Development of an integrated model of natural science practicum based on the daily science project to embed 21st century skills in junior high schools

by E. N. Savitri

Submission date: 04-Oct-2022 11:13AM (UTC+0700)
Submission ID: 1916144084
File name: project_to_embed_21st_century_skills_in_junior_high_schools.docx (177.35K)
Word count: 2717
Character count: 14960

Development of an integrated model of natural science practicum based on the daily science project to embed 21st century skills in junior high schools

Development of an integrated model of natural science practicum based on the daily science project to embed 21st century skills in junior high schools

M Taufiq*, E N Savitri, N R Dewi and I Nadia
Natural Science Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang, Indonesia

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

Abstract. The study aims to develop an integrated model of science practicum based on daily science projectto embed 21st century skills in junior high schools (SMP). The 21st century skills are 21st century skills that must be embeded to students consist of creativity and innovation, criticalthinking and problemsolving, and communication. To achieve the objectives, research and development (R and D) was carried out with ADDIE design (Analysis-Design-Develop-Implement-Evaluate).Integrated model of natural science practicum based on the daily science project has been developed and valid to applied in junior high schools. The implementation of integrated model of natural science practicum based on the daily science project using IDEA (Identification, Develop, Evaluate, Aplied)syntax valid and able to embed 21st century skills of junior high school students.

1. Introduction

Although the era of disruption and industrial revolution 4.0 provided a number of impacts on the world of education and Natural Sciences (IPA), the role of educators has never been replaced. For this reason, an educator must continue to improve competence and see challenges as opportunities. An educator must master, not be controlled by progress. Therefore increasing the competence of educators is an absolute thing to do, in addition to the role to earth science in accordance with the context and in line with the progress of the times.

At present there are many problems that cannot be solved by relying on only one scientific study, such as physics or biology, but must study through various fields of science or interdisciplinary. The study of various sciences in science, such as physics, chemistry, biology, is called integrated science, and learning is called integrated science learning [1]. In addition to integrated learning, some experts call it in other terms, such as interdisciplinary, multidisciplinary, trans-disciplinary, cross-disciplinary, thematic [2].

As an effort to anticipate the needs needed by students to solve problems in daily life that tend to be increasingly complex, some experts recommend the development of integrated science learning [3][4]. In this case, the Indonesian government also tried to begin to implement it through government regulations on the Content Standards for the Primary and Secondary Education Unit, which mandated integration between IPA substances (biology, physics, and chemistry), even with the environment, technology and society. The 2013 curriculum also emphasizes thematic and integrated learning in elementary and junior high schools.

Although integrated science learning has been mandated by the curriculum to be applied but in reality it cannot be implemented properly, especially in practical activities there is no integrated model.

This is due to at least the lack of examples of variations in the material analysis model of the material to be learned, because it is not available either in the policy regulations that have been issued by the government.

Science is not just knowledge, but also discovery and inquiry processes to get that knowledge. The process of gaining knowledge in science applies a paradigm that has a normative order such as objectivity and honesty, and training sensitivity to the environment situation. Learning science is essentially developing science process skills, thus basic skills such as making observations, formulating problems and hypotheses, designing and carrying out experiments, collecting and analyzing data are part of science learning activities. Science is an application of an understanding of things that are unknown or new situations [5].

Science is indeed not just a collection of knowledge, but also a process of discovery and how to apply that knowledge to real life. Science learning should not only transfer knowledge from teachers to students, but also direct students to interact, explore nature to build science knowledge and get used to scientific work. One way to facilitate this is practicum activities [6].

Scientific work habits, which begin with the exploration of problems around their lives (daily science project), are expected to foster thinking habits in solving everyday problems or contextual problems [7][8][9]. If the habit has grown in students, science learning can be said to be successful, ie students learn to be like a scientist (learning to be a scientist). This study aims to theoretically analyze the basic principles of integration of science lab materials, formulate designs and test the validity of the science science integration model based on a daily science project oriented to 21st century skills in junior high schools.

2. Methods

To achieve the stated objectives, research and development (R and D) was carried out with ADDIE design (Analysis-Design-Develop-Implement-Evaluate) [10][11]. The subjects of this study were teachers and students of junior high school in two public and private schools in the city of Semarang, Central Java, Indonesia. In the first stage a curriculum analysis was carried out to identify the SMP Science practicum materials that made it possible to be integrated with each other so that at the end of this stage the theme of the science material was determined which enabled the integration of the material. In the second stage, developing a model integrating science practice material that had been established by its integrated model of natural science practicum based on the daily science projectto embed 21st century skills in junior high schools. In the third stage implementation is a trial that was conducted to test the validity of the integrated model of natural science practicum based on the daily science projectto embed 21st century skills in junior high school. In the fifth stage an evalution model through FGD (Focus Group Discussion) activities.

3. Results and Discussion

This research and development was carried out according to the ADDIE model which stands for Analysis, Design, Development or Production, Implementation and Evaluations. In the analysis of its main activities, namely analyzing the need for the development of integrated model of natural science practicum based on the daily science projectto embed 21st century skills and analyzing the feasibility and development requirements. The development of integrated model of natural science practicum based on the daily science projectto embed 21st century skills was initiated by the existence of problems in the model of integrating the material that had been applied previously, namely planning, aplying, and evaluating. The problem of the existing model can occur because the model of integrated science practice applied by the teacher and the previous group of teachers is not relevant to the needs of the target, the learning environment, technology, and characteristics of the students.

After analyzing the problem, it is necessary to develop a model of integrated science practice that can answer existing problems. The researcher also analyzed the feasibility and requirements for developing the integrated science practice model. The analysis process was carried out by developing expert validation instruments to answer the following questions: (1) whether the integrated model of natural science practicum based on the daily science projectto embed 21st century skills was able to

overcome the learning problems faced, (2) whether the integrated model of natural science practicum based on the daily science projectto embed 21st century skills get facility support to be implemented; (3) whether the lecturer or teacher is able to apply theintegrated model of natural science practicum based on the daily science projectto embed 21st century skills. Analysis of the model of integrated model of natural science practicum based on the daily science projectto embed 21st century skills needs to be done to determine the feasibility if the learning method is applied.

In the design phase of the integrated model of natural science practicum based on the daily science projectto embed 21st century skills, the design phase has similarities to designing teaching and learning activities with inquiry-based experimental methods. The characteristics of inquiry learning model issuitable if applied to the concept or active material that allows students to analyze and solve problems systematically [12]. The activity of developing a design starts from setting learning objectives, designing scenarios or science practicum activities, designing learning devices, designing learning materials and learning outcome evaluation tools. The design integrated model of natural science practicum based on the daily science projectto embed 21st century skills is conceptual and becomes a further development process. The design developed by the researcher as the syntax of implementing the IPA practice integrated model of natural science practicum based on the daily science projectto embed 21st century skills namely Identification, Develop, Evaluate, Aplied (IDEA).

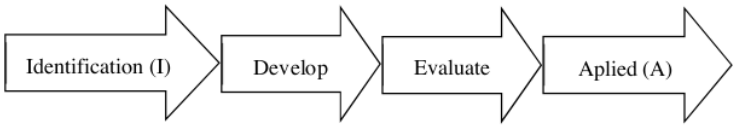

Figure 1. IDEA syntax ofintegrated model of natural science practicum based on the daily science projectto embed 21st century skills

The development stage was carried out by the realization of product design integrated model of natural science practicum based on the daily science projectto embed 21st century skills with IDEA syntax. At the design stage, a conceptual framework for the application of integrated model of natural science practicum based on the daily science projectto embed 21st century skills with the IDEAsyntax. At this stage of development a learning device has been prepared with syntax in the form of lesson plans, integrated science materials, integrated science worksheets, media, tools and integrated science practice materials.

At the stage of implementation the design and methods that have been developed in real situations, namely in the classroom or in the laboratory. During implementation, integrated model of natural science practicum based on the daily science projectto embed 21st century skills that have been developed was applied to the actual conditions. Practical activities carried out in accordance with the integrated model of natural science practicum based on the daily science projectto embed 21st century skills that have been developed. After the application of the method, an initial evaluation was conducted to provide feedback on the application of integrated model of natural science practicum based on the daily science projectto embed 21st century skills.

Evaluation is carried out in two formative and summative forms. Formative evaluation is carried out at the end of each meeting/ course (weekly) while summative evaluation is carried out after the activity ends in its entirety (semester). Summative evaluation measures the final competency of the learning objectives to be achieved. The evaluation results are used to provide feedback to the users of the model. Revisions are made in accordance with the results of evaluations or needs that cannot be met by integrated model of natural science practicum based on the daily science projectto embed 21st century skills, namely teachers or science lecturers.

Based on the results of the analysis (A) and design (D)stage, indicated that the daily science project-based science practicum integration model in junior high school was designed valid and able to (1) overcome the learning problems faced; (2) gets the support of facilities to be applied; and (3) whether

the lecturer or teacher is able to apply IDEA as a integrated model of natural science practicum based on the daily science project to embed 21st century skills. In the third stage develop (D)was carried out and the results arelearning devices were made with a model of integrated science practice based on a daily science project oriented to 21st century skills in the form of lesson plans, integrated science materials, integrated science worksheets, media, tools and materials for integrated science practice.

Based on the implementation (I)were found that the integration model of daily science project-based science practicum was valid and effectively applied in junior high schools. It was concluded that the integrated model of natural science practicum based on the daily science projectto embed 21st century skills in junior high schools.Through practical activities students are required to actively participate and work in groups, so that practicum activities can increase the active role and ability to cooperate with students in the learning process. Practical activities also make learning more meaningful because students are involved in the learning process and gain hands-on experience. Practicum will be carried out efficiently and effectively if available supporting facilities and infrastructure such as laboratories, student practicum guides, tools, materials, and the time needed must be available properly and adequately. Students in practical activities need to be given instructions to facilitate students in conducting experiments [13].

The integrated model of natural science practicum based on the daily science project allows students to broaden their knowledge horizons from learning. Knowledge gained becomes more meaningful and learning activities become more interesting, because knowledge is useful for him to better appreciate his environment, better understand and solve problems faced in everyday life. Thus it can be said that the integrated model of natural science based on the daily relevant science project involves the environmental aspects where students are and learn by involving the creativity and innovation that is in students. Creativity and innovation can also be seen as a process used when an individual brings or raises a new idea. The new idea is a combination of previous ideas that have never been realized. A creative person starts from curiosity, often observes, and can solve problems so that ideas that are present in him and produce something new [14] [15].

The integrated model of natural science practice based on the daily science project allows students to communicate well in writing through lab reports and communication communication through the presentation of results. When compiling a practicum report students are honed in their ability to examine, analyze, interpret, evaluate evidence, critical thinking and problem solving. Students also learn to manage the abundant flow of information so that they can have the ability to choose relevant sources and information, find quality sources and assess sources of objectivity, reliability and proficiency. The integrated model of natural science practice based on the daily science project issuitable if applied to the concept or active material that allows students to analyze and solve problems systematically. The implementation of integrated model of natural science practicum based on the daily science project using IDEA (Identification, Develop, Evaluate, Aplied)syntax is valid and able to embed creativity and innovation, criticalthinking and problemsolving, and communication of the students.

4. Conclusion

Integrated model of natural science practicum based on the daily science project has been developed and valid to applied in junior high schools.The implementation of integrated model of natural science practicum based on the daily science project using IDEA (Identification, Develop, Evaluate, Aplied)syntax is valid and able to embed 21st century skills of junior high school students.

References

[1] Oludipe D I 2011 J. *Soil Sci. Environ. Manag.* 2 (8) 134
[2] Kurt K and Pehlivan M 2013 *Int. J. Educ. inMathematics Sci. Technol*, 1(2) 116
[3] Ajai J T, Imoko B I and O'kwu E I 2013 *J. Educ. Pract.*, 5 (1) 131
[4] Rizki P and Disman 2017 *J. Elem. Educ*, 1 (1) 109
[5] Angela F 2017 *Aust. J. Teach. Educ*, 41 (40) 63
[6] Broks A 2016 *J. Balt. Sci. Educ*, *15* (4) 408
[7] Taufiq M, Dewi N R and Widiyatmoko A 2014 *J. Pendidikan IPA Indonesia* 3 (2) 123

[8] Wusqo I U, Taufiq M and Handayani R 2015 *J. Pendidikan IPA Indonesia,* 4 (2) 135
[9] Taufiq M, Amalia A V, Parmin P and Leviana A 2016 *J. Pendidikan IPA Indonesia* 5(2) 291
[10] Nada A 2015 *Am. Int. J. Contemp. Res.* 5 (6) 68
[11] Amanda K N H and Katie G 2016 *Communications in Information Literacy*, 10 (2) 264
[12] Wiyanto, Nugroho S E and Hartono 2017 *J. Phys.: Conf. Ser.* 824 (1) 012015
[13] Isnaeni A, Arif M and Fatmaryanti S D 2014 *Jurnal Pendidikan Fisika* 5(1) 24
[14] Adzliana M D, Jizah O, Punia T and Kamisah O 2012 *Procedia-Social and Behavioral Sciences* 59 (2012) 467
[15] Fatmawati B 2011 *Jurnal Pengajaran MIPA*, 16 (2) 85

Development of an integrated model of natural science practicum based on the daily science project to embed 21st century skills in junior high schools

ORIGINALITY REPORT

19%	18%	7%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	eprints.uny.ac.id Internet Source	4%
2	scholarsmepub.com Internet Source	3%
3	jehdnet.com Internet Source	2%
4	M Mustari, P Marwoto, R S Iswari, F A Ginanjar, Y Anjelinar. "Development of physics practicum module based on collaborative teamwork learning model", Journal of Physics: Conference Series, 2020 Publication	2%
5	acris.aalto.fi Internet Source	2%
6	irep.iium.edu.my Internet Source	2%
7	core.ac.uk Internet Source	1%

8	media.neliti.com Internet Source	1 %
9	Budiaman Budiaman, Komarudin Komarudin, Nuruddin Nuruddin, Cecep Kustandi. "Learning Design on Social Studies Through Digital Book in Senior High School", International Journal of Interactive Mobile Technologies (iJIM), 2021 Publication	1 %
10	digilib.unimed.ac.id Internet Source	<1 %
11	biblio.ugent.be Internet Source	<1 %
12	L Lia, Zulkardi, K Wiyono. "Development of Interactive Learning Multimedia Using the Drill & Practice Model on Scientific Literacy of Junior High School Student", Journal of Physics: Conference Series, 2021 Publication	<1 %
13	prosiding.unirow.ac.id Internet Source	<1 %

Exclude quotes	On	Exclude matches	< 3 words
Exclude bibliography	On		