

Jurnal

by Suharto Linuwih

Submission date: 08-Aug-2018 04:10PM (UTC+0700)

Submission ID: 988420683

File name: Sarwi_2017_J_Phys_3A_Conf_Ser_824_012011.docx (67.39K)

Word count: 3280

Character count: 18352

Physics Structure Analysis of Parallel Waves Concept of Physics Teacher Candidate

S Sarwi^{1*}, K I Supardi², and S Linuwih¹

¹Physics Department, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang

²Chemistry Department, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang

*Corresponding author: sarwi_dosen@mail.unnes.ac.id

Abstract. The aim of this research was to find a parallel structure concept of wave physics and the factors that influence on the formation of parallel conceptions of physics teacher candidates. The method used qualitative research which types of cross-sectional design. These subjects were five of the third semester of basic physics and six of the fifth semester of wave course students. Data collection techniques used think aloud and written tests. Quantitative data were analysed with descriptive technique-percentage. The data analysis technique for belief and be aware of answers uses an explanatory analysis. Results of the research include: 1) the structure of the concept can be displayed through the illustration of a map containing the theoretical core, supplements the theory and phenomena that occur daily; 2) the trend of parallel conception of wave physics have been identified on the stationary waves, resonance of the sound and the propagation of transverse electromagnetic waves; 3) the influence on the parallel conception that reading textbooks less comprehensive and knowledge is partial understanding as forming the structure of the theory.

1. Introduction

Teachers have a strategic role in constructing the national character and develop the potential of learners. Education of physics teachers prospective, which will produce a physics teacher has become an important topic related to human resources in education. In connection with the civilizing principles of conservation and development of character values, during the learning process teachers understand what is happening to the students and what students can do, to achieve competence designed. Through understanding the thinking of learners can help the teacher directs learning, forming a more productive epistemology [1]. Learning should consider how mechanisms of thinking of students in constructing knowledge through experiential learning.

Referring to the general issue, will be carried out qualitative research focused on the analysis structure and conception parallel in the mastery of knowledge wave to equip prospective teachers of physics. Studies structure in the physics concept of science teaching according to Andersson *et al.*[2] may help explain the concept of a state structure that was built learners as part of the outcome, and provides input for improvement of curricula to be more effective. Observing the strategic role of teacher candidates who have the responsibility to educate the children of the nation, then it is worth the attention specifically on matters related to the competence of the candidate briefing physics teacher.

Learning Wave is presented in the form of verbal language for the definition of a concept, a mathematical language to explore the association between variables, and illustrations for explanatory variables, which are intended to be easier to understand the concept of waves. Research on sound waves to improve the curriculum of physical education colleges has been conducted [3]. Research on wave learning, especially wave phenomena for the students is continued. Results of research Hartmann [4]states that high school students answered duty mechanics with suggested topics more

than one explanation of the so-called parallel conception. Conception parallel in this physics needs to get a serious note of teachers and lecturers because students have a conception of more than one, but there is only one correct concept. This qualitative study focused on the analysis and conception concept of parallel structures in the prospective teachers of physics is still a little wrestle or researching. This qualitative study explored based on three aspects which include how the pattern structure owned concept, description of the conception of the parallel, and the factors that influence conception in parallel to obtain donations epistemology theory of wave physics. This information will be an important input in the improvement of learning and curriculum development in Physics Education Study Program.

Formulation of the problem in this research is how does the physics teacher candidates to form the structure of concepts and conceptions parallel wave physics. The purpose of this research is to find a pattern structure formed the wave concept of physics teacher candidates, obtain information conception parallel wave physics, as an input to improve the learning of waves, and discover the factors that influence the formation of a parallel conception formed physics teacher candidates. The expected benefits of the research are: 1) the contribution of the theory of the formation of the wave concept of physics teacher candidates; and 2) gave a briefing wave physics knowledge as fundamental knowledge for prospective physics teachers to master the advanced physics course.

The results of the investigation gradually student views and analysis of the content structure contributes importantly to build student knowledge, i.e., the exact meaning of the illustrations that facilitate students in understanding the concept of wave [5]. Research on the use of mechanical waves pedagogy components has been developed, including Mamolo *et al.* [6]. Results of research on the properties of mechanical waves through the analysis of the subject matter for understanding the structure of physics (The Constructing Physics Understanding) has been carried out [5]. The conclusion of the research is the use of dynamic transfer model analysis, and constructivist-based curriculum can help to map the elements of knowledge of the properties of waves.

Niedderer [7] stated that the concept is a brainchild of the knowledge structure interaction with the situation at hand. Someone is possible to have more than one conception of a context, where the conception that competes with one another in one's mind [7, 8]. Answer individually in the minds of students on the one task that has not completely controlled, sometimes showing more than one possible explanation; this indicates that more than one conception. Conception more than one happens to someone about a context be regarded as a parallel conception [9]. Another research stated that in a physics lesson, students are thinking about the absence of the relationship between facts and formulas, or relationships between concepts which are represented in the form of the equation [10].

In a simple existence of parallel conception can be explained as follows. When a student asked a question about the concepts of physics, and they are given enough time, it is possible there will be more than one answer in the minds of students. Among the answers were there by the conception of the physicist, and said as a scientific conception. If the answer can not be by the conception of the physicists, then say the answer as alternative conceptions [9]. Parallel conception can occur in the form of thinking and the scientific conception of alternative conceptions that appear simultaneously and be competitive. Parallel conception can be formed of two kinds of alternative conceptions competing. At the thought process occurs fusion between input variations of the concept and context of the structure of knowledge and ideas so as to form a conception. Concepts are formed can be a scientific conception, or alternative conceptions. Sometimes conception that formed in the form of more than one kind of conception is still competing in one's mind, this conception is said to parallel conception. Linuwih [8] found that students from the Department of Physics still understand the concept of mechanics through parallel thinking with conception, so the results of this research contribute to improving the way of thinking to form a concept science. How the wave pattern and conception concept structure parallel understood physics student teachers, will be the provision of important information later taught school.

2. Methods

This study was designed using qualitative research approach; the study aimed to obtain a capital-oriented scientific explanation of the theory, rules, models, patterns or new postulates that support a process of applied research and technology [11]. Subjects were students of the department of physical education, the five students who take the basic physics of the second half and six college students

participating in a wave of the fourth semester. The research subject is determined based on the theoretical and purposive sampling. This study used a qualitative research approach to the cross-sectional design that aims to discover the essence of phenomena that occur at the same time. Steps in the study are shown in Figure 1. In qualitative research, the role of the researcher as well as a research instrument, can collect data in more depth. Data collection tools include thinking aloud, written essay tests, interviews, and discussions.

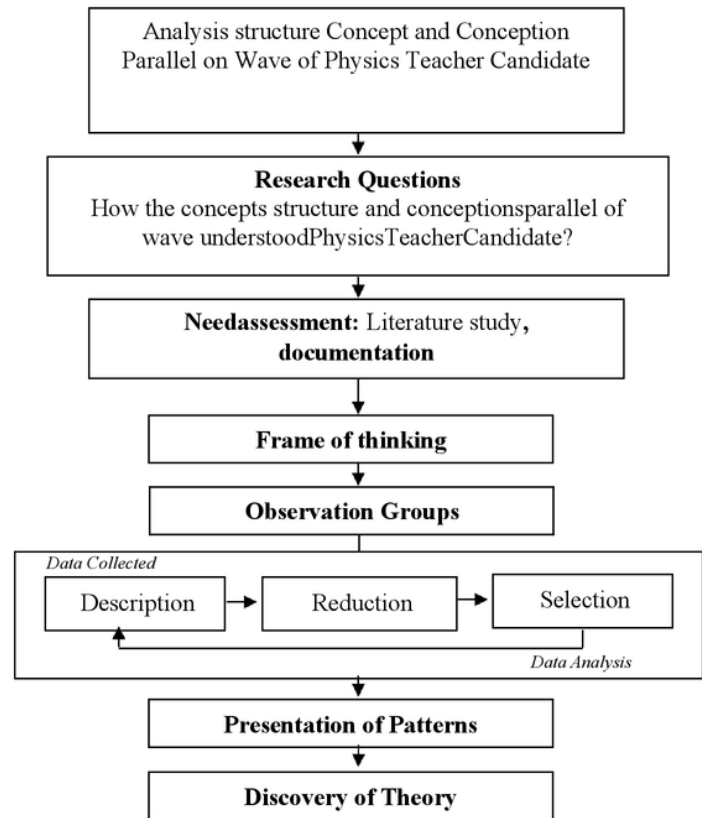


Figure 1. Procedure of research development

Table 1. Criteria CRI by Hasan [12]

Answers Criteria	Low CRI (<2.5)	High CRI (> 2.5)
True Answer	Answer correctly and a lower CRI value means not understand the concept	Answer correctly, and high CRP value means to understand the concept well
False Answer	Answer correctly and the average low CRI means not understand the concept	Answer wrong, but high CRI means no understanding of the concept is wrong

The test structure of concepts analyzed using analysis of the concept. The variable **1** part of the conception of parallel through the tracking of misconceptions developed using techniques **Certainty of Response Index (CRI)**. CRI is usually based on a fixed scale, and the scale used in this study is the CRI scale of six (0-5) developed by Hasan [12]. The criteria proposed is presented in Table 1. Data analysis techniques used, namely a) descriptive percentages for quantitative data, b) analysis unit concept, cognitive structure analysis, and analysis of conception parallel to the qualitative data.

3. Results And Discussion

The results of the study were classified into two parts, namely structural analysis and parallel conception of the wave concept in which students in the science of wave formation. Reports are grouped based on data sourced from students of the second semester of Physical Education (group I) and fourth semester (group II) in the second semester 2015. The results are grouped into two parts: 1) analysis of the structure of the wave concept, and 2) the conception of parallel wave physics teacher candidates.

The structure of the wave concept regarding the core aspects of theoretical, proposition complements, and examples of the phenomena and objects in everyday life. Initial data processing is done by scoring each number on the material rope waves, sound waves and electromagnetic waves are then calculated the average and the percentage of the total score. The next stage is done grouping percentage of respondents in each group I and group II were presented in Table 2 and Table 3.

Table 2. The results of the essay written test Group I of the 3rd Semester

Subject	Respondent					Average	%
	R1	R2	R3	R4	R5		
GT	9	10	9	6	5	7,8	78
GB	7	14	11	11	6	9,8	49
GEM	14	10	8	11	9	10,4	69

Table 3. The results of the essay written test Group II of the 5th Semester

Subject	Respondent						Average	%
	R6	R7	R8	R9	R10	R11		
GT	9	6	10	8	10	6	8,17	82
GB	8	18	14	11	14	13	13	65
GEM	6	12	14	13	12	14	11,83	79

Table 2 and Table 3 show the highest percentage yield of Group I on waves of string that is equal to 78 and the group II 82%. On the wave of the rope, almost all respondents in group I answered very well while writing equations and drawing harmonic wave propagates, especially when $t = 0$ deviation waves reaching the maximum deviation is positive, i.e., where the sin of the angle is 1 so that large deviations will be equal to the amplitude, but respondents still difficulty in explaining the deviation of the medium particles which have the initial phase of $n / 3$. Then in suggesting waves of the string as declarative knowledge or procedural, two out of five respondents thought waves of the string as declarative knowledge, for their discoveries of physicists declared. However, regarding equations and theory of functions used to experiment simply with certain stages, waves of the string is knowledge of a procedural nature, although there is some declarative knowledge, such as the quantities of amplitude, frequency and period.

Table 4. Comparison of Percentage of written test Group I and II

Group Semester	Subject		
	GT	GB	GEM
I	3	78	69,3
II	5	81,7	78,9

Table 4 presents a comparison of the percentage of the results of written test group I (solid) and group II (hatching). Overall, the percentage of group II was higher than group I, both in concept rope

waves, sound waves and electromagnetic waves. The difference in the percentage of Group I and II on the concept of sound waves and electromagnetic waves differently than the waves of string. Figure 2 presents a comparison of the percentage of the results of a written test group I and group II in histograms.

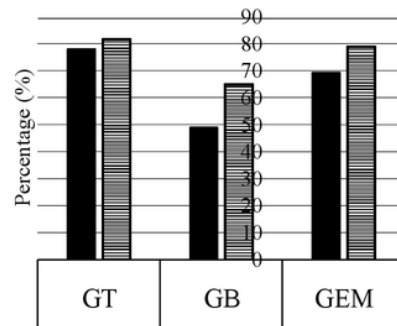


Figure 2 Comparison of Percentage of Written Test Group I (solid) and II (hatching) (GT: string wave, GB: sound wave, GEM: electromagnetics wave)

The results of the written test in the form of multiple choice complexes with more than one correct answer on a parallel conception is presented in Figure 3. The results that the maximum score achieved the fifth semester is 83, while the third semester of 67 (scale 100). The lowest score of each semester of five and three was 29 and 21; while the average score of each is 47 and 40 (scale 100).

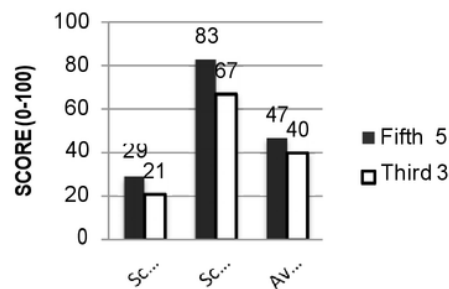


Figure 3. Histogram scores achieved candidate of Physics Teacher Semester 5th and 3rd

The student has completed a complex multiple-choice test, which requires critical thinking. The lower scores may be caused by the second-semester students' knowledge is not comprehensive. The concept of a wave given during the second semester has not yet reached the concept in depth and sequential. Parallel conception appeared on the issues that demanded answers more than one correct choice. Such issues are more open. In the third semester of research objectives, based on the discussion of the results conducted by researchers obtained information that more students understand partially on the waves concept.

Results of research on the conception parallel to express beliefs answers are used. Data belief answer in the form of histograms presented in Figure 4.

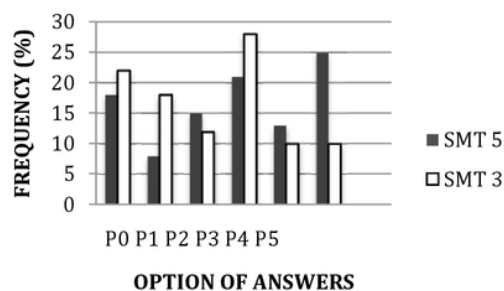


Figure 4. Histogram belief the answers given by physics teacher candidates
 Description: P0 (guesses), P1 (not sure), P2 (doubt), P3 (pretty sure),
 P4 (almost sure), P5 (sure right)

The selected answer choices students have also impacted on the steps when solving physics problems that require higher-level thinking (critical, creative, problem-solving). Problem-solving becomes natural that the higher and the number of students taking courses then the confidence will be the correct answer is also greater. The psychological development also supports the development of college students when answering the question of physics. The problem of harmonic waves, mechanical waves and wave superposition can be answered with almost sure. Why can happen so? It is based on the assessment [13] stated that effective cooperation in small groups was able to resolve the issue with the best solution.

Illustration true is a sound wave formed in the resonance phenomenon is a longitudinal wave. The behavior of air molecules during the wave propagates shows sealing and stretching airborne particles. Conversion sealing or particles less moving are the node region; while the molecule is stretching the abdominal area (particle moving freely). Research line, Sarwi and Nugroho [14] claimed 2nd and 4th-semester students have difficulty explaining the wave propagation in the medium of air and characteristics of stationary waves. Both the student opinion is an alternative concept that can be accepted by logical thinking that includes a parallel conception. We found many introductory physics textbook illustrations with supporting text for sound standing waves of air columns in pipes inhibit student understanding of sound standing wave [15;16].

Hammer [9] demonstrated conception parallel to the students to basic physics. On an inclined plane slick, laid out a beam that is pulled by a rope. A rope connected to a pulley on the end of the inclined plane and connected with a weight hanging vertically in the form of a load with a mass greater than the mass of the beam. Parallel in student self-conception as stated happen the same acceleration and the same style on both bodies. Studied from the cognitive aspects of some of the causes of conception parallel students in understanding the concept of waves comes from the everyday environment that raises intuition, reading textbooks less comprehensive, understanding that knowledge is partial as the structure theory, the understanding of knowledge as a separate flake. Intuition owned student can be a source and contribute to science formed states. The impact of an incorrect understanding of the concept or less comprehensive and can contribute to the formation of alternative conceptions, which has the potential to produce a parallel conception. Likewise, the understanding of knowledge by students as separate fragments have an impact on the formation of a parallel with the building's conception of science is not true. Interviews revealed that increased content difficulty in college was major factors that negatively influenced incoming freshmen's views about physics, whereas a role change from student and easy content in high school positively impacted end-of-year seniors' views about physics and learning [17].

4. Conclusion

Based on the discussion presented in the next section, concluded several aspects, namely: 1) The structure of the concept of wave can be shown by way of illustration a map containing the core concepts, prepositions, sub-concepts with horizontal and vertical networks; besides the structure of the concept can also be shown by way of illustration map semicircle containing the theoretical core,

supplements theory and examples phenomena that occur daily; 2) the tendency of the conception of the parallel wave physics has been identified on the stationary waves, resonance of the sound and the propagation of transverse electromagnetic waves; 3) parallel conception of students emerged as influenced factors: the everyday environment that raises intuition, reading textbooks less comprehensive, understanding that knowledge is partial as forming the structure of the theory, and understanding of knowledge as a separated parts.

Acknowledgments

The fundamental research titled Analysis of the structure and conception of the parallel wave of prospective physics teacher, has been completed. Acknowledgments submitted to the Rector of the University in Semarang through the Chairman of the Institute for Research and Community Service awarded grants to fund research DIPA.

References

- [1] Lising, L, &Elby, A 2005 *Am. J. Phys.* 73 (4)
- [2] Andersson, B. Bach, F. Hagman, M. Olander, C. & Wallin, A 2005 p. 221-230
- [3] Wittmann, M.C., Steinberg, R.N., & Redish, E.F 2003 25 (8) : 991-1013
- [4] Hartmann, S. & Niedderer, H 2005 p.471 – 481; Springer AA, The Netherlands
- [5] Hrepic, Z. 2005 *Proceedings of the National Association for Research in Science Teaching (NARST), 2005*
- [6] Mamolo, C.B., Fletcher, P.R., & Rebello, N.S 2006 United States: San Francisco, CA.
- [7] Niedderer, H. 2001. "Physics Learning as Cognitive Development". In Evans R.H., Andersen A.M., SBrensen H.: *Bridging Research Methodology and Research Aims. Student and Faculty Contributions from the 5th ESERA Summerschool in Gilleleje*, Denmark. The Danish University of Education. p. 397-414 (ISBN :87-7701-875-3)
- [8] Linuwih, S. 2011 UPI Bandung, Indonesia
- [9] Hammer, D. 2004 *Proceedings of the Enrico Fermi Summer School*, Course CLVI: Italian Physical Society.
- [10] Osewold, D. 2005 *Proceedings of the Seventh International History, Philosophy and Science Teaching (IHPST)*. Winnipeg: Conference Winnipeg,2005
- [11] Creswell, J.W. 2014 Singapore: SAGE Publications Asia-Pasific, Pte, Ltd.
- [12] Hasan, S., Bagayoko, D. & Kelley, E.L. (September, 1999 *Phys. Educ.* 34(5)
- [13] Laughlin, P.R., Hatch, E.C., Silver, J.S., & Boh, L. 2006. *Journal of Personality and Social Psychology*, 90 (4): 644-651
- [14] Sarwi & Nugroho, S.E. 2013. Epistemological analysis of the concept of waves on the Physics Teacher Candidate. *Fundamental Research Reports*, LP2M Universitas Negeri Semarang
- [15] Ozcan, O. 2015 *Eur. J.Phys.* 36, doi:10.1088/0143-0807/36/6/065042
- [16] Zeng, L., Smith, C., Poelzer, G.H., Rodriguez, J.,Corpuz, E. & Yanev, G. 2014 *Physical Review Special Topics - Physics Education Research* 10, 020110
- [17] Ding, L. & Zhang, P. 2016 *Physical Review Physics Education Research* 12, 020137

Jurnal

ORIGINALITY REPORT

3%

SIMILARITY INDEX

1%

INTERNET SOURCES

2%

PUBLICATIONS

0%

STUDENT PAPERS

PRIMARY SOURCES

- 1 Yusmina Hala, U A Syahdan, Halifah Pagarra, S Saenab. "Identification of Misconceptions on Cell Concepts among Biology Teachers by Using CRI Method", Journal of Physics: Conference Series, 2018
Publication 1%
 - 2 Lin Ding, Ping Zhang. "Making of epistemologically sophisticated physics teachers: A cross-sequential study of epistemological progression from preservice to in-service teachers", Physical Review Physics Education Research, 2016
Publication 1%
 - 3 www.science.gov
Internet Source 1%
-

Exclude quotes Off

Exclude matches Off

Exclude bibliography Off