

## Learning devices using the project-based learning (PJBL) model to learn environmental change materials and augment environmental literacy

Ridwan Abd Tholib Zain \*, Ramli Utina and Marini Susanti Hamidun

*Department of Biology, Universitas Negeri Gorontalo, Jalan Jenderal Sudirman No. 6 Gorontalo City, Indonesia.*

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### Abstract

It is research and development using the 4D (define, design, develop, and disseminate) model to learn environmental change materials and augment environmental literacy. We carried out the research on tenth graders Mia SMA Negeri 1 Tabukan Utara, Sangihe. The research aims to:

- Define the validity of learning devices using the project-based learning (PjBL) model,
- Define the practicality of learning devices using the project-based learning (PjBL) model,
- Define the effectiveness of learning devices using the project-based learning (PjBL) model.

We collected data from 15 students in the first trial test and 60 students in the second one. The data were then validated by referring to lesson plans, E-LKPD, tests, and model attractiveness. Additionally, we also collected data on student pretest and posttest, skills, and concerns about the environment. The results demonstrated that learning devices using project-based learning (PjBL) to learn environmental change materials were reliable and effective for elevating students' knowledge, skills, and environmental literacy.

**Keywords:** Literacy; Learning Device; Project-based Learning; Model

### 1. Introduction

Developing education is a hot topic debatable from time to time as education plays a paramount role in setting up human resources for development aligned with the era's development. Educational actors, either the government or educational institutions, accordingly, endeavor to afford quality educational services, breeding quality graduates relevant to the era's development and changes. In the 4.0 revolution era, coinciding with the COVID-19 pandemic, educational institutions, including schools, should employ technological advancement in delivering educational services to students as capital for facing technological changes and development, when either working or pursuing higher education levels (Faturrohman, 2020:2). And yet, attempts to employ technology, information, and communication (TIK) in education are still problematic. Some issues appearing ardently in the integration (TIK) into learning processes are TIK-related capability of teachers, facility and infrastructure availability, and managerial competencies of the educational institutions concerned. A lack of the schools' managerial competencies in exerting TIK during a learning process brings about poorly leveraged TIK-advocating facilities and infrastructures. In addition, the strategy applied is conventional, making students prefer to imitate than bring on new ideas (Maimun and Fitri, 2012:9). The learning strategy is considered old because being unable to be customized with the advanced era development.

The Ministry of Education and Culture of the Republic of Indonesia, through Circular Letter Number 4/2020 concerning Implementation Education-Related Policy during the emergency because of the Coronavirus Disease (COVID-19)

\* Corresponding author: Ridwan Abd Tholib Zain

transmission, commands to hold online learning. In adapting the new learning habit by virtue of the COVID-19 pandemic, online learning materials with media appealing and accessible are of importance. The policy of long-distance learning (PJJ) causes a new problem in the field. At least four challenges are coming into existence during the PJJ implementation: 1) teachers experiencing difficulties in managing PJJ focusing on curriculum completeness, 2) several parents finding hassles in accompanying children learning from home, 3) some students having no adequate facilities sustaining online PJJ, and 4) students' psychological state being destabilized due to tediousness which may lead to mental health disorders (Kemendikbud, 2020:2). The challenges make the government formulate a new policy concerning learning implementation during the COVID-19 pandemic. Limited offline learning implementation demands teachers and students to conduct teaching-learning activities using internet-based learning media and applications. All teachers in all education units should arrange a complete and systematic learning device allowing interactive, inspiring, attractive, and challenging learning, motivating students to participate actively and cultivate creativity and self-independence commensurate with skills, interests, and physical and psychological development.

Learning devices are of paramount importance in that they guide teachers, act as yardsticks, enhance teacher professionalism, and assist teachers in facilitating learning processes. However, teachers find straits in developing them, although, as argued by Ibrahim in Trianto (2011:201), learning devices are of utmost importance in teaching-learning process management. The research addresses learning device development and concentrates on lesson plans (RPP), student worksheets (LKPD), and assessment by tests. RPP serves as teacher guidelines for doing learning activities enabling students to achieve the predefined basic competencies. RPP made should possess good criteria endorsing teaching-learning processes. Besides, it should come with high validity.

The biology teacher we interview conveys several drawbacks in the existing RPP documents: no prerequisite materials, no use of learning models, teacher-centered learning, no learning indicators, no scoring guidelines, and a lack of learning media implementation. As regards learning implementation during the new normal in light of the COVID-19 pandemic, our observation at SMA Negeri 1 Tabukan Utara, Sangihe, exhibits poor online learning on account of online learning material paucity, e.g., e-LKPD. The school leverages printed LKPD, which is less compelling for students, who, accordingly, find trouble in apprehending learning materials, especially thematic ones. LKPD comes in square-formed printed pages. The technology development engenders a digital LKPD which allows users to access it using a PC or smartphone. Nevertheless, SMA Negeri 1 Tabukan Utara, Sangihe, does not use the recommended, low-cost LKPD accessible to the community. As such, the school calls for e-LKPD which caters to the standard, is practical, and is accessible.

In addition to deploying e-LKPD as teaching media and materials, teachers should also entail learning models comporting with students' needs. One of the applicable learning models is project-based learning (PjBL). The PjBL model exerts a real-life context allowing students to learn how to find solutions to a problem and acquire essential knowledge and concepts after learning. Hence, students will be more active, think scientifically, and earn new experiences (Lismaya, 2019:65).

In responding to the issues, teachers can leverage e-LKPD in limited offline learning. The media are made using the anyflip application. The application enables users to make an animated e-book desktop or mobile-friendly and exciting for students. It comes with several features, i.e., easy registration by a single click via Google and some starting templates. We can edit the extant templates or add a .pdf file and relevant components. Students' competencies after learning using e-LKPD should be tested or scored using assessment forms available, e.g., written tests, oral tests, and assignments.

Our observation of teachers' assessment of learning processes features evidence that teachers do not compile test grids, test cards, and guidelines for scoring, especially for daily assessments assessing basic competency completeness. Teachers design tests haphazardly using available books and, in so doing, give off unreliable tests with low validity.

The research's development of learning devices is aimed at escalating students' comprehension of biology, particularly basic competencies 3.11 (analyzing data on environmental changes, causes, and effects on life) and 4.11 (formulating solutions to environmental change problems ensuing around). The learning materials concerned are delivered using two learning devices: lesson plans and e-LKPD using the project-based learning model. PjBL-based learning devices allow students to directly engage in learning processes on the grounds that they are afforded a project they should accomplish either individually or in groups. It comports with Rose and Prasetya (2014:360-369), that PjBL learning confers opportunities for learning, collaborating to solve an issue, and presenting the results. PjBL learning administers simplistic projects to students and, that being so, makes them more active in learning and finding solutions to daily problems attributed to the materials learned. Students can collaborate and develop a notion to create a product in project-based learning. Building on the explanation, we execute research on the development of learning devices using

the project-based learning (PjBL) model to learn about environmental changes and heighten the environmental literacy of tenth graders Mia SMA Negeri 1 Tabukan Utara, Sangihe.

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## 2. Research Method

### 2.1. Research Method and Approach

We used the research and development method. The method had several models. We deployed the 4D development model here. Furthermore, we employed two approaches, which were qualitative and quantitative.

### 2.2. Research Procedure

The products developed were learning devices. Procedures for development were using the research and development steps by Borg and Gall (2003) modified by Sugiyono (2016:321).

- Preliminary Study
- Model Development

#### 2.2.1. Development Model

The research development model, i.e., research and development, focused on bringing about a given product and examining the effectiveness of the product (Sugiyono, 2012:407). The research design used here was the 4D model.

#### 2.2.2. Design Validation

The validation test was done to investigate the validity of the product design. Two experts of education were designated to execute the validation test. The test rendered a product decent for production.

#### 2.2.3. Revision

Experts' and practitioners' assessments, arguments, and comments on the product design were exerted to flesh it out.

#### 2.2.4. Product Test

##### Test Design

We developed learning devices through the following phases.

- Define
- Design
- Develop
- Disseminate

##### Test Subject

The test subjects were 30 tenth graders MIPA1 SMA Negeri 1 Tabukan Utara, Sangihe for the small-scale test and 30 tenth graders MIPA 2 and 30 tenth graders MIPA 3 for the large-scale one.

##### Data Type

- Data gathered were
  - Data on the process of learning device development using project-based learning congruent with the development procedures determined.
  - Data on the reliability of the learning device development using project-based learning (PbJL).
  - Qualitative data (the observation results) on the use of media in learning processes (and the interview results with teachers and students after leveraging learning devices using project-based learning (PjBL).

##### Data Collection Instrument

Research instruments were validation sheets from material and media experts, observation sheets, and interview guidelines. Validation sheets from material experts were used to observe the extent to which the materials were delivered and related to the competencies. Validation sheets from media experts were deployed to research the media

reliability for learning. Observation sheets were employed to study the use of media in learning. Guidelines for interviews were used to probe teachers' and students' responses, commentaries, or advice after using the media in learning.

#### Data Analysis Technique

- Data on Product Development Process
- Data on Product Reliability
  - Analysis of learning implementedness using the project-based learning model
  - Analysis of students' learning outcomes
  - Analysis of teachers' and students' responses to learning devices
  
- Model Development Evaluation

The phase was divided into two. A formative evaluation was exerted during the development process. A summative evaluation was the end-evaluation of all phases producing the end-product of learning devices using the project-based learning model to learn biology, specifically environmental change materials, and improve the environmental literacy of tenth graders SMA Negeri 1 Tabukan Utara, Sangihe.

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### 3. Results and Discussion

#### 3.1. Validity of Learning Devices Using Project-Based Learning (PjBL)

The products, namely learning devices using project-based learning (PjBL), were developed using the 4D development model. We integrated environmental change materials with learning device products using project-based learning for tenth graders. We selected the materials to optimize students' capability of fathoming environment and implementing the knowledge on a daily basis. The use of the 4D development model in product development aimed to result in reliable learning device products using project-based learning. We were also aimed at yielding products effective for espousing learning and increasing students' awareness of the environment, skills, and knowledge.

The development phases of the 4D model were define, design, develop, and disseminate. The analysis phase was performed to elicit the description of the need for learning devices using project-based learning. The define phase bred a conceptual product framework and learning devices consisting of RPP, instruments for assessing students' concerns about the environment, skills, and knowledge. Here, we referred to students' needs figured out in the analysis phase. The develop phase realized the product design. The end products were learning devices using project-based learning (PjBL) having passed the analysis, design, and develop phases. The products were then assessed for reliability. Product validity was assessed by lecturers expert in materials and designs, teachers, and students. Additionally, the assessment was carried out by students in the limited test. Recommendations and critics delivered were employed for product improvement.

Learning devices assisted teachers in delivering learning materials by underlining certain aspects to promote students' activities, one of which was integrated process skills (Kurniawati et al., 2016). E-LKPD designed to scale up integrated process skills was underpinned by the project-based learning model using the constructivist learning theory augmenting integrated process skills and students' active involvement in learning processes (Schultz, 2015). Integrated process skills embraced defining variables, making a data table, collecting and processing data, analyzing research data, formulating hypotheses, defining variables, designing research, experimenting, and drawing conclusions (Zaki, 2013).

Learning devices using project-based learning to learn environmental change materials were aimed at supporting learning and furnishing opportunities to students, allowing them to be more active in learning processes, either individually or in groups. In addition, learning devices using project-based learning focused on constructing students' three knowledge and experiences by enabling students to learn materials actively, grasp the meanings, perform, and build a good mindset, either individually or in groups. Students, that being so, could gain competencies they should achieve after learning (Ergin, 2012).

#### 3.2. Practicality of Learning Devices Using Project-Based Learning (PjBL)

Assessment of learning devices using project-based learning embraced three aspects. Predicated on experts' assessment, our learning devices, using project-based learning (PjBL) were very good. The devices, therefore, were very

reliable to test on students. Students gave very good responses to learning devices using project-based learning. 63% provided such responses, and 33% rendered good ones. Learning devices using project-based learning, therefore, were reliable to test on students on a larger scale. In the test on a large scale, 73% of the students vested very good responses to learning devices using project-based learning. The learning devices, thus, were reliable to disseminate to students to learn biology.

Besides e-LKPD, other components, such as learning devices and instruments, were assessed for reliability by experts as well. Learning devices made up of lesson plans (RPP) and test instruments were considered reliable to use in learning by experts. Research instruments, comprising observation sheets, skill tests, and questionnaire sheets to analyze students' concerns about the environment, were assessed for their content validity by experts.

### **3.3. Effectiveness of Learning Devices Using Project-Based Learning (PjBL) to Elevate Attitudes, Skills, and Knowledge**

The effectiveness of learning devices using project-based learning (PjBL) was assessed based on the result of disseminating learning devices during the field tests. Field tests were carried out in two classes: tenth graders MIPA 2 and MIPA 3. Aspects assessed in e-LKPD implementation were attitudes, skills, and knowledge. The effectiveness of project-based learning (PjBL)-based e-LKPD building on students' attitudes, skills, and knowledge was defined through the results of observation and test (for the skill variable) and self-assessment questionnaire (for the concerns about the environment variable).

Exerting learning devices using project-based learning (PjBL), students featured enthusiasm in learning, especially when observing objects indicating their concerns about the environment at school. In-group learning activities excited students to be concerned about the environment. In-group learning activities excited students to be concerned about the environment. It was since through collaboration, students could boost others to conjure up the attitudes of being concerned about the environment, such as being curious, objective, critical, open-minded, and willing to collaborate. Learning devices using project-based learning (PjBL) were designed to facilitate students to learn in a more structured manner.

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## **4. Conclusion**

Building on the results and discussion, in conclusion, concerning validation, learning devices, i.e., lesson plans, e-LKPD, and test instruments, using the project-based learning (PjBL) model to learn environmental change materials and enhance environmental literacy of tenth graders Mia SMA Negeri 1 Tabukan Utara, Sangihe, developed in the form of digital-based student worksheets using the anyflip application were good and thus reliable to use. The practicality of learning devices using the project-based learning (PjBL) model to learn environmental change materials and escalate environmental literacy of tenth graders Mia SMA Negeri 1 Tabukan Utara, Sangihe, predicated on the test on validation by design and material-expert lecturers, was very reliable. Teachers had stated the reliability of the learning devices using the project-based learning model, and so had students' responses. Learning devices using the project-based learning model developed were thus very reliable to use. Finally, learning devices using the project-based learning (PjBL) model to learn environmental change materials and heighten environmental literacy of tenth graders Mia SMA Negeri 1 Tabukan Utara, Sangihe could improve students' learning outcomes, especially in the knowledge, skill, and attitude aspects.

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## **Compliance with ethical standards**

### *Disclosure of conflict of interest*

No conflict of interest.

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