Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram
https://e-journal.undikma.ac.id/index.php/prismasains/index
e-mail: prismasains.pkpsm@gmail.com

April 2023. Vol. 11, No. 2
p-ISSN: 2338-4530
e-ISSN: 2540-7899
pp. 581-595

Assessment Evaluation Using Solo Taxonomy for Measuring Levels of Critical Thinking Skills: PYP International Baccalaureate Case Study

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Received: March 2022; Revised: March 2023; Published: April 2023

Abstract

This study aims to evaluate and document learning outcomes using the SOLO taxonomy model as an indicator of learning outcomes. Higher order thinking skills towards critical thinking elements. This research uses case studies with mixed methods qualitative and quantitative research methods with documentation research instruments of data analysis. The research sample was conducted in 2 4th grade elementary schools in Jakarta which implemented the IB (International Baccalaureate) curriculum by using the results of the SOLO taxonomy assessment. Data collection is done by interview method, analysis of the researched data documentation on critical thinking skills using the SOLO Taxonomy framework in the learning process and the level of assessment descriptors as scores or grading student report card assessments. The SOLO taxonomy descriptor level of the highest level of thinking skills is Extended Abstract with an assessment descriptor value of 5 and the lowest descriptor value of 3 (multi-structural) for reporting learning outcomes based on the achievement of student learning outcomes on understanding the concept of knowledge. Stages of students' critical thinking from not knowing to the level of understanding of concepts/learning outcomes related to real life. So it can be concluded that the results of this case study research can be used as an evaluation of the reporting of learning outcomes on critical thinking skills in the learning process and documentation of reporting assessments of learning at the elementary school level. The higher the students' critical thinking skills in understanding the concept of learning outcomes, the students reach the Higher Order Thinking Skills stage or the high-level skills needed in 21st century learning in solving real-life cognitive problems.

Keywords: Descriptor assessment, SOLO taxonomy, reporting of learning outcomes, critical thinking skills, International Baccalaureate

How to Cite: Triana, H., Abustang, P., Utomo, E., Rakhman, G., & Fahrurrozi, F. (2023). Assessment Evaluation Using Solo Taxonomy for Measuring Levels of Critical Thinking Skills: PYP International Baccalaureate Case Study. *Prisma Sains : Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram, 11*(2), 581-595. doi:https://doi.org/10.33394/j-ps.v11i2.7894

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INTRODUCTION

Holistic student learning outcomes include competency aspects of knowledge, skills, and attitudes or student profiles. In the International Baccalaurate curriculum, there are essential components that teachers and students need to know as a community of learners or a community of lifelong learners. There are 5 essential components, namely knowledge covering learning objectives or learning outcomes from each phase of the PYP (Primary Years Programme) level, namely the elementary school level aged 3-12 years. Second, skills for certain subjects with a learning and teaching approach known as ATL skills (Approach to Learning Skills) or a skills approach which includes thinking skills, social skills, communication skills, self-management skills (Self-Management Skills), and research skills (Research Skills). The focus of this research is the application of thinking skills to the

elements of critical thinking skills as students and the Approach to Teaching (ATT) teaching skills of all these skills including methods, strategies and development frameworks in teaching activities. Third, the concept is an in-depth understanding of the scope of material in certain subjects, especially the application of multidiscipline in elementary school. Fourth, namely student profiles which include 10 IB learner's profiles including inquirers, knowledgeable, thinkers, communicators, principled, open-minded, caring, risk-takers, balanced, reflective. The focus of this research is on the application of students' critical and creative thinking in the ability to analyze and be responsible for solving problems in taking initiative, reasons and ethical decision making. The fifth essential component is action which includes actions for oneself and the community as concrete actions from understanding learning outcomes, all of the above aspects are explained in the IB PYP Learning and Teaching document.(IBO, 2018).Of these 5 elements, the PYP learning framework is a foundation for transdisciplinary thinking so that students can explore real-life issues for change to become students who have an international mindedness.

The teaching skills approach / Approach to Learning Skills (Learning Approach (IB ATL Skill) is a collection of several skills used during learning that must be carried out by IB students. The ATL skills in the IB curriculum were first compiled by Lance King. The following is a description of the skills that must be shown by IB students during the learning process (Mcmahon & Garrett, n.d.). One of them is Thinking Skill which is divided into several sub namely Thinking Skills: Critical Thinking (Analyzing and evaluating problems and ideas, and making decisions), Creative thinking (Generating new ideas and considering new perspectives), Transfer of Information (using skills and knowledge in various contexts), and reflection and metacognition (using thinking skills to reflect on the learning process).

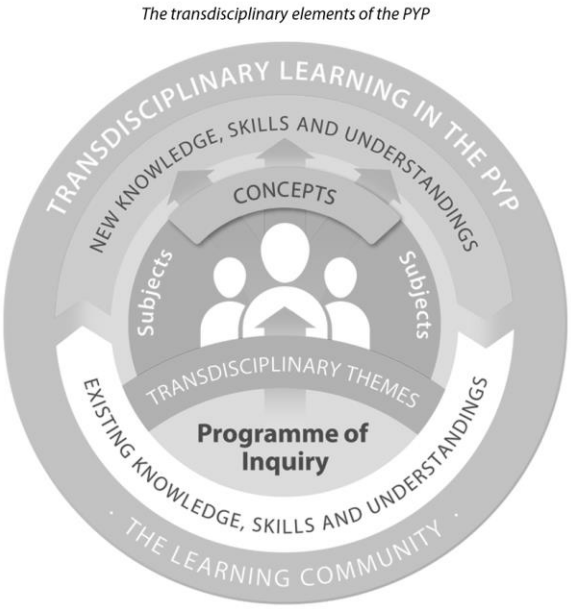


Figure 1. Elements of Transdisciplinary PYP (IBO, 2018).

Assessment at PYP is an ongoing process of learning (ongoing assessment) as a process for collecting, analysing, reflecting, and informing evidence of student learning outcomes. This assessment activity is carried out collaboratively in monitoring, documenting and measuring and reporting learning outcomes. In this case the student's development of knowledge, conceptual understanding, and teacher and student skills in their capabilities. How to do an evaluation, PYP assessment focuses on 4 dimensions, namely monitoring, documenting, measuring and to inform learning outcomes, one of which is Reporting on Learning.

This study aims to analyse learning and evaluate student progress. Teachers use assessment instruments and strategies to collect evidence or evidence of learning outcomes.

The next stage is reporting learning outcomes (reporting learning). This is done to inform the extent to which we learn? Describe the achievement of student achievement contained in the report card. The report card data was obtained from various forms of assessment results including based on the learning process of student development both cognitive and non-cognitive tests. This process is an ongoing assessment that can be identified in the formative learning process by observing, providing feedback, and strengthening concepts. As well as a summative assessment carried out to determine the achievement of students' critical thinking understanding of learning objectives in certain subjects. Assessment of learning understanding using the SOLO (The Structure of Observed Learning Outcomes) taxonomy(Biggs, 1982).Consisting of 5 levels of thinking, the first level where students do not have initial understanding, the second is in-depth knowledge (conceptual understanding). This model was developed to develop rubrics, make observations, design learning experiences, and assessment assignments. It is hoped that students will gain understanding and knowledge in harmony. In this case, critical thinking skills are skills that are needed now and in the future.

Creative skills and critical thinking are needed in today's life where we face various ways of solving problems every day. In addition, critical thinking skills are needed in the world of work. In this case critical thinking skills are highly emphasized in education in Indonesia which is the application of 21st century learning. As shown in the table below, the competencies needed for the 21st century are quoted from (Fajari et al., 2020):

Table. 1 Readiness of workforce competence

Competence	2016 Essential Needs Ranking
Critical thinking/problem solving	4.7
Professionalism/Work Ethics	4.7
Cooperation/Collaboration	4.6
Communication speaking/writing	4.4
Information and Technology Applications	3.9
Leadership	3.9
Career Management	3.6

Notes: Weighted average, rated on a 5-point scale where 1 = Not important; 2 = Not very important; 3 = Somewhat important; 4 = Important; 5 = Very important [3].

Educators around the world are discussing how to develop 21st century skills in students. Like other developed countries for the K-12 Education program. One example is in the Philippines where 21st century education is the current learning system. The Shift in Education caused by Covid-19 has brought the reality of limiting education services towards a new normal period. This crisis focuses us on safeguarding the health and well-being of students and teachers. Schools have adapted assessment practices which focus on student development and respond to a variety of contexts today. This study focuses on how to report learning outcomes on the learning process with the SOLO Taxonomy learning framework to improve students' critical thinking skills at the elementary school level which apply multidisciplinary knowledge in their learning.

Getting to know Solo Taxonomy (Structure of Observed Learning Outcomes) developed by (Biggs and Collins, 1982), is a systematic way of describing how students' understanding is built from easy to difficult while studying different assignments or subjects. Solo's taxonomy can be used to improve the quality of learning in classroom teaching and provide a systematic way to develop in-depth understanding(Damopolii, 2020). Learner learning can be guided in ways that promote deep learning. In addition, SOLO offers a structured outline for learners to use to build their learning and thinking. This can motivate students to increase the progress or development of learning(Biggs, 1982).Students' critical thinking skills can use the SOLO Taxonomy framework which is designed as an evaluation tool for the quality of learning in responding students to a task or effort in solving problems

in learning(Biggs, 1982).The levels or stages of Solo Taxonomy consist of prestructural, unistructural, multistructural, relational, and extended abstract. The ability to think critically as a basis for solving problems especially in learning as an example of mathematics lessons to improve students' cognitive thinking(Appulembang & Tamba, 2021).

Examples of learning practices using Solo taxonomy, especially Mathematics in problem solving. In this case it is related to the enthusiasm of students learning mathematics that needs to be linked to everyday life. The way students think can be measured using the SOLO taxonomy in learning according to their level of thinking(Hastari et al., 2021).Other learning can be done in science or science learning in solving assessment questions which usually use Bloom Taxonomy but, student responses use the SOLO taxonomy as a framework that can describe the complexity of the responses given by students. The level of students' thinking responses can be likened to steps that students must climb during learning, this is in line with the principle of constructivism learning where students build their own understanding supported by teacher facilities during the learning process. Students can be given the opportunity to discover and apply their thinking ideas by using learning strategies, and teachers can facilitate students to a higher understanding which of course the students themselves are trying to achieve.(Desyana, 2020).

In addition, the SOLO taxonomy framework can be applied to literacy learning, especially in English as second language, so that learning does not only reach the surface but is deeper and can be transferred to student learning levels, one of which is thinking skills in SOLO taxonomy. The questioning method can facilitate students in developing students' cognitive thinking skills regarding aspects of reading ESL(Kamal & Badr, 2020). Educators must engage in a deliberate effort to foster deep learning in their students. This section provides recommendations for promoting deep learning among students. We have also used classroom scenarios in learning to illustrate how the SOLO taxonomy can be translated into practical learning(Smith & Colby, n.d.). Application of applying Solo Taxonomy as a learning strategy in the task of reading melodies and notations that can be grouped into Solo taxonomy levels(Scott, 2000)

The purpose of the assessment at PYP-IB is to report the results of learning and teaching activities, this is done to collect and analyse information about student learning outcomes from teaching and learning activities. This is done to identify what students know, understand and do in each learning process or phase. The Learning Outcomes Report is informed to the parents of the students. It is hoped that parents can support the level of progress of their children by understanding the learning goals and progress of students and contributing to the enjoyment of learning. A good assessment has characteristics including being authentic, diverse, in accordance with student developmental achievements, collaboration between teachers and students, interactive assessment and providing input (feedback and feed forward).(IBO, 2018). Developing assessments and capabilities of learning communities and assessments of the need to understand determining monitor objectives and reflecting on learning outcomes. Among them are understanding the reasons for conducting the assessment, what will be evaluated, the achievement criteria, and the assessment method made. This is done by teachers and students so that the agency attitude of students and teachers emerges. In practice, the assessment for learning process is a learning practice for students and teachers to be able to mutually reflect, demonstrate and observe to enhance continuous learning. In this case the teacher can provide feedback, criteria achievement, trigger questions to students (Dargusch & Charteris, 2018).

Assessment is carried out on an ongoing basis (ongoing assessment) in this case emphasizing the formative form of assessment (AfL) so that teachers and students can monitor themselves, provide feedback and improve learning outcomes, the process here is called assessment as learning so that the desire and motivation student. The next form of assessment is the summative assessment which is carried out at the end of the assessment to find out development understanding of learning concepts and skills in the inquiry process.

Assessment of the form of assessment and the learning process using the SOLO taxonomy. Lots taxonomies mention level of understanding and thinking, including learning Design instrument assessment to determine the level of students' thinking skills. The Structure of Observed Learning Outcomes (SOLO) taxonomy which consists of 5 levels of student thinking. Starting from the first level where are students do not know the initial competence, the next 2 levels are the level of knowledge and the next 2 levels of skillsthinkto understanding the concept. The SOLO model can be used to develop assessment instruments such as rubrics, observations, learning experience designs, and assessment assignments (Hooked, 2011).

Critical thinking skills are 21st century skills needed in life and can influence student motivation in learning. The higher the motivation to learn then the higher the students' thinking skills(Fajari et al., 2020). SOLO taxonomy isinstrumentassessment that provides informationimportantfor teachers to providerepairlearning process. The SOLO taxonomy developed by Biggs and Collins (1982) is a systematic way to measure students' development in higher order thinking (Dumaraos, 2022). Students' responses in answering tests can be analyzed using the SOLO taxonomy, the framework describes the complexity of the responses given by students, besides that it is usefuldeterminethe level given by students to a question while for teachers it can be used as an analysis of student learning responses (Desyana, 2020).The SOLO taxonomy is used to elevate teaching and learning to the thinking and understanding levels. The stages in SOLO taxonomy consist of pre-structural, un-structural, multi-structural, uni-structural, multi-structural, relational and expanded abstract levels (Wall & Manger, 2015).

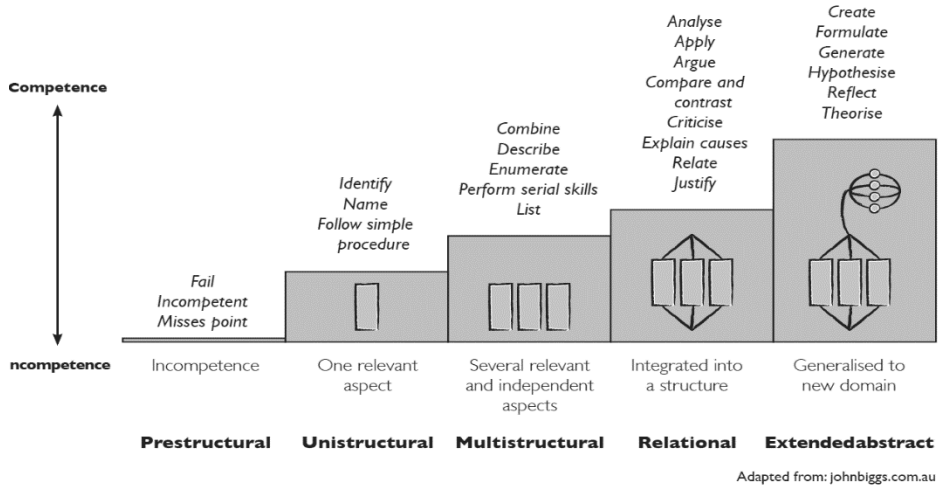


Figure 2. SOLO taxonomy with verbs according to their level of understanding (Martin, 2011)

We can use the SOLO taxonomy in formulating questions or assignments, one example is the question about carbon dioxide at different taxonomic levels in IPA:

Table 2. An example of the design of the SOLO taxonomy science learning framework

Unistructural	Identify one property of carbon dioxide.
Multistructural	Describe two or more properties of carbon dioxide.
Relational	Relate carbon dioxide to the greenhouse effect.
Extended abstract	What are the possible consequences of the increasing levels of carbon dioxide in the atmosphere?

SOLO has significant applications in both assessment and developmental curricula. Curriculum is considered as a set of parameters that determine the intended development of students' development in skills and attitudes. The curriculum is a document that addresses the objectives of a particular educational level, the content to be taught, teaching methods and evaluation techniques. The SOLO taxonomy addresses all of the above effectively. The selection of aims and objectives for organizing education is a major function of the curriculum. The Evaluation System is intended to determine the achievement of standards of knowledge, attitudes and skills. The role of evaluation as a component of the curriculum is:

- To measure the achievement of the intended general goals.
- To measure the achievement of certain goals in question.
- Diagnosing student problems
- To assess the effectiveness of teachers and their teaching strategies(Ali Khan & Abbas, 2021)
- Develop educational management recommendations for curriculum revision (Orlich, 2004).

Another perspective on the main difference between Bloom and Gagne is that the former defines the cognitive level at which something can be understood, whereas the latter classifies what is to be understood based on the type of knowledge. More contemporary taxonomies embrace both of these dimensions. Merrill Performance Content Matrix (Merrill, 1983), classifies results according to student performance as well as subject matter content. Classification of student performance includes Remember-Instance, Remember-Generality, Use, and Find, while the classification of subject matter content combines facts, concepts, procedures, and principles. Learning outcomes can thus be classified using two separate dimensions and in multiple cells of the Performance Content Matrix. While the Structure of the Observed Learning Outcome (SOLO) Taxonomy (Biggs,(Mcmahon & Garrett, n.d.)

Higher-order thinking skills in elementary school are the most important thing. It is stated in the International Baccalaureate Organization (2019) that students must have the ability to be able to solve problems in everyday life. This is done to prepare students to have critical and creative thinking skills and global understanding*("The Strategy in Developing International Baccalaureate (IB) High Level Thinking Abilities in Primary School Mathematics Learning (PYP),"*2019). To develop high-level thinking skills, especially critical thinking, there are 5 ways or strategies that can be used by teachers during learning, namely; 1) Setting learning goals, 2) inquiry-based teaching, 3) Practice, 4) Periodically reviewing, refining and developing understanding, and 5) Carrying out through feedback and assessing learning(Kusuma et al., 2017).

SOLO Taxonomy as established by Biggs and Collins, is the result of assessing the answers of hundreds of students who have been educated in subjects such as history, mathematics, literacy, geography, computer technology, and foreign languages in schools. from elementary school to college(Korkmaz & Unsal, 2017).Formative assessment with an emphasis on feedback has been linked to developmental assessment goals, while summative assessment is assumed to focus on assessment and quality assurance objectives. This dichotomy is questionable but designs to blend formative and summative assessment in a constructive way are rare in health care education(Svensäter & Rohlin, 2023). The level of thinking skills, structural complexity in connecting meta-concepts and substantive concepts and taxonomic suitability in increasing students' understanding of history are reviewed. To assess students' historical understanding in terms of conceptual, factual and procedural knowledge, it was decided that the SOLO (Structure of Observed Learning Outcomes) taxonomy(Masood, 2016). The goal is not just to have surface learning and the ability to retain material but truly meaningful learning where material is retained, transferred to solve new problems in real-life situations. Curriculum alignment, the need for ongoing education

system improvement was evaluated in this research study(Hassan, 2023). The following table summarizes the text above and suggests activities to help students acquire knowledge at each level and progress to the next level. Note that it may be necessary to start at a lower SOLO level to help students understand enough to "move up the ladder"(Potter & Kustra, nd)

Table 3. SOLO Learning Design Level Framework (Adeniji et al., 2022)

LEVEL OF UNDERSTANDING	BIGGS DESCRIPTION	TYPICAL CHARACTERISTICS	BLOOM LEVELS	SUGGESTED ACTIVITIES
1. Pre-Structural	Students do not understand	• Gather alienated items of information • No organization of information • No meaning • No demonstrated understanding • Misses the point	None	None
2. Unistructural	Students learn one relevant aspect of the whole	• Simple, obvious, connections made • Focused on one aspect • Information still has little meaning • Value and significance unclear • Concrete level • Unnecessarily reductive	Recollection Comprehension / Interpretation	• Identify content to be memorized, show examples • Provide disciplinary context • Mnemonics in groups • Repetition of procedures • Games • Repetitive testing and matching • Peer testing (one student asks, one answers)
3. Multistructural	Students learn several relevant independent aspects of the whole	• Some connections made • Focus on several aspects • Meta-connections between connections missing – each treated independently, additively • Some disorganization and alienation of related concepts • Significance of parts to whole is absent	Comprehension / Interpretation Analysis Synthesis / Creation	• Glossaries of key terms with definitions, classifications, examples to build disciplinary vocabulary • Simple laboratory exercises • Define terms, compare to glossary • Games modelled on Trivial Pursuit, Family Feud
4. Relational	Students learn to integrate several different aspects into a structure	• Some meta-connections • Connections between facts and theory, behaviour and purpose • Understanding and integration of significance of parts to each other, and parts to whole • Able to apply to some problem situations • Generally considered adequate to end here	Analysis Synthesis / Creation Evaluation	• Case studies, simulations and complex lab exercises • Concept maps • Research projects and experiential learning cycles • Application of theoretical models • Reflective journals • Student seminars and debates • Syndicate groups (each group is part of whole) • Problem-Based Learning and Inquiry Learning
5. Extended Abstract	Students can generalize what they learn into a new area of knowledge	• Connections with other information in discipline and beyond course, program and discipline • Generalization and abstraction of principles and underlying assumptions • Transfer to new experiences and unexpected problems	Synthesis / Creation Evaluation	• Self-directed projects involving research, design, application, argumentation, evaluation • Case studies involving extensive analysis, debate, reflection, argumentation, evaluation, forecasting • Development of a theory or model • Experiential learning cycles • Problem Based Learning and Inquiry learning • Teaching

Adopting the definition of scientific discipline literacy Moje (2008) assumes that knowledge transformation will be reflected in students' thinking levels. Therefore, response can be assessed at various levels of the SOLO taxonomy (Biggs and Collis 1982). This will reflect the complexity of students' thinking processes in answering the assessment questions(Chubko et al., 2019).The SOLO model has been reported to not only improve the assessment of educational outcomes but also promote student learning(Hattie, 2004)

SOLO modes	Description
Sensorimotor (from birth)	This mode of functioning helps in acquisition & development of fine motor skills (tacit knowledge)–knowing how to complete a physical task such as counting, sorting, making shapes, & building numbers. Sensorimotor mode extends beyond childhood, & an individual's fine motor skills continue to develop throughout lifespan.
Ikonic (from 18 months)	In this mode, children acquire intuitive knowledge, where they can use images or words to represent events, objects, or things. They link images to language, which helps in developing mathematical vocabulary. Form of knowledge they acquire within this mode is subjective because they have no reason, inference, or experience to justify their representations. Examples are naming & defining different shapes, & comparing, ordering, & matching objects by length.
Concrete symbolic (from 6 years)	Usually, from age of six years, a child applies a symbol system to express his or her thoughts. Use of symbols such as written language & number system increases their experiences of empirical world, which helps to build abstraction such as demonstrating rules for mathematical equations & facts. School curriculum focuses mainly on this mode & it is often referred to as target mode. Knowledge in this mode is declarative.
Formal (from 16 years)	Response in this mode involves abstract concepts such as principles & theories. There is no restriction or strong tie to refer to empirical or concrete world, thereby creating a range of possibilities to explore such as manipulating a theoretical construct.
Post formal (from 20 years)	Abstract concepts identified in previous mode are questioned, queried, & challenged. Individuals within this mode perceive real & likely possible things, which helps them to operate using theoretical knowledge.

Figure 3. Model of Student Learning Method in its Developmental Phase

Student performance, as understood in this study relates to non-SOLO assessment outcomes (usually of marked quantity of responses) on multiple dimensions that can contribute to their holistic growth in the cognitive, affective, and psychomotor learning domains. In the studies reviewed, 10 studies provided evidence of correspondence between various performance studies and their levels of SOLO. The performance dimensions available in the studies reviewed are: learning outcomes(Atasoy, 2019), the level of student ability(Hooi Lian et al., n.d.),spatial visualization skills(Ozdemir, 2015),activeness in learning activities (Kaharuddin & Hajeniati, 2020), cognitive style(Mulbar, 2017),self-

efficacy level(Princess, 2017),problem solving skill(Lian, 2006), attitude(Sudihartinih, 2019), and student beliefs(Watson, 2001).The available literature links several affective, behavioral, and cognitive dimensions of student performance with the SOLO model.

The ATL skills applied to the IB curriculum are strategies and developments carried out by schools using the IB curriculum to improve their students' higher order thinking skills, the aims of this research are:

1. Analyze the concept of critical thinking skills using the SOLO Taxonomy framework in elementary schools.
2. Evaluate the reporting of learning outcomes in the form of a report card with an assessment using the SOLO Taxonomy descriptor assessment according to the range.

METHODS

This research uses mixed methods with case studies and documentation analysis. Quantitative methods are used to analyze the relationship between student learning outcomes assessment reporting on the application of critical thinking skills. Qualitative with a method to describe the analysis of the application of reporting learning outcomes. The population in this study involved 4th grade elementary schools in Jakarta. Data collection techniques by analyzing the documentation of learning outcomes and interview techniques. Quantitative data analysis interviews were used to determine parents' understanding of reporting student learning outcomes with the SOLO taxonomy framework to measure student skills, quantitative data used student descriptor levels of critical thinking skills.

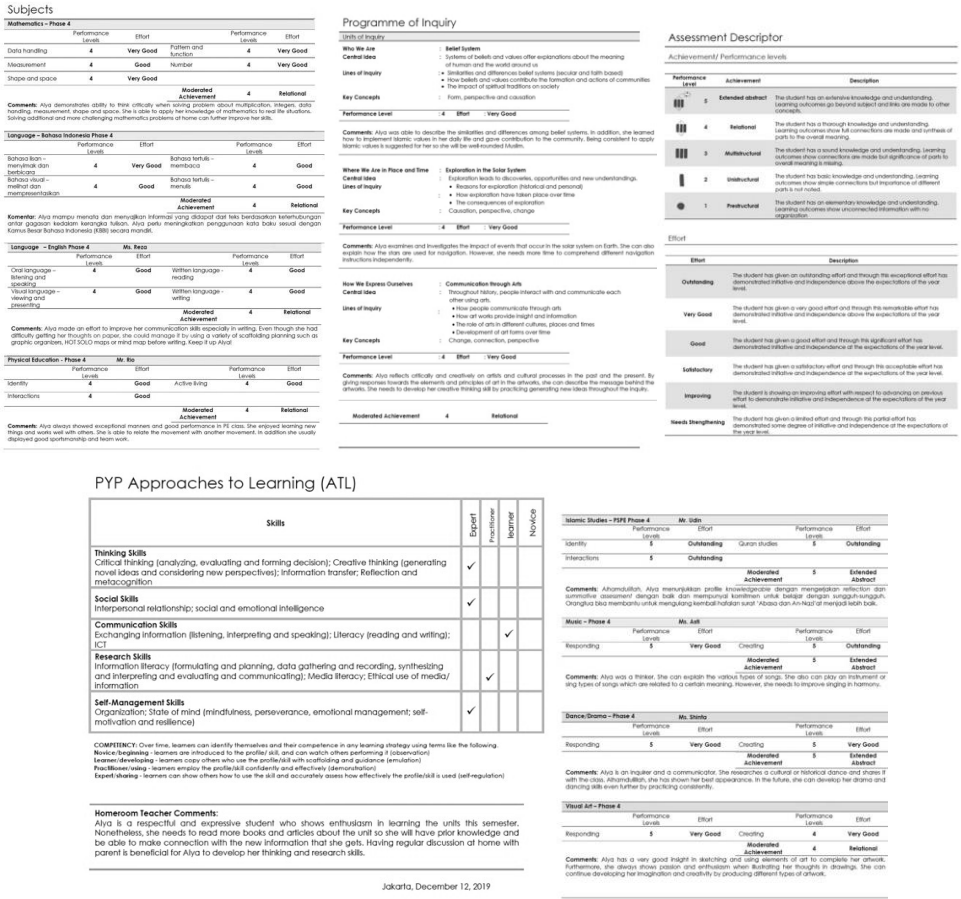


Figure 4. Example of reporting student learning outcomes at the end of the semester with SOLO Taxonomy

Reporting student learning outcomes is a new assessment model using the SOLO taxonomy, this is done by providing socialization to parents of students related to understanding and how to read indicators of achievement of student learning outcomes. There are several questions collected as a form of inquiry questions for parents of studentspreviously focused on the national curriculum, including:

Conducted by 3 teachers and parents using qualitative techniques through interviews related to feedback and questions about the format of reporting learning outcomes using the SOLO taxonomy framework:

1. **How to read the IB curriculum learning outcomes report using the SOLO Taxonomy model?**"The written report is seen as a summative record for students, parents and the school itself based on student progress. Nonetheless, the process of formative activities or ongoing assessment is an effective reporting procedure.IB Report Card Rating System by developing a scoring model based SOLO taxonomy. The theory of SOLO taxonomy which stands for The structure *of observed learning outcomes (*SOLO) taxonomy is a theory from Biggs Collisywhich explains that each cognitive stage has the same and more responses increasing from simple to complex. This model can be used in the development of rubrics, observations, designs learning experiences, and assessments where students are required to be able to achieve both basic and in-depth understanding.

2. **Why do IB report card assessments use SOLO Taxonomy? Not using an assessment with a value range of 0-100?**
   "With the transition from the previous assessment concept where students were declared successful in achieving competence through quantitative tests to find out how deep students understand learning material. With the concept of SOLO, the taxonomy is useful for facilitating the learning process, especially for obtaining and achieving goals and thinking skills.

3. **Does the SOLO Taxonomy assessment use the same minimum completeness/KKM as usual?**
   "The learning objectives known as SOLO taxonomy are grouped into student ability levels at five different levels and are hierarchical in nature, namely:
   Level 1: prestructural (pre-structural)
   Level 2: unistructural (uni-structural)
   Level 3: multistructural (multi-structural),
   Level 4: relational (relational), and
   Level 5: extended abstract (Biggs and Collis, 1982, p. 24)".

4. **What is the minimum completeness criteria (KKM) for each subject?**
   "The provision of learning outcomes is determined by the extent to which students are in learning and the phase. Differences in learning outcomes are based on the extent to which the unit of inquiry is explored, stimuli from sources of information obtained through meaningful learning."

5. **Why isn't the basic competency or objective of each subject written down on the report card like an official report card?**
   "The learning objectives for each subject can be seen from the student learning targets documented in See Saw, Google Classroom, or the learning objectives in the unit letters given to students. Achievement details can be summarized in the semester 1 report card based on the teacher's comments on achievement for certain subjects.

6. **Usually in the report card there is an assessment of knowledge and skills. Does the IB report card also have the same assessment or not?**

"In learning outcomes, knowledge and skills become one unit with different learning strategies that include aspects of knowledge and skills, character, and learning abilities/skills approaches."

7. **What do you mean by strands?**

"Strands are found in every subject in PYP which supports or supports the unit of inquiry to find out what do we want students to know/what students want to know from knowledge and abilities in each subject."

In PYP each subject is identified based on several strands including:

1. Language: human language, visual language, and written language reading/ writing
2. Mathematics: data handling, measurement, shape and space, pattern and punctuation and number.
3. Science: living things, Earth and space, materials and matter, forces and energy.
4. Social studies: human systems and economic activities, social organization and culture, continuity and change through time, human and natural environment.
5. PSPE: identify, active living and interactions
6. Arts: creating and responding”

8. **Does the report card have to be in English?**

Report cards can be communicated flexibly either in English or translated into Indonesian. The need for IB terminology adjustments in use in English.

Participant

This research was conducted in 2 schools that implemented the IB (International Baccalaurate) curriculum. Involved 25 students and conducted interviews with 3 teachers regarding feedback and questions from parents regarding the reporting format of student learning outcomes using the SOLO taxonomy to measure students' thinking skills.

Data analysis

Data analysis was taken from the assessment data for each student's learning outcomes. Based on these data, it can be seen that reports on student learning outcomes are based on one example of calculating a particular subject. The influence of research on critical thinking skills, thus reporting student learning outcomes can be taken based on the value data taken by the teacher from the highest and lowest, namely at the Extended Abstract and Multi-structural levels.

RESULTS AND DISCUSSION

Students' critical thinking skills are measured using data analysis instruments on the achievement of learning outcomes on subjects. The five graphical data below show the achievement of learning outcomes based on the SOLO taxonomy assessment descriptor on critical thinking skills by doing an average of the taxonomy point levels with a range of values

The data analysis technique used quantitative methods based on the SOLO taxonomy level and then averaged the moderate level of achievement. The indicators for the assessment range of learning outcomes are as follows:

Assessment Descriptor

Achievement/ Performance levels

Performance Level		Achievement	Description
	5	Extended abstract	The student has an extensive knowledge and understanding. Learning outcomes go beyond subject and links are made to other concepts.
	4	Relational	The student has a thorough knowledge and understanding. Learning outcomes show full connections are made and synthesis of parts to the overall meaning.
	3	Multistructural	The student has a sound knowledge and understanding. Learning outcomes show connections are made but significance of parts to overall meaning is missing.
	2	Unistructural	The student has basic knowledge and understanding. Learning outcomes show simple connections but importance of different parts is not noted.
	1	Prestructural	The student has an elementary knowledge and understanding. Learning outcomes show unconnected information with no organization

Effort

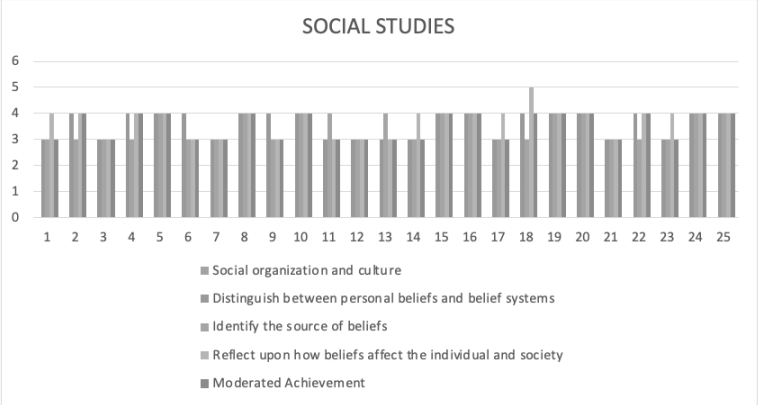
Effort	Description
Outstanding	The student has given an outstanding effort and through this exceptional effort has demonstrated initiative and independence above the expectations of the year level.
Very Good	The student has given a very good effort and through this remarkable effort has demonstrated initiative and independence above the expectations of the year level.
Good	The student has given a good effort and through this significant effort has demonstrated initiative and independence at the expectations of the year level.
Satisfactory	The student has given a satisfactory effort and through this acceptable effort has demonstrated initiative and independence at the expectations of the year level.
Improving	The student is showing an improving effort with respect to advancing on previous effort to demonstrate initiative and independence at the expectations of the year level.
Needs Strengthening	The student has given a limited effort and through this partial effort has demonstrated some degree of initiative and independence at the expectations of the year level.

The data analysis technique used quantitative methods based on the SOLO taxonomy level and then averaged the moderate level of achievement. The indicators for the assessment range of learning outcomes are as follows:

The range of values in the table beside shows the level of the assessment indicators:

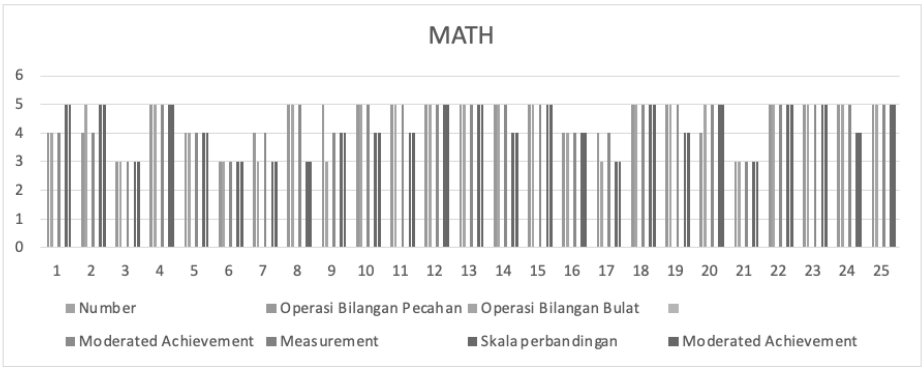
Extended Abstracts: 5 with a description where students have an understanding of the achievement of learning outcomes and the relationship between the concepts of the subjects studied.
relational:4 with a description of understanding where students have understanding and connections from what has been learned.
Multistructural:3 with a description where students have an understanding and show a meaningful relationship from what has been learned.
Unistructural:2 with a description where students have basic understanding and knowledge of learning outcomes but still need guidance
Prestructural:1 with a description where students have knowledge and understanding of the achievement of learning outcomes without organizing

This research method uses mixed methods quantitative methods

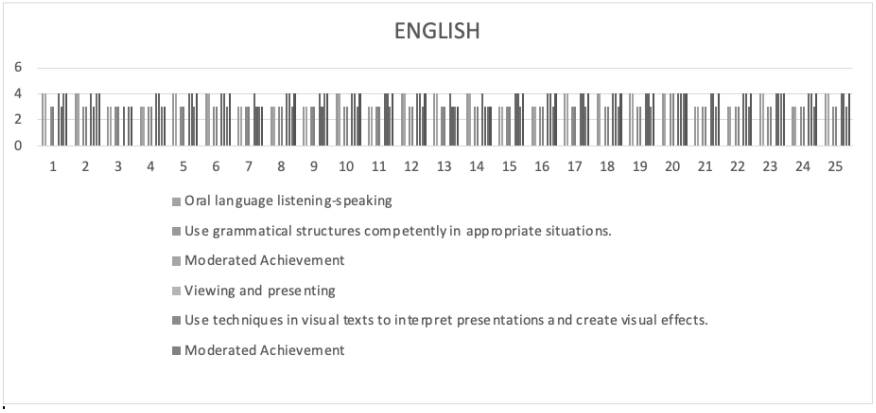


The graph above shows student learning outcomes for social studies subjects with the highest average descriptor 4 (Relational) which shows critical thinking skills and understanding that is able to connect with what is learned in real life. While the lowest average descriptor is 3 (multistructural) where students show a meaningful understanding of what they have learned.

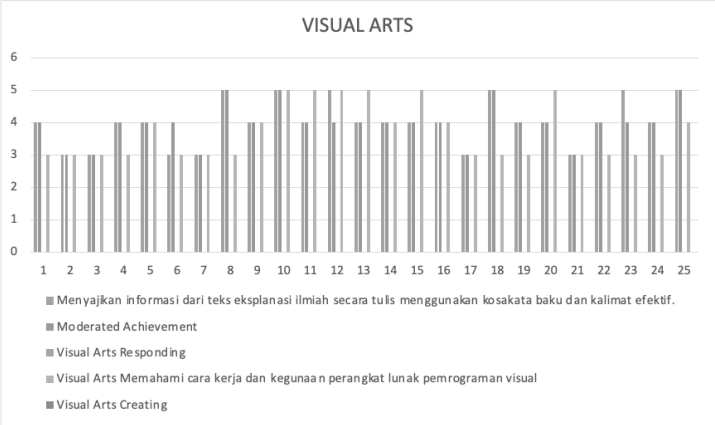
The graph above shows student learning outcomes for Indonesian subjects with the highest average descriptor 4 (Relational) which shows critical thinking skills and understanding that is able to connect with what is learned in real life. While the lowest average descriptor is 4 (Relational).



The graph above shows student learning outcomes for Mathematics with the highest average descriptor 5 (Extended Abstract) which shows the achievement of learning outcomes and the relationship between the concepts of the subjects studied. While the lowest average descriptor is 4 (Relational) which shows critical thinking skills and understanding that is able to connect with what is learned in real life.



The graph above shows student learning outcomes for English subject with the highest average descriptor 4 (Relational) which shows critical thinking skills and understanding that is able to connect with what is learned in real life. While the lowest average descriptor is 3 (multistructural) where students show a meaningful understanding of what they have learned.



The graph above shows student learning outcomes for visual arts subjects with the highest average descriptor of 5 (Extended Abstract) which shows what learning outcomes are and the conceptual relationships of the subjects studied. While the lowest average descriptor is 3 (multistructural) where students show a meaningful understanding of what they have learned.

Based on the analysis of the data documentation above, the results of students' critical thinking skills show on a scale of 4 (Relational) which shows critical thinking skills and understanding that is able to connect with what is learned in real life. And the lowest average is moderate at level 3 (Relational) where students show a meaningful understanding of what they have learned. With these descriptors students are able to apply critical thinking skills by associating understanding of learning outcomes or learning objectives in everyday life. Where students are able to analyze material through various methods and strategies. It needs to be improved to strengthen conceptual understanding of integrated learning outcomes between disciplines or other subjects.

CONCLUSION

It can be concluded that the taxonomic SOLO level can be used as an instrument for assessing critical thinking not only in asking questions, assignments, assessment designs and also reporting student learning outcomes. This is also evidenced by the competence in understanding concepts and skills at the PYP level which focus on the ability to think, communicate, research self-regulation and social skills. The calculation criteria in determining the level is made up of a range of indicator values with quantitative data as the calculation.

RECOMMENDATIONS

It is recommended to use the SOLO taxonomy for the elementary school level which can be used as an instrument for assessing and reporting student learning outcomes by using a checklist or taxonomy SOLO achievement levels. Thus, with a range of qualitative values and their descriptions, they serve as the basis for the development of student learning outcomes. It can be combined with using the BLOOM taxonomy in using verbs and determining learning objectives and student learning achievements and the taxonomy SOLO

can be used as an assessment instrument. Thus, the two models are the same model of student thinking from lower order thinking skills to higher order thinking skills.

ACKNOWLEDGMENTS

We would like to thank all parties involved in the preparation of this research regarding the reporting of assessment of student learning outcomes with the SOLO taxonomy model on students' ability to think critically and creatively in each subject. First, we would like to thank our respected lecturers who have provided directions, models, and sources of information regarding critical thinking skills. Especially in terms of this research, for the Head of the Education Program, Prof. Dr. Mohammad Syarif Sumantri M.Pd., Erry Utomo, M.Ed., Ph. D and Dr. Gumgum Gumelar Fajar Rakhman, M.Si. We also thank schools that apply the SOLO Taxonomy model in reporting learning outcomes, which is the development of a form of calculation using integration technology.

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