Mobile learning design and development to develop student decision making skills in social emotional learning process

Budi Astuti[1], Edi Purwanta[1], Rizqi Lestari[1*], Caraka Putra Bhakti[2]
[1]Universitas Negeri Yogyakarta, Indonesia
[2]Universitas Ahmad Dahlan, Indonesia

Article Info	ABSTRACT
	The development of technology and education is a set of two inseparable things. In education, technology affects both the learning process and the interaction between teacher and students. This condition poses a challenge for teachers, students, and schools to prepare innovative and exciting learning strategies so that the learning process runs optimally. This research aims to develop mobile learning as a learning medium in education. The research uses Research and Development Method with the ADDIE development model. The data collection method utilizes Social-Emotional in Learning Questionnaire previously tested for its validity and reliability to 30 students in Tangerang, Indonesia. The data analysis technique used is Pearson product-moment in quantitative approach. The results of this study reveal that there are 20 valid items of the SEL Questionnaire in addition to a model of mobile learning to equip decision making skill as one of the Social-Emotional skills needed in the 4.0 industrial revolutions. The model consists of 4 parts: pretest form, contents about decision-making skill, case study, and evaluation form. This research provides an alternative approach based on technology to enhance students' decision-making abilities in guidance and counselling services.

Corresponding Author:
Rizqi Lestari
Universitas Negeri Yogyakarta
Email: rizqilestari.2020@student.uny.ac.id

Introduction

Human civilization continues to develop from time to time. Humans create a variety of innovations to simplify life and fulfil daily needs. One innovation being developed currently is innovation in the field of technology. The rapid development of technology has brought humans to the era of the Industrial Revolution 4.0 (Rojko, 2017). In the 4.0 industrial revolution era, technology no longer mainly uses machines, computers, or other mechanical devices to help human needs. Instead, the era of the 4.0 industrial revolution tries to create cooperation between humans and technology. Humans are no longer the main actors in the industrial world. Humans are made possible to work collaboratively with machines, robots, and other various automatic machines (B. Astuti et al., 2020). Furthermore, during the more advanced era, the 5.0 industrial revolution, modern technology forms such as IoT (Internet of Things), Artificial Intelligence, Augmented Reality. Various other technologies are applied in the industrial sector and everyday life as technology is highly expected to bring benefits and convenience to humans (SKobelev & Borovik, 2017).

In the educational field, massive technology in various sectors of academic life undoubtedly becomes a challenge. Nearly every day, as part of the 4.0 industrial revolution society, students have used technology on various occasions. Technological developments have facilitated students' communication and search for information via the internet (Wiretna et al., 2020). This condition complies with the characteristics of students nowadays, of various levels from elementary to senior high school, who belong to generation Z. Generation Z, which is also called digital generation, is the students who were born between 1995 and 2012

period (Singh, 2014). Practically, generation Z grows up with technology and has access to mobile phones and the internet for various digital entertainment and communication needs (Dwidienawati & Gandasari, 2018). Moreover, generation Z is also accustomed to using technology to play games, seek entertainment through online videos and films, interact using social media, and various other internet-based activities (Dolot, 2018).

The primary characteristic of generation Z students accustomed to using technology for various purposes needs to be responded to well by teachers and schools. This notion is in line with the opinion of Schwieger & Ladwig (2018), stating that creativity and innovation are essential for generation Z students. Teachers and schools have an essential role in improving the students' competency (Maryani et al., 2020). If teachers and schools do not keep up with the changes and still maintain conventional learning patterns instead, students will lose interest and are not enthusiastic about learning. The loss of interest and motivation due to monotonous and non-creative learning can undoubtedly impact students' achievement (Riswanto & Aryani, 2017; Tokan & Imakulata, 2019). Furthermore, teachers need to organize a learning process that follows students' characteristics, needs, and interests to improve students' motivation, and the learning process can take place effectively.

Learning methods are critical to increasing students' motivation (Williams, K.C; Williams, C.C.: 2011). One of the current and relevant learning methods is the one that combines technology with the learning process, which is usually called a blended learning method. Blended learning is a method in learning that combines several learning methods to create an active learning process for the students. Blended learning can be carried out by combining the conventional face-to-face learning process with technology (Caraka Putra Bhakti & Ghiffari, 2018). The use of technology in learning can increase students' motivation and learning achievement (Harris et al., 2020; Higgins et al., 2019).

One of the types of relevant technology for teachers is mobile learning. Mobile learning is implementing learning that enables both students and teachers to use mobile devices such as mobile phones, tablets, and other devices to support learning (Mehdipour & Zerehkafi, 2013). Mobile learning can improve students' achievement and understanding of the material studied (Sulisworo, 2019; Elfeky & Masadeh, 2016). Fortunately, mobile learning can be used by course subjects teachers to enhance learning outcomes (Aripin, 2018) and guidance and counselling teachers to improve students' development. Mobile learning, which is based on the Android operating system, can be used as guidance and counselling media supporting students' provision of essential services. In other words, guidance and counselling teachers can use mobile learning to provide information and improve students' development, especially in social-emotional learning.

Social and emotional learning is a conceptual framework related to learning motivation, emotional management, social relationship, and self-regulation in learning activities that occur along with increasing challenges. It's related to the relationship among social, emotional, and cognitive aspects that will eventually chape the students' competencies (Jarvela, 2011). This kind of learning is considered an effective and coordinated strategy to improve students' socio-emotional competence, academic performance, health, and citizenship and prevent and reduce health, mental health, and behavioural problems (Durlak et al., 2015). Social-emotional learning is a combination of child and adolescent development, mental health, educational principles, positive psychology, affective neuroscience, cognitive therapy, behavioural therapy, and the function of preventing negative behaviour (Engelman et al., 2016). The ability includes recognizing and managing emotions, developing and achieving positive goals, appreciating other people's opinions, building and maintaining positive relationships with others, making responsible decisions, and managing constructive social situations (Frey et al., 2019).

One of the student's social and emotional skills that can be improved through mobile learning is decision-making ability. Decision making is a process that involves mental and cognitive aspects to choose a decision from various choices available (Shahsavarani & Abadi, 2015). Decision making is one of the crucial abilities needed in 4the .0 industrial revolution era (Astuti et al., 2019). This condition is caused by the extensive use of technology, which can give both positive and negative impacts and several problems and conflicts in the students' school environment and work environment faced by them later. Moreover, especially for the adolescent students, the condition might be more challenging as they face potential problems due to the developmental stage issue such as aggressive behaviour, conflict, bullying, violence, and various other problems (Saputra, Supriyanto, Astuti, Ayriza, Adiputra, et al., 2020).

Students need to develop the decision-making ability to resolve conflicts and problems appropriately. Besides, students also need to practice making decisions to compete and survive in the workforce after graduating. Practically, teachers usually give materials about decision making in classical guidance service by

lecturing or explaining it. Unfortunately, this kind of method makes students feel bored and unable to understand the material clearly. Therefore, guidance and counselling teachers need to create new approaches to develop the ability of these digital generations in the decision-making process. As previously stated, since technology holds an essential role nowadays, Guidance and Counselling teachers need to use technology to develop the students' competencies (Bhakti & Rahman, 2020). To develop the students' decision-making ability, Guidance and Counseling teachers can develop mobile learning.

Researchers and experts agree that mobile learning can improve students' achievements in the learning process (Ardiansyah & Nana, 2020). Many previous types of research showed that mobile learning could be used to support learning in biology, mathematics, and geography (Aripin, 2018; Yuliani, 2010; Rahmawati & Mukminan, 2018). Furthermore, it can also improve students' skills from elementary school to (Kamasi & Saruan, 2020) higher education level (Kurniawan, 2017). Several researchers also state that mobile learning can enhance students' soft skills, such as creative thinking (Cavus & Uzunboylu, 2009). It provides students with educational experiences, including meaningful learning experiences, communication and collaboration skills, digital literacy, and social skills (Edmonds & Smith, 2017).

Based on these research results, it can be said that as mobile learning can improve students' creative thinking, communication skills, collaboration skills, and other skills, which are parts of social-emotional learning, it can be assumed that mobile learning can improve the students' decision-making skill as well. This research aims to develop a concept and design of mobile learning to improve students' decision-making skills. Furthermore, it's regarded as a form of advancement in the development of mobile learning to improve students' skills in social-emotional learning. It's mainly because the design of mobile learning is attractive, modern, and enabling students to feel interested in learning. If students are interested in the learning, they take it because the media used are exciting and relevant; consequently, they will understand the material more easily and practise their decision-making ability as well.

Method

The research belongs to Research and Development. The development model used is the ADDIE model developed by Dick, Walter; Carey, Lou; Carey, James (2015). It consists of the analysis, design, develop, implement, and evaluation stages. This research aims to develop mobile learning to practice students' decision-making skill. As for now, this research is in the analysis and design stage. The researchers analyze the condition of the decision-making skill among 108 college students and make a design of mobile learning based on it. In the next stage, a mobile learning application will be developed, implemented, and evaluated. The steps utilized in this research is depicted through the following figure 1:
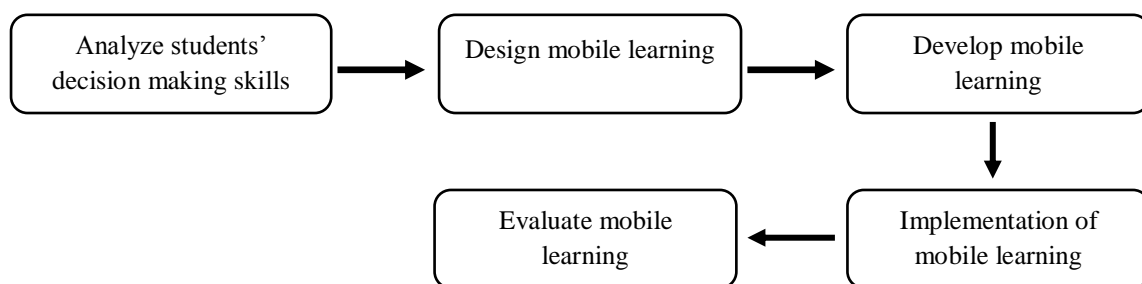

Figure 1. ADDIE models for mobile learning development

In addition, a meticulous literature study from various sources is also conducted to collect information about content that would be included in the intended mobile learning. Various aspects of decision-making ability and examples of decision-making cases as learning material are collected following the procedures:

Decision Making Skills
Decision making is the process of choosing a solution between two or more available choices. Decision making involves cognitive processes to choose a choice or desired action based on several alternatives that meet specific criteria (Wang & Ruhe, 2007). The decision-making process needs to be done with full consideration to achieve the desired goals. According to Huitt (1992), the decision-making process consists of 4 stages as follows:
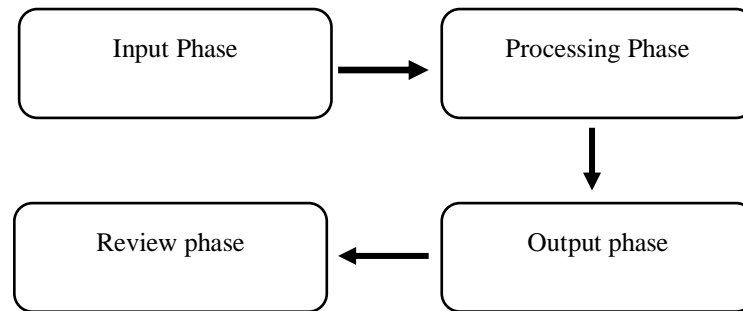
Figure 2. Decision-making process

1) Input phase, this phase is the phase of problem recognition and perception formation. In this phase, students need to understand a problem or situation that is being faced; 2) Processing phase, this phase is the core phase of decision making. Students have begun to make choices about decision choices and finally choose an option that suits the problem or situation at hand; 3) Output phase, in this phase, students can plan ways to implement the decisions that have been taken. Students can also plan strategies to carry out these decisions; 3) Review phase, this phase is the last after the decision is taken and carried out. Students can evaluate whether the decision is correct or it needs to be changed and adjusted to achieve the desired goals.

Based on these procedures, it can be concluded that the decision-making process does not stop until someone can choose from the various options available. Consequently, it is necessary to design a strategy to implement the decision and evaluate whether the decision follows the problem at hand or still needs to be fixed. In this research, this decision-making stage will be the basis for developing the intended mobile learning content.

Social-Emotional in Learning Questionnaire
The social-emotional learning questionnaire used in this study is a modified questionnaire developed by Zhou & Ee (2012). The questionnaire contains 25 self-awareness, social awareness, self-management, relationship management, and responsible decision-making skills. The social-emotional learning score is divided into five categories: very high, high, medium, low, and very low. The questionnaire is used as a pretest and posttest content in the mobile learning concept.

Data Analysis Technique
Pearson Product Moments analysis technique is used to analyze the validity and reliability of the questionnaire. After undergoing the validity and reliability test, it results in 20 valid items with a reliability score of 0.882.

Results and Discussion

The material in mobile learning is designed to improve the students' decision-making skill through the social and emotional learning process. The social and emotional learning process involves fostering social and emotional competence through explicit instruction and student-centred learning (Durlak et al., 2015). Meanwhile, student-centred learning aims to help students and give them direct access to various knowledge bases during the learning process and be directly involved in it. It also aims to develop the students' problem-solving, general competence, and social skills (Asoodeh et al., 2012). The following table shows the result of the questionnaire validity test on the students' social, emotional learning:

Table 1. Aspects of SEL Questionnaire

No.	Aspect	Number of items
1.	Self-Awareness	3 items
2.	Social Awareness	5 items
3.	Self-management	3 items
4.	Relationship management	4 items
5.	Responsible decision making	5 items
Total		20 items

Responsible decision making is one of the components of the social and emotional learning process, which refers to the ability to consider ethical, safety, and societal factors in making the decision (Zhou & Ee, 2012). Competence in this domain requires considering the risk and impact of the decision (Shah et al., 2016). Furthermore, steps are needed to evaluate the realistic consequences of various actions and consider personal well-being and mental health (Durlak et al., 2015).

The mobile learning application developed in this study contains three major parts: pretest, content, and posttest. In the first part, students are asked to fill in a pretest on decision-making abilities. The pretest is in the form of a questionnaire consisting of 15 questions. The purpose of giving the pretest is to find out the initial score of the students' decision-making ability. After that, the students will go on to the second part of the mobile learning design related to material and information about decision-making abilities. The material is presented in the form of videos and illustrations and supported by language which they easily understand. This is made in line with Almarabeh et al. (2015), stating that multimedia learning can increase interactions between students and teachers and make learning more attractive due to the innovation feature used. The condition can make students understand the material better because the learning process becomes more dynamic and fun. The details of the material in the intended mobile learning is as follows:

Table 2. Details of Content in Mobile Learning

Phase	Indicators	Methods
Input Phase	Recognizing problems or conditions that are not appropriate Recognize the type of problem/condition Identify the cause of the problem	Case study, narrative videos, illustrated images, podcasts
Processing Phase	Arrange alternative decisions Consider the benefits and risks of each decision Make decisions	Case study, narrative videos, illustrated images, podcasts
Output Phase	Develop strategies for implementing decisions Implement decisions that have been taken	Case study, narrative videos, illustrated images
Review Phase	Evaluate the results of applying decisions Change or maintain a decision that has been taken	Case study, narrative videos, illustrated images

The results of the development of these competencies are analyzed based on the decision making stages: (1) generating ideas and designs, teachers design specific information technology-based learning media by combining material and technology, (2) clarifying ideas, teachers considering the use of systematic technology-based learning media design based on the students' conditions and intended learning outcomes, (3) assessing the fairness of ideas, teachers have a belief that due to the aspects of validity, practicality, and effectiveness of the designed technology-based learning media, the media are considered appropriate to improve the students' interests and motivations in learning.

Stages and activities in responsible decision making consist of three stages: the pre-decision stage, differentiation, and consolidation. In the pre-decision stage, students acknowledge problems and identify alternative decisions. The next stage, which is the stage of differentiation, covers the steps taken by the students in (a) establishing criteria, (b) considering the severity of pros and cons, (c) assessing available information, (d) gathering more information, (e) testing information in the situation and (f) identifying new alternatives. Meanwhile, the consolidation stage, which is the final stage, includes students' skills in increasing confidence in decision making and minimizing remorse or harmful things from the impact of inappropriate decision making (Meyer, 2018). Murtafiah et al. (2019) et al. however, summarize the stages of decision making into three types: generating ideas, clarifying ideas, and evaluating the level of validity of ideas.

After learning the material about decision-making abilities, the students are asked to complete the exercises that have been prepared beforehand. In this stage, the students are given several case examples that need to be solved immediately. There is a time limit for each problem; if the students have successfully solved a case, they must solve the next case with a higher difficulty level. Final scores will be given after they have completed all cases. At this stage, the student's performance in solving the cases shows their performance in the decision-making process. Students' performance can particularly be seen when they conduct case analyses, critical power, and persuasive argumentation so that the decision-making is taken place appropriately. Fortunately, students' performance positively affects their academic achievement (Saputra, Supriyanto, Astuti, Ayriza, & Adiputra, 2020). In other words, it can be said that giving training in

the form of cases or games is expected to improve the students' decision-making abilities, which is in line with the opinion of Gozcu & Caganaga (2016), explaining that the use of learning methods that utilize games can improve students' abilities because the students feel happy and don't realize that they are learning the material.

The final step is filling in the posttest, in which the students are asked to fill in the decision-making questionnaire. This posttest aims to know and analyze the students' improvement after learning material and trying to make decisions through the cases provided. The posttest scores are compared with the pretest scores done in the first stage. Based on the posttest results, the students can find out the improvement of their abilities. The outlook of the mobile learning of the decision-making capabilities is shown below:

Figure 1. Pretest Decision-Making Skills

Figure 1 shows the first section of the intended mobile learning, which is the pretest of the decision-making skills. This test is conducted to determine the individual's initial ability before going on to the next stage: studying the material. The questions of the pretest are displayed one by one to the side in sequence. The results automatically come out after the participants do the pretest.

Figure 2. Decision-Making Content

Figure 2 shows the material about decision making the students should learn. The material is displayed with attractive illustrations so that the students can understand the presented material more efficiently.
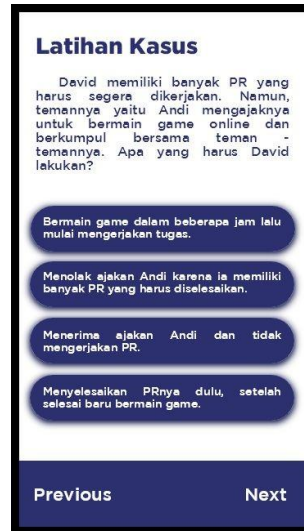
Figure 3. Case Study

Figure 3 presents the case study section. At this stage, the students are provided with some examples of various situations and problems in everyday life. The students are asked to make decisions based on the problems existing in the given situation. This case study section can improve the students' analytical skills to solve the problems, explore the selection of available decisions, and make the best decisions based on some decision alternatives.

Figure 4. Postest Decision-Making Skill

Figure 4 displays the posttest stage page, which contains one of the posttest questions regarding decision-making abilities. This test is conducted to determine each student's understanding after learning the material in the intended mobile learning. In its complete form, all questions are presented one by one in order. The result score will automatically come out after the student participants do the posttest. In addition, the score display is equipped with an attractive animation display such as presented in Fig 5 below:
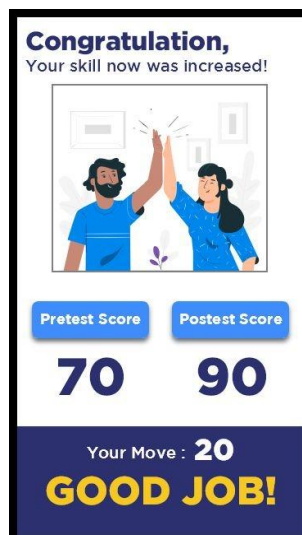
Figure 5. Students' skills evaluation

After completing the posttest, the students are provided with an evaluation score, as shown in figure 5. This feature contains a trace of the pretest and posttest scores they get. Using this, the students can access and review independently to find out the progress they make regarding their understanding and skills regarding decision-making abilities. The score display is arranged downwards and can be clicked easily to check the pretest and posttest scores. This feature can surely make the students easier in keeping up with the progress they make in developing their decision-making skills. This confirms the results of the research conducted by Elmorshidy (2012) researching perceived usefulness and perceived ease of use as predictors for intention and behaviours to use mobile learning. The use of the attractive visual animation in the score display, it's merely used to give more visual support to the score display. The use of this feature follows the results of the study conducted by Cahyana et al. (2020), which concluded that text, animation, and video in mobile learning could help students improve their knowledge. Furthermore, the concept of using animation in mobile learning is also following the results of the study by Wijaya & Abbas (2018), highlighting that animation is an effective strategy to provide an exciting way of learning.

In the context of Guidance and Counseling, the use of animation functions similarly in which it's utilized to make students more interested in their learning. This is based on the results of the study by Veronica et al. (2020), which recommended that Guidance and Counseling teachers should devise strategies to provide innovative services by utilizing technology, including using animations. Concerning the urgency to fulfil the needs of the students in improving their decision-making abilities, the development of mobile learning applications is an appropriate alternative at this time. This is relevant to the study conducted by Cavus & Uzunboylu (2009), which stated that mobile learning can increase students' soft skills. Furthermore, mobile learning is highly expected to be one of the promising media in providing Guidance and Counseling services to prepare students with the decision-making skills needed in the industrial revolution 4.0. This is following the study results conducted by Edmonds & Smith (2017) confirming that mobile learning can enhance the learning experience, including communication, collaboration, and social skills, which is one of the components of social-emotional learning (Jarvela, 2011). Students must have the ability to build and maintain positive relationships, make responsible decisions, and involve in various social situations (Frey et al., 2019). The use of mobile learning can increase students' decision making in their social, emotional learning. As for this research, it's still in its initial stages of designing and preparing the material content. Therefore, mobile learning in this study is only intended for the scope of the target school. Future research is expected to be able o develop mobile learning in other aspects of social-emotional learning and implement the media in a broader area.

Conclusion

Mobile learning can be used as one of the strategies for Guidance and Counseling teachers to help develop the students' decision-making abilities. This research tries to design mobile learning, consisting of 3 major parts: pretest, content, and posttest. The pretest and posttest parts cover the SEL questionnaire

containing 20 question items. These items have undergone the validity and reliability test procedures. The designed mobile learning intends to gradually improve students' decision-making skills, starting from the input and processing phases, output, and review phases. All of the contents are related to decision-making and presented through videos, texts, animations, illustrated images, case studies, and cases/games to give students a better understanding of decision-making skills and improve their skills. This research provides an advancement in the field of mobile learning development, supporting previous research on mobile learning development to improve the students' understanding of school subjects such as biology (Aripin, 2018), mathematics (Yuliani, 2010) and geography (Rahmawati & Mukminan, 2018). This research also provides additional strategies to improve social-emotional learning skills, especially in the decision making aspects, which practically complements the previous related researches that develop mobile learning to improve creative thinking and social skills in social-emotional learning (Edmonds & Smith, 2017). The use of media in this study is only intended for the scope of the target school. Future research is expected to be able o develop mobile learning in other aspects of social-emotional learning and implement the media widely so that it can be generalized.

References

Almarabeh, H., Amer, E. F., & Sulieman, A. (2015). The Effectiveness of Multimedia Learning Tools in Education. *International Journal of Advanced Research in Computer Science and Software Engineering*, *5*(12), 761–764.

Aripin, I. (2018). Mobile Learning Sebuah Aplikasi Teknologi Pembelajaran Biologi. *Bio Educatio Journal*, *3*(1), 01–09.

Asoodeh, M. H., Asoodeh, M. B., & Zarepour, M. (2012). The Impact of SStudentcentredLearning on Academic Achievement and Social Skills. *Procedia - Social and Behavioral Sciences*, *46*, 560–564. https://doi.org/10.1016/j.sbspro.2012.05.160

Astuti, B., Lestari, R., & Bhakti, C. P. (2020). Student problem-focused-coping ability for reducing technostress in higher education. *International Journal of Advanced Science and Technology*, *29*(7), 558–564.

Astuti, Budi, Lestari, R., & Bhakti, C. P. (2019). Student decision-making ability as a preparation for facing the industrial revolution 4.0. *International Journal of Scientific and Technology Research*, *8*(10), 1200–1204.

Bhakti, C. P., & Rahman, F. A. (2020). Android application development of exploration career based on Multiple Intellegence: A model hypothetical. *Journal of Physics: Conference Series*, *1470*(1). https://doi.org/10.1088/1742-6596/1470/1/012043

Bhakti, Caraka Putra, & Ghiffari, M. A. N. (2018). Blended Learning: Alternative Method Of Core Curriculum To Improve 21th Century Student�s Creative Thinking Skills. *International Colloquium: Opportunities and Challenges on Education Management in 21st Century*, *1*(1), 125–130.

Cahyana, U., Septian, I., & Erdawati, E. (2020). the Effect of Mobile Learning and Learning Styles on Students' Scientific Literacy in Salt Hydrolysis Concept. *JTK (Jurnal Tadris Kimiya)*, *5*(2), 252–260. https://doi.org/10.15575/jtk.v5i2.9087

Cavus, N., & Uzunboylu, H. (2009). Improving critical thinking skills in mobile learning. *Procedia - Social and Behavioral Sciences*, *1*(1), 434–438. https://doi.org/10.1016/j.sbspro.2009.01.078

Dick, Walter; Carey, Lou; Carey, J. O. (2015). *The Systematic Design of Instruction*. London: Pearson Education Inc.

Dolot, A. (2018). The characteristics of Generation Z. *Journal E-Mentor*, *2*(74), 44–50. https://doi.org/10.15219/em74.1351

Durlak, J., Weissberg, R., Domitrovich, C., & Gullotta, T. (2015). *Handbook of Social and Emotional Learning: Research and Practice*. New York: Guilford Press.

Dwidienawati, D., & Gandasari, D. (2018). Understanding Indonesia's generation Z. *International Journal of Engineering and Technology(UAE)*, *7*(3), 250–252. https://doi.org/10.14419/ijet.v7i3.25.17556

Edmonds, R., & Smith, S. (2017). From playing to designing: Enhancing educational experiences with location-based mobile learning games. *Australasian Journal of Educational Technology*, *33*(6), 41–53. https://doi.org/10.14742/ajet.3583

Elfeky, A. I. M., & Yakoub Masadeh, T. S. (2016). The Effect of Mobile Learning on Students' Achievement and Conversational Skills. *International Journal of Higher Education*, *5*(3), 20–31. https://doi.org/10.5430/ijhe.v5n3p20

Elmorshidy, A. (2012). Mobile learning–a new success model. *The Journal of Global Business Management*, *8*(02), 18–27.

Engelman, D., Feuerborn, L., Gueldner, B., & Tran, O. (2016). *Merrell's Strong Teens Grades 9-12: A Social and Emotional Learning Curriculum*.

Frey, N., Fisher, D., & Smith, D. (2019). All Learning Is Social and Emotional : Helping Students Develop Essential Skills. *Alexandria: ASCD Publisher.*

Gozcu, E., & Caganaga, C. K. (2016). The importance of using games in EFL classrooms. *Cypriot Journal of Educational Sciences*, *11*(3), 126. https://doi.org/10.18844/cjes.v11i3.625

Harris, J. L., Al-Bataineh, M. T., & Al-Bataineh, A. (2020). One to One Technology and its Effect on Student Academic Achievement and Motivation. *Contemporary Educational Technology*, *7*(4), 368–381. https://doi.org/10.30935/cedtech/6182

Higgins, K., Huscroft-D'Angelo, J., & Crawford, L. (2019). Effects of Technology in Mathematics on Achievement, Motivation, and Attitude: A Meta-Analysis. *Journal of Educational Computing Research*, *57*(2), 283–319. https://doi.org/10.1177/0735633117748416

Huitt, W. G. (1992). Problem Solving and Decision Making: Consideration of Individual Differences Using the Myers-Briggs Type Indicator. *Journal of Psychology Type*, *24*, 33–44.

Jarvela, S. (2011). *Social-Emotional Aspects of Learning* (1st ed.). Elsevier.

Kamasi, N. V. V., & Saruan, T. J. (2020). Mobile Learning (M-Learning) Based Learning Application Design for Elementary School Students. *Jurnal Ilmiah Sains*, *20*(2), 70. https://doi.org/10.35799/jis.20.2.2020.27877

Kurniawan, H. (2017). Media Pembelajaran Mobile Learning Menggunakan Android (Studi Kasus : Jurusan Sistem Informasi IIB Darmajaya). *Explore: Jurnal Sistem Informasi Dan Telematika*, *8*(1). https://doi.org/10.36448/jsit.v8i1.866

Maryani, I., Putri, D. R., Urbayatun, S., Suyatno, & Bhakti, C. P. (2020). Metacognition and integrated-project based learning (I-PjBL) in elementary schools. *Universal Journal of Educational Research*, *8*(3), 1046–1054. https://doi.org/10.13189/ujer.2020.080339

Mehdipour, Y., & Zerehkafi, H. (2013). Presence and the Eucharistic Presence. *International Journal of Computational Engineering Research*, *3*(6), 93–101.

Meyer, H. (2018). Teachers' thoughts on student decision making during engineering design lessons. *Journal Education Sciences*, *8*(9), 1–11. https://doi.org/10.3390/educsci8010009

Murtafiah, W., Sa'dijah, C., Chandra, T. D., & Susiswo, S. (2019). Decision making of the winner of the national student creativity program in designing ICT-based learning media. *TEM Journal*, *8*(3), 1039–1045. https://doi.org/10.18421/TEM83-49

P. O. SKobelev, & Borovik, S. Y. (2017). On the Way From Industry 4 . 0 To Industry 5. 0. *International Scientific Journal "Industry 4.0,"* *2*(6), 307–311. https://stumejournals.com/journals/i4/2017/6/307/pdf

Rahmawati, E. M., & Mukminan, M. (2018). Pengembangang m-learning untuk mendukung kemandirian dan hasil belajar mata pelajaran Geografi. *Jurnal Inovasi Teknologi Pendidikan*, *4*(2), 157. https://doi.org/10.21831/jitp.v4i2.12726

Riswanto, A., & Aryani, S. (2017). Learning motivation and student achievement : description analysis and relationships both. *COUNS-EDU: The International Journal of Counseling and Education*, *2*(1), 42. https://doi.org/10.23916/002017026010

Rojko, A. (2017). Industry 4.0 concept: Background and overview. *International Journal of Interactive Mobile Technologies*, *11*(5), 77–90. https://doi.org/10.3991/ijim.v11i5.7072

Saputra, W. N. E., Supriyanto, A., Astuti, B., Ayriza, Y., & Adiputra, S. (2020). The effect of student perception of negative school climate on poor academic performance of students in Indonesia. *International Journal of Learning, Teaching and Educational Research*, *19*(2), 279–291. https://doi.org/10.26803/ijlter.19.2.17

Saputra, W. N. E., Supriyanto, A., Astuti, B., Ayriza, Y., Adiputra, S., da Costa, A., & Ediyanto. (2020). Peacecounsellingg approach (PCA) to reduce negative,e aggressive behaviour of students. *Universal Journal of Educational Research*, *8*(2), 631–637. https://doi.org/10.13189/ujer.2020.080236

Schwieger, D., & Ladwig, C. (2018). Reaching and Retaining the Next Generation: Adapting to the Expectations of Gen Z in the Classroom. *Information Systems Education Journal*, *16*(3), 45–54.

Shah, L. A., Etienne, A., Siadat, A., & Vernadat, F. (2016). Decision-making in the manufacturing environment using a value-risk graph. *Journal of Intelligent Manufacturing*, *27*(3), 617–630. https://doi.org/10.1007/s10845-014-0895-6

Shahsavarani, A. M., & Azad Marz Abadi, E. (2015). The Bases, Principles, and Methods of Decision-Making: A Review of Literature. *International Journal of Medical Reviews*, *2*(1), 214–225.

Singh, A. (2014). Challenges and Issues of Generation Z. *IOSR Journal of Business and Management*, *16*(7), 59–63. https://doi.org/10.9790/487x-16715963

Sulisworo, D. (2019). *Teori dan praktek mobile collaborative learning*. Yogyakarta: Markumi. http://eprints.uad.ac.id/15870/1/Buku_MobileCollaborativeLearning.pdf

Tokan, M. K., & Imakulata, M. M. (2019). The effect of motivation and learning behaviour on student

achievement. *South African Journal of Education*, *39*(1). https://doi.org/10.15700/saje.v39n1a1510

Wang, Y., & Ruhe, G. (2007). The Cognitive Process of Decision Making. *International Journal of Cognitive Informatics and Natural Intelligence (IJCINI)*, *1*(2), 73–85. https://doi.org/10.4018/jcini.2007040105

Wijaya, H., & Abbas, R. A. (2018). Animation effectiveness for E-learning with progressive web APP approach: A narrative review. *International Journal of Engineering and Technology(UAE)*, *7*(4), 112–120. https://doi.org/10.14419/ijet.v7i4.11.20785

Williams, K.C; Williams, C. C. (2011). Five key ingredients for improving student motivation. *Research in Higher Education Journal*, Vol.*12*, pp. 1–23. https://scholarsarchive.library.albany.edu/cgi/viewcontent.cgi?article=1000&context=math_fac_scholar

Wiretna, C. D., Saputra, W. N. E., Muarifah, A., & Barida, M. (2020). Effectiveness of solution-focused brief counselling to reduce online aggression of student. *Universal Journal of Educational Research*, *8*(3), 1092–1099. https://doi.org/10.13189/ujer.2020.080344

Yuliani, R. E. (2010). Pengembangan Mobile Learning (M-Learning) Sebagai Model Pembelajaran Alternatif Dalam Meningkatkan Minat Dan Kemampuan Siswa Terhadap Matematika. *Jurnal Pendidikan MIPA*, *1*(1), 52–61.

Zhou, M., & Ee, J. (2012). Development and validation of the social-emotional competence questionnaire (SECQ). *International Journal of Emotional Education*, *4*(2), 27–42. www.enseceurope.org/journal