

Meta-analysis of learning design on sciences to develop a teacher's professionalism training model

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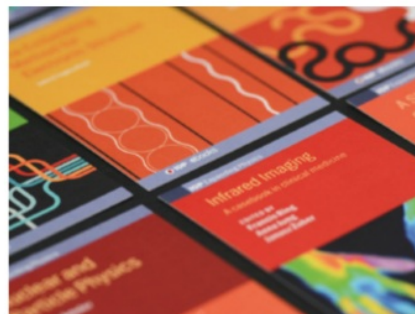
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Meta-analysis of learning design on sciences to develop a teacher's professionalism training model

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Abstract. This research explored a meta-analysis of the teaching design on sciences teachers' lesson plans to develop the training model in achieving 21st-century learning competence and the implementation of the scientifically literate school model. This is a qualitative research with descriptively qualitative analysis. The sample was the members of sciences teacher's organizations in Brebes Central Java Indonesia. Data was collected by documentation, observation, interviews, and questionnaires scale understanding. Analysis of the lesson plans focused on the correctness of development concept and integration of Strengthening Character Education; School Literacy Movement; Communication, Collaboration, Critical Thinking and Creativity; and Higher Order Thinking Skill. The sciences teachers had a good understanding of the components of the lesson plan, but needed further training. The integration of the character education by the teacher was not explicitly written into their lesson plan. The teachers' skill to integrate the components was still needed improvements. It is found that training and mentoring of lesson plan development to improve the skills of science teachers in achieving 21st-century learning competencies are still urgent to be done. The training and mentoring model proposed here is Peretipe model, to help teachers skillfully design good lesson plans based on Technological Pedagogical, and Content Knowledge.

1. Introduction

Learning design is one of the crucial components that teachers must prepare before beginning classroom learning. Thus, the design of learning can also be interpreted as a lesson plan drawn up by teachers as an integral part of learning activities. Learning design or a lesson plan developed/created by the teacher based on basic competence and learning activities contained in syllabus subjects. The course syllabus is designed based on the learning achievement and the graduation standard as outlined in the curriculum according to the particular topic.

Science subjects are one of the compulsory subjects to be followed by junior high school students. It has a great opportunity in developing the potential and character of learners through the scientific methods. The process of developing the potential and character development of students will be more effective and efficient when prepared correctly. One of the references of the success of the learning objectives is the availability of a good lesson plan.

A proper sciences lesson plan implementation is based on the category of the fulfillment of key components in a lesson plan. These components include the existence of basic competencies, indicators, learning objectives, subject description, determination of approach/strategy/model/method used in learning activities, learning source provisions (media, tools, and reading material related to the



translation of concepts), and determination of evaluation tools to measure learning objectives. Each of the mentioned components needs to be adequately and well described. Furthermore, [1] said that the sciences teachers had drawn out that although they had sufficient theoretical knowledge about instructional methods, techniques, strategies, measurement and assessment, they encountered some problems in transferring the theoretical knowledge into practicum.

The components a sciences lesson plan need to be explained referring to the current curriculum demands, the 2013 curriculum in Indonesia and the 21st era development. The 2013 curriculum in Indonesia demands are aligned with the development of the 21st century. This is reflected in the required criteria in teacher's lesson plan in the 2013 curriculum in Indonesia. These measures include Strengthening Character Education (SCE), School Literacy Movement (SLM), Communication, Collaboration, Critical Thinking and Problem Solving, and Creativity and Innovation (4C) and Higher Order Thinking Skill (HOTs). The Lesson Plan should represent those standards. Thus, it is necessary to the teachers to design a lesson plan creatively.

The characters generated in SCE are primarily: religious, nationalist, independent, mutual cooperation, and integrity. The SCE movement needs to integrate, deepen, expand, and simultaneously align the various character education programs and activities that have been implemented. The integration of SCE in the learning activities could be: integration of classroom activities, outside the classroom at school, and outside school; the integration of intracurricular, co-curricular, and extracurricular activities; the simultaneous involvement of school, family, and community residents. The deepening and extension of SCE could be the addition and intensification of activities oriented to the development of student character, addition and refinement of student learning activities, and re-arrangement of student learning time at school or outside school; the extermination might be the adjustment of teachers' basic tasks, School-Based Management, and School Committee functions with the needs of the SCE Movement.

The literacy in the context of SLM is the ability to access, understand, and use something intelligently through various activities such as reading, seeing, listening, writing, and or speaking. The SLM is a comprehensive effort to make the school a learning organization whose citizens are literate throughout life through public engagement. Literacy is more than reading and writing, but it includes thinking skills using printed, visual, digital, and auditory sources of knowledge. Literacy can be defined into basic literacy, library literacy, media literacy, technology literacy, and visual literacy.

21st-century skills are literally said as 4C. The 4C skills are the goals of the 2013 curriculum in Indonesia, so the learning process is not just a transfer of information but a 4C formation. Mastery of 4C is as a means of success, especially in the 21st century, where the world is progressive and dynamically developed. The mastery of 21st-century skills is essential and the 4C is a softskill that is in daily implementation, preferable and useful than hardskill mastery by learners.

HOTs is the critical, logical, reflective, metacognitive, and creative thinking ability that is a high-level thinking ability. The 2013 curriculum in Indonesia also requires learning materials up to metacognitive that require learners to be able to predict, design, and estimate. Correspondingly, the domain of HOTs is an analysis that is the ability to think in specifying aspects of a particular context; evaluation is the capacity to think in making decisions based on facts or information; and to create is the ability to think in building ideas/ideas. Thus, it is impossible to use teacher-centered model, method, strategy, approach, but need to activate learners in learning. Thus, it is necessary to do a meta-analysis related to the teacher's ability to develop lesson plan as part of his professionalism as an educator

Teacher professionalism is not only determined by the good mastery of subject matter or concept, but also their skills in their pedagogic, personality, and social field. The meta-analysis of their instructional design is also a necessary first step to determine which teachers are professionals in their field or even less or even unprofessional. One professional indicator is that teachers are able to plan indoor and outdoor learning. To help teachers improve their professionalism can be done by providing training related to human resource development that can adapt to changing and challenging era with accurate models appropriate to training objectives.

The training model to develop their professionalism, is inseparable from the teacher's understanding of Technological, Pedagogical, and Content Knowledge (TPACK) in which professional teachers are required to be able to educate learners by integrating technology and pedagogy in the mastery of material content by staying on SCE, SLM, 4C, and HOTs. The finding of the research showed a pattern teachers' PCK needs to be improved. Coding analysis's classified all experienced teachers observed in middle category, and almost all prospective teachers observed in upper category [2]. The Prospective Primary Teachers' lesson plans indicated some pitfalls on teaching and learning activities. The Prospective Primary Teachers designed lesson plans ought to be given more opportunities to transfer their PCK into related subject matter [1].

2. Methods

The research method used was descriptive qualitative, which describes facts encountered in the field during research activities. Data were from the best lesson plan documentation made by teachers, interviews, classroom observations, and teacher-scale comprehension questionnaires related to teacher professional development with a focus on the development of sciences lesson plan. The sample in this research is the members of sciences teachers' organization in Brebes on Central Java Indonesia. The research findings were analyzed descriptively qualitatively by triangulation based on the same framework for the various data collection techniques. Indicators of achievement were determined by the suitability of data findings with the structure associated with lesson plan development by science teachers in the 21st century which includes SCE, SLM, 4C, and HOTs.

3. Results and discussion

The best lesson plan data by teachers were analyzed based on component completeness, component characteristic, the correctness of translation and or how to describe each lesson plan component. Then, it was cross-checked with lesson plan component development theory by sciences teachers, and analysis of the accuracy of SCE, SLM, 4C, and HOTs. The results of the descriptive analysis conducted on the best lesson plans for science teachers in Brebes on Central Java in Indonesia obtained summary results as follows:

3.1. Basic competencies translation components as sciences learning indicators

The indicators articulated by science teachers, generally have standards under the required basic competence. The verbs used were not in accordance with the basic competencies requirements outlined in the 2013 curriculum in Indonesia. The chosen verbs by teachers to describe the indicator had not shown measurable and operational verbs. This happened because the science teachers did not understand the theory of basic competence translation into an indicator. The statement was supported by the scienceteacher's statement stating that they had difficulty when selecting appropriate words to formulate indicators according to the basic competence. Furthermore, they also said that misunderstanding categories of the basic competence levels in the process dimensions in the Bloom's taxonomy. Indicators were defined or formulated to facilitate teachers to measure basic competency achievement. The ways of formulating good indicators are: oriented to basic competence; expressed by using operational verbs to be more easily measured; operational verbs are chosen based on behavioral or skill changes after learning with the minimum achievement of basic competencies.

3.2. Components of sciences learning goal translation

Learning objectives are often translated by science teachers only containing the components of the audience and behavior. The lack of science teachers when describing the true and proper learning objectives was due to their limited understanding of how the learning objectives are translated to help them measure the knowledge. Learning objective formulation is by referring to ABCD components (Audience, Behavior, Condition, and Degree). The goal and activities of the learning process designed by teachers should be clear and constructivist oriented [3]. The formulation of clear, right and propergoals enables teachers to develop evaluation tools to measure them. When the measuring tool

used to evaluate learning achievement of goals is correct and appropriate, then learning becomes more objective. The tendency of inaccuracy in the formulation of learning objectives listed in the lesson plan experienced by most teachers, because 56 of 91 sciences teachers stated that they developed a lesson plan in communities of school-based and subject-based lesson study.

3.3. Component of learning approach/strategy/model/method translation in sciences learning core activities

Sciences teachers have been able to choose right and proper approach/strategy/model/learning method in the selection process. However, when they describe it in the core activities of learning, there was an inappropriateness between approach/strategy/model/learning method and core learning activities. This was because the science teacher had difficulty understanding the correct theory of the approach/strategy/model/learning method chosen. The statement was proven when the teacher tested the characteristics of open-inquiry learning model, 18 out of 76 science teachers answered correctly. The same thing happened when the science teachers tested the features of compulsory learning models in the 2013 curriculum, the discovery learning, 11 out of 46 science teachers answered correctly. The fact showed that teachers need refreshing related to the correct approach/strategy/model/method of learning. The selection of appropriate approach/strategy/model/method of learning and its proper elaboration in science learning activities become one of the benchmarks of teacher's professional ability mastery [3].

3.4. Components of Strengthening Character Education, School Literacy Movement, Critical, Creative, Communication, and Collaboration), and Higher Order Thinking Skill in sciences learning

The analysis of the best science teachers' lesson plan during teaching in sciences classes indicated that SCE components have been implied but not yet explicit. The lack of component was found in the SLM, 4C, and HOTS when analyzing and critiquing the lesson plan. The SLM in teachers' lesson plan was relatively low in the category because only 11 out of 96 science teachers utilized the sociocultural environment and 20 out of 96 science teachers used the technological environment as learning resources for learners. Nevertheless, 66 of 96 science teachers had employed the physical environment around learners as learning resources. Environmental literacy around learners when learning science becomes very important, because the object of learning science is the environment itself, both physical and non-physical. Sciences learning would be useful when the objects are the environment around the students [3,4]. Further Dragos & Mih states that facilitating science learning as in the existing reality and with concrete actions could strengthen the students' skills on the scientific knowledge [5].

Regarding 4C, teachers lacked the courage to explore the critical and creative skills of learners. This is evident from the problems stated in their lesson plan were still at the Low Order Thinking Skill/low level. The questions used to assess learning objectives and basic competencies were below the degree of process dimensions demanded which focus on conceptual understanding that refers to definitive questions. The statement was proved that only 26 out of 96 science teachers who had measured the achievement of science learning goals at the critical thinking level and 24 of 96 science teachers measured the science learning attainment at the level of creative thinking.

The difficulties encountered by science teachers when measuring the achievement of science learning outcomes with the HOTS category questions at the critical and creative thinking level lay in their ability to create a problem at that level. The difficulty was proven when 40 science teachers were tested with HOTS level problems, there was only 1 science teacher who could answer correctly. Teachers' learning design represented in lesson plan needs to integrate knowledge and skills in the learning process through critical thinking and effective communication. These activities need to be supported by other skills that also affect the today's era success that is creative thinking and collaborative skills so as to create a high-quality generation. Collaborative activities, knowledge construction through creative and critical thinking were accompanied by the efficient use of technology as learning innovation and real-life problem solving [3,6]. The power of communication skills could help learners be able to act as good leaders [3,7]. Quality learning not only focuses on the

mastery of knowledge alone, but also needs to consider the relationship between scientific beliefs, scientific literacy, and optimism about science [8].

Creative thinking skills are related to critical thinking skills because creative thinking skills support critical thinking. The critical thinking appears when a person is able to solve problems / make decisions by considering various perspectives of thought holistically and openly. Critical thinking components (analysis, evaluation, and synthesis are often identified as key components of the creative thinking process.) Critical thinking skills require learners to help them quickly adapt to their surroundings and flexibly adapt to faster information developments [9]. The interaction between creative and critical thinking skills is essential for creative problem-solving processes. The opposite and challenging problem to solve requires creative thinking to provide more meaningful solutions. Critical thinking is needed to analyze and evaluate possible solutions. Critical thinking skills are also obliged in the overall creative thinking process resulting in new ideas/products as each plan needs to be examined and assessed to determine the suitability and accuracy of the solution. Creative thinking skills need to be developed to prepare the learners for future changes because of creative thinking skills related to economic and cultural prosperity. Integration of the empowerment of creative thinking skills in the learning process activities can be initiated by cultivating metacognition thinking skills preceded by reflective thinking [10]. Acculturation and empowerment of critical and creative thinking skills might happen in the learning design with the implementation of mastery of knowledge which involves creative thinking and critical thinking through collaborative activities with their peers to solve certain problem. Factors supporting creative thinking activities can be effective when the learning process designed by teachers involves collaborative activities [11].

Based on the previous explanation on the results and discussions, it is vital to conduct training and mentoring of science teachers to provide skills related to the translation of lesson plan components correctly and appropriately which integrate SCE, SLM, 4C and HOTs components in 21st-century learning. The training model and mentoring development of sciences learning design by lesson plan format are then referred to as the "Peretipe" model, which is a model with primary goal of providing training for science teachers to be skilled in developing a good lesson plan as in the development theory and TPACK. Peretipe model has four main phases, namely, Exploratory assessment, Review, Treatment, and Mentoring. Cycle of Peretipe model for training and mentoring to develop a lesson plan in sciences learning design are shown in Figure 1.

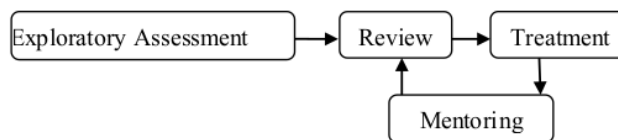


Figure 1. Cycle of peretipe model

3.4.1. Exploratory assessment.

The exploratory phase was conducted by the trainer to deeply and comprehensively explore the challenges experienced by science teachers. This stage provided solutions and problem solving as well as the appropriate treatments to overcome the challenges encountered by the trainees. Activity began with interactive individual or group discussions groups between trainers and trainees followed by joint decision making to determine problem-solving solutions.

3.4.2. Review.

The Review phase was performed on the Peretipe model by the instructor to provide a theoretical understanding of the material related to the proper lesson plan development. It was expected that if the trainees understand the theory of a good lesson plan development properly, then they would be able to practice it as well. The review activity began with a reinforcement of the components of lesson plan

compiled by participants then criticize the products that have been previously developed referred to the theory. If there was a gap between the two then the trainee was assigned to make up the inappropriateness.

3.4.3. Treatment.

This phase was carried out by the trainers to provide the trainees the appropriate skills of good lesson plan development, related to the elaboration of lesson plan components and its realization as correct manifestations. The activities began with interactive discussions related to the review results to capture the difficulties experienced by trainees while critiquing their lesson plan. The action was done in a classical / grouped when finding similar problems/challenges and experienced by most trainees. The particular insolvable problem, then solved by individual clinical supervision as a section of the next mentoring phase.

3.4.4. Mentoring.

The mentoring phase was done to ensure that the trainee has been skilled at developing the appropriate lesson plan. Skill indicators were expressed regarding conformity between the translation of each lesson plan component of the theory. Advisory activities were done through clinical supervision to the trainees. The mentoring process was individualized with a more flexible time management. If the result of the lesson plan product created by the teacher has met the skill criteria, then this phase would end with the review process as the last stage in the Peretipe model. The review process was conducted by self-review and peerreview to ensure that teachers as trainees are considered skilled based on the explained review process by the trainers.

4. Conclusion

The sciences teachers have a good understanding of the sciences learning design components of the lesson plan, but still need improvement on their skills in the translation for each element correctly and properly. Thus, it is necessary to develop skills training of lesson plan development by science teachers with the Peretipe model. The Peretipe model is a model of training and mentoring of lesson plan development based on TPACK, with 4 stages; Preliminary assessment, Review, Treatment, and Mentoring. the main objective in Peretipe's model is the mastery of teacher skills based on TPACK in the development of sciences lesson plans.

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