morrison, Debra, Tami Radohl, and Geri Dickey (2019) state that operational verbs are needed to describe learning objectives that have been planned and set in learning programs. The stages and operational verbs are arranged in the table below.

Table 1. Of Operational Verbs for the Psychomotor Realm Abstract-Adaptation from Dyer

Psychomotor Stages	Operational Verbs
Observe	see, hear, read, pay attention, feel, observe, and identify,
Ask	ask (orally), write down questions, discuss, ask and answer.
Try	conducting experiments, seeking information, reading, conducting interviews
reasoning	conclude, connect, associate, classify, look for causal relationships.
communicate	present, write (report), exhibit.

The existence of operational verbs for the psychomotor domain which are abstract in nature, can realize one of the teacher's functions according to the formation of the minimum completeness criteria (KKM). Santos, Olga C (2019) states that KKM has a function as a pedagogic contract between teachers and students and between educational units and the community (in this case the parents of students). This means that teachers need to understand indicators of the abstract psychomotor domain. The ability to understand indicators of the psychomotor domain will be able to describe the stages that students have just reached and help provide specific constraints on learning mathematics.

CONCLUSION

The results showed that: 37 out of 40 teachers (92.5%) stated that the psychomotor domain indicators had not been understood so that the community (teachers and parents of students) focused on the cognitive domain; 3 out of 40 teachers (7.5%) understand the indicators of the psychomotor domain but have not been able to describe the form of the skills because what is understood is the indicators of the psychomotor domain which are concrete; 40 out of 40 parents of students (100%) did not understand the indicators of the psychomotor domain so they did not understand the specific constraints of learning mathematics felt by students. Furthermore, the form of follow-up in helping their children will be directed to take part in additional learning. The conclusion of this study is that teachers do not understand psychomotor indicators so that the pedagogic contract between the education unit and the community has not been realized properly.

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