Learning-Programming-Technique-through-Visual-Programming-Application-as-Learning-Media-with-Fuzzy-Rating

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Learning Programming Technique through Visual Programming Application as Learning Media with Fuzzy Rating

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ABSTRACT

Programming technique is one of the subjects at Vocational High School in Indonesia. This subject contains theory and application of programming utilizing Visual Programming. Students experience some difficulties to learn textual learning. Therefore, it is necessary to develop media as a tool to transfer learning materials. The objectives of this study are to determine the feasibility of learning media based on Visual Programming and to investigate the response of students who utilize the learning media. Learning media is firstly validated by experts before it is applied to students. This research implemented rating validation with fuzzy rating based on fuzzy inference system. Fuzzy benefits in translating a crisp form into the preference of linguistic variable form and reprocess into a crisp form as a value decision. The results revealed that fuzzy rating can be implemented to measure the feasibility of learning media and students' responses to the use of learning media.

KEYWORDS

Computer Simulation, Fuzzy Rating, Learning Media, Metacognition, Student Response

INTRODUCTION

In today's modern era, most human activities have been involved and engaged with a computer. The need of computer applications becomes an important thing. The variety of computer applications are not only being installed in PC but also in mobile phones, tablets, laptops, etc. In education, computer has been used both as learning media and in learning process (Buditjahjanto, 2013) Computer applications have been widely applied in several disciplines in education, such as mathematics (Arnau, 2013), sciences (Yang, 2015), computer programming (Chrysafiadi & Virvou, 2013), robotics (Bers et al, 2014), and engineering (Johnson et.al, 2015).

The growth of computer technology leads a ubiquitous learning environment which enables learning at anytime and anyplace. Computer assisted instruction has been widely applied for Mobile Learning, Web Based Learning and Intelligent Tutoring System. Fernández-López et al. (2013) have used mobile learning to support student to learn the basic skills. Web Based Learning is able to

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enhance the knowledge of reading comprehension (Wijekumar et al., 2013). In addition, Intelligent Tutoring System (ITS) can train students to attain goals and help-seeking strategies (Vaessen et al., 2014), and ITS also be able to enable learners to build commentary their own knowledge through discussion (Latham et al., 2014).

Computer application which has been developed in education can be formed as animations, simulations and games (Boyle et al., 2014). Computer games have also been used as learning media to study a wide range of issues in education. Yang et al. (2015) has used game-based to learn healthy eating habits among adolescents and to understand nutritional elements. Corral et al. (2014) developed a game-oriented to teach OOP languages with significant learning result for the students. Serious game has been developed to learn Environment/Economic Dispatch (EED) of electrical power in order to make easier to understand EED process (Buditjahjanto & Miyauchi, 2011). The advantages of computer games as learning media are students can experience in real time and real situations and students can play while learning. Moreover, the use of computer can help to develop a variety of media education.

In addition, the relationship between the uses of computers with self-ability, metacognitive self- rule and motivational of students also affects the learning outcomes (Pellas, 2014). Santoso et al. (2014) have investigated a self-regulated learning (SRL) of students' computer self-efficacy and learning behavior of students. SRL has been widely used in the fields related to computer simulations. Douglas (2004) inquired strategies that teachers can use to enhance students' use of self-ruled learning strategies in a Web-based setting. With the results of his research shows a part of the SRL as academic building self-efficacy and self-monitoring feedback confirmed the self-effacing effects on attainment.

Tan, et al. (2014) revealed most of the students that studying computer programming in the conventional manner is still being a difficult thing. Students will be difficult to learn if only textual learning. Therefore, it needs a media that can make it easier to learn computer programming lessons (Rodríguez, et al., 2014). Programming techniques is one of subjects in Vocational High School for competency skills of audio video engineering. This research aims to determine the feasibility of the use of media-based learning Visual Programming in the subject of programming techniques, to investigate the response of the students in the use of media-based learning visual programming in the subject of programming techniques. This research uses fuzzy as a rating for a questionnaire. Fuzzy has an advantage in translating a crisp form into the preference of linguistic variable form and reprocess into a crisp form as a value decision. Therefore, fuzzy rating is implemented to achieve preference of experts to validate questionnaire.

LITERATURE REVIEW

Visual Programming Application as Learning Media

Manifestation of visual programming application as learning media can be formed as: computer assisted learning, e-learning, intelligent tutoring system (ITS), computer simulation, serious games, etc. The utilization of visual programming application in the learning process is to assist students in learning some materials so it improves understanding of what students have learned. Math is considered difficult by most students. However, it can be attracted to the attention of students when learning process uses the right learning media. Arnau et al. (2013) revealed that Intelligent Tutoring System (ITS) offers an extensive experimental evaluation to support tracking in both the Arithmetical and algebraic case. Consequently, ITS able to help students while they learn the Arithmetical and algebraic way of solving problems. One form of the development of ITS is web-based intelligent tutoring system. The study shows that in the case of literacy of web-based intelligent tutoring system in schools shows significantly better achievement of web-based ITS classrooms compared to their control complements with conventional learning (Wijekumar, Meyer, & Lei, 2013). The trial is performed to study the efficiency of web-based intelligent tutoring system to transfer the structure strategy to enhance the knowledge of reading comprehension.

Computer simulation, as learning media, can be used in engineering fields such as to learn wireless network. Mateo et al. (2014) revealed the teaching experience has demonstrated the effectiveness of the followed methodology and significantly reduced the disparity between theory and practice. The research used a computer simulation WiFiSim to simulate realistic and customizable WLAN environments with some case studies on Wi-Fi network design. This WiFiSim helps students to learn wireless network modelling and deployment. In the field of social science, computer simulation can also be used to learn about general equilibrium macroeconomic models and the learning outcomes for students that used computer simulation showed a significant result.

Several studies about computer games have been conducted. Buditjahjanto (2013) developed computer games to learn the components and functions of a computer. Students are becoming increasingly interested in learning because in order to proceed to a higher level in playing computer games, then the student should be able to solve the problem in the form of questions related to learning materials so that students understand the material in order to proceed to the next level. Another use of computer games is related to programming. As we know that programming is a difficult material for students, Rodríguez et al. (2014) implemented a game-oriented based on the interaction with tangible user interfaces (TUIs) to the teaching of object-oriented programming. The research result indicated that the group of students with TUI revealed a greater interest level and achieved an overall better mark than the one that participated the standard introductory C# course.

Rating Scale

Scale rating can be built based on fuzzy inference system. Zen & Jun (2010) constructed the company scale rating based on the fuzzy inference model. The fuzzy inference system consists of inputs, output, and Mamdani fuzzy theory as inference. The steps to build fuzzy inference system are as follows (Zen & Jun, 2010)

a. Build relating data sets into Fuzzy theory
b. Define the input and output linguistic variables and linguistic values
c. Define the membership function of linguistic value
d. Define the fuzzy rules or inference
e. Define fuzzy computing.
f. Obtain the model output

RESEARCH METHODOLOGY

This research was conducted in Indonesia at a vocational school in the 10th grade with the competency skills of audio video engineering. The participants were 37 students. This research consists of several stages in the form of a block diagram as shown in Figure 1.

Design and Build Visual Programming as Learning Media

Design of learning media as outline can be seen in Figure 2. The outline of learning media consists of: First page contains the initial display of learning media, Main Page contains the instruction, learning materials, evaluation, and profile. Instruction serves to provide guidance in carrying out of the learning media, such as an explanation the function of an icon and how to navigate in the learning media. Learning Materials contain two materials such as Decision Structure and Looping structure.

Based on the design, hence we made learning media by using a visual programming. This learning media was used to teach students in the subject of programming techniques in the vocational school in Indonesia. Figure 3(a) shows the initial view of learning media. In the display, there are several button navigations that constitute the content of the media learning such as: instruction, learning materials, evaluation, profile and exit. Figure 3(b) shows the students that learn programming technique

Figure 1. Block Diagram of Research Methodology

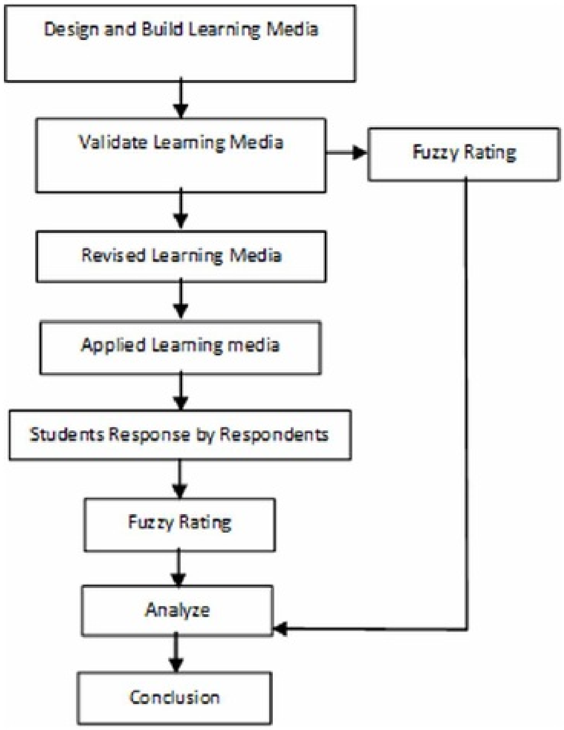


Figure 2. Outline of Learning Media

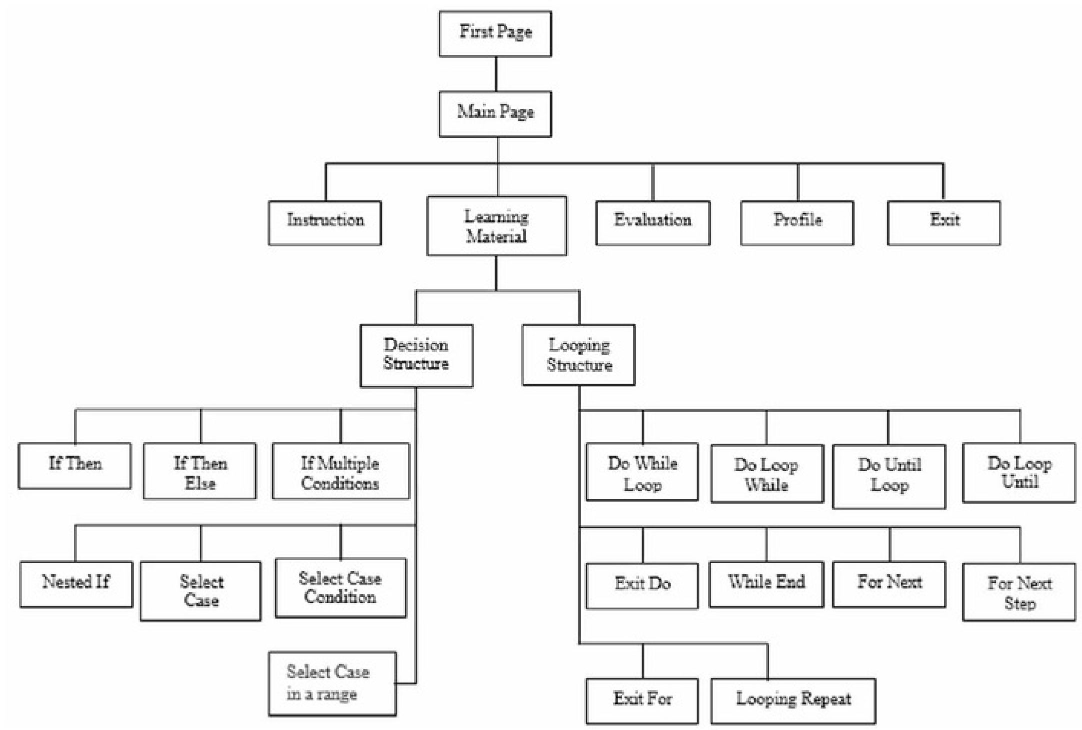


Figure 3. (a) Menu display of learning media (b) Students learn to use visual programming

(a) (b)

by utilizing visual programming as media learning. Figure 4 shows part of learning material being taught. Figure 4(a) shows the case select learning material and Figure 4(b) shows the flowchart of the select case learning material.

Validate Visual Programming as Learning Media

Validation is required to determine the feasibility of learning media that has been created and to obtain the advice of experts in order to improve the shortcomings learning media. Questionnaire validation is performed for interface and content validity. The validity process began by inviting three experts of media learning to review the questionnaire and give comments about the constructs of media learning on each item. The process of validation was an iterative process to evaluate the appropriate wording on each item for recognizing specific media learning feature being assessed. As a result of this process, some revisions were made to improve the infirmity of learning media. Table 1 shows questionnaire validation for learning media. The questionnaire consists of aspects rating and rating preferences.

With the same step to validate the questionnaire for student response, the validity process began also by inviting three experts to review the questionnaire and give comments about the constructs of student response on each item. As a result of this process, some revisions were made to improve the infirmity of questionnaire for student response. Table 2 shows questionnaire validation for student

Figure 4. (a) Select case learning material (b) Flowchart of select case learning material

(a) (b)

Table 1. Questionnaire Validation for Learning Media

Indicators	Aspects Rating	Rating Preferences			
	Media Format	**(SD)**	**(D)**	**(A)**	**(SA)**
MF1	a. The learning media are presented systematically				
MF2	b. The use of letters of instructional media is clear				
MF3	c. The image size in instructional media is conform				
MF4	d. The usefulness of learning media is effective and efficient				
MF5	e. The layout of learning media is compatible				
	Media Design	(SD)	(D)	(A)	(SA)
MD1	a. The video project that displayed in the learning media is able to help student understanding				
MD2	b. The illustrations are presented in a clear, attractive and easy to understand.				
MD3	c. The display of media design with matching colors is presented				
MD4	d. The navigation menu is easy to use				
	Learning Material	(SD)	(D)	(A)	(SA)
LM1	a. The learning materials are conformity with indicators				
LM2	b. The learning media are linkages with the purpose of learning				
LM3	c. The contents of learning materials are in accordance with the field of study				
LM4	d. The sequence of instructional media of the learning material in each section is compatible				
LM5	e. The information that is delivered through images on learning media is explicit				
	Language	(SD)	(D)	(A)	(SA)
L1	a. The language is easily understood				
L2	b. The language in media learning is appropriate with Indonesian Grammar				
L3	c. The language used is able to clarify the learning materials delivered				

SD=Strongly disagree D=Disagree A=Agree SA=Strongly Agree

response. The questionnaire consists of aspects rating and rating preferences. Metacognition abilities are based on (Dawson, T, 2008) such as (a) multiple factors that a person's belief, (b) several students' functions (c) students' action or learning strategies, (d) interactions between users that contain all of the above to success a common goal. These abilities are adapted to be indicators. Point (a) adopted to be the learning media are able to attracting the student interest, point (b) adopted to be the learning media are able to growing the learning interest, point (c) adopted to be the learning media are able to delighting students to study the learning material and point (d) adopted to be the learning media are able to enhance students' understanding. Furthermore, rating preferences are based on linguistic variables such as Strongly Disagree, Disagree, Agree and Strongly Agree.

Table 2. Questionnaire validation for student response

Indicators	Aspects Rating	Rating Preferences			
	Media Design	(SD)	(D)	(A)	(SA)
M1	a. The video project that displayed in the learning media is able to help student understanding				
M2	b. The illustrations are presented in a clear, attractive and easy to understand.				
M3	c. The display of media design with matching colors is presented				
M4	d. The navigation menu is easy to use				
M5	e. The learning media are attractive				
	Content of Learning Media	(SD)	(D)	(A)	(SA)
C1	a. The learning materials are conforming with learning indicators				
C2	b. The language used in the media is easy to understand				
C3	c. The information that is delivered through images on learning media is explicit				
C4	d. The learning media are able to help students to understand the learning materials easier				
	Metacognition Abilities	(SD)	(D)	(A)	(SA)
MT1	a. The learning media are able to attracting the student interest				
MT2	b. The learning media are able to growing the learning interest				
MT3	c. The learning media are able to enhancing students' understanding				
MT4	d. The learning media are able to delighting students to study the learning material				

SD=Strongly disagree D=Disagree A=Agree SA=Strongly Agree

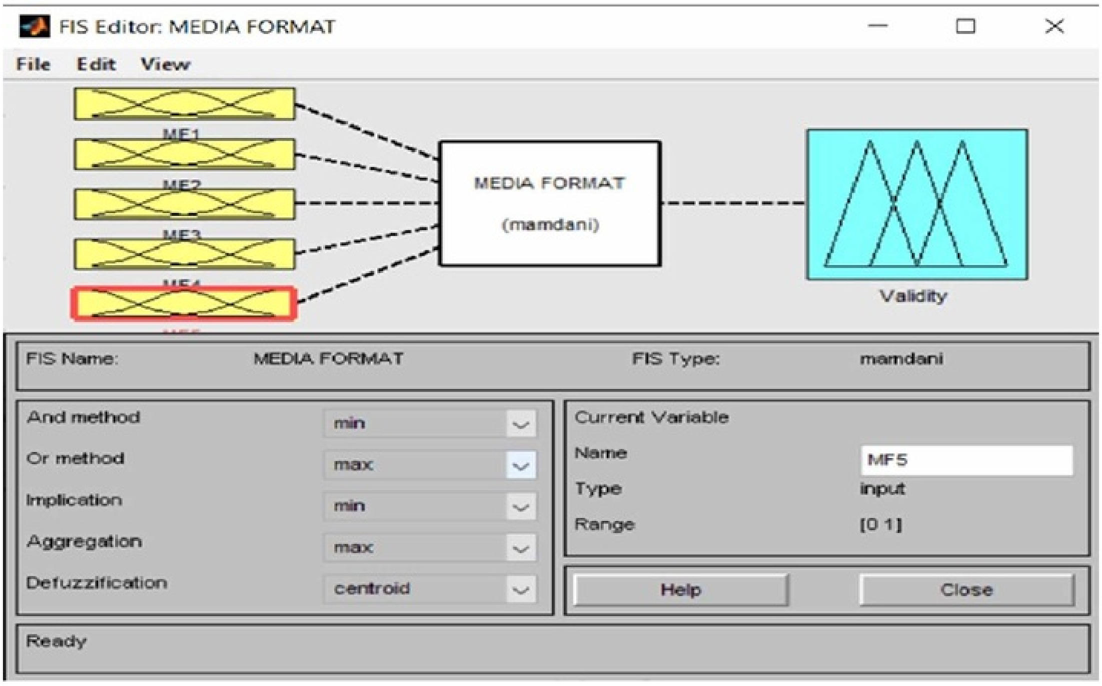
RESULTS

The fuzzy scale rating is used based on the fuzzy inference system, in this research. As we know that fuzzy has the capability to transfer linguistic preference. Three experts give their preference toward the questionnaire validation and give feedback to improve the questionnaire. Fuzzy inference system is built based on the steps on (Zen & Jun, 2010). The following steps are to build the fuzzy inference system for media format aspect that is one of aspect of questionnaire for learning media, where others aspects follow these steps also.

1. Establish relating data sets into fuzzy theory

Relating data sets of fuzzy theory consist of input, fuzzy inference system and output for media format aspect. The input for media format consists of five aspects (MF1, MF2, MF3, MF4 and MF5) detail can be seen in Table 1. All fuzzy inference system, which are used in this simulation, use Mamdani type as the type fuzzy inference. Furthermore, the output only has one output (Validity). Figure 5 shows corresponding data sets into the fuzzy inference system.

Figure 5. Corresponding data sets into the fuzzy inference system



2. Set the input and output linguistic variables and linguistic values

The input of linguistic variables for media format consist of four variables are built as follow: (MF1 – MF5) = {Strongly Disagree (SD), Disagree (D) Agree (A), Strongly Agree (SA)}. These inputs are shown in Figure 6. Furthermore, the output of linguistic variables consists of four variables are built as follows: (Validity) = {Very Not Valid (VNV), Not Valid (NV), Valid (V), Very Valid (VV)}. Figure 7 shows the corresponding fuzzy sets for output.

3. Set the membership function of linguistic value such as types and parameters of membership functions

This research uses two types of memberships namely triangle and trapezoidal refer to (Li, 2013). The formula for triangle membership function (equation (1))

$$f\left(x,a,b,c\right)=\begin{cases}0, x\leq a\\ \dfrac{x-a}{b-a}, a\leq x\leq b\\ \dfrac{c-x}{c-b}, b\leq x\leq c\\ 0, c\ll x\end{cases} \quad (1)$$

On the input side, the membership functions that use triangle membership functions, namely Disagree (D) and Agree (A). Whereas linguistic values for Disagree are (0.2 0.4 0.6) and linguistic values Agree are (0.4 0.6 0.8). In the output side, the membership functions that use triangle

Figure 6. Fuzzy input for media format

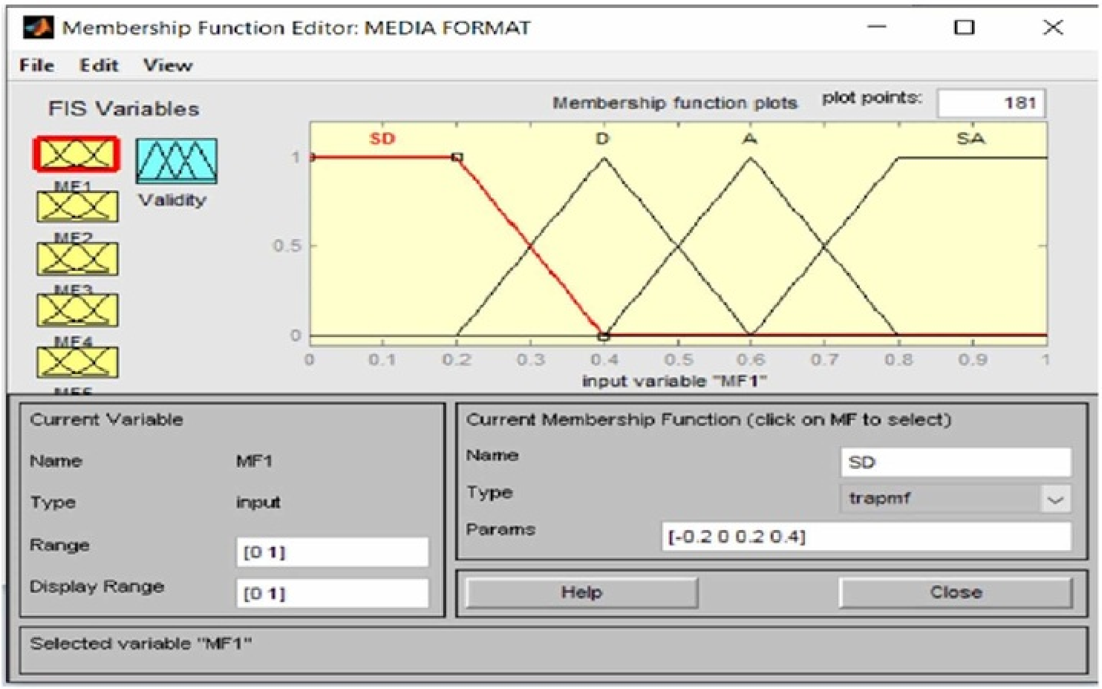
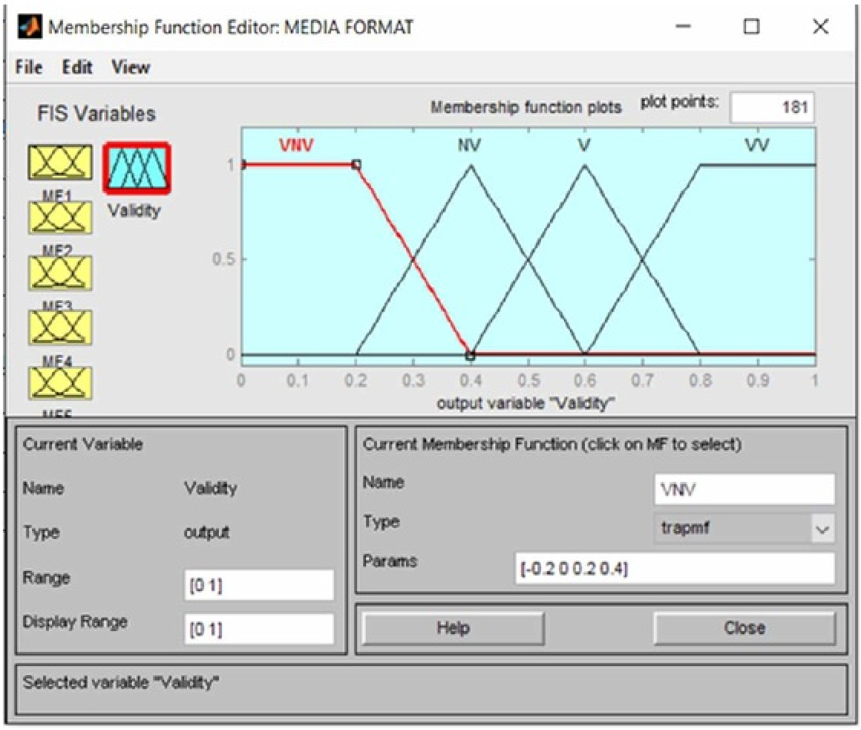


Figure 7. Fuzzy output for media format



membership functions, namely Not Valid (NV), Valid (V). While linguistic values for Not Valid are (0.2 0.4 0.6), and linguistic values Valid are (0.4 0.6 0.8).

The formula for trapezoidal membership functions is then written as equation (2).

$$f\left(x,a,b,c,d\right)=\begin{cases}0, & x\le a\\ \dfrac{x-a}{b-a}, & a\le x\le b\\ 1, & b\le x\le c\\ \dfrac{d-x}{d-c}, & c\le x\le d\\ 0, & d\ll x\end{cases} \tag{2}$$

On the input side, the membership functions that use triangle membership functions are such as Strongly Disagree (D) and Strongly Agree (A). Whereas linguistic values for Disagree are (-0.2 0.0 0.2 0.4) and linguistic values Agree are (0.6 0.8 1.0 1.2). In the output side, the membership functions that use triangle membership functions are such as Very Not Valid (VNV), Very Valid (VV). While linguistic values for Not Valid are ((-0.2 0.0 0.2 0.4), and linguistic values Valid are (0.6 0.8 1.0 1.2).

4. Set the fuzzy rules or inference

Fuzzy inference rule consists of 10 rules and can be specified as follows:

1) If (MF1 – MF5 is SA) then (Validity is VV)
2) If (MF1 – MF5 is A) then (Validity is V)
3) If (MF1 – MF5 is D) then (Validity is NV)
4) If (MF1 – MF5 is SD) then (Validity is VNV)
5) If (MF1 – MF3 is SA) and (MF4 – MF5 is A) then (Validity is VV)
6) If (MF1 – MF3 is A) and (MF4 – MF5 is SA) then (Validity is V)
7) If (MF1 – MF3 is A) and (MF4 – MF5 is D) then (Validity is V)
8) If (MF1 – MF3 is D) and (MF4 – MF5 is A) then (Validity is NV)
9) If (MF1 – MF3 is D) and (MF4 – MF5 is SD) then (Validity is NV)
10) If (MF1 – MF3 is SD) and (MF4 – MF5 is D) then (Validity is VNV)

These 10 rules are applied to Matlab R2008A rule editor to build Fuzzy inference rule as seen in Figure 8.

Figure 9 shows step e and f that consist of fuzzy computing and the output result of fuzzy inference system model. Furthermore, Figure 9 also shows an example of expert's preferences in aspect of media format. The expert's preferences are MF1= Strongly Agree (0.9), MF2= Strongly Agree (0.9), MF3= Strongly Agree (0.9), MF4= Agree (0.7) and MF5= Agree (0.7). Then the output result of validity is Very Valid (0.826).

Furthermore, the model Fuzzy Inference System (FIS), which has been obtained from the above step, is used to calculate the fuzzy rating scale to validate learning media. Validation is performed on all indicators of media format aspects, namely MF1, MF2, MF3, MF4, and MF5. Table 3 shows the data preference of three experts on aspect of media format. The data input in the form of experts' preferences for each of the indicators (MF1, MF2, MF3, MF4 and MF5) and the output is Validity in fuzzy rating scale. From Table 3, it can be seen that the first expert inputs his preferences are as follows: MF1 = Agree, MF2 = Agree, MF3 = Agree, MF4 = Strongly Agree, MF5 = Agree. And as a result, the output of fuzzy calculation is 0.727 with Valid category. Next, the second expert gives

Figure 8. Fuzzy inference rule for media format

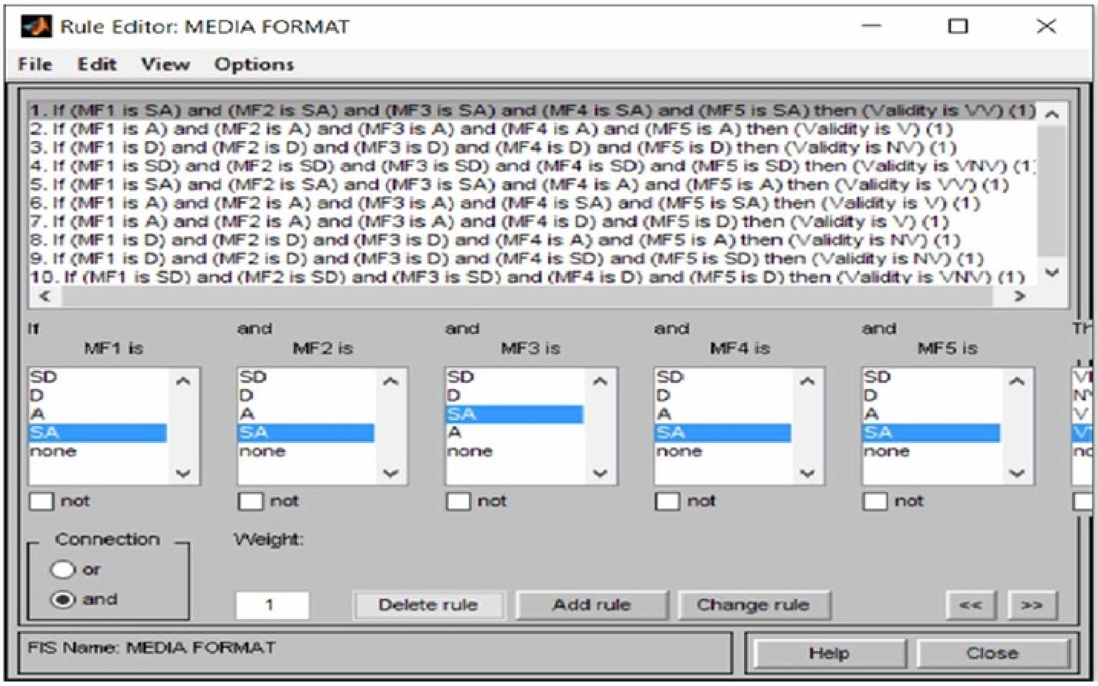


Figure 9. Fuzzy computing and output result of FIS from media format aspect

Table 3. Fuzzy rating result from media format aspect

Media Format						
Expert	MF1	MF2	MF3	MF4	MF5	Category
1	A(0.7)	A(0.7)	A(0.7)	SA(0.9)	A(0.7)	V(0.727)
2	SA(0.9)	SA(0.9)	A(0.7)	SA(0.9)	SA(0.9)	VV(0.826)
3	SA(0.9)	SA(0.9)	SA(0.9)	A(0.7)	A(0.7)	VV(0.826)
Mean						VV(0.793)

his preferences to the indicator MF1, MF2, MF3, MF4 and MF5. As a result, the output of the fuzzy calculation is 0826 with Very Valid category, in a similar way, the third expert gives his preferences to the indicator MF1, MF2, MF3, MF4 and MF5. As a result, the output of the fuzzy calculation is 0826 with Very Valid category. Meanwhile, the mean calculation result of the validity of the experts is 0.793 with Very Valid category.

Table 4 shows the data preference of three experts on aspect of learning material. The data input in the form of experts' preferences for each of the indicators (LM1, LM2, LM3, LM4 and LM5) and the output is Validity in fuzzy rating scale. From Table 4, it can be seen that the first expert inputs his preferences are as follows: LM1 = Strongly Agree, LM2 = Agree, LM3 = Agree, LM4 = Agree, LM5 = Agree. And as a result, the output of fuzzy calculation is 0.826 with Very Valid category. Next, the second expert gives his preferences to the indicator LM1, LM2, LM3, LM4 and LM5. As a result, the output of the fuzzy calculation is 0.826 with Very Valid category, in a similar way, the third expert gives his preferences to the indicator LM1, LM2, LM3, LM4 and LM5. As a result, the output of the fuzzy calculation is 0.826 with Very Valid category. Meanwhile, the mean calculation result of the validity of the experts is 0.826 with Very Valid category.

Table 5 shows the data preference of three experts on aspect of media design. The data input in the form of experts' preferences for each of the indicators (MD1, MD 2, MD3, and MD 4) and

Table 4. Fuzzy rating result from learning material aspect

Learning Material						
Expert	LM1	LM2	LM3	LM4	LM5	Category
1	SA(0.9)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	VV(0.826)
2	A(0.7)	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VV(0.826)
3	A(0.7)	A(0.7)	SA(0.9)	SA(0.9)	SA(0.9)	VV(0.826)
Mean						VV(0.826)

Table 5. Fuzzy rating result from media design aspect

Media Design					
Expert	MD1	MD2	MD3	MD4	Category
1	A(0.7)	A(0.7)	A(0.7)	A(0.7)	V(0.727)
2	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VV(0.847)
3	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VV(0.847)
Mean					VV(0.807)

the output is Validity in fuzzy rating scale. From Table 3, it can be seen that the first expert inputs his preferences are as follows: MD 1 = Agree, MD2 = Agree, MD3 = Agree, MD4 = Agree. As a result, the output of fuzzy calculation is 0.727 with Valid category. Next, the second expert gives his preferences to the indicator MD1, MD2, MD3, and MD4. As a result, the output of the fuzzy calculation is 0.847 with Very Valid category, in a similar way, the third expert gives his preferences to the indicator MD1, MD2, MD3, and MD4. As a result, the output of the fuzzy calculation is 0.847 with Very Valid category. Meanwhile, the mean calculation result of the validity of the experts is 0.807 with Very Valid category.

Table 6 shows the data preference of three experts on an aspect of language. The data input in the form of experts' preferences for each of the indicators (L1, L2, and L3) and the output is Validity in fuzzy rating scale. From Table 3, it can be seen that the first expert inputs his preferences are as follows: L1 = Agree, L2 = Agree, L3 = Agree. And as a result, the output of fuzzy calculation is 0.727 with Valid category. Next, the second expert gives his preferences to the indicator L1, L2, and L3. As a result, the output of the fuzzy calculation is 0.847 with Very Valid category, in a similar way, the third expert gives his preferences to the indicator L1, L2, and L3. As a result, the output of the fuzzy calculation is 0.847 with Very Valid category. Meanwhile, the mean calculation result of the validity of the experts is 0.807 with Very Valid category.

Student Response

By following the steps as in Zen & Jun (2010), the Fuzzy Inference System for the student response is built. Figure 10(a) shows fuzzy input and output for media design aspect and Figure 10(b) shows fuzzy output for media design aspect.

Table 6. Fuzzy rating result from language aspect

Language				
Expert	L1	L2	L3	Category
1	A(0.7)	A(0.7)	A(0.7)	V(0.727)
2	SA(0.9)	SA(0.9)	SA(0.9)	VV(0.847)
3	SA(0.9)	SA(0.9)	SA(0.9)	VV(0.847)
Mean				VV(0.807)

Figure 10. (a) Fuzzy input for media design; (b) Fuzzy output for media design

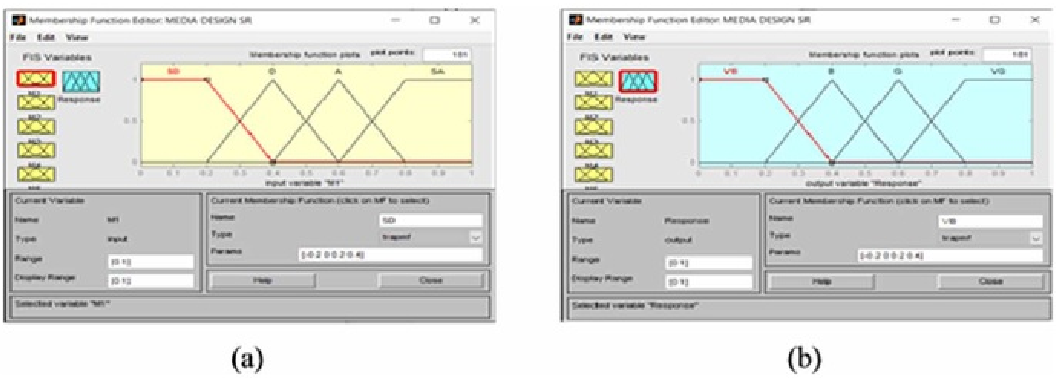


Figure 11 depicts 10 rules to build Fuzzy inference rule. Figure 12 shows fuzzy computing and the output result of fuzzy inference system model. Furthermore, Figure 12 also shows an example of expert's preferences in aspect of media design.

Table 7 shows data preference of 37 students on aspect of media design. Indicators (M1, M2, M3, M4, and M5) are the inputs of students' preferences and the output is a response value in the fuzzy rating scale. As an example, the student with ID number 1 has preferences as follows: M1 = SA, M2 = SA, M3 = SA, M4 = SA, M5 = SA. As a result, the output of fuzzy calculation is 0.847 with VG category. In a similar way, all students' preferences are calculated to yield response value. Then all response values are calculated to get the mean value. The result of mean calculation for the response of media design aspect is 0.807 with VG category.

Table 8 shows data preference of 37 students on an aspect of learning media. Indicators (C1, C2, C3, and C4) are the inputs of students' preferences and the output is the response value of fuzzy rating scale. As an example, the student with ID number 1 has preferences as follows: C1 = A, C2 = VG, C3 = VG, C4 = VG. As a result, the output of fuzzy calculation is 0.826 with VG category. In a similar way, all students' preferences are calculated to produce response value. Then all response values are calculated to get the mean value. The result of mean calculation for the response of media design aspect is 0.733 with VG category.

Table 9 shows data preference of 37 students on an aspect of metacognition abilities. Indicators (MT1, MT2, MT3, and MT4) are the inputs of students' preferences and the output is the response value of fuzzy rating scale. As an example, the student with ID number 1 has preferences as follows: MT1 = SA, MT2 = SA, MT3 = SA, MT4 = SA. As a result, the output of fuzzy calculation is 0.847 with VG category. In a similar way, all students' preferences are calculated to yield response value. Then all response values are calculated to get the mean value. The result of mean calculation of the response of media design aspect is 0.732 with VG category.

Figure 11. Fuzzy rule base for media design

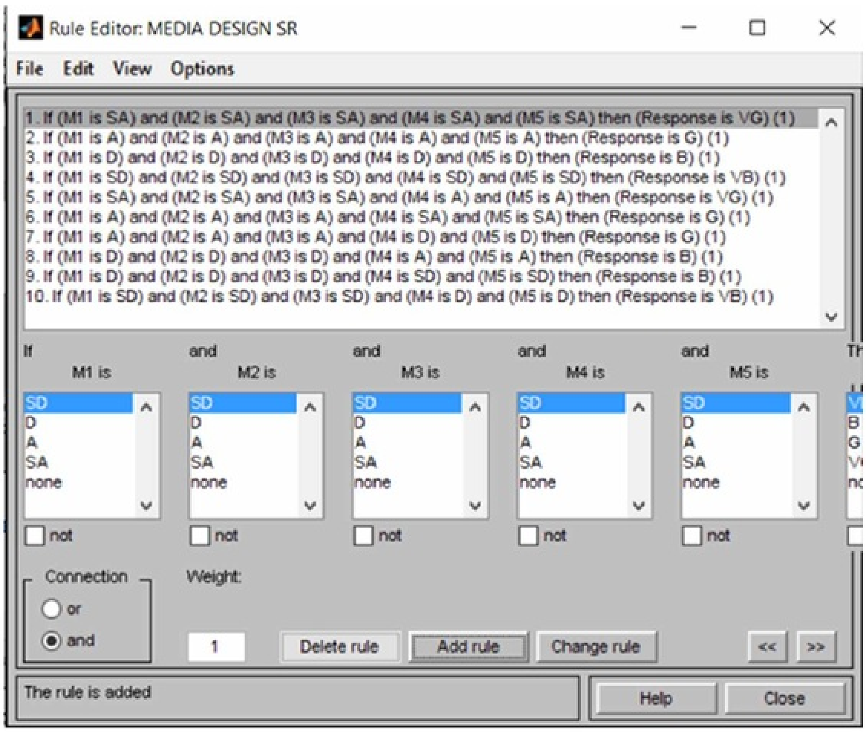


Figure 12. Fuzzy inference system calculation of student response

Table 7. Fuzzy rating result from media design aspect for student response

Media Design						
Student ID	M1	M2	M3	M4	M5	Category
1	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
2	A(0.7)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
3	A(0.7)	SA(0.9)	A(0.7)	A(0.7)	SA(0.9)	VG(0.826)
4	A(0.7)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
5	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
6	SA(0.9)	A(0.7)	A(0.7)	SA(0.9)	SA(0.9)	VG(0.826)
7	SA(0.9)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	VG(0.826)
8	A(0.7)	A(0.7)	D(0.4)	D(0.4)	A(0.7)	G(0.5)
9	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
10	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
11	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
12	A(0.7)	D(0.4)	SA(0.9)	SA(0.9)	D(0.4)	G(0.5)
13	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
14	A(0.7)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
15	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)

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Table 7. Continued

Media Design						
Student ID	M1	M2	M3	M4	M5	Category
16	A(0.7)	A(0.7)	SA(0.9)	A(0.7)	SA(0.9)	VG(0.826)
17	A(0.7)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
18	A(0.7)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
19	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
20	A(0.7)	D(0.4)	A(0.7)	SA(0.9)	D(0.4)	G(0.5)
21	A(0.7)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
22	A(0.7)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
23	SA(0.9)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	VG(0.826)
24	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	A(0.7)	VG(0.826)
25	A(0.7)	A(0.7)	A(0.7)	A(0.7)	SA(0.9)	G(0.727)
26	A(0.7)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
27	SA(0.9)	SA(0.9)	A(0.7)	SA(0.9)	SA(0.9)	VG(0.826)
28	SA(0.9)	A(0.7)	A(0.7)	SA(0.9)	A(0.7)	VG(0.826)
29	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
30	A(0.7)	SA(0.9)	A(0.7)	A(0.7)	SA(0.9)	VG(0.826)
31	SA(0.9)	A(0.7)	A(0.7)	D(0.4)	SA(0.9)	G(0.5)
32	A(0.7)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
33	SA(0.9)	A(0.7)	A(0.7)	D(0.4)	SA(0.9)	G(0.5)
34	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	A(0.7)	VG(0.826)
35	A(0.7)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
36	SA(0.9)	SA(0.9)	A(0.7)	SA(0.9)	SA(0.9)	VG(0.826)
37	A(0.7)	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
					Mean	VG(0.755)

Table 8. Fuzzy rating results from content learning media aspect for student response

Content Learning Media					
Student ID	C1	C2	C3	C4	Category
1	A(0.7)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.826)
2	A(0.7)	A(0.7)	A(0.7)	SA(0.9)	G(0.727)
3	SA(0.9)	A(0.7)	D(0.4)	A(0.7)	G(0.5)
4	A(0.7)	A(0.7)	A(0.7)	SA(0.9)	G(0.727)
5	SA(0.9)	SA(0.9)	SA(0.9)	A(0.7)	VG(0.826)
6	A(0.7)	A(0.7)	A(0.7)	SA(0.9)	G(0.727)
7	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
8	A(0.7)	A(0.7)	A(0.7)	D(0.4)	G(0.5)
9	A(0.7)	A(0.7)	SA(0.9)	SA(0.9)	VG(0.826)

continued on following page

Table 8. Continued

Content Learning Media					
Student ID	C1	C2	C3	C4	Category
10	A(0.7)	SA(0.9)	SA(0.9)	A(0.7)	G(0.727)
11	SA(0.9)	SA(0.9)	A(0.7)	SA(0.9)	VG(0.826)
12	SA(0.9)	SA(0.9)	SA(0.9)	D(0.4)	G(0.5)
13	SA(0.9)	A(0.7)	SA(0.9)	SA(0.9)	VG(0.826)
14	A(0.7)	A(0.7)	SA(0.9)	A(0.7)	VG(0.826)
15	SA(0.9)	A(0.7)	SA(0.9)	SA(0.9)	VG(0.826)
16	A(0.7)	SA(0.9)	A(0.7)	SA(0.9)	VG(0.826)
17	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
18	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
19	A(0.7)	A(0.7)	SA(0.9)	SA(0.9)	VG(0.826)
20	D(0.4)	D(0.4)	D(0.4)	D(0.4)	B(0.4)
21	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
22	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
23	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
24	SA(0.9)	SA(0.9)	SA(0.9)	A(0.7)	VG(0.826)
25	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
26	A(0.7)	A(0.7)	A(0.7)	SA(0.9)	G(0.727)
27	A(0.7)	A(0.7)	SA(0.9)	SA(0.9)	VG(0.826)
28	SA(0.9)	SA(0.9)	A(0.7)	SA(0.9)	VG(0.826)
29	A(0.7)	SA(0.9)	A(0.7)	SA(0.9)	VG(0.826)
30	A(0.7)	SA(0.9)	A(0.7)	A(0.7)	VG(0.826)
31	D(0.4)	A(0.7)	A(0.7)	SA(0.9)	G(0.5)
32	A(0.7)	A(0.7)	A(0.7)	SA(0.9)	G(0.727)
33	D(0.4)	A(0.7)	A(0.7)	SA(0.9)	G(0.5)
34	SA(0.9)	SA(0.9)	A(0.7)	A(0.7)	VG(0.826)
35	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
36	SA(0.9)	SA(0.9)	A(0.7)	SA(0.9)	VG(0.826)
37	A(0.7)	SA(0.9)	A(0.7)	A(0.7)	VG(0.826)
				Mean	VG(0.733)

Table 9. Fuzzy rating results from Metacognition abilities aspect for student response

Metacognition abilities					
Student ID	MT1	MT2	MT3	MT4	Category
1	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
2	SA(0.9)	A(0.7)	A(0.7)	D(0.4)	G(0.5)
3	SA(0.9)	A(0.7)	A(0.7)	A(0.7)	VG(0.826)

continued on following page

Table 9. Continued

Metacognition abilities					
Student ID	MT1	MT2	MT3	MT4	Category
4	SA(0.9)	A(0.7)	A(0.7)	D(0.4)	G(0.5)
5	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
6	A(0.7)	A(0.7)	SA(0.9)	SA(0.9)	VG(0.826)
7	A(0.7)	A(0.7)	SA(0.9)	A(0.7)	VG(0.826)
8	A(0.7)	D(0.4)	A(0.7)	D(0.4)	G(0.6)
9	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
10	SA(0.9)	SA(0.9)	A(0.7)	SA(0.9)	VG(0.826)
11	A(0.7)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.826)
12	D(0.4)	A(0.7)	A(0.7)	A(0.7)	B(0.5)
13	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
14	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
15	A(0.7)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.826)
16	SA(0.9)	SA(0.9)	A(0.7)	A(0.7)	VG(0.826)
17	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
18	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
19	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
20	SA(0.9)	A(0.7)	D(0.4)	SA(0.9)	G(0.5)
21	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
22	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
23	A(0.7)	A(0.7)	SA(0.9)	A(0.7)	VG(0.826)
24	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
25	SA(0.9)	D(0.4)	SA(0.9)	A(0.7)	G(0.5)
26	SA(0.9)	A(0.7)	A(0.7)	D(0.4)	G(0.5)
27	SA(0.9)	SA(0.9)	A(0.7)	SA(0.9)	VG(0.826)
28	A(0.7)	SA(0.9)	A(0.7)	A(0.7)	G(0.727)
29	SA(0.9)	A(0.7)	A(0.7)	A(0.7)	VG(0.826)
30	SA(0.9)	SA(0.9)	A(0.7)	A(0.7)	VG(0.826)
31	A(0.7)	A(0.7)	SA(0.9)	D(0.4)	G(0.5)
32	A(0.7)	A(0.7)	SA(0.9)	A(0.7)	VG(0.826)
33	A(0.7)	A(0.7)	SA(0.9)	D(0.4)	G(0.5)
34	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
35	A(0.7)	A(0.7)	A(0.7)	A(0.7)	G(0.727)
36	SA(0.9)	SA(0.9)	SA(0.9)	SA(0.9)	VG(0.847)
37	A(0.7)	A(0.7)	SA(0.9)	A(0.7)	VG(0.826)
				Mean	VG(0.732)

CONCLUSION

Learning Media was validated by three experts. Rating validation of learning media based on four aspects which are media formats, learning material, media design, and language aspects. Rating fuzzy preferences of all three experts indicated the mean value for the media format aspect is 0793 with a category Very Valid, the mean value for the learning material aspect is 0.826 with a category Very Valid, the mean value for media design aspect is 0.807 by category Very Valid, and value mean for the language aspect is 0.807 with a category Very Valid. It can be concluded that learning media based on Visual Programming are feasible to be used as learning media for subjects of programming techniques in vocational school.

The student response was given by 37 respondents. Rating validation of learning media based on three aspects which are media design, media learning content, and Metacognition abilities aspects. Rating fuzzy preferences from all 37 respondents indicated the mean value for media design aspect is 0.755 with a category Very Good, the mean value for media learning content aspect is 0.733 with a category Very Good, and the means for Metacognition abilities aspect is 0.732 with a category Very Good. It can be concluded that learning media based on Visual Programming received a very good response from students for subjects of programming techniques.

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