



## **PROPORTION: CLAIM, REBUTTAL AND BACKING DATA BASED ON TEACHER QUESTIONS AS REASONING INDICATOR OF PROBLEM BASED LEARNING IN HIGHSCHOOL SYSTEM REPRODUCTIONS**

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### **ABSTRACT**

The reseach purpose is to compare learning proportion of the students based on arguments to learners Claim which is supported by facts, data and theories between conventional learning and PBL as the answers for teacher questions. Research Procedure began with 4 times biology teachers discussion workshops to compile PBL learning plan to be used on treatment class. 61 participants with 30 in control class and 31 in treatment class. Reasoning calculation based on arguments during communication in form of the answers to teacher questions. Basic Grouping of Learning is : Claim Rebuttal (CR), Claim Data (CD), Claim Backing (CB) and Claim (C). Results indicates that: C decreases during PBL learning; CB increases during PBL; CD doesn't exhibit real change during PBL. PBL utilization needs the readiness and competence of the teachers which influences the reasoning quality of the learners.

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**Keywords:** Claim, Claim rebuttal, Claim Backing, PBL, arguments, reasoning

### **INTRODUCTION**

Knowledge construction through learning, one of its success indicator is the identified ability of reasoning that function as problem solver. (Özgelen, 2012). Scientific reasoning developed through arguments that appeared from communication inside the class (Acar *et al.*, 2015) through various science which one of them is human reproduction materials in Highschool. Reproduction material constitute a study full of problems which haven't been structured and happened in daily lives such as: the outbreak of various diseases connected with reproduction structures and organs like LGBT, the world population boom, which analysis needs various sciences. These unstructured problems are called

ill structure. (Tawfik, Trueman, & Lorz, 2013). The unstructured problems have 5 unclear parameters (intransparency) heterogeneity of interpretation, interdisciplinary, dynamic, and legitimacy to be done with various solutions (Hung, 2016). The problems that have not been structured on the reproduction material were began in the case of an effort to address the world population boom which is shown by the graph of the fast growth of world population. The almost similiar argument to the reasoning is seen as the center in constructing an explanation as scientists were using arguments or reasoning as Claim followed by evidence of Warrant or Backing which is very important to be noted during learning in the class (Simonneaux, 2007), so it can be interpreted as an argument which is basic reasoning to construct scientific knowledge.

Based on the dynamic of the effort to control the population boom that interacted with the

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dynamic change of culture, then learning with the problems of “How businesses cope with the population boom” is an issue that has not been structured, so it becomes a problem to be used as to learn human reproduction material through PBL. Learning using the unstructured problems to be analyzed further until knowledge in a structured manner were obtained and connected to each is the problem based learning (PBL). PBL is a learning that begins with a problem that ill or have not been structured with the main stage is meeting the problem (Tan, 2007), but not all problems can be used as the unstructured problems in PBL learning (Jonassen & Hung, 2015). Expectations on the learning with the unstructured problems, allows plenty of interdisciplinary knowledge to arrange the discourse and efforts of students that serves to organize the material and application on reproduction knowledge in life. Ultimately becoming into meaningful knowledge for the benefits of themselves and solve more complex problems.

The amount of knowledge that interdisciplinary and the amount of effort to organize significant knowledge associated with meaningful communication capability to participate in the form of ideas or delivering of opinions in the form of discourse. Discourse is a statement and answer for teachers question is a logical dialogue that was built during the learning in the form of ideas or criticism that became the basis of the establishment of the arguments. The structure of scientific arguments to control variables such as the components of Toulmin Model: Claim, evidence, warrants and disclaimers are an attempt to support the scientific contextual process. (Ford, 012). Claim proportion based on evidence, data or theory, which became the basis for the reasoning arguments on learning problem based learning on the human reproductive material is the purpose of this study. Arguments or reasoning is the way to show the meaningfulness and meaninglessness through a claim supported by facts, events and reasons are rarely done because of the many obstacles and difficulties of learning the classroom (Berland & Hammer, 2012), among them is a reason to answers as well the connection between the answers and the facts are studied. Supporting research results were conducted by Acar et al., (2015) shows that the arguments relating to the difficulty of the studied material, the harder the material the smaller the reasoning of students.

## METHODS

The Research would be qualitative research which calculate the percentage of Claim and Claim which based on facts, backing data or theories, also Claim rebuttal. The number participants involved were 61 which consist of 30 in control class and 31 in treatment class. Control class used conventional learning conducted daily by the teachers while treatment class used PBL learning.

PBL learning plan were compiled by the teachers through 4 times in biology teachers discussion workshops or “ musyawarah guru mata pelajaran biologi” (MGMP) by following the steps of *meeting the problem, problem analysis and generation learning issues, discovery and reporting, presentation and reflection and overview integration and evaluation* (Tan, 2007). Learning plan was needed as the conducting scenario of the learning according to the stages of PBL. Learning plan constitute the teacher preparation to construct and express science in form of activities or attitudes. (Harris & Hofer, 2016). Learning plan organization was compiled by the teacher based on constextual investigation experiences which oriented to build students knowledge (Argote & Miron-Spektor, 2011)

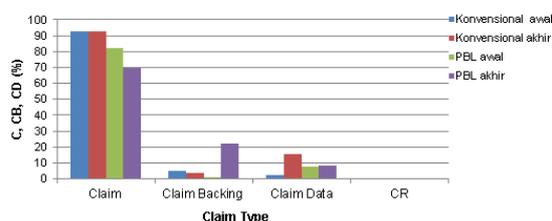
Reasoning calculation was based on arguments delivered during logical dialogue between teacher and students (Kim & Roth, 2014). Reasoning calculation was focused on students answers to all teachers questions. Analysis result of students answers was studied based on argumentation components according to Toulmin models which consists of: Claim, (C), Claim Backing (CB), Claim Data (CD), Claim Warrant (CW) dan Claim Refusal or Rebuttal (CR). The answers consist of the students statement during learning process, be it in control or treatment class. (Reed & Rowe, 2005).

Data collecting in control and treatment classes was done before and after treatment class conducted PBL learning. Learners statement and answer were analyzed following Garcia-Mila, Gilabert, Erduran, & Felton, (2013). Percentage was calculated based on statement and answer numbers categorized in C, CB, CD, and CR. Scores in Claim were not considered, the one which is considered and calculated was Claim type frequency divided by total Claim then times 100.

## RESULTS AND DISCUSSIONS

Based on communication between learners and teacher on the answers for teacher questions : C, CB and CR were obtained (Table 1).

Percentage of Claim in the early and end of the learning in control class does not change the percentage, but in the treatment class showed a decrease. Claim relates to the statement, the percentage decrease shows that through PBL statement that is not supported by facts or the theory experience a decrease, means that learners who express their opinions are more considering the knowledge acquired during the learning process. Based on a bigger decrease than the control class, then PBL had an effect on the numbers of answers and statements of the learners. PBL has the effect to declare C is more careful to give an answer. Contrary to the CB and CD which has an obvious increase. CB and CD is learners Claim based on the theory and the data obtained through solving the unstructured problems. CR is a refusal of a Claim that is not found in either the conventional or treatment class. Through conventional learning or PBL, learners do not indicate a refusal of any statement, so only C, CB and CD were detected. More detailed analysis for percentage of Claim backing is shown in Figure below.



**Figure 1.** Percentage of Claim, Claim Backing dan Claim Data on conventional class and PBL class.

The percentage shown in the Figure above shows Claim in the control class did not experience any change while in treatment classes, it has decreased. The relatively fixed percentage of C in the control class while decreased in PBL classes

are: 1) the manifestation of interdisciplinary knowledge required in PBL learning cause changes to the statements of learners in constructing knowledge; 2) the differences of the learners in appreciating learning through ill structure problem solving which requires the scientific solution that needs data and theories so Claim on PBL learning decreased while Claim and Claim Data Backing increased. The complex problems which requires the support of many scientific knowledge become a difficult effort for all students to answer teachers questions or the submitted answers have the same quality, as the following example;

The almost similar answers by 4 students showed the students desire just to participate in all the questions, but unfortunately the clarification was not carried out by teachers with the follow-up question about the reasons of the given answers. Teachers were asked to examine the books used, without continuing answers given by the students who need clarification. The answers written in the book or reference is the end of discussion. In the case of teachers who do not perform the follow-up questions to discover arguments or reasoning given from the answers, closes the possibilities of the students reasoning. Teachers question are often become a trigger for learners to use more of their thought processes (Turiman, Omar, David, & Osman, 2012). Teachers question become sparks of an answer that leads to reasoning, so looking for the learners answer with continuing teachers question are able to improve the skills of teachers and learners to think more.

Teachers clarification oriented to the corresponding facts began with events that happened to all female students is an interesting discussion, because it happened in real life. With looking for the answers and questions that continues to be the basis for understanding the assessment of a wide range of knowledge that is used to solve problems in tackling the population boom. Thinking of fact to be applied in a larger problem that requires analogy and logic in the form of C, CB, and CD and CR. C is the student answer that is not an argument, and further testing is needed

**Table 1.** Percentage of C, CB dan CR learners based on teacher questions in kontrol and treatment class learning

	C, CB, CD dan CR (%)			
	Claim (C)	Claim Backing (CB)	Claim backing data (CD)	CR
First Control	92,85	4,76	2,38	0
Last Control	92,85	3,57	15,47	0
First Treatment	81,91	1,12	7,86	0
Last Treatment	69,67	22,13	8,19	0

to assess the reasons to obtain reasoning. Gouvier, (2013) states that the argument is a set of Claim that has meaning between one proposition and the other, so it is logical with increased the percentage of the CB in PBL, CD that increased in conventional learning, shows that understanding the two propositions with connections are indispensable. Another meaning for similarity of Claim on learning using conventional learning is a statement about using less real phenomenon or contextual support material is less meaningful, so that between the beginning and the end of learning used didn't show a different percentages. Based on the observations result that shows C has smaller percentage in PBL learning, the possibility to get more thought processes are: 1) Statements often use the basic knowledge, data, theories that have been owned so the results of the analysis are not categorized in the Claim; 2) Utilization of the data, theoretical or real events had an effect on the reasons of an answer.

Based on the difference of the percentage changes of CB and CD in the conventional class learning and PBL treatment showed that, at the end of learning, the answer learning has greater support in the form of data or theory. Data and theory is the basis of the study of problem solving. The increase of CB and CD on PBL class has greater percentage than conventional class, which is possible because; 1) The number of issues solved through scientific procedures, thus adding support for the answer; 2) PBL learning requires collaboration among students to do activities, because the statement is used to answer a teacher's question into an argument required to collaborate in studying science (Osborne, 2010).

In case of problem solving to the countermeasures of population boom which is based on human reproduction by using PBL requires several considerations such as: 1) The integrity of the propositions connected to each other with the content in question, so they have the meaning which needs to be understood; 2) reference is required to support the study, but not as fast

as providing an opportunity without the support of data. This fact is evident in the increasing of Claim Data (CD) before and after using the PBL, in the end which is relatively equal, meaning that the data used as the basis for constructing knowledge is the same, the beginning and the end of learning, data and theories used in quality does not experience any increase. Improving the quality of data and theory that is unreal is seen from: 1) The use of complex reproduction problems in PBL learning should be rooted in events around the learners, so it becomes a contextual learning (Allen & Tanner, 2003); 2) The process of thinking to obtain the reasons of an answer does not continue.

Another possibility of this assumption is, the competence of teachers using PBL in treatment class were not good, making it less able to convey the core of PBL which is expecting for the students independence in constructing knowledge in addition to a wide range of scientific skills that serve to improve reasoning based Claim supported by facts, events or theory, The research results showed a significant increase of CD in the control class while at the beginning and end of class PBL, no real change was observed for CD. The increase of CB was evident in PBL class, so the data changes of C, CB and CD do not look linear. The data shows that the competence of teachers in using PBL requires further study, because teacher competence have a big influence on the quality of the students learning outcomes. Teacher competence determines the quality of students learning (Opfer & Pedder, 2011), including organizing the planning and implementation in the class. The hardest to be done in organizing lesson plans to follow the stages PBL is stage of problem analysis and generation learning issues (Widoretno et al., 2016). *Problem analysis and generation learning issues* from unstructured problems requires various unknown studies and learned by the learners that it requires the teachers as companion in learning.

Mastery stages of PBL by teachers is a

Teacher Questions	Presention Num.	Learner Answers
"How long does menstrual cycle last?"	7	"Menstruation last for a week ."
	24	"Menstruation last for two weeks."
	17	"Menstruation last for four weeks, a week."
	11	"Menstrual cycle last for 28 days."
"How long does ovulation cycle last?"	18	"Ovulation last for 14 days."
	24	"Ovulation last for 14 days."
	20	"Ovulation last for two weeks."
	24	"Ovulation last for two weeks."

competence associated with the material as content, pedagogy as a learning science and context as a way to teach the materials to students contextually. Imbalance between them could result in difficulty for teachers to make question which serves to organize CB and CD. Result in study states that the competence of teachers which consists of content knowledge, pedagogy, context relating to how to motivate learners with questions and self-regulation is crucial to the learning outcomes (Harris & Hofer, 2011). Kunter et al., (2013) stated that the quality of teachers' academic level does not affect instruction, thus mastery of instructions and questions, teachers need training to support their competence and not on the academic level. The necessary training is to meaningfully communicating by using a variety of sources to improve the quality as the lecturer. Giannakos, Doukakis, Pappas, Adamopoulos, & Giannopoulou (2015) stated that the challenge of teaching should adjust the conditions and difficulties encountered, including reasoning build upon the arguments consisting of C, CB, CD, Cw and CR.

Mastering the PBL learning does not just prepare a lesson plan which is a scenario used to teach. Plan implementation which was compiled become more important than preparing lesson plans, for visualizing is the actual competence of the teacher. Implementation requires monitoring for perfection and compatibility between plans and their implementation, all of them require the involvement of policy makers and behavioral changes teachers become the lecturers

### CONCLUSION

The reasoning of the learners using PBL on reproduction material are influenced by the integrity of proportion built by the learners which cannot be separated from teacher competence in using constructed instructional design. Claim Data and Claim Backing is the differentiator of PBL from conventional learning, PBL has a potential to develop identified reasoning from the increase of Claim Backing and Claim Data.

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### REFERENCE

- Acar, Ö., Patton, B. R., & White, A. L. (2015). Prospective Secondary Science Teachers' Argumentation Skills and the Interaction of These Skills with Their Conceptual Knowledge. *Australian Journal of Teacher Education*, 40(9), 8.
- Allen, D., & Tanner, K. (2003). Approaches to cell biology teaching: learning content in context—problem-based learning. *Cell Biology Education*, 2(2), 73–81.
- Argote, L., & Miron-Spektor, E. (2011). Organizational learning: From experience to knowledge. *Organization Science*, 22(5), 1123–1137.
- Berland, L. K., & Hammer, D. (2012). Framing for scientific argumentation. *Journal of Research in Science Teaching*, 49(1), 68–94.
- Ford, M. J. (2012). A dialogic account of sense-making in scientific argumentation and reasoning. *Cognition and Instruction*, 30(3), 207–245.
- Garcia-Mila, M., Gilabert, S., Erduran, S., & Felton, M. (2013). The effect of argumentative task goal on the quality of argumentative discourse. *Science Education*, 97(4), 497–523.
- Giannakos, M. N., Doukakis, S., Pappas, I. O., Adamopoulos, N., & Giannopoulou, P. (2015). Investigating teachers' confidence on technological pedagogical and content knowledge: an initial validation of TPACK scales in K-12 computing education context. *Journal of Computers in Education*, 2(1), 43–59.
- Govier, T. (2013). *A practical study of argument*. Cengage Learning. Retrieved from <https://www.google.com/books?hl=id&lr=&id=nUMWAAAAQBAJ&oi=fnd&pg=PR3&dq=support+to+low+claim+as+argument++in+problem+based+learning&ots=xgcf00--aQ&sig=LeRPsejUGRfHMhFInOFwEk26iZg>
- Harris, J. B., & Hofer, M. J. (2011). Technological pedagogical content knowledge (TPACK) in action: A descriptive study of secondary teachers' curriculum-based, technology-related instructional planning. *Journal of Research on Technology in Education*, 43(3), 211–229.
- Harris, J., & Hofer, M. (2016). Planning for Deep Learning Using TPACK-based Learning Activity Types. In *Society for Information Technology & Teacher Education International Conference* (Vol. 2016, pp. 4832–4839). Retrieved from [https://www.learntechlib.org/p/172101/proceedings\\_172101.pdf](https://www.learntechlib.org/p/172101/proceedings_172101.pdf)
- Hung, W. (2016). All PBL Starts Here: The Problem. *Interdisciplinary Journal of Problem-Based Learning*, 10(2), 2.
- Jonassen, D. H., & Hung, W. (2015). All problems are not equal: implications for problem-based learning. *Essential Readings in Problem-Based Learning: Exploring and Extending the Legacy of Howard S. Barrows*, 17–41.
- Kim, M., & Roth, W.-M. (2014). Argumentation as/in/for dialogic relation: A case study from elementary school science. *Pedagogies: An Inter-*

- national Journal*, 9(4), 300–321.
- Opfer, V. D., & Pedder, D. (2011). Conceptualizing teacher professional learning. *Review of Educational Research*, 81(3), 376–407.
- Osborne, J. (2010). Arguing to learn in science: The role of collaborative, critical discourse. *Science*, 328(5977), 463–466.
- Özgelen, S. (2012). Students' science process skills within a cognitive domain framework. *Eurasia Journal of Mathematics, Science & Technology Education*, 8(4), 283–292.
- Reed, C., & Rowe, G. (2005). Translating Toulmin diagrams: Theory neutrality in argument representation. *Argumentation*, 19(3), 267–286.
- Simonneaux, L. (2007). Argumentation in Science Education: An Overview. In *Argumentation in science education* (pp. 179–199). Springer. Retrieved from [http://link.springer.com/chapter/10.1007/978-1-4020-6670-2\\_9](http://link.springer.com/chapter/10.1007/978-1-4020-6670-2_9)
- Tan, O.-S. (2007). Problem-based learning pedagogies: psychological processes and enhancement of intelligences. *Educational Research for Policy and Practice*, 6(2), 101–114.
- Tawfik, A. A., Trueman, R. J., & Lorz, M. M. (2013). Designing a PBL environment using the 3C3R method. *International Journal of Designs for Learning*, 4(1). Retrieved from <http://scholarworks.dlib.indiana.edu/journals/index.php/ijdl/article/view/3151>
- Turiman, P., Omar, J., Daud, A. M., & Osman, K. (2012). Fostering the 21 st Century Skills through Scientific Literacy and Science Process Skills. *Procedia-Social and Behavioral Sciences*, 59, 110–116.
- Widoretno, S., Ramli, M., Ariyanto, J., Santoso, S., Atika, G. A., & others. (2016). The Role of Lesson Study to Improve Posing Question Skills of Teacher and Students in Problem Based Learning. In *Proceeding of International Conference on Teacher Training and Education* (Vol. 1). Retrieved from <http://www.jurnal.fkip.uns.ac.id/index.php/ictte/article/view/7637>