Sort Elements Based on Priority, in order to Improve the Quality of E-Learning in Health Using Difficulty-Usefulness Pyramid with Weighting (DUP-We)

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Abstract—Many health education institutions in Indonesia are starting the implementation of e-learning, but there are still many technical obstacles. The elements of e-learning that must be improved are relatively many, so it is necessary to choose which elements will be prioritized to handle first. This study proposes a new method for selecting elements that will be prioritized to be improved using Difficulty-Usefulness Pyramid with Weighting (DUP-We). The subjects were 200 students from the Environmental Health Department of Magetan, Health Polytechnic of Surabaya. The elements chosen were learning design, handout, book, links to resources, discussion, chat, assignment, feedback, quiz and survey. The attributes that were used as the basis for determining priorities were difficulty and usefulness. Weighting (1 to 10) was based on the importance of each attribute. Data about attributes and weighting were obtained through filling in questionnaires. For each element a determination was made: 1) weighted difficulty (difficulty x weight) and weighted usefulness (usefullness x weight); 2) weighted difficulty mean and weighted usefulness mean; 3) range (weighted difficulty mean up to weighted usefulness mean). Furthermore, the range was sorted from the smallest and described in the form of a pyramid. The pyramid shows that the order of elements based on priority was assignment, quiz, feedback, discussion, link to resources, book, survey, learning design, handout and chat.

Keywords—Difficulty-Usefulness Pyramid with Weighting (DUP-We), priority, e-learning in health

1 Introduction

In the information age, information and communication technology (ICT) in general has been used by health institutions such as health services, hospitals, health clin-

ics, including health education institutions. [1] Health education institutions must be able to follow the development of the world of education as an output of ICT development globally, in order to obtain a leap forward in progress, including the implementation of e-learning. [2] This is very important, because the use of e-learning systems can be a strategic way to achieve competitive advantage, which is certainly different from the use of traditional systems. E-learning will allow the learning process to take place more flexibly, not too constrained by time, place, busyness, physical presence, and stressful teaching-learning. [3],[4] The implementation of e-learning is also proven to increase student motivation. [5]

Today, many health education institutions in Indonesia are starting to implement e-learning, so they still need improvement efforts. The lecturers as learning managers for the courses that they provide, still face many technical obstacles in managing e-learning, thus causing the lack of e-learning systems to be used. Thus, students are forced to use an e-learning system that is actually not yet fully ready to use. [2]

One e-learning software that is widely used in education management in Indonesia (including in health education), namely Moodle, uses the main components in e-learning that must be managed by lecturers, namely: learning design, handout, book, link to resources, forum discussion, chat, assignment, feedback, quiz, and survey. These elements must be well prepared so that e-learning can be implemented ideally. [6]

Considering that there are still many health e-learning implementations in Indonesia that are in the stages of development, of course there are still many efforts needed to improve the basic elements mentioned above. Given the relatively large number of elements that need to be fixed, it is necessary to choose which elements will be prioritized to be addressed first.

At the beginning of 2018, Nugroho, et al. has introduced DUP as a method for selecting elements based on priority order. In this method, the determination of the elements is done through the literature review, while the attributes used as the basis for determining priorities are difficulty and usefulness. DUP gives equal weight to both attributes or in other words, the level of importance of difficulty and usefulness as a basis for improvement of elements is considered the same. [7] If considered further, this is unfair because everyone can have different views about the importance of difficulty and usefulness. Logically, some people will assume that elements that are difficult to operate should be prioritized (difficulty), but some will assume that what must be improved first is the elements that are more useful (usefulness).

Based on the background above, a new method is proposed to select the elements that will be prioritized for improvement, which is the development of DUP by giving weight to the attributes of difficulty and usefulness.

2 Methods

The study was conducted in the Health Polytechnic Surabaya, Indonesia in 2018. This study involved 200 students from Environmental Health Department of Magetan, Health Polytechnic of Surabaya as research respondents. This study was the develop-

ment of a method for selecting health e-learning elements based on priority order, using a modified DUP by giving weight to the attributes of difficulty and usefulness.

The research steps applied are as follows:

2.1 Determination of elements

The selection of health e-learning elements that will be prioritized refers to the references that had been used in the DUP creation study [7], namely several popular e-learning software in cPanel, including: ATutor, Chamilo, Claroline, DoceboLMS, Dokeos, eFront and Moodle. The elements chosen based on the references above were: learning design, handout, book, links to resources, discussion, chat, assignment, feedback, quiz and survey. [6]

2.2 Determination of attributes

Referring to DUP, the attributes used as a basis for determining priorities were difficulty and usefulness. [7] Both of these attributes were extracted from the Technology Acceptance Model (TAM) [8]. TAM is the most widely used model to explain ICT acceptance by users. Now TAM has developed into three generations, namely TAM, TAM-2, and TAM-3 [9]. TAM [8], TAM-2 [10] and TAM-3 [11] contain two determinants of user acceptance of ICT namely "perceived ease of use" and "perceived usefulness". In DUP, the term "ease of use" was changed to "difficulty", so that usefulness terminology was still used. Based on Figure 1, it is known that difficulty was scored with a negative symbol (0 to -10). Usefulness was scored with positive symbols (0 to 10). [7]

2.3 Weighting attributes

Weighting attributes was based on the importance of each attribute (difficulty and usefulness) with a value of 0 to 10 according to the perceptions of respondents. The next, difficulty weight was multiplied by the difficulty score so that the resulting difficulty was weighted. The same thing applied to usefulness (Figure 1).

Difficulty	Elements	Usefulness
High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 Low	**Learning design**	Low 0 1 2 3 4 5 6 7 8 9 10 High
High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 Low	**Handout**	Low 0 1 2 3 4 5 6 7 8 9 10 High
High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 Low	**Book**	Low 0 1 2 3 4 5 6 7 8 9 10 High
High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 Low	**Link to resources**	Low 0 1 2 3 4 5 6 7 8 9 10 High
High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 Low	**Discussion**	Low 0 1 2 3 4 5 6 7 8 9 10 High
High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 Low	**Chatting**	Low 0 1 2 3 4 5 6 7 8 9 10 High
High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 Low	**Assignment**	Low 0 1 2 3 4 5 6 7 8 9 10 High
High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 Low	**Feedback**	Low 0 1 2 3 4 5 6 7 8 9 10 High
High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 Low	**Quiz**	Low 0 1 2 3 4 5 6 7 8 9 10 High
High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 Low	**Survey**	Low 0 1 2 3 4 5 6 7 8 9 10 High
	Importance of Difficulty	Low 0 1 2 3 4 5 6 7 8 9 10 High
	Importance of Usefulness	Low 0 1 2 3 4 5 6 7 8 9 10 High

Fig. 1. Questionnaire as an instrument for selecting elements of e-learning based on priority

2.4 Data collection and data analysis

At this stage data were collected through filling out the questionnaire (Figure 1). Respondents were asked to fill out questionnaires by being guided directly by the researcher. Next, a check on the accuracy of filling out the questionnaire was carried out and continued with computerized data entry. The next stage was descriptive data analysis, namely:

- Multiplying the difficulty score of each element with importance of difficulty, so that the weighted difficulty score for each element was produced
- Multiplying the usefulness score of each element with importance of usefulness, so that the weighted usefulness score for each element was produced
- Calculating the mean score of weighted difficulty and the mean score of weighted usefulness
- Calculating the range that starts from the mean score of weighted difficulty until the mean score of weighted usefulness
- Ranking according to the smallest range
- Drawing a pyramid diagram based on the sorted range
- Determining the elements based on priority order referring to the pyramid diagram.

3 Results

The results of descriptive data analysis are shown in Table 1. Then the range of each element was arranged sequentially starting from the smallest as shown in Table 2. The range that had been sorted was presented in the form of a pyramid diagram. The largest range was in the lowest position, while the smallest range was in the top position (Figure 2).

Table 1. Mean score and range

Mean Score of Difficulty	Elements	Mean Score of Usefulness	Range
-9.66	Learning design	71.03	80.69
-9.98	Handout	70.06	80.04
-14.21	Book	98.09	112.3
-23.02	Link to resources	98.03	121.05
-40.02	Discussion	86.76	126.78
-14.44	Chatting	26.6	41.04
-71.05	Assignment	90.01	161.06
-60.01	Feedback	73.33	133.34
-65.56	Quiz	82.75	148.31
-35.88	Survey	73.22	109.1

Table 2. The rank of mean score based on range

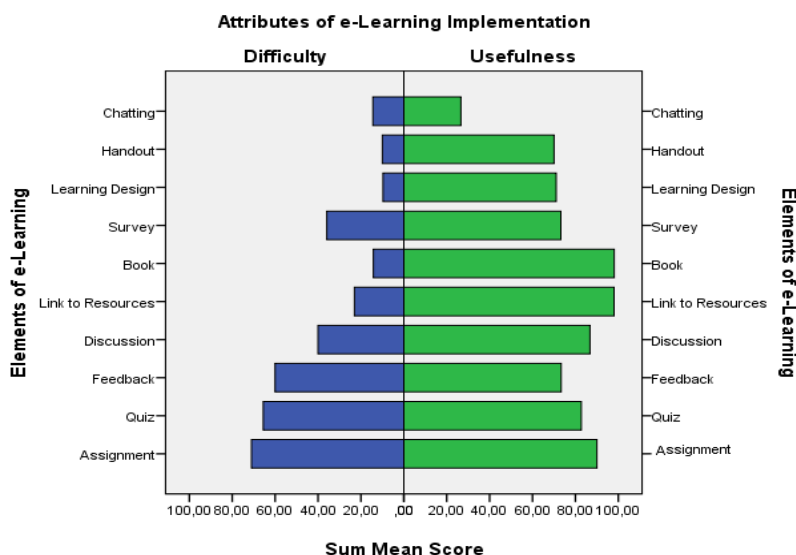| Mean Score of Difficulty	Elements	Mean Score of Usefulness	Range
-14.44	Chatting	26.6	41.04
-9.98	Handout	70.06	80.04
-9.66	Learning design	71.03	80.69
-35.88	Survey	73.22	109.1
-14.21	Book	98.09	112.3
-23.02	Link to resources	98.03	121.05
-40.02	Discussion	86.76	126.78
-60.01	Feedback	73.33	133.34
-65.56	Quiz	82.75	148.31
-71.05	Assignment	90.01	161.06

Fig. 2. The rank of mean score based on range

Referring to Figure 2, the greatest range (bottom position in the pyramid) was "assignment". Thus, in an effort to improve e-learning in health, "assignment" was an element in the first priority position, then the next sequence was quiz, feedback, discussion, link to resources, books, surveys, learning design, handouts and chat. Furthermore, it was recommended that the five elements with the greatest range (assessment, quiz, feedback, discussion and link to resources) be prioritized to be handled first.

4   Discussion

This study resulted in a new method which is the development of DUP, namely the method used to determine the initial steps for efforts to improve the quality of e-

learning in health.[7] Determination of e-learning elements is based on ten elements used in popular e-learning programs namely learning design, handout, book, links to resources, discussion, chat, assignment, feedback, quiz and survey, which are also used in DUP [7], namely software contained in Softaculous, a software organizer in cPanel as a leading website management panel. [6]

The attributes chosen as the basis for prioritizing referring to DUP are difficulty and usefulness. In the process of creating DUP, both attributes were chosen based on careful consideration through the literature review. E-learning is a manifestation of the implementation of ICT-based systems, so a search is made about the main determinants of ICT acceptance by users. [7] In this case, DUP refers to the most popular technology acceptance model, TAM, which has developed in three generations [8], [10], [11]

In the creation of DUP, it was decided that "difficulty" was an attribute that had to be reduced in condition, so that it had to be given a negative score; while "usefulness" is an attribute that must be improved, so it must be given a positive score. [7] The results of this study provide a slight change from DUP, which is given weighting for difficulty and usefulness based on the importance of the two attributes according to respondents' perceptions. Therefore, then this new method is called Difficulty-Usefulness Pyramid with Weighting (DUP-We).

Figure 2 shows that differences in the way scores are given for difficulty and usefulness will result in bars in the opposite direction, namely to the left for "difficulty" and to the right for "usefulness". In this case, the priority is the element with the greatest range starting from the value of "difficulty" to "usefulness". The use of pyramid diagrams is intended so that the results of the analysis can be studied and understood quickly. [7]

Pyramid diagrams can be created with the help of computers manually or using statistical software that provides facilities for making population pyramids such as SPSS. [12] In this case, the researcher could make DUP-We using the facility of making a population pyramid, with several changes, namely:

- "Variable" form filled with mean score
- "Show distribution over" form filled with elements of e-learning
- "Split by" form is filled with attributes of e-learning. [7]

By using DUP and DUP-We, drawing conclusions can be done more easily because the results of data analysis have been presented visually in the form of a pyramid. In this case, the element in the bottom position is the first priority, while the element in the top position is the last priority. Recommendations can also be delivered more easily because they only refer to the order of priorities that have been obtained. Based on conclusions and recommendations, managers can immediately plan for improvements to the elements of e-learning in accordance with the characteristics of these elements.

As explained in the introduction of DUP, the entire process above is an effort in order to improve the quality of e-learning in the health sector, but it is recommended that DUP be extended to other objects, for example hospital information systems, telemedicine, health service systems, e- Health, health e-journal and so on. In this

case, the elements that are relevant to the object must be chosen first, through the literature review or through focused group discussion or brainstorming involving the users of the related system.

5 Conclusion

This research has produced a new method (DUP-We) developed from DUP, which can be used easily to select priority elements in efforts to improve e-learning in health. This finding is expected to contribute significantly in efforts to improve the quality of education management in the health sector, other health systems, even systems outside the education and health fields.

6 References

[1] H. S. W. Nugroho, S. Supriyanto, and H. B. Notobroto, "The role of perceived organizational support, personal characteristic and perceived enjoyment in acceptance model of maternal and child health information systems," Airlangga University, 2016.

[2] H. S. W. Nugroho, The application of classroom action research (CAR) in health education (Aplikasi penelitian tindakan kelas (PTK) dalam pendidikan kesehatan), 1st ed. Ponorogo: Forum Ilmiah Kesehatan (FORIKES), 2017.

[3] Q. N. Naveed, A. Muhammed, S. Sanober, M. R. N. Qureshi, and A. Shah, "Barriers Effecting Successful Implementation of E-Learning in Saudi Arabian Universities," Int. J. Emerg. Technol. Learn., vol. 12, no. 6, pp. 94–107, 2017. https://doi.org/10.3991/ijet.v12i06.7003

[4] O. Daramola, O. Oladipupo, I. Afolabi, and A. Olopade, "Heuristic Evaluation of an Institutional E-learning System: A Nigerian Case," Int. J. Emerg. Technol. Learn., vol. 12, no. 3, pp. 26–42, 2017. https://doi.org/10.3991/ijet.v12i03.6083

[5] M. S. A. El-seoud, N. Seddiek, M. M. El-khouly, and A. Nosseir, "E-Learning and Students ' Motivation: A Research Study on the Effect of E-Learning on Higher Education," Int. J. Emerg. Technol. Learn., vol. 9, no. 4, pp. 20–26, 2014. https://doi.org/10.3991/ijet.v9i4.3465

[6] Tutorials Point, "cPanel Tutorial," Tutorials Point, Simply Easy Learning, 2107. [Online]. Available: https://www.tutorialspoint.com/cpanel. [Accessed: 03-Jan-2018].

[7] H. S. W. Nugroho et al., "Difficulty-Usefulness Pyramid (DUP) as New Method to Select Elements Prioritized in Management of e-Learning in Health," Indian J. Public Heal. Res. Dev., vol. 9, no. 2, pp. 206–211, 2018. https://doi.org/10.5958/0976-5506.2018.00120.1

[8] F. D. Davis, R. P. Bagozzi, and P. R. Warshaw, "User acceptance of computer technology: a comparison of two theoretical models," Manage. Sci., vol. 35, no. 8, pp. 982–1003, 1989. https://doi.org/10.1287/mnsc.35.8.982

[9] P. Surendran, "Technology Acceptance Model : A survey of literature," Int. J. Bus. Soc. Res., vol. 2, no. 4, pp. 175–178, 2012.

[10] V. Venkatesh and F. Davis, "Theoretical extension of the Technology Acceptance Model: Four longitudinal field studies," Manage. Sci., vol. 46, no. 2, pp. 186–204, 2000. https://doi.org/10.1287/mnsc.46.2.186.11926

[11] V. Venkatesh and H. Bala, "Technology Acceptance Model 3 and A Research Agenda on Interventions," Decis. Sci., vol. 39, no. 2, pp. 273–315, 2008. https://doi.org/10.1111/j.1540-5915.2008.00192.x

[12] IBM Knowledge Center, "Obtaining population pyramids," 2018. [Online]. Available: https://www.ibm.com/support/knowledgecenter/en/SSLVMB_24.0.0/spss/base/idh_idd_population_pyramid.html. [Accessed: 04-Jan-2018].

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