Thematic learning design development: STEM model through water play activity

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Abstract. 2013 curriculum is a curriculum model that can integrate skills, themes, concepts, and topics in both within disciplines, across several disciplines and within and across learners. The enactment of the 2013 curriculum will have an impact on the way learning will be designed and implemented by teachers in the classroom. The lessons that are held are not necessarily rigid, absolute housed in the classroom, trapped by an enclosed wall and a short time. Instead learning should be flexible, fun, stimulating student activities and can provide meaningful experiences for students so that students can be creative, productive, and innovative. The purpose of this research is to develop STEM model learning design through water game activity in elementary school. The development of thematic teaching design is done by several experiments to several schools by adopting DBR (Design-Based research) approach. The resulting product is a STEM thematic learning tool based on a water game activity as the implementation of the 2013 curriculum. One of the major reasons for developing this learning tool is to get an example of a learning device integrated with the game. Fun learning but still oriented to learning materials so that learning can be a weapon that will develop student competence.

1. Introduction
Learning is the process of interaction between students and teachers. Learning will run optimally when the teacher prior to the implementation of the study in advance of designing instructional design, determine the source of learning materials, media, and evaluation that will be used. In general the success of a study is determined by the quality of the design of instructional design. Instructional design gives an overview of the learning process. This is in line with Gagne reveals the instructional design is structured to help the learning process of learners in which the learning process have short term stages as well as a long term goal [1].

The design of instructional design needs to pay attention to the involvement of students in the learning process. So that students are directed to active. This is in accordance with the scientific approach used in the curriculum of 2013 thematic learning by applying. Thematic learning to integrate several subjects in one unified theme. Characteristics namely the thematic learning centered on students, providing hands-on experience, the separation of subjects is not so clear, presenting the concept of the various subjects in a process learning, flexible/flexible nature, learning outcomes in accordance with the interests and needs of the students and using the principle of learning while playing [2].
On the basis of thematic learning characteristics, learning process should be oriented to the activity of the students, while teachers act as facilitators [3]. However, the fact that many teachers are still only using conventional methods of usage of methods of domination in the form of lectures, so the teacher-centered learning. Then, the design of learning designed to put more emphasis on thematic learning student involvement actively in the learning process, students get hands-on experience and find out for yourself the knowledge learned and activities the learning fun.

On the development of a thematic study on design the model of the STEM through the activity of water play. This gives the opportunity to students to conduct extensive observations, ask, analyze, and make a conclusion so that a sense of curiosity of students can be missed. Learning thematic priority on granting experience directly to students would give the meaningfulness of learning. The design of thematic study on model of water play activity through STEM facilitates students to do an observation detailed to a concept and give experience meaningful to the students.

Much research has been done on STEM design, including integrated learning through engineering design in sixth grade elementary schools, learning media design, integrated science learning design [4-6]. But research on learning design regarding STEM models through water games is still very limited. Of course this research is one of the efforts in carrying out various innovations to improve learning outcomes of elementary school students. The purpose of this study was to develop the STEM model learning design through water play activities in elementary schools.

2. Research method

Research methods the research method used was Design Based Research. Design research is a systematic study of designing, developing and evaluating educational interventions (programs, strategies and learning materials, products and systems) for the purpose of solving problems complex issues of education, which aims to advance our knowledge of the characteristics of the intervention and intervention process for design and development of education [7].

From that explanation, can be drawn the outline of that Design Based Research aims to develop learning that focuses on solutions to existing problems. To that end, Design Based Research is research methods relevant to develop quality instructional design because it can bridge the development of theory and practice. The steps of research Design Based Research as follows

![Refinement of Problems, Solutions, and Methods, and Design Principles.](image)

**Figure 1.** The steps of research design base research [8].

Activities performed at the stage of identifying and analysis problems by researchers and practitioners collaboratively i.e. conducting preliminary studies to the four elementary school curriculum 2013 in the town of Tasikmalaya. Interview and documentation study was the technique of data collection conducted by researchers to get information related the use of instructional design in elementary school. Based on the foregoing, the researchers began to develop a solution that is based on benchmark theory, design principle and technological innovation. As for development conducted by researchers in the form of thematic instructional design on the model of the STEM through the water play activity for students of class IV elementary school. Next on the third stage, the researcher performs repeated the process to test and refine the solutions are practical. Testing performed internally and externally. For internal tests conducted on two professors experts competent in their
field. As for the external test is done to the subject of research i.e. teachers and learners class IV elementary school. The last stage of reflection to produce design principle and to improve the implementation of practical solutions, at this stage the researcher doing a reflection against the learning design has been developed. The deficiencies found during the testing process will serve as a solution to repair to the products produced are really worth to be used.

The research was carried out at two elementary schools The Town Of Tasikmalaya. Subjects research data source i.e. teachers and learners class IV. To obtain research data, researchers using the technique of collecting data with questionnaires and observations against the video learning process. Data analysis was done using the model and Huberman Milles which consists of three stages of activity, namely data reduction, data display, and conclusion drawing/verification [9]. Data analysis was done by way of analyzing the results of the questionnaire and observation against the video learning activities. The results of the analysis are presented in the form of text descriptions are purely descriptive and in the form of a table. After the data is presented, then a researcher infer the results of the research and development of thematic instructional design on the model STEM through the activity of water play in elementary school.

3. Results and discussion

3.1. The identification of the use of instructional design in elementary school.

Based on the results of the identification and analysis of the problem conducted by researchers and practitioners, it was found that the implementation of learning need to be prepared with optimal. The preparation should be there is minimal presence of the plan of implementation of the learning. The existence of the draft design study is written in the plan of implementation of the learning, then learning may run as expected. The quality of learning of a teacher, if starts with making a lesson plan (implementation plan of study) will be different compared to the teachers who don't perform preparatory lesson plan (Implementation plan of study) before [10,11]. Thus, to create teaching and learning activities (KBM) and as expected, then the prior learning dimualai, a teacher will need to prepare the instructional design that will be performed while in class.

Other potential which is found from the results of the analysis is the presence of learning the process of observing and testing or practice while learning, will encourage students to ask questions. Students as human beings have an innate to know share.

The next thing that becomes the potential is on observing and testing or practice needs to using concrete objects and need to capitalize on the surrounding environment. Thus, the learning will be meaningful and students can find themselves with a fixed concept gets guidance from teachers. In the context of the learning curriculum for 2013, students are conditioned to have done the research, observations, experiments, observations or information gathering from various sources through the interview or the like [1]. For that, the knowledge will be more meaningful when searched and was found by students [12].

3.2. The Form of The Draft Thematic Instructional Design on the model of the STEM through the water play activity in elementary school.

From the results of the identification and analysis of the problem, then the necessary preparations so that optimal learning that is conducted by qualified teachers. Analytical study on process must also involve the activities of students, so that learning can be more meaningful. Therefore, the researchers designed a thematic instructional design based on the model of the STEM through the activity of water play. Educational integration of the STEM is a learning integration between science, technology, engineering, and mathematics to develop the creativity of the students through the process of problem solving in the everyday life [13]. Approach to STEM education teacher learning technology, namely the approach of integration (integrated) which was later adapted for the learning of science [14,15]. Integrated approach to education STEM pictured removing walls between each field of STEM content and teaching them as a single subject. The integration can be done with a minimum of two disciplines, but are not limited to two discipline. An integrated approach linking the material from the different areas of the STEM being taught in different classes and at different times of cross-curricular content and merge with critical thinking skills, problem solving skills, and knowledge to reach a conclusion.
At this stage, after investigators determined the use of the the model of the STEM through the activity of water play to be used in instructional design, then researchers conduct studies against curriculum 2013 to define core competencies and Basic Competencies, define indicators and learning objectives, define and develop towards the learning material, determine the learning matrix will be done, then the compiler of thematic instructional design on the model STEM through the activity of water play.

Water play activity is used because it is understood could bring a variety of activity active students who can bridge the thematic study on the model of the STEM. Children learning from water water play/study clearly is multidisciplinary. It can help children further their understanding of how the world works, where things come from, and how things are made [16].

Stage design validation is performed by the validator. Design validation is performed against the product design of learning with models of practice research. Validation of aims in order to make products that are developed. The validity of being an important point when questioning the quality of the results of a qualitative research [17].

The revised design is done based on validation of product design study carried out by expert validator. The revision was done to rectify the shortcomings and weaknesses are found at the time of validation of the design. The purpose of the revision or improvement is to obtain thematic instructional design on the model STEM through the activity of water play that meet the criteria of kevalidan, practical and easy to understand.

3.3. Implementation of The Draft Thematic Instructional Design on the model of the STEM through the water play activity in elementary school.

Phase 1 trials conducted after learning design products made by researchers of the revised or corrected based on validation by experts. Product testing is not done directly by researchers, but by Sorority UPI Kampus Tasikmalaya. Researchers acting as observer design against the use of thematic study on the model of the STEM through the activity of water play that have been developed.

Based on the trial results have been implemented during the two meetings, the study went smoothly. However, it has not been in accordance with the draft design study expected. It is caused by several things, among them the less time allocation in accordance with planned and the learning material that is widely not understood 1 students. As for the response of the students towards learning quite positive. With a student-centered learning, the existence of various activities in the learning activities and the monitoring and testing of the learning media is done directly by the students, discuss, make the students gave positive response towards the learning done.

Revision 2 product made after the known existence of flaws in trial 1 thematic instructional design of product on the model of the STEM through the water play activity. Based on the results of test 1 found deficiencies that must be corrected for the next trials so that instructional design developed better and more optimal learning. The deficiencies found in the appropriations provided less in accordance with the learning process is done, the learning materials telalu lot and less fit, and there are still editors sentence are less appropriate. One of the stages in the research and development is the existence of a revision or improvement. That is, do the revisions done to correct the weaknesses found in the stages of field test. The revision does is determine the allocation of time to make it more appropriate, replace, replacement material editor language and exchanging order, adds and removes the description of the activities that are less appropriate [18].
The next step is to test 2. After the ill-fated revision II against the instructional design theme based on the model of the STEM through the water play activity, implementation of the learning process can be implemented properly, optimal and in accordance with expectations. Allocation of time determined in accordance with the implemented learning, learning activity measures correspond to the measures in the design of the learning that has been designed. As for the trial against student response 2 give a positive response and increase of trials 1. The results show that through the STEM approach the learning process is more meaningful which ultimately contributes to the improvement of children's learning outcomes [12,19].

3.4. The form of the final design of the thematic study on the model of the STEM through the water play activity in elementary school.

Based on the testing that has been done twice against thematic instructional design on the model of the STEM through the water play activity, then the product can be used. These products have met the criteria for valid based on expert, practical, validator can be used in elementary school, and get a positive response from teachers and students. The resulting product is in the form of implementation plans (RPP) thematic Study on the model of the STEM through the activity of water play.

On the product design of the thematic study on the model of the STEM through the water play activity be Learning implementation plan (RPP) also features the use of Worksheets students (LKS) in learning. LKS as shown in thematic instructional design on the model STEM through the activity of water play.

In addition to the use of implementation plans is worksheets students (LKS) in this learning process is accompanied also the use of the assessment of the attitudes and the use of performance assessment in the learning step is done. It aims to facilitate teachers in determining when the use of the assessment of the attitudes and the use of performance assessment.

Through thematic learning design in STEM models based on water game activities the tendency will contribute to increasing motivation and attitudes of elementary school students so that learning outcomes can be optimized. STEM learning has an impact on student motivation in learning [20].

4. Conclusion

Based on the results of the research and development of instructional design on the model of the STEM through the water games activity implemented in elementary curriculum Land 2013 in the town of Tasikmalaya, then the conclusion can be drawn:

Instructional design used in elementary school that existed in the town of Tasikmalaya is still very rarely do activities learning model of STEM or through water games. In addition to this, generally still held conventionally and have not centered on students. Thus, the learning process has not been in accordance with the scientific approach. The draft design of the thematic study on the model of the STEM through the water games activity arranged so that the learning process centred on the students, more meaningful, and according to the scientific approach. Stage design of instructional design based on the method of Design Based Research models of Reeves. At this stage the draft generated thematic instructional design on the model STEM through the activity of the water games (draft 1) form of Learning implementation plan (RPP) Thematic blending some matapelajaran. After the thematic instructional design on the model of the STEM through the water games activity (draft 1) are designed, carried out the validation of the product by the validator expert to know the kevalidan of the product to be tested. Furthermore, the revision is done based on advice from experts, then the validator generated thematic instructional design on the model STEM through the activity of the water games (draft 2) shaped Renacana Implementation Learning that is ready to be used for testing. On the process of trial performed twice. Based on the results of the pelaksanaan test 1 there is still a lot of shortcomings, and do revision II to improve the design of learning so that the learning process that is implemented more optimal. On a test run to 2 runs with optimal learning and in accordance with the design of the learning that has been designed. The response of teachers towards instructional design which was designed to give a positive response by delivering a statement that instructional design that has been made is relevant to the material to be taught and easily understood. As for the response of the students towards the learning activities have been done giving a response with not feeling had difficulty against the learning that has been done. The form of thematic learning design on the model of the STEM through the water games activity emphasized scientific approach in accordance with the
curriculum of 2013 and the principle of model STEM and water games. The resulting end products in the form of thematic Learning implementation plan on STEM model through water games for class IV. These products can be used in elementary school.

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