Development of Telegram Bot for Flipped Learning Chemistry Class with UCD Approach

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Abstract. The need for media that supports online learning is increasing along with the Covid-19 pandemic that is spreading in the world. The learning media is expected to be in the form of media that is easy to use and does not require additional costs incurred by students. One application that is widely used today is Telegram. The application provides a telegram bot facility that can assist teachers in delivering the material they are taught. By using the telegram bot, students can easily use applications on their mobile phones without installing additional applications. This study discusses the development of online learning methods using telegram bots as a medium for delivering material to students using the approach of UCD. This study used usability testing to evaluate the Telegram bot as the media for flipped learning. There are five indicators measured in the usability evaluation we used in this research. The result of the assesment is 83.56%.

Keywords: *telegram bot, flipped classroom, chemistry, User-centered Design, learning media*

1   Introduction

Online learning has been used as an alternative way of gaining knowledge today. Especially with the pandemic due to the covid-19 virus, online learning is the only option to implement [1].

Various methods and media are used as a means of providing subject matter to students. One of the methods used is the flipped classroom, a learning model through multimedia-assisted learning [2]. This method is used as the tool for the teachers to share the learning material with the students. Some learning media used were requiring them to install several new applications that they had never used before. Sometimes it becomes a problem for the students and the teachers to install the new application into their gadget and adapt to it.

Today, many people have a smartphone, and they are active smartphone users. According to the survey in 2017 held by the Indonesian Ministry of Communication and Informatics on 6,246 respondents, 66.36% owns a smartphone, and 70.98% are students [3]. The survey also mentioned that 79,56% of them are from high school. High school students between the ages of 15-18 years are pretty active use social media [4].

Telegram is one polular social network site (SNS) with the most downloaded social media application [5]. As a popular application, Telegram has become one of the applications already installed in smartphones purchased by the customer. The Telegram

is special because it has unique features, such as chat groups and channels, high security and bots. Because Telegram has become one of the most widely used applications and provides bot features as mentioned, in this research telegram was chosen as a learning media for the students to learn Basic Chemistry.

The e-learning material module using telegram bot was developed by [6] resulted in 87% of the dissemination products average percentage. A study that evaluated the Telegram bot validity as a learning media for the Bahasa Indonesia course shows 83% of the students' responses [6]. A design of a telegram bot for sharing the information on campus was also conducted by [7]. This study intends to appraise the Kimia Dasar usability, the telegram bot, as the Chemistry learning media in the flipped classroom.

2   Material and Methods

The development of this learning media will be based on the needs of students who will study introductory chemistry. One method that can be used to accommodate this is to use a user-centered design (UCD) approach. According to [8], UCD is a method that can be used to develop an interface that can fulfil the users' needs iteratively.

After going through a series of completing users' demands and desires in developing their communication media, [9] declared that using the UCD is the way to accomplishment of hereafter business for the products built.

Application development with the UCD approach must be prepared thoroughly, and it has to pay attention to all factors in the method [10]. The development process consists of a series of meaningful activities, explained in the next section.

2.1   Specifying and Determining the Usage-Context

First, when a product or application is generated, some special rules must be applied. The system or the application will undoubtedly be directed to users with certain characteristics, goals, and tasks. The application or system will also be used within a particular scope, certain conditions (physically and socially) that will affect the use [9].

2.2   Specifying and Determining the User Requirements

Describing clearly what the user needs is the basis for developing an application or system. The success of the development of the system is the result of a complete needs elicitation process.

The gathering of needs in this research is by interviewing several people as resource components to obtain information about the needs and desires of users regarding the system to be developed. The data collection is usually done by semi-structured interviews because it adjusts to the scope of the user to see responses from users. This type of interview will be beneficial in a specific condition where the problems are pretty comprehensive, but the reactions from respondents do not lead to conclusions. Meanwhile, structured interviews can be accomplished in situations where the area of the respondent's return is quite clear, and the existing demand to measure the standard of each style of thought. Interviews can also be used as an function analysis aspect [11].

The requirements of user involve a description and assignment resume that the system will reinforce. The user requirements have the tendency to provide examples of possible job scheme and interaction phase for the following plans and represent any system's features to encounter the characteristics of the use context. The user requirement gathering process is fundamental, leading to the following design process [12].

2.3 The Solution of Design Reiteration

The design adjustments may come up from various viewpoints, from replication and developing to insightful creativity. No matter what the main source, all configuration of thought as its progress undergo repeated increments. Whatever the initial design form is formed, it is the result of ideas. And the design shall always change in each development iteratively [11].

2.4 Evaluating the Design in Case of the Requirement

The design that has been made must then be evaluated. The evaluation can be done and followed by a more complex model. The review is a necessary action in the framework improvement life cycle, which can confirm how far the targets of users and related parties have been met. It also provides additional data to polish up the plan [11].

The users will receive the questionnaire to collect their idea about the application/system utilization, how it influences them, and how it suits them. We can manage feedback from the users through the questionnaire given.

3 Result and Discussion

3.1 Specifying and Determining the Usage-Context

In this research, the user observation was conducted on the students of a high school in Pasuruan city. The survey interviewed relevant stakeholders, including the teachers who teach Introductory Chemistry lessons and the students. This observation method is essential to record and notice some tangible things from the activities of users who will later play a role in application development.

3.2 Specifying and Determining the User Requirements

The researcher used a pre-questionnaire containing several questions to collect information and background from users and stakeholders involved in this study. As mentioned above, the stakeholders are the Chemistry teachers and the students. The questions in the questionnaire are related to the personal data and background of the users.

The answers to the questionnaires distributed may direct the needs of the users in learning introductory chemistry. Table 1 represents the question list that used in the pre-questionnaire.

Table 1. Question list in pre-questionnaire

1.	Can you mention the difficulty in studying Basic Chemistry by online learning?
2.	Do you have to install a new application to join the online class?
3.	Do you have the application Telegram on your smartphone?
4.	Will you be cooperated to try the learning media for studying Chemistry?

The pre-questionnaire answers from the students and teachers can be summarized into the requirements, which are:
1. The media must be able to help the teachers to share the material with the students.
2. The media must be able to ease the student in studying introductory chemistry.

3.3   The Solution of Design Reiteration

This stage is the first time the media was formed. It is done by using as much information from many resources related to telegram bot development.
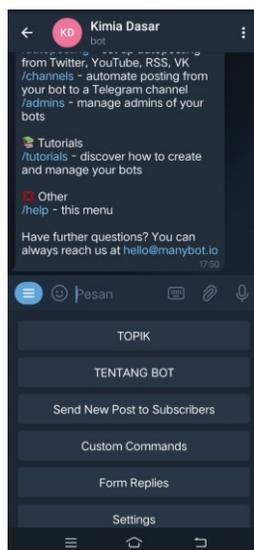

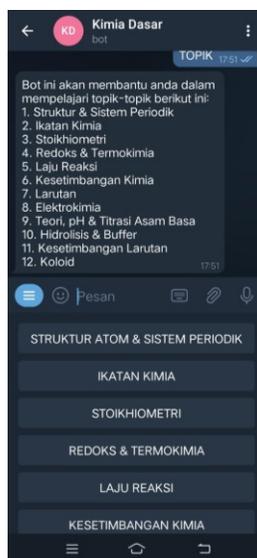Fig 1. The construction of Bot Telegram Kimia Dasar

Fig 2. Menus and Buttons in the Telegram bot Kimia Dasar

This telegram bot is made based on the rules that the telegram application has determined. However, the menu that will be created results from thinking by the development team by reckoning the needs and desires of the users and stakeholders involved.

The total topics of introductory chemistry that will be delivered through this medium are 12 topics. Each subject is divided into several sub-sections containing: materials, pretests, quizzes, answer keys, fun facts and videos related to the topic.

Initial commands in the menu in the media were initially made by typing commands manually. Fig 1 shows the process of Telegram bot construction.

Then the options menu is adjusted in the form of buttons that make it easier for users not to have to type manually anymore. Fig 2 shows the appearance of the Telegram bot, which already displays a menu in the form of buttons.

3.4 Evaluating the Design in Case of the Requirement

The evaluating assessment used in this research is in the form of usability evaluation. To measure the indicators, the researcher prepared some questions given to the users. Several indicators are measured in usability evaluation, including Learnability, Efficiency, Memorability, Errors and Satisfaction [13] [14]. After the users tried and tested the media, they had to answer the questionnaires.

Table 2. The score of the answer

Score	Description
1	Strenuously Do Not Agree
2	Do Not Agree
3	Impartial
4	Agree
5	Very Agree

Table 3. Result of the questionnaire

No	Questions	Score					Total score
		1	2	3	4	5	
	Learnability						
1	I believe this telegram bot is simple to utilize.	0	0	9	20	15	182
2	I think this app helps me learn Basic Chemistry.	0	0	6	23	15	185
3	I think the content in this telegram bot is easy to understand	0	0	8	25	11	179
	Efficiency						
4	I think it is easy to install the application Telegram on my smartphone.	0	0	5	23	16	187
5	I think this telegram bot does not burden my HP performance.	0	1	8	15	20	186
	Memorability						
6	I think this app has easy-to-understand selection buttons.	0	1	3	26	14	185
7	I believe the menus in this telegram bot are very easy to remember	0	0	8	18	18	186
8	I think this telegram bot is easy to utilize	0	0	6	20	18	188
	Errors						
9	I don't think I made much error when operating this telegram bot	0	4	2	30	8	174
10	In my opinion, if I do some errors, it will be easy to correct them	0	2	6	25	11	177
	Satisfaction						
11	I believe it's very enjoyable to use the telegram bot	0	0	5	20	19	190
12	I think this telegram bot overall is satisfactory	0	0	2	29	13	187

For the measurement, the Likert scale is used for acquiring the usability assesment. There are five scores, each of which describes the user's opinion, from score one representing " Strenuously Do Not Agree " to score five representing " Very Agree ". Table 2 shows the score of the answer. Table 3 shows the list of the questions and the result of the questionnaire.

Table 3 represents the calculation of the respondents' answers regarding the bot Telegram. Each respon is calculated by multilpying it to the score from Table 2. From Table 3, we see that the result shows zero answers of "score 1", eight answers of "score 2", sixty-eight answers of "score 3", two hundred and seventy-four answers of "score 4" and one hundred answers of "score 5". Table 4 shows the value of each indicator. In Table 5, we can see the result of the usability in each indicator. From the assesment of usability, the result is 83.56%.

Table 4. The assesment for each indicator

No	Indicator	1	2	3	4	5	Total
1	Learnability	0 x 1	0 x 2	23 x 3	68 x 4	41 x 5	546
2	Efficiency	0 x 1	1 x 2	13 x 3	38 x 4	36 x 5	373
3	Memorability	0 x 1	1 x 2	17 x 3	64 x 4	50 x 5	559
4	Errors	0 x 1	6 x 2	8 x 3	55 x 4	19 x 5	351
5	Satisfaction	0 x 1	0 x 2	7 x 3	49 x 4	32 x 5	377
	TOTAL	0 x 1	8 x 2	68 x 3	274 x 4	178 x 5	2206

Table 5. The Usability result for each indicator

No	Indicator	Total Score x Likert Score	Maximum Score	Result
1	Learnability	546	660	(546/660) x 100% = 82.73%
2	Efficiency	373	440	(373/440) x 100% = 84.77%
3	Memorability	559	660	(559/660) x 100% = 84.70%
4	Errors	351	440	(351/440) x 100% = 79.77%
5	Satisfaction	377	440	(546/660) x 100% = 85.68 %
	TOTAL	2206	2640	(2206/2640) x 100% = 83.56%

4   Conclusion

This research focuses on developing the Telegram Bot for flipped learning chemistry class with UCD approach, which has four stages of development. The first stage was understanding and specifying the usage-context. This is the procedure of establishing the telegram bot and also the stakeholder. The study was taken place in a high school in Pasuruan city. The second stage was understanding and specifying the user requirements. This stage focused on gathering the background data of the stakeholders (students and teachers) and collecting their needs and requirements. Stage three was regarding the media designing to fulfil the users' satisfaction. This process was making a complete product, including the appearance, menus and contents. It all was based on the user requirements from stage two. And the last stage was the evaluation of the whole product. The review is done by accumulating the users' points of view from the questionnaire given. Evaluation results must meet at least 80% of the indicators provided. This research also conducted the A-B-testing for the student involved. They were divided into two groups, the first one uses the conventional method, and the second uses the telegram bot. The students were given the pretest and the post-test to compare the result between the two groups. A complete report about the result is presented by the researcher in other paper.

Acknowledgement

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