

Development of introductory teaching materials for the collaborative science laboratory of culture, Islam and technology

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Article Information	Abstract
Keyword: Teaching materials; Introduction to science laboratories; Local potential; Islam-science; Augmented reality Kata Kunci: Bahan ajar; Pengantar laboratorium sains; Potensi local; Islam-sains; Augmented reality History: Received : 22/03/2022 Accepted : 06/06/2022	The development of introductory teaching materials for the collaborative science of culture, Islam, and technology is research that produces innovative teaching materials as references for introductory laboratory courses and similar subjects. This study aims to develop teaching materials and validate products by material experts and media experts. The development of teaching materials is carried out in stages: (1) enrichment of teaching materials by laboratory introductory materials in the curriculum of biology, physics, and chemistry study programs, (2) collecting local potential data that can be included and explained in teaching materials according to laboratory introductory materials, (3) explore information related to Islam-science according to the phenomena presented, (4) innovate material content by presenting 3D augmented reality technology which has explained the use and installation of supporting applications, (5) validate teaching materials on material and media aspects, (6) implement teaching materials in the introductory laboratory learning process and or laboratory management in physics, chemistry and biology study programs. This development research stage is in line with the ADDIE model development research. The validation results obtained a percentage of 79% for material experts and 88% for media experts who both belong to the "strongly agree" category to be suitable for use by revising. Abstrak Pengembangan bahan ajar pengantar laboratorium sains kolaborasi budaya, islam dan teknologi merupakan penelitian yang menghasilkan produk bahan ajar inovatif sebagai referensi mata kuliah pengantar laboratorium dan mata kuliah sejenisnya. Penelitian ini bertujuan untuk mengembangkan bahan ajar dan menvalidasi produk oleh ahli materi dan ahli media. Pengembangan bahan ajar dilakukan dengan tahapan: (1) pengayaan materi ajar sesuai dengan materi pengantar laboratorium pada kurikulum program studi tadris biologi, fisika dan kimia, (2) mengumpulkan data potensi local yang dapat dicantumkan dan dijelaskan pada bahan ajar menyesuaikan materi pengantar laboratorium, (3) menggali informasi berkenaan dengan islam-sains sesuai pada fenomena yang disajikan, (4) melakukan inovasi konten materi dengan menyajikan teknologi augmented reality 3D yang telah dijelaskan penggunaan dan pemasangan aplikasi pendukung, (5) melakukan validasi bahan ajar pada aspek materi dan media, (6) mengimplementasikan bahan ajar dalam proses pembelajaran pengantar laboratorium dan atau manajemen laboratorium pada program studi tadris fisika, kimia dan biologi. Tahapan penelitian pengembangan ini selaras dengan penelitian pengembangan model ADDIE. Hasil validasi diperoleh persentase 79% pada ahli materi dan 88% pada ahli media yang sama-sama termasuk pada kategori "sangat setuju" untuk layak digunakan dengan melakukan revisi.

A. Introduction

One component of the learning process that must be held is teaching materials. Teaching materials can support information on teaching materials and help students understand the concept of science to achieve the desired competencies (Situmorang et al., 2016). Teaching materials that can be developed with interactive multimedia can be used by students as a reference for students to understand the material more quickly, and educators can use them as a variety of teaching media that is not boring (Wardani et al., 2020). Teaching materials need breakthroughs to produce teaching materials that can present good, regular, systematic, varied, and rich sources of information. Therefore, teaching materials are a teacher's guide in guiding the learning process for the substance of competence as well as an evaluation tool for the achievement of learning outcomes (Irmania et al., 2016). More importantly, teaching materials must be able to attract students to use them. Elements that must be considered in the learning process include learning objectives, teaching materials/materials, teaching methods, and learning media (Ferdianto & Setiyani 2018).

Planning for the management of laboratory facilities and infrastructure is also an effort to improve the quality of learning. These efforts must be based on an understanding of the procurement, inventory, storage, arrangement, use, and maintenance of the laboratory (Nurhadi, 2018). The basis of this understanding depends on the managerial competence and laboratory organization to be able to carry out the process of utilizing all resources in achieving laboratory goals as set out (Intan 2021). One of the efforts that can be done is to present material that is open to real local phenomena/wisdom (Satriawan & Rosmiati, 2016), connect with religion (Islam) (Arimadona 2017), and involve technology/animation (Zain & Vebrianto, 2017). Analysis of the need for the use of Islamic integrated learning literature occupies a percentage of 100% and 89% of students agree that Islamic integrated learning literature can help students' understanding (Vitrianingsih et al., 2021) and support an increase in students' KKM completeness by 92% (Ratriana et al., 2021). Similarly, the use of Augmented Reality technology is able to provide an interesting and realistic atmosphere so as to help students understand and analyze problem scenarios (Purwandari et al., 2021).

With regard to laboratory facilities, which are not all educational institutions are evenly distributed (School Facilities Still Inadequate, n.d.), alternative literature to meet the needs of

understanding laboratory tools and materials will be very much needed (Anon, n.d.-a), alternative literature to meet the needs of understanding laboratory tools and materials will be very much needed. This teaching material is certainly appropriate for use at every level of education from elementary to tertiary education. University is included in the level of education that develops the potential of students to produce graduates who master science and technology (Anon, n.d.-b).

UIN Antasari Banjarmasin is an Islamic university that has implemented a KKKI-based learning process to improve the quality and competitiveness of human resources through qualifications based on a learning achievement equality assessment system. Learning outcomes according to the KKKI include 2 kinds of assignments, namely 1) mastering theoretical concepts in certain areas of knowledge and skills in general; and 2) mastering the theoretical concepts of special sections in the field of in-depth knowledge and skills (Ristekdikti, 2014). This learning achievement applies to all courses, one of which is the Laboratory Management course, Introduction to the Laboratory, and similar courses.

Educational laboratories at universities are included in academic facilities intended to be used in conducting academic activities, research, and community service supported by the availability of laboratory equipment and materials according to certain scientific methods and methods (Kertiasih, 2016). The specific definition put forward by Emda (2014) is that the laboratory is a place to conduct experiments, measurements, research, or scientific research related to science and other sciences. This definition explains that the existence of laboratories at universities has an important role in improving the quality of educational institutions, especially to train human resources who are more skilled, professional, creative, and have high scientific insight. Therefore, the function of the laboratory is a place to strengthen theoretical information, find causality, obtain empirical evidence on certain phenomena, formulate laws or propositions from experimental data that have been tested for truth, practice things that are not yet known, develop the psychomotor domain, conduct training, apply methods scientific research as well as conducting research both individually and in groups (Amien in Katili et al., 2013).

For the function of the laboratory to run optimally, the laboratory needs to be supported by the availability of facilities and infrastructure in the form of room facilities. The facilities and infrastructure provided cover the needs of

laboratory administration and management activities, equipment maintenance and preparation activities, and tool storage. In addition to laboratory facilities and infrastructure, organizational structure and management are also important factors to create continuity in the working style of the laboratory (Katili et al., 2013). With the optimal role of laboratory management and facilities and infrastructure, effective education can be realized because it is able to facilitate students to make positive contributions. Knowledge of laboratory management and the substance of teaching materials can increase motivation, insight (Jonuarti et al., 2014), independence (Saifuddin & Puspitasari, 2021), and able to support an effective and efficient learning process for teachers (Suseno & Riswanto, 2017). Research shows the relationship between the ability to use and manage the laboratory in students is directly proportional to the increase in student learning outcomes in subjects that have practicum (Susanto, 2018). Barnawi in Kertiasih (2016) explained educational facilities including all equipment and equipment to support the learning process. Therefore, facilities and infrastructure and their management are mandatory factors to optimize teaching and learning activities. This cannot be separated from the teaching and learning process at universities where students will be equipped with theoretical and practical knowledge. In this gap, the laboratory is present because it can be a place to prove theoretical knowledge with concrete practicals such as phenomena around students.

An effective surrounding phenomenon that can be used in the learning process is local wisdom. Teaching materials that present the phenomenon of local wisdom can help students understand concepts in the form of moral messages (Satriawan & Rosmiati, 2016). Local wisdom can also be used as a guide in the life and character of the nation that teaches students to be familiar with concrete situations in the surrounding environment (Ferdianto & Setiyani 2018). In order to deepen moral values in the religious aspect, Islamic-science content is also appropriate if it is included in teaching materials because the verses of Allah SWT are in the form of the Qur'an and the words of the Prophet in the form of Hadith, both of which are included in learning resources that are messages, events, facts and incident (Dewi, 2017). Furthermore, the integration approach of Islam with science and technology is able to unite various knowledge groups into one unified system of knowledge (Zain & Vebrianto, 2017). Developing teaching materials that mix and match religious

and general knowledge can lead students to avoid hedonic characters (Aslan 2020), materialistic (Nurjanah et al., 2019), and deviant behavior (Asysyifa et al., 2017).

Entering the industrial era 4.0, the application of technology in learning has become a separate demand in the world of education. This is in line with the increasing interest in using Augmented Reality technology in creating unified educational settings (Chen et al., 2017). Augmented reality is one of the significant technologies in changing the location and time of training education (Lee, 2012). Nevertheless, Augmented Reality poses challenges for both students and teachers, especially in the relationship between pedagogy and technology. For example, students who use augmented reality technology must have a cognitive balance from the information provided by interactive teaching materials. This happens because augmented reality is a new medium in combining aspects of real and social computing within the reach of the physical and virtual world, which is controlled by the user (Kesim & Ozarslan, 2012). In order to support the understanding of the role of the laboratory from its components to its management, it is necessary to provide teaching materials that contain this subject in the packaging of introductory teaching materials for cultural, Islamic and technology collaboration science laboratories. One of them is to develop a validated Introductory Teaching Material for the Cultural, Islamic and Technology Collaboration Science Laboratory to be implemented in learning.

B. Material and Method

The stages of research implementation refer to the ADDIE model with sequence analysis procedures, design, development, implementation, and evaluation. This procedure is a generic process that can be carried out by researchers in developing dynamic and flexible products so that each component interacts and can be analyzed (Rayanto & Sugianti, 2020). These teaching materials are developed by educators who work in related subjects who start the concept of analyzing the RPS presentation from each science family (physics, chemistry, and biology). Next is material enrichment, integration of local/cultural wisdom phenomena, Islamic-science based and 3D augmented reality technology innovation. The results of the revised teaching materials are then entered at the validation stage to be implemented in the learning process, especially in chemistry, physics, and biology education study programs in universities.

The validation process for developing teaching materials is carried out on the aspects of material and media experts by validators who are competent in their fields as many as 4 validators. The validation process is carried out independently by providing validation products and instruments. The validity of teaching materials is assessed by material experts with regard to construction, content that is in accordance with the curriculum and the truth of concepts that are free from misconceptions. Meanwhile, the validity of media experts relates to the flexibility of teaching materials regarding readability, readability, size, so that they are easy to read by users (Irmania et al., 2016).

The results of the revised teaching materials are then entered at the validation stage to be implemented in the learning process, especially in

chemistry, physics, and biology education study programs in universities. Data calculation use formula of Riduwan & Akdon (2010):

$$\text{percentage} = \frac{\text{score obtained}}{\text{max score}} \times 100\%$$

Riduwan (2012) divides the eligibility criteria for presentation analysis expressed in 4 ranges as shown in table 1 as follows:

Tabel 1 Percentage analysis eligibility criteria

Percentage	Information
80-100	Good/Valid/Decent
60-79	Fairly good/fairly valid/decent enough
50-59	Not good / not valid / not worth it
0-49	Not good (change)

(Source: Riduwan, 2012)

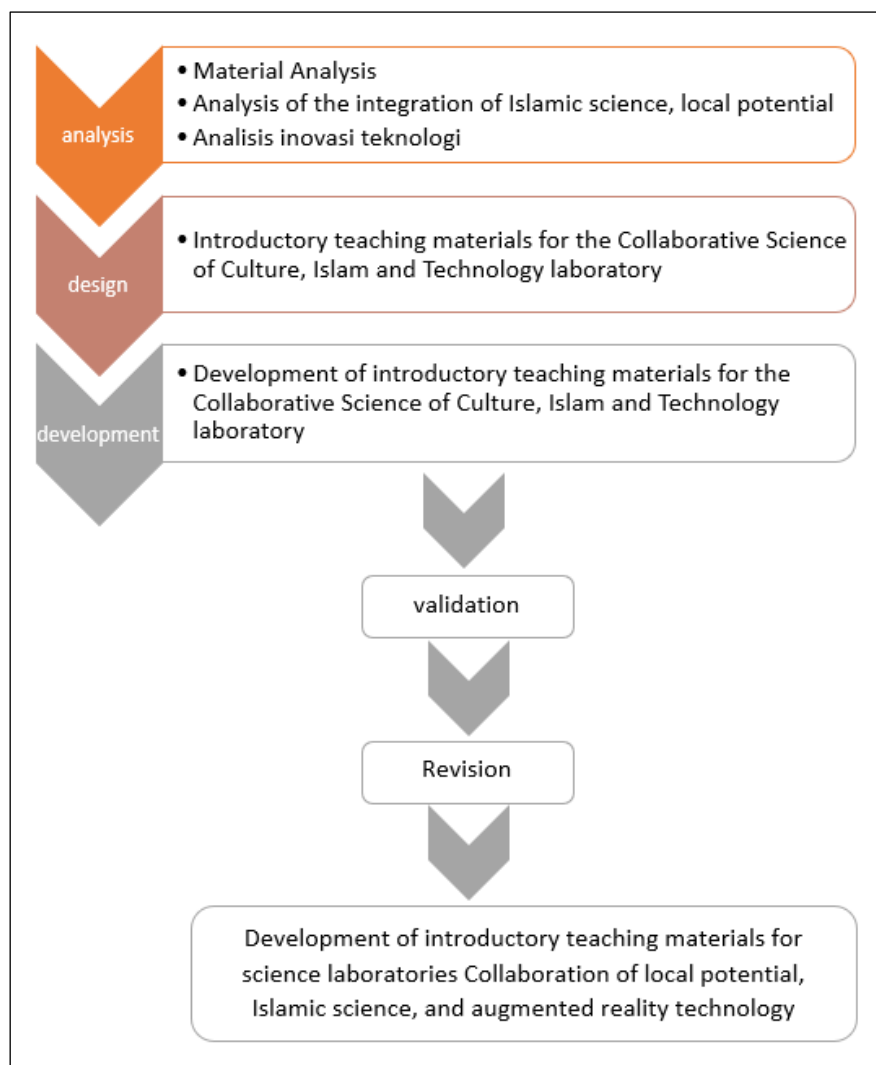


Figure 1

Development Phase of Introductory Science Laboratory Teaching Materials based on the modified ADDIE model

C. Results and Discussion

The result of this research is an introductory product for teaching materials for collaborative science laboratories with local potential, Islam-science, and augmented reality technology. The development design model referred to is the ADDIE model, but specifically in the development of this teaching material the ADDIE stage used has been modified to the development stage, this is because this research aims to develop and produce a valid teaching material which can then be implemented. based on the validator's assessment.

The development of these teaching materials emphasizes the analysis of how each component that is owned interacts with each other by coordinating according to the existing phases. The initial stage is the analysis stage, which is to enrich teaching materials in accordance with laboratory introductory materials in the curriculum of biology, physics and chemistry tadrís study programs. This stage uses various literatures and literature studies both from books and relevant research in order to obtain a theoretical basis so that this development research has a strong basis. Next is to dig up the actual information that is happening in class conditions regarding the analysis of the needs of students and educators, especially in laboratory management learning. The need analysis data is oriented towards learning abilities, learning scenarios, learning media and student attitudes. So that the instrument used is to observe the implementation of learning.

In the second stage, namely the design stage, it is done by designing the teaching materials that will be developed. This design process begins with collecting local potential data that can be included and explained in teaching materials, adjusting introductory laboratory materials, digging up information related to Islam-science according to the phenomena presented, and innovating material content by presenting 3D augmented reality technology which has been explained using and installation of supporting applications. The next step is to validate teaching materials on the material and media aspects. This research was validated by lecturers with appropriate education fields both on material and media experts as many as 4 validators. The results of the validation of teaching materials occupy the assessment results in the good category so that the development of teaching materials is categorized as suitable for learning introductory laboratory courses and similar subjects. The following is a recapitulation graph of the validation results of material and media experts.

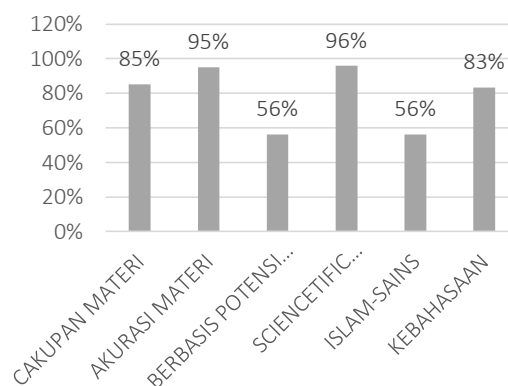


Figure 2
Recapitulation of material expert validation results

The development of teaching materials in the material expert aspect got a percentage of 79% which was included in the "strongly agree" category on the material expert validation instrument interval 25. The material expert assessment was divided into 6 aspects as shown in Figure 1. There were 4 aspects categorized as "strongly agree" namely in the aspects of: (1) material coverage, (2) material accuracy, (3) scientific approach, and (4) language. Meanwhile, the "agree" category is based on aspects based on local potential and Islam-science. The results of this validation place the development of teaching materials suitable for use with revisions. Based on the percentage data, the revision that must be optimized is related to the wealth of local potential insights and Islamic-science that can be developed more broadly so that it can correct the shortcomings of this teaching material. The next validation process is media validation which is shown in Figure 3.

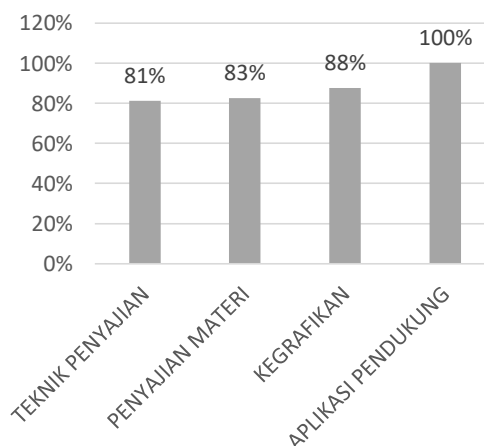
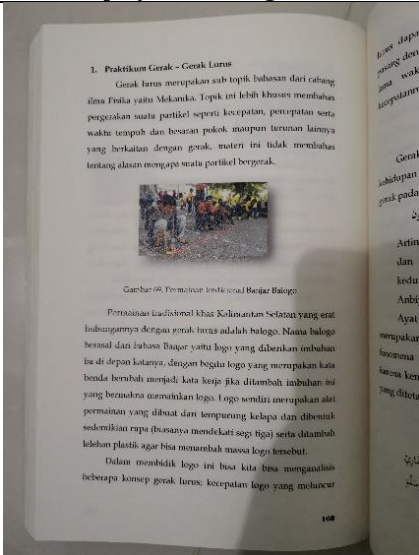
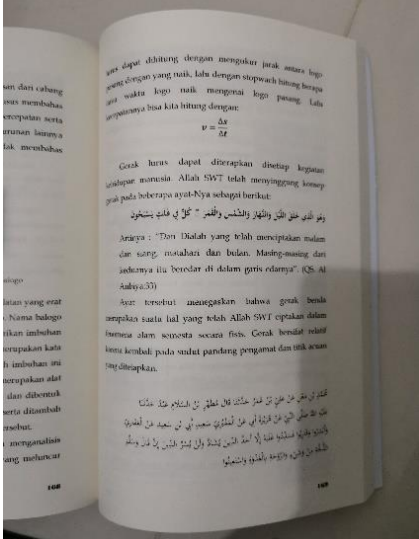


Figure 3
Recapitulation of media expert validation results

Table 2 Description of the components of the development of teaching materials Introduction to the Collaborative Science Laboratory of Culture, Islam and Technology

No	Development Component	Display of teaching materials
1	Local Wisdom/Potential; provide insight into local wisdom that is included in teaching materials	
2	Islam-science; provide an explanation of the correlation of the meaning of the verse pieces used with the material	
3	3D Augmented Reality Technology; use landscape format to make it more representative	

The results of the media expert validator's assessment were 88% with the "strongly agree" category which was in line with the development of introductory laboratory teaching materials suitable for use with revision improvements. The media expert aspect is divided into 4 aspects, all of which are in the "strongly agree" category. The development of these teaching materials focuses on 3 innovations, namely local potential, Islamic-science and augmented reality technology. This innovation supports the development of teaching materials in presenting media that are renewable, interesting, and practical. Augmented reality can be applied to both learning and entertainment at the same time. The information that students get from augmented reality in virtual form can help users convert to the real world without interacting directly (Kesim & Ozarslan, 2012). The development of introductory laboratory teaching materials is appropriate for the integration of laboratory activities and classroom activities. This introduction to the laboratory is a compulsory subject that is presented in every science study program, namely physics, chemistry, and biology. The practice in this course is a discussion of the introduction of the types of tools and materials in the laboratory, how to use them, how to maintain them, and how to sort tools and materials correctly (inventory). Entering the development stage, this stage is carried out by improving instructional materials and media as recommended from the validation results. The following are the results of the development stage of teaching materials referring to aspects that need to be improved.

This stage must be clear and coherently carried out in order to obtain comprehensive teaching materials. The integration of attitude and character values in the learning process needs to consider the character of the subject and the learning model that will be used (Irmania et al., 2016). Likewise, naming Islamic-science values in teaching materials to suit the character of science itself. Meanwhile, the value of local wisdom needs to be studied more deeply in order to take positive moral values on the subject (Sudarmin et al., 2017). Nilai moral pada kearifan local dapat diambil dari softskills dan karakter dari kondisi lingkungan sekitar peserta didik. Kearifan local dapat menjadi pematik peserta didik dalam memahami budaya local, karena memberi kesempatan seluas-luasnya pada peserta didik dalam mencapai tujuan pembelajaran (Utami & Dewi, 2021).

Laboratory introductory courses have an important contribution in equipping students with deepening and knowledge of the use of laboratory tools and materials both independently and in

groups. The practical value in the development of these teaching materials is that the practical presentations are packaged on a local potential basis (South Kalimantan), so that they can be used independently (self introduction) with systematic steps and tutorials. The application of local potential-based teaching materials contains contextual learning because it can integrate local wisdom in the learner's environment. These teaching materials can improve students' understanding of physics concepts (Satriawan & Rosmiati, 2016). Innovative value is shown by the collaboration of renewable technology, namely Augmented reality which is included in introductory laboratory teaching materials assisted by smartphone applications.



Figure 4
The result of moving barcodes using the AR application

Augmented reality technology helps users (students) in blocking laboratory tools and materials that are dangerous or break easily. This experience is expected to strengthen user understanding, especially on hazardous materials in the laboratory. This technology can be an alternative teaching media in online learning because it is facilitated by applications that can be done independently. Facilities for innovative teaching materials in electronic form (technology) can increase efficient learning activities (Situmorang et al., 2016), develop critical thinking skills (Syawaludin et al., 2019), practical (Hung et al., 2017), not bored quickly (Wardani et al., 2020), it can motivate students to be interesting (Destiara et al., 2021), and teaching and learning activities become student-centered (Saidin et al., 2015).

Supporting the deepening of students' moral and religious values, introductory laboratory teaching materials present Islamic-science values obtained from the Qur'an and hadith. Religion and science coexist independently with each character. So that the integration of Islam-science is

interesting to collaborate as a scientific criterion to identify assumptions to be real (Zain & Vebrianto, 2017) and become a reinforcement of the explanations that have been put forward by experts (tafsir) (Muliawati & Pathoni, 2020). This teaching material consists of 11 chapters, namely: (1) introduction to the laboratory; (2) laboratory management; (3) laboratory design and facilities; (4) types and laboratory equipment; (5) laboratory materials; (6) inventory of tools and materials, (7) Laboratory SOPs, (8) Laboratory Safety and Security, (9) Local Potential-Based Practicum, (10) Islam-Sains in practicum; (11) Measurement Uncertainty. It is hoped that the development of introductory laboratory teaching materials can become one of the newest innovative teaching materials provide benefits in the fields of teaching, technological progress and Islamic-science.

Analysis of research data was carried out through qualitative and quantitative descriptive research according to the criteria. The results of the development are in the form of lesson plans and introductory laboratory textbooks. This research was validated by lecturers with appropriate education fields, both material and media experts. The results of the validation of teaching materials occupy the assessment results in the good category so that the development of teaching materials is categorized as suitable for learning introductory laboratory courses and similar subjects. The following is a recapitulation graph of the validation results of material and media experts.

D. Conclusion

The development of teaching materials for the Collaborative Science of Culture, Islam and Technology laboratory has been validated to be implemented in learning through the stages of developing modified systematic teaching materials. Further research can be done in the form of an analysis of the effectiveness of the use of teaching materials on students (students).

E. References

- Anon. n.d.-a. "Sarana sekolah masih belum memadai." Retrieved June 1, 2022 (<https://edukasi.kompas.com/read/2009/10/21/20121752/~Edukasi~News>).
- Anon. n.d.-b. "UU No. 12 tahun 2012 tentang Pendidikan Tinggi [JDIH BPK RI]." Retrieved March 9, 2022 (<https://peraturan.bpk.go.id/Home/Details/39063/uu-no-12-tahun-2012>).
- Arimadona, S. (2017). Pengembangan modul pembelajaran biologi berbasis integrasi Islam sains. *Jurnal Pendidikan Rokania*, 1(2), 89–98.
- Aslan, A. (2020). Pengembangan bahan ajar berbasis imtaq dan iptek di era revolusi industri 4.0 pada mata pelajaran sains Madrasah Ibtidaiyah. *Ta'Limuna: Jurnal Pendidikan Islam*, 9(1), 1–15. doi: 10.32478/talimuna.v9i1.345.
- Asysyifa, D. S., Sopyan, A., & Masturi, M. (2017). Pengembangan bahan ajar IPA berbasis komplementasi ayat-ayat sains Quran pada pokok bahasan sistem tata surya. *UPEJ Unnes Physics Education Journal*, 6(1), 44–54. doi: 10.15294/upej.v6i1.13932.
- Chen, P., Liu, X., Cheng, W., & Huang, R. (2017). A review of using augmented reality in education from 2011 to 2016. Pp. 13–18 in *Innovations in Smart Learning, Lecture Notes in Educational Technology*, edited by E. Popescu, Kinshuk, M. K. Khribi, R. Huang, M. Jemni, N.-S. Chen, and D. G. Sampson. Singapore: Springer.
- Destiara, M., Himmah, N., & Indriyani, S. (2021). Pengembangan LKPD materi arthropoda berbasis STEM berteknologi augmented reality. *Bioeduca : Journal of Biology Education*, 3(1), 37–45. doi: 10.21580/bioeduca.v3i1.6629.
- Dewi, T.M. (2017). Pengembangan modul pencemaran lingkungan berbasis Islam-Sains untuk siswa Madrasah Aliyah/MA. *Jurnal Pendidikan Biologi*, 6(2), 274–278. doi: 10.24114/jpb.v6i2.6545.
- Ristekdikti. (2014). Panduan penyusunan capaian pembelajaran KKNi.
- Ferdianto, F., & Setiyani, S. (2018). Pengembangan bahan ajar media pembelajaran berbasis kearifan lokal mahasiswa pendidikan matematika. *Jurnal Nasional Pendidikan Matematika*, 2(1), 37–47. doi: 10.33603/jnpm.v2i1.781.
- Hung, Y. H., Chen, C. H., & Huang, S. W. (2017). Applying augmented reality to enhance learning: a study of different teaching materials. *Journal of Computer Assisted Learning*, 33(3), 252–266. doi: 10.1111/jcal.12173.
- Intan, S. (2021). Modul pengelolaan laboratorium. Undergraduate, UIN Raden Intan Lampung.
- Irmania, N., Rahardjo, R., & Suyono, S. (2016). Pengembangan bahan ajar biologi terintegrasi imtaq pada materi vertebrata sesuai Kurikulum 2013 kelas X SMA. *Jurnal Penelitian Pendidikan Sains*, 5(2), 983–990. doi: 10.26740/jpps.v5n2.p983-990.
- Jonuarti, R., Yurnetti, Y., Hidayati, H., & Mufit, F. (2014). Efektivitas pengetahuan pengelolaan laboratorium dan substansi bahan ajar terhadap pengetahuan guru membuat modul praktikum IPA SMP dalam menyambut Kuri-kulum 2013. *Penelitian Pendidikan*, 5(1), 1–8.

- Katili, N. S., Sadia, W., & Suma, K. (2013). Analisis sarana dan intensitas penggunaan laboratorium fisika serta kontribusinya terhadap hasil belajar siswa SMA Negeri di Kabupaten Jembrana. *Jurnal Pendidikan Dan Pembelajaran IPA Indonesia*, 3(2).
- Kertiasih, N.L.P. (2016). Peranan laboratorium pendidikan untuk menunjang proses perkuliahan Jurusan Keperawatan Gigi Poltekkes Denpasar. *Jurnal Kesehatan Gigi (Dental Health Journal)*, 4(2), 59–66.
- Kesim, M., & Ozarslan, Y. (2012). Augmented reality in education: Current technologies and the potential for education. *Procedia-Social and Behavioral Sciences* (Vol. 47, 297–302). doi: 10.1016/j.sbspro.2012.06.654.
- Lee, K. (2012). Augmented reality in education and training. *TechTrends*, 56(2), 13–21. doi: 10.1007/s11528-012-0559-3.
- Muliawati, L., & Pathoni, H. (2020). E-modules development with Al-Qur'an integration scientific approach based on 3D pageflip professional in biochemistry course. Pp. 176–179 in. Atlantis Press.
- Nurhadi, A. (2018). Manajemen laboratorium dalam upaya meningkatkan mutu pembelajaran. *Tarbawi: Jurnal Keilmuan Manajemen Pendidikan*, 4(1), 1–12. doi: 10.32678/tarbawi.v4i01.1225.
- Nurjanah, F., Triwoelandari, R., & Nawawi, M. K. (2019). Pengembangan bahan ajar tematik terintegrasi nilai-nilai Islam dan sains untuk meningkatkan karakter religius siswa. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, 3(2), 178–181. doi: 10.23969/jp.v3i2.1393.
- Purwandari, P., Yusro, A. C., & Purwito, A. (2021). Modul fisika berbasis augmented reality sebagai alternatif sumber belajar siswa. *Jurnal Ilmiah Pendidikan Fisika* 5(1), 38–46. doi: 10.20527/jipf.v5i1.2874.
- Ratriana, D., Purwoko, R. Y., & Yuzianah, D. (2021). Pengembangan E-modul berbasis etnomatematika yang mengeksplorasi nilai dan budaya islam untuk siswa SMP. *AlphaMath : Journal of Mathematics Education*, 7(1), 11–19. doi: 10.30595/alphamath.v7i1.8498.
- Rayanto, Y.H., & Sugianti. (2020). *Penelitian pengembangan model ADDIE dan R2D2: Teori & praktek*. Lembaga Academic & Research Institute.
- Riduwan. (2012). *Metode & teknik menyusun proposal penelitian*. Bandung: Alfabeta.
- Riduwan, and Akdon. (2010). *Rumus dan data dalam analisis statistika*. Bandung: CV. Alfabeta.
- Saidin, N. F., Halim, N. D. A., & Yahaya, N. (2015). A review of research on augmented reality in education: Advantages and applications. *International education studies*, 8(13), 1–8. doi: 10.5539/ies.v8n13p1.
- Saifuddin, M. F., & Puspitasari, E. D. (2021). The characteristics teaching materials of biology laboratory management. *Edubiotik: Jurnal Pendidikan, Biologi dan Terapan*, 6(2), 108–115. doi: 10.33503/ebio.v6i02.1298.
- Satriawan, M., & Rosmiati, R. (2016). Pengembangan bahan ajar fisika berbasis kontekstual dengan mengintegrasikan kearifan lokal untuk meningkatkan pemahaman konsep fisika pada mahasiswa. *JPPS (Jurnal Penelitian Pendidikan Sains)*, 6(1), 1212–1217. doi: 10.26740/jpps.v6n1.p1212-1217.
- Situmorang, M., Sitorus, M., & Situmorang, Z. (2016). Pengembangan bahan ajar kimia SMA/MA inovatif dan interaktif berbasis multimedia. *SEMIRATA 2015*.
- Sudarmin, S., Mastur, Z., & Parmin, P. (2017). Pengetahuan ilmiah berbasis budaya dan kearifan lokal di Karimunjawa untuk menumbuhkan soft skills konservasi." *Jurnal Penelitian Pendidikan Sains*, 6(2), 1363–1369. doi: 10.26740/jpps.v6n2.p1363-1369.
- Susanto, I. (2018). Korelasi kemampuan pengelolaan laboratorium dan hasil belajar pada mata kuliah pengelolaan laboratorium. *Jurnal Penelitian Bidang Pendidikan*, 23(2), 80–85. doi: 10.24114/jpp.v23i2.10004.
- Suseno, N., & Riswanto, R. (2017). Program optimalisasi peran laboratorium fisika SMA di Kota Metro, Lampung. *Jurnal Pengabdian Pada Masyarakat*, 2(2), 149–158. doi: 10.30653/002.201722.28.
- Syawaludin, A., & Rintayati, P. (2019). Development of augmented reality-based interactive multimedia to improve critical thinking skills in science learning. *International Journal of Instruction*, 12(4), 331–344.
- Utami, S. D., & Dewi, I. N. (2021). Efektivitas model pembelajaran jigsaw berorientasi kearifan lokal terhadap hasil belajar kognitif mahasiswa. *Jurnal Penelitian Pendidikan Sains*, 10(2), 1996–2004. doi: 10.26740/jpps.v10n2.p1996-2004.
- Wardani, P. T., Alwi, M., & Hakim, A. R. (2020). Pengembangan bahan ajar IPA kelas V Sekolah Dasar menggunakan multimedia interaktif berbantuan animasi. *Prima Magistra: Jurnal Ilmiah Kependidikan*, 1(2), 191–198. doi: 10.37478/jpm.v1i2.658.
- Zain, Z., & Vebrianto, R. (2017). Integrasi keilmuan sains dan Islam dalam proses pembelajaran rumpun IPA. In *Seminar Nasional Teknologi Informatika Komunikasi dan Industri* (pp. 703–708).