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South Kalimantan Local Wisdom-Based Biology Learning Model

Siti Ramdiah
STKIP PGRI Banjarmasin, INDONESIA

A. Abidinsyah
STKIP PGRI Banjarmasin, INDONESIA

Muhammad Royani
STKIP PGRI Banjarmasin, INDONESIA

H. Husamah*
Universitas Muhammadiyah Malang, INDONESIA

Ahmad Fauzi
Universitas Muhammadiyah Malang, INDONESIA

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Abstract: The objectives of this study were to analyze the validity, practicality, and effectiveness of South Kalimantan local wisdom-based biology learning and its effect on student learning outcomes. The research method used is research and development. This research was in a Develop stage of Thiagarajan's Model. This development has produced learning models (lesson plans, student's worksheet, learning achievement test questions, teacher activity sheets, student activity sheets, and student response sheets). The local wisdom-based learning model were designed with seven stages using Banjar language (regional language of South Kalimantan). Model that have been developed were tested for the level of validity, practicality, effectiveness, and its effect in learning. The level of validity is determined based on the assessment and review of the four validators. To find out the effectiveness and the effect of the learning model, quasi-experimental design was applied by involving two classes at SMAN 7 Banjarmasin-Indonesia. Data were collected using a variety of instruments, namely the validity assessment sheet, the student's worksheet and lesson plan sheets, student achievement test questions, and student response sheets. Data analysis was implemented to measure the effectiveness and the effect of learning by calculating n-Gain and ANCOVA, respectively. The results, the learning tools met the "valid" criteria so that it can be implemented. Learning also concluded having good practicality criteria. Moreover, it can be seen that the application of local wisdom-based learning model and tools was quite effective in improving student learning outcomes, in contrast to learning in the control class. Furthermore, ANCOVA test concluded that there were significant differences in learning outcomes between students in the experimental and the control class.

Keywords: *Biodiversity material, biology learning tools, South Kalimantan local wisdom.*

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Introduction

There were questions about how do we need to study biology? It was very clear, because biology will connect us with the world, the place where we live and show how it relates to all forms of life in this world. Ballard et al (2017), Darling-Hammond et al (2019), Fleischner et al (2017), Serdyukov (2017), and Turrini et al (2018) all state that biology is also a part of social and economic problems throughout the world. Biology learning is a tool to improve the strengthening of attitudes, skills, knowledge, values and responsibilities as a citizen towards environment, society, nation that is based on faithfulness and devotion to the Almighty God

Biology is concerned with finding out and understanding about nature systematically. Biology concerns not only the mastery of knowledge collection in the form of facts, concepts, principles but also a process of discovery. Learning biology in schools is expected to be a vehicle for students to learn themselves and the surrounding nature (Aida et al., 2016; Karyadi et al., 2018; Usmeldi & Amini, 2019). Various biology learning activities supported by self-regulated learning strategies have been proven to significantly influence self-directed learning readiness and attitudes towards science experiments (Kayacan & Ektem, 2019).

Biology learning will be successful if the teacher is able to develop and use suitable learning tools (Fadilah et al., 2017; Fatmawati, 2016; Mursali, 2015). The teacher as an important component in education has a great responsibility and is very decisive in achieving students' competence (Malm, 2009; Mendo-Lázaro et al., 2018). Every teacher in the

* **Corresponding author:**
H. Husamah, Biology Education Department, Faculty of Teacher Training and Education, Universitas Muhammadiyah Malang, East Java, INDONESIA.
✉ usya_bio@umm.ac.id

education unit is obliged to compile learning tools in a complete and systematic manner so that learning takes place interactively, inspiratively and fun, which then can motivate students to participate actively and independently in accordance with their talents, interests, and physical as well as psychological development (Budiman & Arif, 2018). The selection of appropriate learning tools is significant for a teacher because it can be used as a guide for the learning process to run systematically. The selection of learning tools is also used as a benchmark, enhancing teacher professionalism and tools to facilitate teachers in succeeding the learning process (Chaerunnisa et al., 2017; Ismomon, 2016). In fact, the lack of learning device often becomes an obstacle that causes the learning process to not meet expectations (Aufiana et al., 2015; Gleason et al., 2011).

The utilization of good tools will guide the implementation of quality learning in accordance with expectations and standards that have been set. Appropriate use of the device can certainly improve good results (Darling-Hammond et al., 2019; Serdyukov, 2017). Furthermore, the development of excellent learning device is expected to be able to provide opportunities for students to explore knowledge that will be discussed in class, provide opportunities for a more student-student, student-teacher interactions in group discussions (Le et al., 2018; Taylor & Parsons, 2011). In addition, this learning boosts a positive contribution to students in terms of gaining understanding, increasing interaction and participation, and developing their positive characters (Adawiyah & Hidayah, 2017).

Students are more interested in studying biology if the subject is presented in an integrated and holistic manner (Mustami et al., 2017). The learning tools that are compiled should adjust to the characteristics of students, the nature of biology learning, and the problems encountered in the learning process and in everyday life (Utami et al., 2018). Learning tools are arranged by taking into account the needs of their users, that is, the needs based on geographical, ethnographic, and regional wealth characteristics. Therefore, learning tools should be developed in accordance with local customs or tradition (Hadi, 2017), including the interpretation of aspects of local wisdom, for example from the Province of South Kalimantan-Indonesia.

Biology learning can be developed by relying on the uniqueness and abundance potentials of an area, including local (traditional) culture and technology (Damayanti et al., 2013; Peat, 2012; Whiten et al., 2017). The development of a learning tool that is integrated with local wisdom is expected to develop the potential of each region and increase the creativity and character of students (Mannan et al., 2015). Emphasis on local wisdom as indigenous science in learning biology is considered very necessary. Utilization of local wisdom content in learning, besides being able to save the knowledge of local wisdom can also help students in learning biology with real life learning (Anwari et al., 2016; Hadi, 2017; Parmin et al., 2015). In addition, learning with local wisdom can improve students' relationships with surrounding communities and can link local knowledge with modern knowledge (Leksono, 2016). This is certainly in line with the concept that the expected outcome of learning biology is so that students have both scientific and environmental literacy. This shows that the environmental context cannot be separated in biology learning (Ilhami et al., 2018).

Efforts to develop biology learning tools based on local wisdom are still not widely researched in Indonesian school context (Lestari et al., 2019). General research and development of learning tools have indeed been carried out by previous researchers. In the Indonesian context, researchers have tried to focus on developing science and biology learning tools. Some of them were the development of inquiry-based learning with the subject of digestive system in biology (Handriyan, 2016), the development of learning tools specifying on student worksheets (Jamdin, 2014; Mujahidin, 2017), development of an instrument to measure the higher-order thinking skill in physics (Ramadhan et al., 2019) or also on textbooks and student worksheets (Setiawati et al., 2017). There was also a research on the development of concept-based biology learning tools consisting of lesson plans, worksheets and mind map learning media to foster interest in learning of junior high school students (Jon, 2017), or equipped with evaluation tools (Marneli, 2017). Some researchers have focused on developing biology learning tools with a contextual approach and with the guided inquiry method on angiosperm material (Norra, 2018), fungi material, and the excretion system (Aida et al., 2016; Fadilah et al., 2017). Meanwhile, more specifically there are researchers who develop biology learning tools using problem based learning models (Wardah, 2016) and produce e-modules based on valid and appropriate local wisdom at kindergartens in general topics (Sofyan et al., 2019). Based on this, it can be concluded that their research results have not touched the aspects of biology learning tools based on local wisdom.

It is still considered very rare to find previous studies that focused on high school biology learning tools based on local wisdom, especially those related to the local wisdom of South Kalimantan Province. In fact, local potential and wisdoms exist in South Kalimantan Province if not utilized will be neglected and vanish or even extinct (Rusmana et al., 2019). One of the provinces in Indonesia that has its own uniqueness is South Kalimantan. South Kalimantan is a province located in the south-eastern part of the island of Borneo, which has a lowland area on the west and east coast, and a plateau formed by the Meratus Mountains in the center. Other geographical conditions of South Kalimantan are the existence of many swamps and rivers, while the largest tribe in South Kalimantan is the Banjar tribe. *Urang Banjar* (Banjarese) is the largest ethnic group that inhabits this province (Istiqomah & Setyobudihono, 2014). Local wisdom in South Kalimantan implies a view of people's lives towards life values (Yulianto, 2019). Cultural properties that are characteristic in South Kalimantan can be an inspiration in learning science (Fuad et al., 2018). This proposed study

will certainly make a concrete contribution to the strategy of building environmental awareness through the values of local wisdom that originate concretely from the lives of river communities in South Kalimantan (Suratno et al., 2015).

Research that needs to be elaborated for example was Kahar and Fadhilah (2018), on environmental literacy, and conservation attitudes. However, the focus was on local potential in West Kalimantan, which was differentiated according to the fields of Natural Resource, Human Resource, Arts and Culture, Tourism and Culinary. Also the research of Tomi et al (2018) on the development of a biology learning tool based on local wisdom of Kerinci-Jambi Province; Hadi and Dazrullisa's research (2018) about the development of biological teaching materials based on local wisdom in West Aceh; and Hasanah et al (2018) research on the development of biology learning tools based on the local potential of West Lombok-West Nusa Tenggara. There is also a study of Saputra et al (2016) which is more specific on the development of a Natural Science module based on local wisdom in the Puger-East Java coastal area on the subject of the plant transportation system at Secondary level. While other research was more focused on aspects of the model and/or learning strategy, for example the implementation of a Natural Science learning model based on local wisdom in junior high school students (Pamungkas et al., 2017); and mini-research based on local wisdom on the ability to master the material of conservation biology (Leksono, 2016).

Based on the various descriptions, it can be said that there has been no development research related to the biology learning tools based on local wisdom in South Kalimantan as a support for biodiversity material for class X, SMA/MA (senior high school) level. Researchers have developed the indispensable learning tools.

Research Goal

The goals of this study are to (1) analyze the validity of South Kalimantan local wisdom-based biology learning model and tools; (2) analyze the practicality of the biology learning tools based on South Kalimantan local wisdom; (3) analyze the effectiveness of the biology learning tools based on South Kalimantan local wisdom; and (4) analyze its effect on students' learning outcomes.

Methodology

Type of Research

This development research was the continuation of the previous study by Thiagarajan et al (1974) by implementing the following stages: Define, Design, Develop, and Disseminate. This research is in the Develop stage, to develop learning model based on South Kalimantan's local wisdom. Learning tools that have been developed consisted of lesson plans, student's worksheet, learning achievement test questions, teacher activity sheets, student activity sheets, and student response sheets. At this Develop stage, to find out the effectiveness of the learning model, the quasi-experimental design was applied.

The local wisdom-based learning model was designed with seven stages using Banjar language as the regional language of the people of South Kalimantan. It was utilized as a form of local wisdom to understand and preserve Banjar language. The seven stages in question namely "*Urientasi"* (orientation)*, "Mambaca"* (reading)*, "Tatakonan"* (questioning)*, "Panyalidikan"* (investigating)*, "Rifliksi"* (reflection)*, "Paninjauan"* (re-checking), and "*Pengkaran"* (mind mapping).

At the stage of "*urientasi*", the teacher opened the learning by presenting a problem related to nature both potential and local wisdom in South Kalimantan. The next stage was "*mambaca"* where students read material provided by the teacher. The reading material has been designed by the teacher by utilizing the phenomena of the potential and local wisdom of South Kalimantan. In the stage, *"tatakonan",* students made questions after reading activities. Then, at the *"panyalidikan*" stage, students had the opportunity to carry out investigations in the field and establish relationships with the community to obtain various for problem solving. In the *"rifliksi"* stage, the teacher directed students to be able to connect and link concepts from general to specific based on the results of the investigation. Then in the *"paninjauan"* stage students actively reviewed the reading material or phenomena conveyed. The last stage was the *"pengkaran"* which came from the word "*kar"* which means map. At this stage, after students completed the previous stages, students mapped the concepts that had been found, both in the form of concept and thought maps. On the other hand, the *"panilaian"* stage was an assessment activity by the teacher which was carried out from the "*urientasi"* stage to "*pengkaran"*. In more detail, a diagram explaining all the learning activities in this model is presented in Appendix 1.

Sample and Data Collection

In this study, model and tools that have been developed were tested for the level of validity, practicality, effectiveness, and its effect in learning. The level of validity was determined based on research from the validator. There were four validators involved, namely teaching experts, curriculum instructors, Banjar linguists (local language), and Indonesian linguists. Afterwards the practicality of the learning model was assessed based on student responses after participating in the learning. To find out the effectiveness of the learning model and its effect on student learning outcomes, quasi-experimental design was applied by involving two classes at SMAN 7 Banjarmasin (each class consists of 34 students, so the total number of samples is 64 students). The sample selection is done by purposive sampling technique. Pretest-

posttest control group design was implemented, where the X-MIPA-5 class was positioned as the control group and X-MIPA-3 as the experimental group. The control class follows the learning with lecture and question-answer method learning, while the experimental class implemented local wisdom-based learning. The material chosen in implementing local wisdom-based learning was biodiversity, while the local wisdom raised is the diversity of genes, species, to ecosystems that describe various types of rice, fruits, plants, animals, and ecosystems typical of South Kalimantan.

Collecting and Analyzing of Data

Data were collected using a variety of instruments to measure learning validity, namely the validity assessment sheet of the learning model, the lesson plan and student's worksheet validity sheets, student achievement test questions, and student response sheets. There were nine components used as bases for evaluating the validity of the learning model by the validator, namely (1) philosophical foundation; (2) supporting theories; (3) empirical basis; (4) the description of each syntax; (5) syntax; (6) social systems; (7) reaction principles; (8) support system; and (9) instructional and accompaniment impacts. Then to measure practicality, the questionnaire responses of students while using the learning tools based on local wisdom in South Kalimantan were used. The questionnaire was composed of eleven items derived from three aspects, namely (1) convenience, (2) attractiveness, and (3) assistance. Furthermore, to measure the effectiveness, the instrument was constructed in the form of student learning outcomes test sheet. The test consists of 19 essay items with C2-C5 cognitive level. The validity of the test instrument was tested using Pearson-Product Moment, while the reliability was tested using Cronbach's Alpha. As a result, all items were valid ($n = 126$, $r>0.174$, $p <0.05$) and the test instrument was very reliable (Alpha = 0.886).

Data analysis in measuring the validity of learning developed referred to Arikunto (2010), as shown in Table 1.

Table 1. Criteria for the level of validity of local wisdom-based learning tools

Scoring Scales (%)	Qualifications	Notes
85.94 – 100	Valid	No revision
67.19%- 85.93	Fair	No revision
48.44 – 67.18	Less valid	With revision
25 – 48.43	Invalid	With revision

Meanwhile, the analysis of the data to measure the practicality of learning tools was done by calculating the percentage of students who provided responses in accordance with the criteria referred to Khabibah's (2006) work, as shown in Table 2.

Table. 2 Practicality criteria South Kalimantan local wisdom-based biology learning tools

Range of Percentage (%)	Practicality Criteria
85 – 100	Very positive
70 – 85	Positive
50 - 70%	Less positive
< 50	Not positive

Furthermore, data analysis was implemented to measure the effectiveness of learning by calculating *n-Gain.* The *n-Gain* value for each student was calculated using the formula proposed by Hake (1998), as shown in Table 3.

Table 3. Interpretation categories of n-Gain effectiveness

Percentage (%)	Interpretation categories
>76	Effective
56 – 75	Fair
40 – 55	Less effective
< 40	Ineffective

In addition, a one-way analysis of covariance (ANCOVA) test was also conducted to determine whether the application of local wisdom-based learning had a significant effect on improving student's learning outcomes.

Findings / Results

Define

At the Define stage, some analysis needs to be conducted where the information obtained will be the basis for the formulation of objectives and learning form. Front-end analysis informed that high school biology learning in South Kalimantan was dominated by teacher-centered where the teacher explains the subject matter directly to the students dominantly. The teacher does not associate learning material with the environment around students and learning sources obtained by students was limited from teacher explanations. In other words, the learning form did not develop students' mindset to respond to natural events that occur around them.

Furthermore, the learner analysis informs that the cognitive development of students at the formal operational stage. They have a low level of learning outcomes (only one of 134 students were able to get a score of 60 when asked to solve test with high cognitive levels questions). Textual learning is the cause of low student learning outcomes. Responding to these results, the results of the concept analysis inform the need for a model that is able to link learning with local wisdom of South Kalimantan as a source of learning. Therefore, the instructional objective formulated in this study is to facilitate students to empower the ability to answer high cognitive level questions through knowledge and in-depth understanding of the potential and local wisdom of South Kalimantan.

Design

The results of the analysis at the Define stage are the basis of the analysis at the Design stage. Based on instructional objectives that have been formulated, then constructivism learning involving local wisdom in South Kalimantan needs to be developed. To evaluate the effectiveness of learning, high cognitive level learning outcomes tests also need to be developed. In more detail, the results of the analysis in the Design stage are presented in Table 4.

Table 4. Results summary of each analysis in Design stage

No	Analysis	Results
1	Constructing criterion-referenced test	19 high cognitive level essays items on the biodiversity concept
2	Media selection	Local wisdom learning model that is equipped with Lesson Plans, Student Worksheets, Learning Outcomes Test Sheets, Teacher Activity Observation Sheets, Student Activity Observation Sheets, Student Response Sheets
3	Format selection	Constructivism, student-centered learning, local wisdom-based learning
4	Initial design	The local wisdom-based learning model is designed with 7 stages using Banjar language as the regional language of the people of South Kalimantan. The seven stages in question are namely "*Urientasi", "Mambaca", "Tatakonan"*, "*Panyalidikan"*, "*Rifliksi", "Paninjauan"*, and "*Pengkaran".*

Develop

After the product design was formulated, the product was developed. Products in the form of learning models and their tools were then validated by the validator. A summary of the results of the model and learning tools' validation is presented in Table 5.

Table 5. Results summary of model and learning tools' validation

No	Validation Components	General Evaluation (%)	Qualification
1	Learning Model	98,21	Valid
2	Lesson Plan	93.00	Valid
3	Student Worksheet	88.22	Valid
4	Learning Outcomes Test Sheet	86.40	Valid
5	Teacher Activity Observation Sheet	93.50	Valid
6	Student Activity Observation Sheet	93.00	Valid
7	Student Response Sheet	88.62	Valid

Based on Table 5, Learning Outcomes Test Sheet has the lowest percentage (86.40%), while the learning model has the highest percentage (98.21%). However, all learning components that have been developed met the "valid" criteria so that they do not need to be revised and can be exemplified in the classroom. Upon measuring the level of validity of the models and learning tools, the practicality of learning tool was also measured. The highest percentage is in the aspect of attractiveness (95.07%), while the lowest is in the aspect of easiness (87.27%). Nevertheless, these three aspects still belong to the "very positive" response category. Therefore, learning that has been developed was able to make it easier for students to study biology, draw their attention to learning, and help them understand the concepts being studied. A summary of practicality test results obtained from students' responses after participating in local wisdom-based learning is presented in Table 6.

Table 6. Summary of practicality test results based on student responses

No	Aspects	Percentages (%)	Notes
1	Easiness	87.27	Very positive
2	Attractiveness	95.07	Very positive
3	Helpfulness	88.02	Very positive

Furthermore, the effectiveness of learning the effect of its learning was measured through the application of quasi-experiment involving two classes. The summary of the N-Gain results of the two classes is presented in Table 7, while the summary of the ANCOVA test results is presented in Table 8. Based on Table 7, it can be seen that the application of local wisdom-based learning was fairly effective in improving student learning outcomes, in contrast to learning in the control class (not effective). This finding was reinforced by the results of the ANCOVA test (Table 8) which concluded that there were significant differences in learning outcomes between students in the experimental class and students in the control class [F (303.06) = $p < 0.05$]. Because the average learning outcomes of the experimental class are better than the control class, students in the experimental class can be stated to have significantly higher learning outcomes than students in the control class.

Table 7. Summary of N-Gain calculation results between control and experiment classes

Classes	Mean ± SD	Results
Experiment	70.18 ± 9.845	Fairly effective
Control	36.36 ± 11.296	Not effective

Table 8. Summary of ANCOVA results on the effect of learning model on learning outcomes

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	21933.372[a]	2	10966.686	151.72	0.000
Intercept	92278.202	1	92278.202	1276.64	0.000
Pretest	4065.096	1	4065.096	56.24	0.000
Groups	21906.127	1	21906.127	303.06	0.000
Error	9468.983	131	72.282		
Total	565917.590	134			
Corrected Total	**31402.355**	**133**			
a. R Squared = .698 (Adjusted R Squared = .694)					

Disseminate

After learning developed was declared valid, practical, effective, and has significant effects, this development product needs to be disseminated. Dissemination is carried out since the product has been successfully developed and tested until it is known in the South Kalimantan region. The target, within 2 years the teachers in various high schools in the region are familiar with this learning. Various steps were taken to disseminate the product. In more detail, a summary of activities at the Disseminate stage is presented in Table 9.

Table 9. Results summary of each analysis in Disseminate stage

No	Analysis	Results
1	User analysis	High school teacher
2	Determination of deployment strategies and themes	Presentation, research, community service
3	Time	Two years after the learning form was declared valid, practical, effective, and have significant effect
4	Dissemination media	Subject Teachers' Forum, internal seminars, several book and booklet products, student thesis studies, community service themes involving biology teachers in Banjarmasin

Discussion

In this study, learning models and learning tools based on local wisdom have been developed. The validation results revealed that all components related to learning have been declared valid by the validators (Table 5). Validation is not only limited to the learning model developed, but validation was also carried out on lesson plans to assessment instruments. Validating the lesson plan is important because the quality of the lesson plan will determine the quality of the learning model implemented by the teacher or other researchers outside this study. Because, lesson plans are an important component in learning (Derri et al., 2014).

Lesson plans contain learning objectives and learning plan that arranged systematically. The learning plan is then carried out while the learning process and students expected will achieve the competencies that have been declared in the learning objectives. Achievement of these competencies will be reflected in learning evaluation activities (Jideani & Jideani, 2012; Khalil & Elkhider, 2016). Applying appropriate learning activities (Al-Mubaid et al., 2016; Ramirez & Ganaden, 2008) to designing appropriate learning evaluation processes (McNeill et al., 2012) will optimize efforts to empower student competencies. Therefore, students' worksheets that direct student activities during learning and assessment instruments as learning evaluation tools are also validated in this research.

Furthermore, based on Table 6, this study revealed that the local wisdom-based learning that has been applied is learning that is easy, interesting, and helps students in learning. This kind of response is important because biology is a learning that is often considered difficult (Cimer, 2012). Biology learning material is also considered boring (Hadiprayitno et al., 2019). But, after participating in local wisdom-based learning, students have a very positive response. Positive student responses are an important condition in optimizing the learning process. Such positive responses will be able to boost student motivation. Good learning motivation is a major factor in student success (Asfani et al., 2016).

Besides being valid and practical, the results of the analysis also revealed that learning is effective (Table 7). The result was in line with several previous studies. Several previous studies reported that by raising local wisdom, teachers were able to improve the mastery of elementary school student knowledge (Uge et al., 2019), junior high school student learning outcomes (Tanjung et al., 2018), and understanding of science concepts of high school students (Hairida, 2017). The optimal student learning outcomes can be caused by learning theories that underlie this learning model.

Constructivism theory acts as a philosophical foundation in the local wisdom learning model of South Kalimantan. In accordance with this theory, students are seen as individuals who build most knowledge based on the initial understanding they have mastered (Bada, 2015; Singh & Yaduvanshi, 2015). During the learning, students were directed to carry out constructive learning activities such as observing phenomena, collecting data, formulating hypotheses through critical questions, and collaborating with others (Bachtold, 2013; Dogra, 2010). In its implementation, local wisdom around students was utilized in the process of learning biology. Learning activities were designed to be student-centered. It was to reflect cooperative processes, and empowered students to think at a higher level (higher-order thinking skills/HOTS) to maintain student retention of biological concepts and their relationship with local wisdom.

The application of constructivism learning was reflected in the first stage in learning. At the stage of *"urientasi*", students made the formulation of the problem from the raised issue. In connection with these learning activities, students can obtain optimal results if science learning departs from problems in the surrounding environment (Mustaffa & Ismail, 2015; Yaqinuddin, 2013). This stage of "*urientasi*" is also supported by a statement which views that science is always dynamic and always evolving (Rörsch, 2014), so that learning requires direct and factual experience in its learning process.

Upon the completion of "*urientasi*" stage, learning process proceeds to the stage of "*mambaca*" followed by "*tatakonan*". Through these two activities, active student participation is expected to be formed during the learning process. "*Mambaca"* aims at activating students' working memory and increasing their insight. "*mambaca"* or reading activity will also develop cognitive processes through students' thinking abilities (Pena & Canon, 2008). On the other hand,

"*tatakonan"* activity aims to broaden students' curiosity and develop higher-order thinking skills through asking themselves about biological concepts related to the potential and local wisdom of South Kalimantan. The activity of compiling questions is said to be able to increase mastery of the material in students' learning sphere (Zubaidah et al., 2019).

The learning phase continued to "*panyalidikan", "rifliksi"* then *"paninjauan".* These three stages help students to construct their cognitive skills. The implication is that students will have deep comprehension of the potential and local wisdom of South Kalimantan. Local potential with a variety of local wisdom of the community is an environment that is very close to students. Through the support of concepts conveyed by the teacher, then students constructed new knowledge. At this stage, the constructive process ran, where students connected concepts they already knew with new information to form a new established knowledge (Bachtold, 2013; Bada, 2015). This process led students to have meaningful construction of concepts (Darling-Hammond et al., 2019).

In the final stage, "*pengkaran",* students were given the opportunity to freely develop what they have learned through mapping activities. In connection with these activities, students were likely to be able to actualize themselves to the maximum level if in the learning process was free from pressure and coercion. Mapping in this stage can be in the form of concept mapping and mind mapping, where students freely expressed their thoughts in systematic or abstract way, but still described their understanding of concepts that have been found in problem solving. With this condition, students' self-potential in the cognitive, affective, and psychomotor domains can be developed. In addition, various learning activities that include concept mapping activities are also reported to have a positive impact on improving student competence (Andariana et al., 2019; Zubaidah et al., 2019; Zvacek et al., 2013).

Beside effective, based on Table 8, this research found that the learning also has a significant effect on student learning outcomes. This result is in line with some previous study that also studying the effect of local wisdom-based learning on students' competencies. Those previous research was implementing local wisdom-based learning in some location, such as in South Sulawesi (Uge et al., 2019), Yogyakarta (Putri & Aznam, 2019), and West Sumatra (Oktavia et al., 2018). This significant effect due to the local wisdom-based learning could facilitate students learn biology contextually. Through contextual learning, learning becomes more meaningful (Hudson & Whisler, 2007). Therefore, not surprisingly, students become easier to understand, remember, and apply what they have learned.

The positive influence of local wisdom-based learning on outcomes is also caused by its benefits in increasing student scientific literacy. As stated in the research method, the implementation of learning models was carried out in science classes with biodiversity material. Earlier reports have informed that learning based on local wisdom can increase scientific literacy, both students in secondary school level (Setiawan et al., 2017) and university level (Saefullah et al., 2017). Increased scientific literacy is also reported to improve student academic achievement (Gucluer & Kesercioglu, 2012).

In addition to the various positive impacts that have been expressed, the learning model that has been developed and researched in this study also still has potential that needs to be explored as learning that is able to voice local wisdom is reported to be able to improve critical thinking skills (Oktavia et al., 2018; Putri & Aznam, 2019; Wahyuni, 2015), problem solving (Kristanto et al., 2019; Putri & Aznam, 2019), and scientific communication skills (Dewi et al., 2017). This learning is also able to generate a positive impact on the entrepreneurial spirit of students (Hairida, 2017). In addition, positive character can also be built through this learning (Khusniati et al., 2017; Rasna & Tantra, 2017; Subali et al., 2015). In fact, learning based on local wisdom is considered as one form of potential learning that is able to facilitate students in mastering the 21st-Century skills (Jumriani & Prasetyo, 2017). Therefore, research that examines the influence of South Kalimantan's local wisdom-based learning model on a variety of thinking skills and other 21st-Century competencies needs to be conducted subsequently.

Conclusion

In this study, the South Kalimantan local wisdom-based learning tools were tested for their validity, practicality, effectiveness, and its effect on student learning outcomes. Based on the assessment of learning experts, curriculum instructors, as well as Banjar and Indonesian Language experts, learning models were declared valid. Based on student responses, the learning model also has practical criteria in the "very positive" category. Quasi-experimental results also state that the learning model was effective where the application of this learning has a significant impact on student learning outcomes Therefore, the application of this learning model is highly recommended to be applied in biology learning in South Kalimantan, given its application, the positive character of students and their love for local wisdom can improve.

Suggestions

Further research aimed at exploring the benefits of learning is also recommended to be carried out, in particular its impact on 21st-Century students' competencies.

Limitations

The limitation of this research is the dissemination was not conducted. In addition, in testing the learning model, the parameters used to determine the effectiveness of the learning were only cognitive learning outcomes. However, the inclusion of two classes during testing the model of the learning model is the strength to this study.

References

Adawiyah, R., & Hidayah, Y. (2017). Pengembangan perangkat pembelajaran ipa biologi kelas VII SMP negeri 27 Sungai Andai Banjarmasin berbasis inquiry terbimbing [Development of biology learning equipment for grade VII of SMP Negeri 27 Sungai Andai Banjarmasin based on guided inquiry]. *Scientific Journal of Education/ LENTERA Jurnal Ilmiah Kependidikan*, *12*(1), 72–84. https://doi.org/10.33654/jpl.v12i1.407

Aida, N., Hala, Y., & Danial, M. (2016). Pengembangan perangkat pembelajaran biologi berbasis inkuiri pada materi sistem ekskresi untuk kelas XI SMA Negeri 10 Bulukumba [Development of inquiry-based biology learning tools on excretory system material for class XI of SMA Negeri 10 Bulukumba]. *Bionature Journal/Jurnal Bionature*, *17*(2), 114–123. https://doi.org/10.35580/bionature.v17i2.2841

Al-Mubaid, H., Abukmail, A., & Bettayeb, S. (2016). Empowering deep thinking to support criticaly thinking in teaching and learning. In Morgan, A. & Quesenberry, J. (Eds), *Proceedings of the 2016 ACM SIGMIS Conference on Computers and People Research – SIGMIS - CPR '16* (pp. 69–75). The ACM Digital Library. https://doi.org/10.1145/2890602.2890606

Andariana, A., Zubaidah, S., Mahanal, S., & Suarsini, E. (2019). Incorporating Remap-STAD into learning cycle 5E to improve preservice biology teachers' critical thinking skills. In Kutaka-Kennedy, J., Kyoko, U., & Kanoksilapatham, B. (Eds), *Proceedings of the 2019 3rd International Conference on Education and Multimedia Technology-ICEMT 2019* (pp. 114–119). The ACM Digital Library. https://doi.org/10.1145/3345120.3345140

Anwari, A., Nahdi, M. S., & Sulistyowati, E. (2016). Biological science learning model based on Turgo's local wisdom on managing biodiversity. In Hidayat, T., Nandiyanto, A. B. N., Jupri, A., Suwarma, I. R., Riza, L. S., Kusumawati, D., Suhendi, E., Munawaroh, H. S. H., Aisyah, S., & Iriani, M. (Eds), *Proceedings of International Seminar on Mathematics, Science, and Computer Science Education (MSCEIS 2015)* (pp. 030001/1-030001/6). AIP Publishing LLC. https://doi.org/10.1063/1.4941146

Arikunto, S. (2010). *Manajemen penelitian* [Research management]. Rineka Cipta.

Asfani, K., Suswanto, H., & Wibawa, A. P. (2016). Influential factors of students' competence. *World Transactions on Engineering and Technology Education*, *14*(3), 416–420.

Aufiana, N. R., Festiyed, F., & Yurnetti, Y. (2015). Pembuatan perangkat pembelajaran sains terpadu pada mata pelajaran IPA SMP kelas VII [Making integrated science learning tools in science subjects of grade VII of junior high school]. *Pillar of Physics Education*, *6*(3), 137–144. https://doi.org/10.24036/1814171074

Bachtold, M. (2013). What do students "construct" according to constructivism in science education? *Research in Science Education*, *43*(6), 2477–2496. https://doi.org/10.1007/s11165-013-9369-7

Bada, S. O. (2015). Constructivism learning theory: A paradigm for teaching and learning. *IOSR Journal of Research & Method in Education Ver. I*, *5*(6), 66–70. https://doi.org/10.9790/7388-05616670

Ballard, H. L., Dixon, C. G. H., & Harris, E. M. (2017). Youth-focused citizen science: Examining the role of environmental science learning and agency for conservation. *Biological Conservation*, *208*(1), 65–75. https://doi.org/10.1016/j.biocon.2016.05.024

Budiman, B., & Arif, I. (2018). Pengembangan perangkat pembelajaran biologi model inkuiri terbimbing berkarakter budaya lokal "nggahi rawi pahu" untuk melatihkan kemampuan berpikir kritis siswa SMA [Development of guided inquiry learning biology tools with local cultural character "nggahi rawi pahu" to practice the critical thinking skills of high school students]. *Journal of Biologi Education/BIOEDUKASI Jurnal Pendidikan Biologi*, *9*(2), 109–123. https://doi.org/10.24127/bioedukasi.v9i2.1606

Chaerunnisa, V., Syauqiyah, S. G., & Ekanara, B. (2017). Pengembangan perangkat pembelajaran biologi berorientasi pengembangan kecerdasan majemuk siswa pada konsep sel kelas XI SMA [Development of biology learning tools oriented towards the development of students' compound intelligence on the cell concept of class XI high school]. *Journal of Biology and Learning/Biodidaktika: Jurnal Biologi dan Pembelajarannya*, *12*(1), 30–37. https://doi.org/10.30870/biodidaktika.v12i1.2344

Cimer, A. (2012). What makes biology learning difficult and effective: Students' views. *Educational Research and Reviews*, *7*(3), 61–71. https://doi.org/10.5897/ERR11.205

Damayanti, C., Dewi, N. R., & Akhlis, I. (2013). Pengembangan CD pembelajaran berbasis kearifan lokal tema getaran

dan gelombang untuk siswa SMP kelas VIII [Development of local wisdom-based learning CDs on vibration and wave themes for VIII grade junior high school students]. *USEJ-Unnes Science Education Journal*, *2*(2), 274–281. https://doi.org/10.15294/usej.v2i2.2036

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2019). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, (In Press). https://doi.org/10.1080/10888691.2018.1537791

Derri, V., Papamitrou, E., Vernadakis, N., Koufou, N., & Zetou, E. (2014). Early professional development of physical education teachers: Effects on lesson planning. *Procedia - Social and Behavioral Sciences* (Vol. 152, pp. 778–783). Elsevier. https://doi.org/10.1016/j.sbspro.2014.09.320

Dewi, I. N., Poedjiastoeti, S., & Prahani, B. K. (2017). ElSII learning model based local wisdom to improve students' problem solving skills and scientific communication. *International Journal of Education and Research*, *5*(1), 107–118.

Dogra, B. (2010). Constructivist classroom activities for biology learning. *Education India Journal*, *36*(1), 1–15. https://doi.org/10.1016/j.porgcoat.2009.04.010

Fadilah, S. I., Kardi, S., & Supardi, Z. A. I. (2017). Pengembangan perangkat pembelajaran Biologi berbasis inkuiri materi sistem ekskresi manusia untuk melatih keterampilan berpikir kritis dan kerjasama siswa SMA [Development of a Biology learning tool based on inquiry material in the human excretion system to train critical thinking skills and cooperation of high school students]. *Journal of Science Education Research/Jurnal Penelitian Pendidikan Sains*, *5*(1), 779–787.

Fatmawati, L. (2016). Peningkatan keaktifan dan pemahaman konsep IPS melalui model learning cycle 5E [Increasing the activeness and understanding of IPS concepts through the 5E learning cycle model]. *Journal of Primary Education/Jurnal Prima Edukasia*, *4*(2), 148–162. https://doi.org/10.21831/jpe.v4i2.9488

Fleischner, T. L., Espinoza, R. E., Gerrish, G. A., Greene, H. W., Kimmerer, R. W., Lacey, E. A., Pace, S., Parrish, J. K., Swain, H. M., Trombulak, S. C., Weisberg, S., Winkler, D. W., & Zander, L. (2017). Teaching biology in the field: Importance, challenges, and solutions. *BioScience*, *67*(6), 558–567. https://doi.org/10.1093/biosci/bix036

Fuad, Z., Misbah, M., Hartini, S., & Zainuddin, Z. (2018). Identifikasi kearifan lokal Kalimantan Selatan sebagai sumber belajar Fisika kelas X [Identification of the local wisdom of South Kalimantan as a source of physics learning class X]. *Proceeding of National Seminar-Banjarmasin* (pp. 158–169). Lambung Mangkurat University.

Gleason, B. L., Peeters, M. J., Resman-Targoff, B. H., Karr, S., McBane, S., Kelley, K., Thomas, T.,& Denetclaw, T. H. (2011). An active-learning strategies primer for achieving ability-based educational outcomes. *American Journal of Pharmaceutical Education*, *75*(9), 186 (1-12). https://doi.org/10.5688/ajpe759186

Gucluer, E., & Kesercioglu, T. (2012). The effect of using activities improving scientific literacy on students' achievement in science and technology lesson. *Online Submission*, *1*(1), 8–13.

Hadi, K. (2017). Pengembangan model problem based learning berbasis kearifan lokal pada materi keanekaragaman hayati kelas X di Kabupaten Aceh Selatan [Development of problem based learning models based on local wisdom on class X biodiversity material in South Aceh District]. *BIOnatural*, *4*(2), 42–52.

Hadi, K., & Dazrullisa, D. (2018). Pengembangan bahan ajar biologi berbasis kearifan lokal [Development of biology teaching materials based on local wisdom.]. *Proceeding of Nasional Seminar-Biotik* (pp. 822–828). State islamic University of Ar-Raniry Darussalam.

Hadiprayitno, G., Muhlis, & Kusmiyati. (2019). Problems in learning biology for senior high schools in Lombok Island. In In Aloysius, S., Subiantoro, A. W., Ariyanti, N. A., Mercuriani, I. S., & Anafisa, R. (Eds.), *Journal of Physics: Conference Series* (p. 012054). IOP Publishing. https://doi.org/10.1088/1742-6596/1241/1/012054

Hairida, H. (2017). Using Learning Science, Environment, Technology and Society (SETS) local wisdom and based colloids teaching material. *JETL (Journal Of Education, Teaching and Learning)*, *2*(1), 84–89. https://doi.org/10.26737/jetl.v2i1.146

Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, *66*(1), 64–74. https://doi.org/10.1119/1.18809

Handriyan, A. (2016). Pengembangan perangkat pembelajaran berbasis inkuiri pokok bahasan sistem pencernaan untuk meningkatkan pemahaman konsep [Development of inquiry-based learning tools on the subject of the digestive system to improve understanding of concepts]. *Journal of Science Pens/Jurnal Pena Sains*, *3*(2), 85–94. https://doi.org/10.21107/jps.v3i2.1996

Hasanah, U., Mahrus, M., & Hadiprayitno, G. (2018). Pengaruh implementasi perangkat pembelajaran biologi berbasis

potensi lokal terhadap kemampuan kognitif peserta didik [The effect of the implementation of biology learning tools based on local potential on students' cognitive abilities]. *Education/Educatio*, *13*(2), 84–89. https://doi.org/10.29408/edc.v13i2.1034

Hudson, C. C., & Whisler, V. R. (2007). Contextual teaching and learning for practitioners. *IMSCI 2007 - International Multi-Conference on Society, Cybernetics and Informatics, Proceedings* (pp. 228–232). International Institute of Informatics and Systemics.

Ilhami, A., Riandi, R., & Sriyati, S. (2018). Analisis kelayakan kearifan lokal ikan larangan sebagai sumber belajar IPA [The effect of the implementation of biology learning tools based on local potential on students' cognitive abilities]. *Jornal of Biology Education: Bioedukatika/Jurnal Bioedukatika*, *6*(1), 40–47. https://doi.org/10.26555/bioedukatika.v6i1.9564

Ismomon, H. (2016). Penggunaan perangkat pembelajaran biologi pada sekolah menengah atas negeri Kabupaten Simeulue [The use of biology learning tools in state high schools in Simeulue Regency]. *Student Journal of Biology Education/Jurnal Ilmiah Mahasiswa Pendidikan Biologi*, *1*(1), 55–70.

Istiqomah, E., & Setyobudihono, S. (2014). Nilai budaya masyarakat Banjar Kalimantan Selatan: Studi indigenous [The cultural values of the Banjar people of South Kalimantan: Indigenous studies]. *Psychology Journal: Theory and Application/Jurnal Psikologi Teori Dan Terapan*, *5*(1), 1–6. https://doi.org/10.26740/jptt.v5n1.p1-6

Jamdin, Z. (2014). Pengembangan LKS berbasis kooperatif tipe stad pada materi sistem ekskresi untuk siswa kelas XI SMA [Development of cooperative type based worksheet on excretion system material for high school students in grade XI]. *Jurnal Biology Science & Education*, *3*(2), 136–142. https://doi.org/10.33477/bs.v3i2.517

Jideani, V. A., & Jideani, I. A. (2012). Alignment of assessment objectives with instructional objectives using revised Bloom's Taxonomy-The case for food science and technology education. *Journal of Food Science Education*, *11*(3), 34–42. https://doi.org/10.1111/j.1541-4329.2012.00141.x

Jon, E. (2017). Pengembangan perangkat pembelajaran biologi yang berbasis konsep media mind map dalam menumbuhkan minat belajar siswa sekolah menengah pertama (SMP/sederajat) di Kabupaten Kerinci [Development of biology learning tools based on mind map media concepts in fostering learning interest in junior high school (SMP / equivalent) in Kerinci Regency]. *Scientific Magazine/Majalah Ilmiah*, *24*(1), 155–161.

Jumriani, J., & K. Prasetyo, Z. (2017). Important roles of local potency based science learning to support the 21st century learning. *European Journal of Engineering and Formal Sciences*, *1*(1), 6–16. https://doi.org/10.26417/ejef.v1i1.p6-16

Kahar, A. P., & Fadhilah, R. (2018). Pengembangan perangkat pembelajaran biologi SMA berbasis potensi lokal, literasi lingkungan dan sikap konservasi [Development of high school biology learning tools based on local potential, environmental literacy and conservation attitudes]. *Pedagogi Hayati*, *2*(2), 16–24. https://doi.org/10.31629/PEDAG. HAYATI.V2I2.832

Karyadi, B., Susanta, A., Winari, E. W., Ekaputri, R. Z., & Enersi, D. (2018). The development of learning model for natural science based on environmental in conservation area of Bengkulu University. *Journal of Physics: Conference Series*, *1013*(1): 1-8. https://doi.org/10.1088/1742-6596/1013/1/012074

Kayacan, K., & Ektem, I. S. (2019). The effects of biology laboratory practices supported with self-regulated learning strategies on students' self-directed learning readiness and their attitudes towards science experiments. *European Journal of Educational Research*, *8*(1), 313–323. https://doi.org/10.12973/eu-jer.8.1.313

Khabibah, S. (2006). Pengembangan model pembelajaran matematika dengan soal terbuka untuk meningkatkan kreativitas siswa sekolah dasar [Development of mathematical learning models with open questions to improve the creativity of elementary school students]. *Journal of Mathematics Education/Jurnal Pendidikan Matematika (MATHEDU)*, *2*(1), 103–110.

Khalil, M. K., & Elkhider, I. A. (2016). Applying learning theories and instructional design models for effective instruction. *Advances in Physiology Education*, *40*(2), 147–156. https://doi.org/10.1152/advan.00138.2015

Khusniati, M., Parmin, & Sudarmin. (2017). Local wisdom-based science learning model through reconstruction of indigenous science to improve student's conservationist character. *Journal of Turkish Science Education*, *14*(3), 16–23. https://doi.org/10.12973/tused.10202a

Kristanto, A., Suharno, & Gunarhadi. (2019). Promoting local wisdom in international primary curriculum aims to develop learners' problem solving skills. *International Journal of Educational Research Review*, *4*(3), 439–447. https://doi.org/10.24331/ijere.573947

Le, H., Janssen, J., & Wubbels, T. (2018). Collaborative learning practices: teacher and student perceived obstacles to effective student collaboration. *Cambridge Journal of Education*, *48*(1), 103–122.

https://doi.org/10.1080/0305764X.2016.1259389

Leksono, S. (2016). Pengaruh pembelajaran mini riset berbasis kearifan lokal terhadap kemampuan penguasaan materi biologi konservasi [The effect of learning mini research based on local wisdom on the ability to master conservation biology material]. *Proceeding Biology Education Conference*, *13*(1), 575–578. Retrieved from http://www.jurnal.fkip.uns.ac.id/index.php/prosbio/article/view/9580

Lestari, A. W., Lianah, L., & Hidayat, S. (2019). Pengembangan modul pembelajaran biologi berbasis kearifan lokal di kawasan wisata Goa Kreo pada materi ekosistem kelas X SMA [Development of biology learning modules based on local wisdom in the Goa Kreo tourist area on high school class X ecosystem material]. *Jurnal Phenomenon*, *9*(1), 1–9. https://doi.org/10.21580/phen.2019.9.1.3113

Malm, B. (2009). Towards a new professionalism: Enhancing personal and professional development in teacher education. *Journal of Education for Teaching*, *35*(1), 77–91. https://doi.org/10.1080/02607470802587160

Mannan, M. N., Sopyan, A., & Sunarno, S. (2015). Pengembangan perangkat pembelajaran berbasis kearifan lokal untuk mengembangkan karakter positif siswa SD [Development of learning tools based on local wisdom to develop positive character of elementary school students]. *Journal of Innovation and Physics Learning/Jurnal Inovasi Dan Pembelajaran Fisika*, *2*(2), 141–146.

Marneli, D. (2017). Pengembangan perangkat pembelajaran biologi sekolah menengah pertama berorientasi inkuiri pada materi organisasi kehidupan [Development of junior high school biology learning tools oriented towards inquiry into the organization of life*]. Education Innovation/Inovasi Pendidikan*, *1*(17), 1689–1699.

McNeill, M., Gosper, M., & Xu, J. (2012). Assessment choices to target higher order learning outcomes: The power of academic empowerment. *Research in Learning Technology*, *20*(3), 283–296. https://doi.org/10.3402/rlt.v20i0.17595

Mendo-Lázaro, S., Leon-del-Barco, B., Felipe-Castano, E., Polo-del-Río, M. I., & Iglesias-Gallego, D. (2018). Cooperative team learning and the development of social skills in higher education: The variables involved. *Frontiers in Psychology*, *9*(1536): 1-11. https://doi.org/10.3389/fpsyg.2018.01536

Mujahidin, A. (2017). Contextual inquiry (CO-IN) worksheet pada materi struktur dan fungsi jaringan tumbuhan [Contextual inquiry (CO-IN) worksheet on the structure and function of plant tissue]. Proceeding of National Seminar- *Hayati V 2017*(pp. 264–271). Universitas Nusantara PGRI Kediri, East Java Indonesia.

Mursali, S. (2015). Implementasi perangkat pembelajaran biologi SMA berbasis metakognitif untuk meningkatkan kemampuan kognitif dan mengembangkan karakter mandiri siswa [Implementation of metacognitive-based high school biology learning tools to improve cognitive abilities and develop students' independent character]. *Indonesian Journal of Biology Education/JPBI (Jurnal Pendidikan Biologi Indonesia)*, *1*(3), 307–314. https://doi.org/10.22219/jpbi.v1i3.2663

Mustaffa, N., & Ismail, Z. (2015). Problem-Based Learning (PBL) in schools: A meta-analysis. In Rogerson, A. (Ed), *12th International Conference of The Mathematics Education into the 21st Century Project The Future of Mathematics Education in a Connected World*, (pp. 1-6). UNESCO.

Mustami, M. K., Suyuti, M., & Maryam, M. (2017). Validitas, kepraktisan dan efektivitas perangkat pembelajaran biologi intgrasi spiritual Islam [The validity, practicality and effectiveness of the biological learning tools of Islamic spiritual integration]. *Journal of Al-Qalam/Jurnal "Al-Qalam,"* *23*(1), 70–77. https://doi.org/10.31969/alq.v23i1.392

Norra, B. I. (2018). Pengembangan perangkat pembelajaran kontekstual dengan pendekatan guided inquiry materi tumbuhan berbiji pada siswa SMK Farmasi Nusaputera [Development of contextual learning tools with a guided inquiry approach to seeded plant material in Nusaputera Vocational School students]. *Al-Hayat: Journal of Biology and Applied Biology*, *1*(1), 27–33. https://doi.org/10.21580/ah.v1i1.2684

Oktavia, R. A., Usmeldi, & Yohandri. (2018). Development of physics learning material based on problem based learning by integrating local wisdom West Sumatra to improve critical thinking ability of students. *International Journal of Progressive Sciences and Technologies (IJPSAT)*, *553*(2), 544–553.

Pamungkas, A., Subali, B., & Linuwih, S. (2017). Implementasi model pembelajaran IPA berbasis kearifan lokal untuk meningkatkan kreativitas dan hasil belajar siswa [Implementation of science learning models based on local wisdom to increase creativity and student learning outcomes]. *Jurnal Inovasi Pendidikan IPA*, *3*(2), 118–127. https://doi.org/10.21831/jipi.v3i2.14562

Parmin, Sajidan, Ashadi, & Sutikno. (2015). Skill of prospective teacher in integrating the concept of science with local wisdom model. *Jurnal Pendidikan IPA Indonesia*, *4*(2), 120–126. https://doi.org/10.15294/jpii.v4i2.4179

Peat, F. D. (2012). Traditional knowledge and Western science. *Anthropologists, Indigenous Scholars and the Research*

Endeavour: Seeking Bridges Towards Mutual Respect, 118–127. https://doi.org/10.4324/9780203122136

Pena, A. N., & Canon, J. M. (2008). Developing cognitive processes in teenagers through the reading of short stories. *Profile Issues in Teachers' Professional Development*, *9*(1), 9–22.

Putri, A. S., & Aznam, N. (2019). The effect of the science web module integrated on batik's local potential towards students' critical thinking and problem solving (thinking skill). *Journal of Science Learning*, *2*(3), 92–96. https://doi.org/10.17509/jsl.v2i3.16843

Ramadhan, S., Mardapi, D., Prasetyo, Z. K., & Utomo, H. B. (2019). The development of an instrument to measure the higher order thinking skill in physics. *European Journal of Educational Research*, *8*(3), 743–751. https://doi.org/10.12973/eu-jer.8.3.743

Ramirez, R. P. B., & Ganaden, M. S. (2008). Creative activities and students' higher order thinking skills. *Education Quarterly*, *66*(1), 22–33.

Rasna, I. W., & Tantra, D. K. (2017). Reconstruction of local wisdom for character education through the Indonesia Language learning: An ethno-pedagogical methodology. *Theory and Practice in Language Studies*, *7*(12), 1229. https://doi.org/10.17507/tpls.0712.09

Rörsch, A. (2014). The progress of science—Past, present and future. *Humanities*, *3*(4), 442–516. https://doi.org/10.3390/h3040442

Rusmana, J., Ramdiah, S., & Prayitno, B. (2019). Development of booklet as a biology learning resource through local wisdom values in producing Bakul Purun. In M. A. Soendjoto, D. Dharmono, M. K. Riefani, N. H. Utami, I. Irwandi, M. R. Anwar, & S. Hairani (Eds.), *Proceeding of National Seminar of Wetland Environment* (pp. 603–607). Lambung Mangkurat University.

Saefullah, A., Samanhudi, U., Nulhakim, L., Berlian, L., Rakhmawan, A., Rohimah, B., & El Islami, R. A. Z. (2017). Efforts to improve scientific literacy of students through guided inquiry learning based on local wisdom of Baduy's society. *Journal of Research and Science Learning/Jurnal Penelitian Dan Pembelajaran IPA*, *3*(2), 84–91. https://doi.org/10.30870/jppi.v3i2.2482

Saputra, A., Wahyuni, S., & Handayani, R. D. (2016). Pengembangan modul IPA berbasis kearifan lokal daerah pesisir puger pada pokok bahasan sistem transportasi di SMP [Development of science modules based on local wisdom of the coastal area of Puger on the subject of the transportation system in SMP]. *Journal of Physics Learning/Jurnal Pembelajaran Fisika*, *5*(2), 182–189.

Serdyukov, P. (2017). Innovation in education: What works, what doesn't, and what to do about it? *Journal of Research in Innovative Teaching & Learning*, *10*(1), 4–33. https://doi.org/10.1108/jrit-10-2016-0007

Setiawan, B., Innatesari, D. K., Sabtiawan, W. B., & Sudarmin, S. (2017). The development of local wisdom-based natural science module to improve science literation of students. *Indonesian Journal of Science Education/Jurnal Pendidikan IPA Indonesia*, *6*(1), 49–54. https://doi.org/10.15294/jpii.v6i1.9595

Setiawati, E., Rahayu, H. M., & Setiadi, A. E. (2017). Pengembangan media pembelajaran modul pada materi animalia kelas X SMAN 1 Pontianak [Development of learning media modules on animalia material in class X SMAN 1 Pontianak]. *Journal Bioeducation*, *4*(1), 47–57. https://doi.org/10.29406/522

Singh, S., & Yaduvanshi, S. (2015). Constructivism in science classroom: Why and how. *International Journal of Scientific and Research Publications*, *5*(3), 1–5.

Sofyan, H., Anggrereini, E., & Saadiah, J. (2019). Development of e-modules based on local wisdom in central learning model at kindergartens in Jambi City. *European Journal of Educational Research*, *8*(4), 1137–1143. https://doi.org/10.12973/eu-jer.8.4.1137

Subali, B., Sopyan, A., & Ellianawati. (2015). Developing local wisdom based science learning design to establish positive character in elementary school. *Indonesian Journal of Physics Education/Jurnal Pendidikan Fisika Indonesia*, *11*(1), 1–7. https://doi.org/10.15294/jpfi.v11i1.3998

Suratno, S., Swandari, F., & Yamin, M. (2015). Pengembangan model pembelajaran berbasis kearifan lokal di daerah bantaran Sungai Barito [Development of learning models based on local wisdom in the Barito River]. *Journal of Progressive Education/Jurnal Pendidikan Progresif*, *5*(2), 178–189.

Tanjung, P., Daulay, S., & Ghafari, O. F. (2018). The development of lokal wisdom of Labuhanbatu based on teaching material of descriptive text for 7th grade student at SMP Negeri 1 Bilah Barat, Indonesia. *International Journal of Education, Learning and Development*, *6*(1), 80–92.

Taylor, L., & Parsons, J. (2011). Improving student engagement. *Current Issues in Education*, *14*(1), 1–33.

Thiagarajan, S., Semmel, D. S., & Semmel, M. I. (1974). *Instructional development for training teachers of exceptional*

children: A sourcebook.

Tomi, D., Anggereini, E., & Muhaimin, M. (2018). The development of biology learning toolswith Kerinci's local wisdom-based on biodiversity material for senior high schools. *Edu-Sains*, *7*(2), 11–20.

Turrini, T., Dörler, D., Richter, A., Heigl, F., & Bonn, A. (2018). The threefold potential of environmental citizen science - Generating knowledge, creating learning opportunities and enabling civic participation. *Biological Conservation*, *225*(July), 176–186. https://doi.org/10.1016/j.biocon.2018.03.024

Uge, S., Neolaka, A., & Yasin, M. (2019). Development of social studies learning model based on local wisdom in improving students' knowledge and social attitude. *International Journal of Instruction*, *12*(3), 375–388. https://doi.org/10.29333/iji.2019.12323a

Usmeldi, U., & Amini, R. (2019). The effect of integrated learning model to the students competency on the natural science. *Journal of Physics: Conference Series*, *1157*(2). https://doi.org/10.1088/1742-6596/1157/2/022022

Utami, Y. E., Suwono, H., & Mahanal, S. (2018). Pengembangan perangkat pembelajaran biologi berbasis potensi lokal bahan baku pewarna kain tenun ikat di kelas X SMA Kabupaten Sintang [Development of biology learning tools based on local potential raw materials for ikat woven fabric dye in class X Sintang District High School]. *Proceeding of National Seminar-HAYATI* (pp. 235–239). Universitas Nusantara PGRI Kediri.

Wahyuni, S. (2015). Developing science learning instruments based on local wisdom to improve student's critical thinking skills. *Indonesian Journal of Physics Education/Jurnal Pendidikan Fisika Indonesia*, *11*(2), 156–161. https://doi.org/10.15294/jpfi .v11i2.4228

Wardah, A. (2016). Pengembangan perangkat pembelajaran IPA-biologi menggunakan model pembelajaran berdasarkan masalah di madrasah tsanawiyah [The development of science-biology learning tools uses problem-based learning models in tsanawiyah madrasas]. *Journal of Learning Innovantion/JINoP (Jurnal Inovasi Pembelajaran)*, *2*(1), 225. https://doi.org/10.22219/jinop.v2i1.3281

Whiten, A., Ayala, F. J., Feldman, M. W., & Laland, K. N. (2017). The extension of biology through culture. *Proceedings of the National Academy of Sciences of the United States of America*, *114*(30), 7775–7781. https://doi.org/10.1073/pnas.1707630114

Yaqinuddin, A. (2013). Problem-based learning as an instructional method. *Journal of the College of Physicians and Surgeons Pakistan*, *23*(5), 83–85.

Yulianto, A. (2019). Kepercayaan lokal dalam pemali Banjar di Kalimantan Selatan [Local belief in Banjar pemali in South Kalimantan]. *Scientific Journal of Language and Literature/Jurnal MABASAN*, *3*(1), 1–13. https://doi.org/10.26499/mab.v13i1.240

Zubaidah, S., Mahanal, S., Sholihah, M., Rosyida, F., & Kurniawati, Z. L. (2019). Using Remap RT (Reading – Concept Mapping – Reciprocal Teaching) learning model to improve low-ability students' achievement in biology. *Center for Educational Policy Studies Journal*, 1–28. https://doi.org/10.26529/cepsj.777

Zvacek, S. M., Restivo, M. T., & Chouzal, M. F. (2013). Concept mapping for higher order thinking. *International Journal of Engineering Pedagogy, 3*(1), 6–10. https://doi.org/10.3991/ijep.v3iS1.2401

Appendix

Appendix 1. A flow diagram of South Kalimantan local wisdom-based learning model