How to make slow learners learn science

I A Nugroho\textsuperscript{1,}\* and Z K Prasetyo\textsuperscript{2}

\textsuperscript{1}Graduate student of Elementary Education Doctoral Program, Post Graduate of Yogyakarta State University, Yogyakarta, Indonesia
\textsuperscript{2}Departemen of Elementary Education, Post Graduate of Yogyakarta State University, Yogyakarta, Indonesia

*Corresponding author: ardi.2017@student.uny.ac.id

Abstract. One of the goals of ESD is the implementation of inclusive education. That goal is prepared through the fulfillment of teacher competencies through teacher education in the universities. However, not all in-service teachers understand the nature of inclusive education. The results of the preliminary study show that preservice teachers need practical understanding with the existence of learning device models for inclusive classes. This study aim is to produce teaching materials in ESD context which consists of lesson plan and media for slow learners. This research was designed using Research and Development (R & D) adapted from Plomp which consists of five stages, namely (1) Initial investigation, (2) Design (3) Realization/construction, (4) Test, evaluation and revision, and (5) Implementation. This research was limited to fourth stage. Validation used the consideration of science education expert and special education expert. The instruments used in this research were assessment form and observation form. The lesson plan and media tested in one-group pretest-posttest experimental design. The result of this research is effective lesson plan and media of science for slow learner student.

1. Introduction

One of the goals of Educational for Sustainability Development (ESD) is to ensure that education takes place in an inclusive and equitable manner for all students, including in primary schools [1]. Moreover, in the ESD framework, inclusive education will be more meaningful if held in green school (Adiwiyata school) which is one part of the strategy to realize ESD. Inclusion and Adiwiyata school are both synergic programs. Adiwiyata school, according to Ministerial Regulation Number. 9 of 2009 concerning Guidelines for the implementation of Adiwiyata programs, are schools that have environmentally friendly policies; implemented an environment-based school curriculum; carry out participatory school-based activities; and have facilities and infrastructure to support schools that are environmentally friendly. This condition is friendly to children with special needs. Some suggestions for inclusive schools as follows: should involve the community/local NGOs/ DPOs and the government in improving infrastructure, the infrastructure including sanitation, to be safe, clean, accessible and private for all learners - also for children with disabilities and have a good environment (having trees, flowers, parks, clean school grounds, school building complexes, etc.) [2].

The process of learning in inclusive school certainly involves various elements. Contemporary thinkers think that children, including children with special needs, are part of a broad social system and become a part that influences or is influenced by the environment. This context, known as ecology is views of individuals in relation to other individuals in various environments, including families of
children with special needs. Ecological perspectives consider behavior as a function of interactions between people and the environment [3]. This perspective was first proposed by Brofenbrenner and modified by Anderson, Boyle, & Deppeler [4].

Based on the ecological theory, one element that has a role is a teacher. Therefore, an elementary school teacher must have adequate competence. Three of the abilities that show a teacher having competence are (1) analyze the material to be learned; (2) determine the strategies used in learning; and (3) designing teaching materials [5]. These abilities must be in a preservice teacher.

To explore further about the competence of teachers in the field, a preliminary study was conducted to 249 pre-service teachers at Primary Teacher Education Study Program Yogyakarta State University who have taken the student teaching to find out their understanding about characteristics of children with special needs and science learning for children with special needs, especially children with slow learners (SL). The results show that 245 pre-service teachers have not yet gained a sufficient understanding about characteristics of children with special needs, as well as how to teach science for slow learners. Teaching and learning method for children with special needs then were embedded in science education syllabus in Primary Teacher Education Study Program State University of Yogyakarta. Nevertheless, the questionnaire results indicated the need for a model that can be used as a reference in science education for children with special needs.

In addition, the survey results obtained from 100 primary school teachers who participated in Education and Professional Practice for Teachers (PLPG/Pendidikan dan Latihan Profesi Guru) in 2016 showed that 97% of those teachers did not understand the characteristics of children with special needs, especially slow learners; how to teach children with slow learners, and have never obtained a model of lesson plan for children with slow learners. This phenomenon is supported by the results of another study that found that teachers in 9 schools of 9 districts in Bandung have not been able to modify the curriculum according to the ability of students with special needs [6].

Based on the preliminary study in inclusive school, it is found that the main problem of SL student in learning science is interest. An observation was made of SL student to find characteristics of interest in science learning. The indicators of observation are, 1) Engagement in the learning process, 2) Time utilization in completing work, 3) joy in learning, 4) Attention to teacher, 5) Response when receiving an explanation, and 6) effort to find answers. Based on these indicators, an assessment of SL students is carried out with a score of 1-3 for each indicator. Observation results show a value of 6 for the score of students’ slow learner. Interview results show that developing a science lesson plan and media that can be a model for teachers to educate children with slow learners is necessary. Among the children with special needs, slow learners is the most common type in every primary school of inclusion and has the greatest number in Indonesia [7,8]. Thus, this research will develop lesson plan and media which focused for slow learner to improve interest for learning science.

Slow learner, actually, can learn by using curriculum for normal student. Those curriculums require some modification to fill the need of slow learner. [9] An approach that helps planning and implementation of learning based on diversity (differentiated learning) and for slow learner too, is Universal Design for Learning (UDL) [10]. Universal Design for Learning is a scientifically valid framework for guiding learning practices that provide the flexibility of information presentation, giving students greater freedom to respond and demonstrate their knowledge and skills, and have diverse ways of getting students to become involved in learning; and reduce the challenges in every instruction, providing suitable accommodation, challenging and maintaining outstanding achievement expectations for all students, including special needs students[11, 12, 13].

That approach used in the curriculum and teaching strategies in the classroom so as to accommodate all children. UDL contains the following components.

a. Provide various ways of representing (and/or participating). These methods include diversifying the media used in the learning as appropriate
b. Provide a variety of ways to engage students in learning. The consequences of various ways of involvement include the use of cooperative learning and role play.
c. Provide a variety of ways so that students can demonstrate what is known [14].
Slow learner student is a child with below average intelligence. Their thinking skills have developed more slowly than normal children for his/her age. Children of this type are entitled to special education services [15]. The term slow learner is not a category of diagnosis, but rather a term to describe the condition of a child who still has academic ability and reasoning, but their ability is below the average of their classmates. Some characteristics of slow learner children are [16],

a. Less attention to be active in learning and lack of concentration
b. Slow response to external stimuli
c. Limited ability to work with abstract things and to generalize
d. Slow in forming associations between words and phrases
e. Not able to analyze, solve problems, and think critically
f. Lack of ability to use higher mental processes
g. Tend not to mature in the association
h. Have difficulty in following directions consisting of several steps.
i. Not able to transfer what has been learned from one task to another

2. Methods

2.1. Development procedure
The development model used in this study is the Plomp Development Model which uses four stages of the five stages: (1) Preliminary study, (2) design, (3) realization or construction and (4) tests, revision and evaluation [17]. The initial investigation collected information about science learning issues for children with special needs in elementary schools and pre-service teachers’ views on teaching children with special needs in elementary schools through interviews. Step continued with the design phase (design) and produced alternative solutions in the form of initial design. The initial design as the results of the design phase is then realized in the form of learning tools and performed conceptual validation through expert judgment and focus group discussion with elementary school teachers and shadow teachers. The initial product was tested in an experimental study using one-group pre-posttest design. The diagram of the design can be seen Table 1.

| Table 1. Research design of one-group pretest-posttest [18] |
|------------------|------------------|------------------|
| Pretest | Treatment | Posttest |
|   O |   X |   O |

2.2. Research setting
These research involved 20 fourth grader which included one slow learner student of inclusive school. The research was conducted in two years. The research participants consist of experts in science education and inclusive education, classroom teacher, and shadow teacher.

2.3. Techniques and data collection instruments
The data in this research were collected using lesson plan assessment forms and observation form. The lesson plan assessment forms consist of lesson plan sheets for elementary science education experts. The observation form consists of interest quality of slow learner.

The research instrument was validated by judgement expert. Quantitative data obtained from expert judgments are converted to qualitative data on a scale of 5 to determine product quality. Conversion of qualitative data refers to the conversion formula [19]. More details see Table 2.

The student interest data were collected from observation form before and after learning process. The effectiveness of lesson plan and media to improve students’ interest were determined by N-Gain (<g>) [20]. The acquisition of N-Gain scores is classified into three categories that is high if <g> greater than 0.7, moderate if 0.3 ≤ <g> < 0.7, and ‘low’ when <g> < 0.3. Learning devices are said to be effective if the gain score is equal to or greater than 0.7.
Table 2. Judgement criteria

| Criteria    | Score formula          |
|-------------|------------------------|
| Very good   | $X > \overline{X} + 1.8 Sb_i$ |
| Good        | $\overline{X} + 0.6 Sb_i < X \leq \overline{X} + 1.8 Sb_i$ |
| Acceptable  | $\overline{X} - 0.6 Sb_i < X \leq \overline{X} + 0.6 Sb_i$ |
| Poor        | $\overline{X} - 1.8 Sb_i < X \leq \overline{X} - 0.6 Sb_i$ |
| Very poor   | $X \leq \overline{X} - 1.8 Sb_i$ |

Where:

\[ \text{Ideal Mean (} \overline{X} \text{)} = \frac{1}{2} \text{ (maximum score + minimum score)} \]

\[ \text{Ideal Standard deviation (} Sb_i \text{)} = \frac{1}{6} \text{ (maximum score – minimum score)} \]

\[ X \text{ = empirical score} \]

3. Results and Discussion

Development of lesson plans and media is carried out in two. The first year, the research objective was to develop lesson plan prototypes and media for inclusion classes with slow learners, the book used can be seen in Figure 1. Validation of lesson plans and media is done by consultation with experts. The expert who gives the assessment is a lecturer with the field of science education and special education expertise.

Aspects of the lesson plan that are assessed are, 1) attention getter, 2) explanation of learning objectives, 3) activation of various sense, 4) use of media, 5) sequencing of learning phase, 6) reliance of reading ability, 7) slow learner opportunity to repeat certain activities, and 8) use of various methods and learning interactions. The assessment of the science education experts resulted in a score of 34 out of a maximum score of 36. While the assessment of special needs education specialists produced a score of 33 from a maximum score of 33. The total score of the average score of the two experts was 33.5. The score is then converted into a qualitative scale and is in a very good category. In addition, focus group discussions were conducted with classroom teachers and shadow teachers.

Figure 1. Big book
In the second year, the research activities carried out were test the product. Product test were conducted in classrooms that have slow learner student. The strategy used is discovery learning. This strategy was found to make students participate in learning activities. The finding has strengthened suggests that students with special needs need support to keep participating in inquiry-based learning and show improvement in achievement in science subjects [21]. The model used is discovery learning which consists of stimulation, problem statement, data collection, data processing, verification, and generalization [22].

Stimulation begins with repeated greetings. The teacher then asks about the trees that the students ever seen, and the characteristics of the trees. The question and answer method make SL children gave his attention to the learning process, showed interest in learning and cooperative when answering questions. This method is based on the opinion that information for slow learners should be connected to real experience. Slow learner children should be brought to the real environment, physical, social, or natural environment [23]. The activities are shown in Figure 2 and Figure 3.

![Figure 2. Slow learner students (marked arrows) are enthusiastic in answering questions.](image)

![Figure 3. Slow learner students (marked arrows) are enthusiastic in observing plants](image)

At this stage, the teacher shows the citrus fruit that has been fruitful. SL students enthusiastically observe it (see, touch, and smell). The next stage is problem statement which contains the activity of conveying questions related to the parts of the plant. Questions given by the teacher are answered by students through activities outside the classroom at the stage of 'data collection'. The data collection stage is the stage where the student performs observation and communicates the observation result. Observations were made on fruit plants in pots, and outside the classroom. It was found that the SL students were distracted by the ball which was then played and the gazebo used for lying down. Several times the teacher must remind him to keep returning to his group. After the observation activity is carried out, the next stage is processing data. The data processing stage contains student activities discussing the results of observations and inferences that are conducted. In addition, students also present the results of discussion to his/her friends. In the verification phase, teachers use the big book to clarify and introduce the vocabulary to the students.

Big book is able to attract attention and motivate students, including slow learner [24]. It is found that the big book can draw attention and increase student interest in reading, also, has easily visible sentences and illustrations related to sentences, vocabulary is well visualized [25]. Big book also makes learning more meaningful and fun [26, 27]. As for making a big book, it is necessary to pay attention to the following criteria: it contains short sentences, clear and interesting pictures, and vocabulary is clearly legible [28]. The last stage, namely generalizing, students are guided to conclude the discussion. At this stage, the teacher gives more opportunities to SL students to respond or answer questions. It is found that SL children interested in these activities. After the treatment is given, the
gain is derived from the pretest score and posttest score. This score is derived from the scores of SL students. The posttest score obtained was 15. Therefore, the gain obtained was 0.75 and in the high category. Thus, the learning tools developed are effective to tie the learning interest of SL children.

4. Conclusion
Based on the findings, it can be concluded that the lesson plan for slow learners using discovery learning model with syntax a) Stimulation, b) Problem statement (Identification problem), c) Data collection d) Data processing, e) Verification, and f) Generalization. The media used are real objects and Big Book. The methods used are varied lectures, demonstrations, questions and answers, and group discussions. The results of empirical tests show that implementation of lesson plan with real object as learning source and Big Book as media increase the interest of slow learner students in learning science. However, there is a need for further studies related to the development of evaluation tools for slow learner student.

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