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Interactive Mobile Learning-Based Gamification to Improve the Collaboration Skills of 11th Grade Students in High School

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ABSTRAK

Penanaman multikulturalisme dan sikap gotong-royong masyarakat dalam menjaga integrasi Bangsa dapat dilakukan melalui proses pembelajaran Sosiologi. Namun, proses pembelajaran Sosiologi yang terjadi tidak terlaksana dengan optimal. Sehingga, keterampilan kolaborasi sebagai keterampilan dasar dalam membangun knowledge society abad 21 tidak tercapai. Hal ini terlihat pada bentuk-bentuk interaksi peserta didik yang masih mementingkan kepentingan pribadi dari pada kelompok dalam mencapai tujuan bersama. Hal ini terjadi pada mata pelajaran Sosiologi kelas XI SMA. Berdasarkan pada permasalahan tersebut, maka dibutuhkan suatu penelitian yang bertujuan untuk mengoptimalisasi proses pembelajaran Sosiologi melalui pengembangan dan elaborasi media mobile learning berbasis gamifikasi dalam meningkatkan keterampilan kolaborasi. Penelitian ini merupakan jenis penelitian pengembangan (R&D). Media mobile learning berbasis gamifikasi tersebut diujicobakan menggunakan pendekatan static group comparisen design pada kelas eksperimen dan kelas pembanding. Hasil pengujian tersebut ialah kelas eksperimen mendapatkan nilai 82.66 dan kelas pembanding mendapatkan nilai 67.40. Hal ini berarti bahwa terjadi perbedaan rata-rata dimana kelas eksperimen lebih unggul 15.26 point atau lebih unggul 22.63% dari pada kelas pembanding. Hasil uji-t menunjukan produk media mobile learning berbasis gamifikasi efektif dalam meningkatkan keterampilan kolaborasi. Disimpulkan bahwa media mobile learning yang dikembangkan dinyatakan layak untuk digunakan dan efektif dalam meningkatkan keterampilan kolaborasi peserta didik kelas XI SMA.

ABSTRACT

Instilling multiculturalism and a community attitude of cooperation in maintaining national integration can be done through the Sociology learning process. However, the Sociology learning process that occurred have not been carried out optimally. Thus, collaboration skills as an essential skill in building a 21st-century knowledge society need to be achieved. It can be seen interaction between students who still prioritize personal interests rather than group interests to attain common goals. This happened in the Sociology subject in class XI high school. Based on these problems, this research aimed at optimizing the Sociology learning process through the development and elaboration of gamification-based mobile learning media to improve collaboration skills. This research was a development research (R&D). The gamification-based mobile learning media was tested using a static group comparison design approach in the experimental class and comparison class. The test results were that the practical course scored 82.66, and the comparison class scored 67.40. It indicated that, there were an average difference where the experimental type was 15.26 points superior or 22.63% premium to the comparison class. The t-test results showed that gamification-based mobile learning media products improved collaboration skills. It was concluded that the mobile learning media developed is suitable for use and effective in enhancing the collaboration skills of class XI high school students.

1. INTRODUCTION

Indonesia is a country full of diversity as a necessity by God's grace. This diversity is united by its motto "*Bhineka Tunggal Ika*" which means "Different But Still One" (Nugraha, 2019; Putri & Dewi, 2021). The diversity of Indonesia includes the diversity of culture, ethnicity, language, and many others (Martono et al., 2022; Trixie, 2020). The diversity that exists in Indonesia creates multiculturalism in society. Multiculturalism is a situation in which all different cultural or racial groups within a society have the same rights and opportunities, and none are ignored or considered unimportant (Sudargini & Purwanto, 2020; Ulfa et al., 2021). Multiculturalism provides an illustration of how certain societies coexist with cultural diversity. However, this diversity can lead to social dynamics in society. There is the potential for friction or clashes in society due to differences (Fabricius et al., 2017; Mahfud et al., 2018). Especially in modern civilization, which is very fast, there is an increased possibility of provocations and clashes that disrupt the integration of the Indonesian (De

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Zarobe & De Zarobe, 2018; Suradi, 2018). This phenomenon is a challenge for the people of Indonesia in maintaining the unity and integration of the nation. Therefore, in order to be able to answer these challenges, the Indonesian people must build a knowledge society, which is very fast, and there is an increased possibility of provocations and clashes that disrupt the integration of the Indonesian (Ashour, 2020; Ashour & Fatima, 2016). A knowledge society is one in which a society is aware of the importance of knowledge as a provision to face the challenges of the 21st century (Lungu, 2021; Nisbett, 2020). The knowledge society creates a society that is smarter in dealing with all situations and conditions, is not easily provoked, is more open to change, and becomes more aware of information whose truth is not yet known (Gallardo-Echenique et al., 2015; Janssen et al., 2013). One method that can be used to foster a knowledge society is through education. Education is important in preparing students to enter society as agents of change (Laksana, 2021; Thach et al., 2018). Education can be used as a means to build 21st century skills as a provision in realizing an intelligent society in the 21st century. 21st century, or 4C, skills include critical thinking, communication, collaboration, and creativity (Ramdani et al., 2021; Smith, 2020). These 21st century skills can be taught through a learning process.

Four types of 21st century skills are very important in realizing a knowledge society, but collaboration skills are very relevant in maintaining multiculturalism and national integration. Collaboration skills are oriented towards mutual cooperation or mutual assistance with one another (Anton & Trisoni, 2022; Santoso et al., 2023). Collaboration skills are skills used in participating in any activity that involves groups to build mutual social relations, respect, and cooperation in achieving goals (Geisinger, 2016; Le et al., 2018). These collaboration skills can foster social harmony and help maintain multiculturalism in society. Collaboration skills consist of five indicators, which include actively contributing, working productively, showing flexibility and compromise, showing responsibility, and showing respect (Hamida & Desnita, 2021; Soulé & Warrick, 2015). The learning process can be used to realize students' collaboration skills through relevant learning contents such as those in Sociology, especially the learning content of social harmony (Nnebedum, 2019; Ratama et al., 2021). Learning the content of social harmony teaches students an understanding of multiculturalism so they can understand diversity in Indonesia. Social harmony is part of phase F in the subject of Sociology in the 11th grade of high school. The purpose of this phase is to build an attitude of mutual cooperation and cooperation in realizing collaboration between students. However, the fact is that the practice of the Sociology learning process does not run optimally, as seen from the non-achievement of the learning objectives. This can be seen in the attitudes of students, who show a lack of forms of interaction and cooperation among themselves. This phenomenon indicates the low collaboration skills of students. Other research shows the low collaboration skills that occur in vocational high schools in Sukoharjo City, which are indicated by not being able to contribute to each other in groups, a lack of coordination, and others caused by non-optimal learning processes (Rochmiatun, 2017; Sidi, 2020). In addition, there is research that shows low collaboration skills due to the learning process of building collaboration skills being hampered by many factors that occur in the 11th grade for students of Light Vehicle Engineering in vocational high school 1 in Sanaman city (García, 2016; Mawaddah et al., 2021).

There is other research that shows concern about the collaboration skills of students at the 10th grade high school in Bandar Lampung city, so it is necessary to produce products that can improve students' collaboration skills again (Saepuloh et al., 2021; Tam, 2018). This phenomenon also occurs in high schools in Sragen City. The non-optimality of the Sociology learning process, especially in the learning content, has the impact on students' collaboration skills. This is shown in the decreasing levels of interaction and forms of collaboration and mutual cooperation among students. In fact, students show different forms of opinion, from each other's egocentrism to the difficulty of communicating. This indicates that collaboration skills are still not well embedded. In addition, the researcher conducted pre-research to find out the initial collaboration skills of 91 students in the 11th grade at Sragen City High School by random sampling. The pre-research data shows that only 8 students, or 9%, have poor collaboration skills. The majority, with a total of 50 participants, or 55%, are quite collaborative. While those included in the collaborative-very collaborative category only amounted to 32 students, or 36%. The average of all scores obtained is only 56, which is included in the quite collaborative category. This shows that the less-than-optimal impact of the learning process affects students' collaboration skills. The optimization effort that can be made in the Sociology learning process is to increase the role of the learning components. Optimal elaboration of learning components can increase effectiveness in achieving learning objectives (Salwah & Ashari, 2016; Tofade et al., 2013). Elaborating precisely on content, models, and learning media in Sociology learning is an alternative solution to solving this problem. The problem of a non-optimal sociology learning process has a big impact if it is not addressed. This has an effect on national integration. In fact, national integration continues to experience attacks from various aspects, especially globalization. One aspect that can maintain this integration is the sociology learning process. Thus, this research is urgently needed in order to maintain the values of national integration.The learning models are divided into four groups, which include: (1) information management learning models; (2) personal learning models; (3) social learning models; and (4) behavioral learning models. Each type of learning model has its own purpose. As an example of a type of social learning model that aims to improve social skills among students by using a group

collaboration approach (Notari et al., 2014; Olsson et al., 2020). One of the learning models for social learning is the gamification model. Gamification is a learning model that uses approaches to game elements with the aim of arousing student motivation and participation by providing an enjoyable and engaging learning experience (Buckley & Doyle, 2016; Oliveira et al., 2023). The gamification model is a derivative of the Team Games Tournament (TGT) learning model. The TGT learning model is one of the various collaborative learning models that focus on the process of cooperation between students (Kamaruddin & Yusoff, 2019; Zakaria et al., 2013).

The TGT model involves collaboration between students in one group in solving tournaments in the form of games in learning activities (Muttaqien et al., 2021; Panggabean et al., 2021). Gamification is a form of TGT that utilizes academic tournaments and digital media such as mobile learning in a learning activity. So, it is very suitable to use the gamification model to improve students' collaboration skills. The gamification learning model requires a learning media that supports the process of implementing the tournament so that a form of collaboration is achieved with students. So, a mobile-based learning media was chosen. Mobile learning is a learning term that focuses on learning activities using mobile devices that accommodate multimedia delivery (Criollo-C et al., 2021; Göksu & Atici, 2013). Mobile learning refers to the use of handheld and mobile information technology devices such as Personal Digital Assistants (PDAs), smartphones, laptops, and tablets designed to support the learning process. The main advantage of mobile learning is that it focuses on student interaction and learning media (Hamidi & Chavoshi, 2018; Sönmez et al., 2018). The use of interactive mobile learning is very suitable to be combined with a collaboration-based learning model. Thus, mobile learning is very relevant when combined with gamification based on team game tournaments for improving students' collaboration skills.Literature studies related to the recent development of mobile learning-based gamification show that it is increasingly being accepted as a useful learning tool for producing a more interesting learning environment, increasing motivation and learning participation (Poondej & Lerdpornkulrat, 2020; Saleem et al., 2022). Other research also shows that the elaboration between gamification and digital-based learning tools can encourage meaningful learning and student involvement so as to increase collaboration between students.

Based on the description of the problem of low collaboration skills in 11th grade students at a high school in Sragen City, this will become very serious if it is not addressed immediately because it has an impact on the values of social integration among students. So that the solution to this problem becomes an urgency for the need for a solution through a product development approach that can overcome these problems. Through from relevance of the instructional component between mobile learning media and gamification models being alternative solution of this problem. So, this development research aims to produce mobile learning that is elaborated with gamification in a personalized manner for 11th grade students in high school in Sragen city in Sociology learning. Elaborating mobile learning and gamification into a single unit of learning to become a specific novelty value. Other researchs have only demonstrated the feasibility level of a stand-alone product, while this research simultaneously combines mobile learning and gamification through experimental testing. This is a novelty in sociology learning, specifically carried out in Indonesia. Solving this problem is a solution to the low sociology learning outcome among high school students and strengthens the value of national integration.

2. METHOD

This research is development research (R&D), which produces gamification-based mobile learning media for Sociology learning. The research design used was the True Experiment Static Group Comparison Design which aimed to determine the effectiveness of mobile learning media in improving students' collaboration skills in learning Sociology especially in learning content about social harmony, in the 11th grade of high school. The subjects of this research were students in the 11th grade at a high school in Sragen City, which consisted of 64 students divided into an experimental class and a comparative class. The sampling technique used was purposive sampling, with the aim of producing a heterogeneous group sample with a certain number. The research instrument used was a non-test instrument in the form of an observation sheet containing 10 criteria indicators filled in by the observer. The 10 indicators are an elaboration of 5 aspects of collaboration skills, which include (1) active contribution; (2) productivity; (3) flexibility and compromise; (4) responsibility; and (5) respect for one another (Laksana, 2021; Soulé & Warrick, 2015). The development model used was a reliable model, which consisted of 3 stages: (1) a pre-research, (2) product producting and (3) product testing. The first stage of the Sukmadinata model was pre-research, which was divided into two parts, namely a literature study and an observation study. Literature study was related to the search for ideas, relevant theories, and the concept of innovation. While observation studies were conducting analysis and observations on the learning process of Sociology, students and teachers in high school in Sragen City. The second stage was product, research instruments, and learning designs. All parts produced in the second stage would be used in the third stage. The third stage was testing carried out by experts to determine the level of product validity and by research subjects to determine the level of effectiveness of the product. Expert testing uses a validity instrument

in the form of a closed criteria questionnaire. Whereas in the experiment using non-observation test instruments made based on collaboration skills indicators formulated by Greenstein (Laksana, 2021; Soulé & Warrick, 2015). The following is a grid of expert testing instruments that have been presented in Table 1, Table 2, and Table 3.

Table 1. The Grid of Learning Media Validation Questionnaire for Learning Content Experts

Aspect	Indicator
Software	Maintainable (easily maintained)
	Usable (easy to use and operate)
	Compatible (easy to operate on various devices)
	Operasional Instruction (installation and operating instructions)
	Reusable (product can be developed again with a better version)
Visual Communication	Communicative (way of delivering messages can be received by users easily)
	Navigation (navigation buttons that are easy to use and understand)
	Audio (narration, sound effects, backsound, appropriate and relevant music)
	Visual (design layout, typography, colors)
	Animation and picture inside

(Wahono, 2006)

Table 2. The Grid of Learning Media Validation Questionnaire for Learning Media Experts

Aspect	InIndcator
Instructional Design	The suitability of the contents presented in the learning media with basic competencies, indicators, and learning objectives
	The suitability of the presentation of the learning content with the media used
	Contextuality in connecting the content presented with everyday life
	The accuracy of the use of terms and symbols in the content presented
	The suitability of the content presented and the cognitive level of students
	The learning content inside in the media can motivate learning
Language	The use of Indonesia language according to national Indonesian writing standards
	The use of language that does not lead to multiple interpretations

(Wahono, 2006)

Table 3. The Grid of Collaboration Skills Observation Sheet

Aspect	Indicator
Contribution	Participate and contribute actively both in group discussions and decision making
Work Productively	Work productively with group members
Flexibility and Compromise	Flexibility and compromise within the group
	Decision-making skills based on different perspectives
	Work collaboratively with group members
Responsibility	Responsible together to complete the work in groups
	Committed to prioritizing group goals
Respect	Matching the tasks and work of each group member and respecting differences of opinion
	Appreciate the contribution of each group member
	Respectful attitude in group discussions

(Greenstein, 2012)

The expert test instrument used answer choices on a Likert scale with four levels: (1) Strongly Agree, (2) Agree, (3) Disagree and (4) Strongly Disagree. The data processing used was descriptive quantitative percentage analysis with the formula approach from Arikunto (Arikunto, 2021). The results of the analysis are matched with the table of criteria for the level of media validity that has been presented in Table 4.

Table 4. Criteria for Validity Level of Learning Media

Category	Percentace	Qualification	Desctiption
A	81%-100%	Valid	Decent
B	61%-80%	Valid Enough	Decent
C	41%-60%	Invalid	Not Decent
D	<40%	Invalid	Not Decent

(Arikunto, 2021)

The non-test observation instrument was carried out by three observers for each individual student in the group. The instrument contains five criteria for collaboration skills, which are divided into equal amounts. The results of the observational calculations are matched with the collaboration skill level table that has been presented in Table 5.

Table 5. Criteria For Collaboration Skill Level

No	Score Range	Desctiption
1	$80 < x \geq 100$	Very Good
2	$60 < x \leq 80$	Good
3	$40 < x \leq 60$	Acceptable
4	$20 < x \leq 40$	Poor
5	$0 < x \leq 20$	Very Poor

(Widoyoko, 2009)

3. RESULT AND DISCUSSION

Result

The development model used was the Sukmadinata model, which was divided into three stages, namely observation, product production, and product testing. At the observation stage, an analysis was carried out on 11th-grade high school students in Sragen City. The following are the results of the analysis of student characteristics that have been presented in Table 6.

Table 6. Learner Characteristics

Category	Description
Level	11^{th} grade of several high school in Sragen city
Number of Students	96 students
Age	±17 years old
Learning Style	• 58,82% of students have visual learning style, • 16,47% of students have auditory learning style, • 24,71% of students have kinesthetic learning style.
Digital Technology Using Ability	100% of students have personal smartphone and proficient in using the internet
Response to Interactive Digital Learning Media	• 72% of students need digital learning media to help with learning, • 82% of student interested to try interactive-digital learning media in learning.

In addition to analyzing students, it is necessary to analyze the components of instructional design to determine the relevance of each component. The instructional design was made according to the "Kurikulum Merdeka", which is the current curriculum in Indonesia. The following are the instructional designs that have been presented in Table 7.

Table 7. *Instructional Design*

Category	Description
Learning Subjects	Sociology
Learning Content	Phase E – Social Harmony: 1. Definition of social harmony 2. Equality and the principle of equality 3. Factors that affect social harmony 4. Ways to create a harmonious social life 5. Examples of the application of social harmony
Learning Model / Method	Gamification
Learning Media	Mobile Learning
Learning Goal	Encourage collaboration skills in students through Sociology learning in social harmony learning content using gamification-based mobile learning

Based on the data that have been presented in Table 7 shows that elaborating the instructional design components can produce optimal learning for achieving the goal of fostering collaboration skills. Sociology learning content on social harmony is the basis for strengthening social relations and interaction between students. Gamification learning models and mobile learning media can improve student interaction in heterogeneous teams by solving each challenge collaboratively. The concept of instructional design is embodied in the development of mobile learning media based on gamification in Sociology learning. The following is a description of the resulting media can be seen in Table 8.

Table 8. Mobile Learning

Category	Description
Media Type	Digital-based learning media on mobile devices
Purpose	Producing mobile learning media that contains social harmony in Sociology learning for 11th grade high school students that is effective in improving collaboration skills
Format	*Mobile Application*
Interactivity	Students can use this media in collaborative gamification learning
Tools	Smart Apps Creators & CorelDraw

This mobile learning was tested for its validity using an expert judgment approach. Testing by this expert was followed by testing by two other categories of experts, namely learning media experts and learning content experts. Each expert consists of 2 experts, for a total of 4 experts. The validity level measurement instrument uses a closed measurement instrument based on the principles of multimedia learning developed by Lee and Owen. The instrument used has a scale of 4 choices from strongly disagree (1) to strongly agree (4). The following are the results of testing the level of media validity using quantitative descriptive analysis of percentages that have been presented in Table 9.

Table 9. Learning Media Validity Test Results By Learning Media Experts

Expert	Score	Percentace	Category	Description
Learning Media Expert 1	3.47	86.76%	4	Valid
Learning Media Expert 2	3.24	80.88%	4	Valid
Learning Content Expert 1	3.45	86.36%	4	Valid
Learning Content Expert 2	3.27	81.82%	4	Valid
Mean of Learning Media Expert Score	3.35	83.82%	4	Valid
Mean of Learning Content Expert Score	3.36	84.09%	4	Valid

The results of data analysis presented in Table 9 show that learning media experts provide a total score with an average of 3.35 or 83.82%, which is classified as category A or valid. Whereas the learning content experts give a total score with an average of 3.36 or 84.09%, which is classified as category A or valid. So, it can be concluded that the product mobile learning is declared valid in terms of media aspects and learning content. After the product is declared valid, it can be tested using an experimental approach. The approach used is a Static Group Comparison Design in the experimental class and a comparison class to be compared using the group performance analysis method. The following data results obtained in the testing process can be seen in Table 10.

Table 10. Mean of Result of Collaboration Test and Each Indicators of Collaboration Skill

Category	Experiment Class	Comparison Class	Deviation	Persentage
Score Mean	82.66	67.40	15.26	22.63%
Indicator of Contribution	86.61	49.01	37.60	76.7%
Indicator of Productivity	85.93	52.13	33.80	64.8%
Indicator of Flexible & Compromise	83.69	74.16	9.53	12.8%
Indicator of Responbility	77.08	83.95	-6.87	-8.18%
Indicator of Respect	80	77.76	2.23	2.8%

Analysis of the results of the collaboration skills test showed an average deviation of 15.26 points, or 22.63%. This means that the treatment given to the experimental class in the form of using gamification-based mobile learning media is more effective in improving collaboration skills than the comparison product in the comparison class. Based on testing on each indicator of collaboration skills, it shows that the experimental class is better on 4 indicators of collaboration skills, namely active contribution indicators are superior by 15.26

points, indicators of productive work are superior by 37.60 points, indicators of flexibility and compromise are superior by 9.53 points, and indicators of respect are superior by 2.23 points. However, the responsibility indicator shows the superior comparison class with a deviation of 6.87 points. This is presumably because responsibility is not influenced by learning media but rather comes from the awareness of students. In addition to being descriptive, comparisons were made using the Independent Sample T-Test on the post-test results of the experimental class and the comparison class. However, before the test is carried out, it is necessary to first carry out a homogeneity test and a normality test as a pre-requisite test.

Table 11. Normality and Homogenity Test

Category	Sig. Score	Condition	Description
Normality Test on Experiment Group	0.169	> 0,05	Normal
Normality Test on Comparison Group	0.705	> 0,05	Normal
Homogenity Test	0.301	> 0,05	Homogeneous

The data presented in Table 11 show that the data is normally distributed and homogeneous. This means that the data can be tested using the Independent Sample T-Test. Here are the test results:

Table 12. Independent Sample T-Test

Independent Sample T-Test	Sig. (2-Tialed)	Condition	Description
Equal Variances Assumed	0.000	< 0,05	Difference
Equal Variances Not Assumed	0.000	< 0,05	Difference

Based on the description of the results of the Independent Sample T-Test that has been presented in Table 12, it shows that the equal var and not equal var show a sig value of 0.000, which means that there is a difference in the average value between the post-test of the experimental class and the comparison class. So, the conclusion from the entire test above is that based on the test results using the Independent Sample T-Test, it shows that there is an average deviation between the two classes. This deviation is indicated by a positive score, namely that the deviation between the experimental class and the comparison class is 15.26 points. The conclusion is that gamification-based mobile learning products in Sociology learning are 22.63% more effective than comparison products at improving the collaboration skills of students in 11th grade high school in Sragen City.

Discussion

Indonesia, with its cultural diversity, is united by a unified motto, namely "*Bhineka Tunggal Ika*" which functions as an instrument that maintains national integration (Nugraha, 2019; Putri & Dewi, 2021). This diversity creates multiculturalism in society, so it is necessary to protect it through the inculcation of multiculturalism. However, multiculturalism is not enough to maintain national integration with the modernization of technology and information and the challenges of a changing era (Fabricius et al., 2017; Mahfud et al., 2018). Indonesian people must be smart in building a knowledge society (Ashour, 2020; Ashour & Fatima, 2016). The knowledge society creates a society that is smarter in dealing with all situations and conditions, is not easily provoked, is more open to change, and becomes more aware of information whose truth is unknown (Gallardo-Echenique et al., 2015; Janssen et al., 2013). Instilling 21st century skills, namely the 4C, which include critical thinking, communication, collaboration, and creativity, are steps in creating a knowledge society (Ramdani et al., 2021; Smith, 2020). However, the skills that play the most role in maintaining multiculturalism and national integration are collaboration skills that are oriented towards mutual cooperation or mutual assistance (Anton & Trisoni, 2022; Santoso et al., 2023). These collaboration skills can foster social harmony and help maintain multiculturalism in society.

All of these goals can be instilled in students through the Sociology learning process, especially when learning content about social harmony (Nnebedum, 2019; Ratama et al., 2021). Sociology learning plays a role in cultivating an understanding of multiculturalism in students through social interactions such as collaboration and mutual cooperation. However, the fact is that the practice of learning Sociology does not run optimally, as evidenced by the failure to achieve the learning objectives, which can be seen in the attitudes of students. Based on the results of preliminary research on the collaboration skills of students at the high school in Sragen City, it showed that 9% of students have not developed their collaborative skills enough, while the majority of 55% were classified as having just enough level collaboration skills. The optimization effort that can be made in the Sociology learning process is to increase the role of the learning components. Optimal elaboration of learning components can increase effectiveness in achieving learning goals (Salwah & Ashari, 2016; Tofade et al., 2013). This is also what is applied in various schools, such as vocational school 1 in Sukoharjo City, which produces

learning products to improve students' collaboration skills (Rochmiatun, 2017; Sidi, 2020). Therefore, this development research aimed to produce mobile learning that is elaborated with gamification in a personalized way for students of the 11th grade of high school in Sragen city in Sociology learning. The production of mobile learning media used the Sukmadinata development model approach. This model is a guide for designing and testing the products that are made. These mobile learning products were tested using expert judgment methods by media experts and learning content experts. Based on these tests, mobile learning is declared valid based on the media feasibility level table on media aspects and learning content which is presented in Table 10. In addition, mobile learning was also experimented with using the Static Group Comparison Design approach in the experimental class and the comparison class. The test results were analyzed using the independent sample t-test method, with significant results or mean differences which is presented in Table 11.

The results of the data processing also showed that there were positive differences in 4 indicators and negative differences in 1 indicator. So, it could be concluded that gamification-based mobile learning products are effective in improving the collaboration skills of students in the 11th grade of high school in Sragen City. Instructional design elaboration can increase the effectiveness of the learning process, including in Sociology learning, which is not optimal. The combination of mobile learning with gamification models can improve collaborative interaction and collaboration in heterogeneous groups (Su & Cheng, 2013, 2015). Gamification that is packaged in the Team Games Tournament (TGT) provided a group role for students so that it stimulates communication and collaboration in solving each challenge. Meanwhile, mobile learning is a flexible container for implementing instructions and challenges from gamification to make learning more meaningful at the level of acting on Edgar Dale's cone of learning experience (Kärki et al., 2018; Passey & Zozimo, 2016). The potential possessed by a combination of mobile learning and gamification can optimize the Sociology learning process by improving students' collaboration skills. This research has attempted to improve collaboration skills by using a measurement approach based on indicators of collaboration skills (Laksana, 2021; Soulé & Warrick, 2015). However, the fact is that only indicators of contribution, indicators of productivity, indicators of flexibility and compromise, and indicators of appreciation experience a positive score increase when compared to the comparison class. Meanwhile, the responsibility indicator showed a negative score in the comparison class. Even after accumulating that the experimental group with the mobile learning treatment was better than the comparison class and the product was declared effective, there was still a negative score on the responsibility indicator. These are the limitations of this research. However, this research remains valid and can be used as a reference for scientific developments, especially in the use of mobile learning and gamification. There was no previous research that specifically develops itself and integrates mobile learning and gamification in improving collaboration skills in Sociology learning, especially in social harmony learning content.

Other research only focused on the use of gamification-based mobile devices in improving collaboration skills, such as research conducted by Zhampeissova and colleagues on Moscow State Pedagogical University students (Criollo-C et al., 2021; Göksu & Atici, 2013). In addition, other research conducted by Sehoon Kim focuses on the use of mobile social learning platforms as a form of gamification strategy in cooperative learning, which showed significant value in organizational effectiveness and has positive implications (Bitrián et al., 2021; Kim, 2021). This research actually elaborates on the values of gamification and learning based on mobile social learning in cooperative learning. However, there has been no research that focuses on the production of gamification-based mobile learning that is developed in a personalized environment in the 11th grade of high school in Sragen City to improve collaboration skills. So that this research becomes a starting point for scientific contributions to the elaboration of instructional design components. This is also the novelty of this research, which combines two main concepts, namely gamification and mobile learning, into a single product unit to improve students' collaboration skills, this is specific to high school-level students. This research has broad implications for solving similar problems in sociology learning at the senior high school level in various schools, especially in Indonesia. Of course, this will strengthen the student collaboration skill of maintaining integration among students while maintaining national integration. In addition, this research can contribute to enriching knowledge in the field of improving learning performance through a strengthening learning component approach. As a result, this research has specific specifications only for sociology learning and specifically for learning the content of social harmony, so it is very irrelevant for use in different contexts. The level of flexibility of the product of this research is very minimal, even though the concept can be utilized in other learning processes. Thus, it is hoped that in the future, similar research can be carried out on different learning content according to the characteristics of the learning content and students in order to enrich scientific contributions in the field of mobile learning and gamification.

4. CONCLUSION

The problem of this research was the non-optimality of the learning process of Sociology at high school in Sragen City, that impacted on the students' low collaboration skills. If it continues to be ignored, it will have

an impact on integration in schools and also national integration. Based on this problem, development research approach used to produce solutions to that's problem. The results of this research are intended to produce gamification-based mobile learning media in Sociology learning that can solve the problem of a nonoptimality of the learning process. The product are stated valid and feasible to be used in the Sociology learning process and effective in improving the collaboration skills of 11th grade high school students in Sragen City. This finding can be an alternative to similar problems in sociology learning in high school. Thus, it will have an impact on increasing student collaboration skills and avoiding disintegration.

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