QoDU (Quadrant of Difficulty-Usefulness) as new method in preparing for improvement of e-learning in health college

By Heru Santoso Wahito Nugroho

QoDU (Quadrant of Difficulty-Usefulness) as new method in preparing for improvement of e-learning in health college

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Abstract:

Background: Many educational institutions around the world are implementing e-learning, but there are still many technical obstacles. Relatively many elements of e-learning must be improved in performance, so which elements should be selected which are prioritized to be improved first.

Methods: This research applied a new method in order to select e-learning elements of health workforce education that will be prioritized for improvement. This new method was called the Quadrant of Difficulty-Usefulness (QoDU). The subjects of this study were 200 students of Environmental Health Department of Magetan, Poltekkes Kemenkes Surabaya, Indonesia.

Results: The elements that were sorted by priority were learning design, handout, book, link to resources, discussion forum, chatting, assignment, feedback, quiz and survey. The attributes used as the basis for determining priorities were difficulty and usefulness. Data about the attributes obtained through filling out the questionnaire. For each element the following were determined: 1) difficulty and usefulness; 2) mean score of difficulty and mean score of usefulness. Furthermore, 4 quadrants were arranged based on the difficulty position of each element compared to the average difficulty and the position usefulness of each element compared to the average usefulness.

Conclusion: The order of elements of e-learning in the health sector at the Environmental Health Department of Magetan, Poltekkes Kemenkes Surabaya based on priority were assignment, quiz and discussion forum as the first priority; feedback and survey as second priority; link to resources and book as third priority; and learning design, handout and chatting as the last priority.

Keywords: health college, e-learning improvement, e-learning elements, prioritized elements

Introduction

In the global era as it is today, information and communication technology (ICT) is commonly utilized by health institutions such as hospitals, community health centers, health clinics, health services, as well as educational institutions in health.[1,2] Educational institutions in health should not be left behind by the rapid development of the world of education which is the

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result of the development of ICT, in order to achieve progress far ahead, including the implementation of e-learning in health.[2,3] This is an urgent need, because the use of e-learning is one of the strategic efforts to achieve competitive advantage. E-learning can increase the flexibility of the learning process, not too affected by time, place, busyness, physical presence, and stressful teaching-learning.[2,4,5] It has also been proven in previous research that the implementation of e-learning can increase student motivation.[6]

Today, educational institutions that produce health workers in Indonesia, many are starting the implementation of e-learning, so efforts to improve quality are still very much needed. Most lecturers who act as e-learning managers for their courses, still face many technical problems, so the implementation of e-learning is imperfect. Thus, students are forced to use e-learning that is actually not perfect for use in the learning process.[2,3]

One e-learning program that is very widely used in health education learning programs in Indonesia is Moodle. This e-learning program consists of the main elements of learning design, handout, book, link to resources, discussion forum, chatting, assignment, feedback, quiz, and survey. Every lecturer should prepare and manage these elements well so that e-learning can be implemented ideally.[7]

With the view that the implementation of e-learning in health in Indonesia is still many who are in the status of pioneering, then of course there are still very much needed efforts to improve the quality of e-learning, especially for the performance of the ten elements mentioned above. With the large number of elements that must be improved in quality, selection of elements should be based on priority order.[2]

In early 2018 and 2019, Nugroho, et al introduced the method of selecting elements based on priority order, using two attributes, difficulty and usefulness, known as difficulty-usefulness pyramid (DUP). In its application, the elements were determined through a literature review. Then the difficulty and usefulness were assessed for each element. A combination of difficulty and usefulnes values was used to arrange the bars for each element. Next, the bars were arranged sequentially starting from the widest in the lowest position, and ending with the bar that was the narrowest in the topmost position. The element that becomes the first priority was

the bar which was at the lowest position, which indicated that the element had the highest level of difficulty and the level of usefulness.[2,8]

The availability of various methods in order to select elements based on priority order is important. Therefore, with the same elements and attributes, it is deemed important to introduce ways to select prioritized elements, one of which is to group elements into four quadrants, initiated by Nugroho et al. in Indonesia a few years ago.[9]

Based on the description above, a simple innovative method is introduced to select elements of e-learning in health that are prioritized for improvement and improvement, by grouping elements into four quadrants, based on difficulty and uselfulness.

Material and methods

Time, location and type of research

This research was conducted in 2018 to 2019 at the Poltekkes Kemenkes Surabaya, one of the institutions that produces health professionals, under the auspices of the Ministry of Health of the Republic of Indonesia. This research was a quantitative descriptive study, which was intended to introduce a simple innovative method for selecting elements of e-learning in health that will be upgraded in the form of priority order, based on the difficulty and usefulness of these elements.

Population and sample

The study population was all students of the Environmental Health Department of Magetan, Poltekkes Kemenkes Surabaya, Indonesia in 2018, with a population size of 240 students. The specified error margin was 0.05. Next, the sample size was determined based on the Slovin formula, namely:

$$n = N / (1 + N.e2) = 240 / (1 + 240 \times 0.052) = 240 / 1.6 = 150$$

Note: n = sample size; N = population size; e = margin error

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The results of the above calculation was for the minimum sample size, and in this study, the sample size was enlarged to 200 students. The sample was selected by simple random sampling technique using a random number table.

Research stages

The study population was all students of the Environmental Health Department of Magetan, Poltekkes Kemenkes Surabaya, Indonesia in 2018, with a population size of 240 students. The specified error margin was 0.05. Next, the sample size was determined based on the Slovin formula, namely:

This research was conducted in the following stages:

1) Determination of e-learning elements that will be sorted by priority

The determination of elements of e-learning in health that will be prioritized referred to previous research, namely difficulness-usefulness pyramid (DUP)[8] and difficulty-usefulness pyramid with weighting (DUP-We)[2], which consists of 10 elements, namely: 1) learning design; 2) handout; 3) book; 4) link to resources; 5) discussion forum; 6) chatting; 7) assignment; 8) feedback; 9) quiz and; 10) survey. In previous studies, the determination of these 10 elements had been done carefully with the difference in time that was not too long, so the consideration was still relevant for use in this study.

2) Determination of the attributes used as a basis for determining priorities

The determination of these attributes also referred to the DUP and DUP-We methods, so the attributes used as the basis for determining priorities were difficulty and usefulness.[2,8] As explained in the two previous studies, the difficulty and usefulness were explored from the Technology Acceptance Model (TAM).[10,11,12] TAM was chosen because it was the most widely used information technology acceptance model.[13] As an information technology acceptance model, TAM was built by two important determinants namely "perceived ease of use" and "perceived usefulness".

3) Measurement of difficulty and usefulness for each element

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Referring to DUP-we, the term "ease of use" had been changed to "difficulty", while "usefulness" was still used without change.[2] In this case, the two attributes were measured by completing a semantic differential questionnaire with a range of 0 to 10. For difficulty, the highest difficulty level was given a minimum score, while for usefulness, the highest usefulness level was given a maximum score (Figure 1).

4) The method of selecting elements based on priority order

After the data had been collected and had been convinced that it was correct and complete, a descriptive analysis of the data was then performed, namely:

a) Calculated the mean score of difficulty for each element

b) Calculated the mean score of difficulty for all elements

c) Calculated the mean score of usefulness for each element

d) Calculated the mean score of usefulness for all elements

Furthermore, the mean score of difficulty and the mean score of usefulness in total was used as the basis for making the Y axis and X axis. Meanwhile, for each element the coordinates were arranged based on the mean score of difficulty and the mean score of usefulness, so that the resulting quadrant image, in which there were elements with the quadrant location different ones. The first priority was the elements in Quadrant I, followed by the elements in Quadrant IV, Quadrant II, and the last was Quadrant III.

Results

The results of descriptive data analysis were the mean score of difficulty for each element, the mean score of difficulty for all elements, the mean score of usefulness for each element and the mean score of usefulness for all elements, which are shown in Table 1.

Furthermore, the mean score of difficulty and the mean score of usefulness in total namely 6.57 and 7.70 were used as the basis for making the Y axis and the X axis. Meanwhile for each element the coordinates were arranged based on the mean score of difficulty and the mean score of usefulnes, for example (9.03; 7,10) for element A, namely learning design. Next, the 4 quadrants produced are shown in Figure 2.

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Based on Figure 2, the order of health e-learning elements based on priorities were:

1) The first priority (Quadrant I) were assignment (G), quiz (I) and discussion forum (E).

2) The second priority (Quadrant IV) were feedback (H) and survey (J).

3) The third priority (Quadrant II) were link to resources (D) and book (C).

4) The fourth priority (Quadrant III) were learning design (A), handout (B) and chatting (F).

Discussion

The results showed that the order of elements of e-learning in health was arranged according to priority based on difficulty and usefulness, with the following explanation.

First priority (quadrant I)

The elements that are in quadrant I have a high level of usefulness (in the top position), but have a high level of difficulty to apply (in the left position). It may also be said to be very useful elements, but in fact it is still very difficult to realize. Therefore, these elements need to be immediately improved in quality, so that they can quickly meet the needs of users. If it is successful, then these elements can move to quadrant II.

In the presentation of the results of the analysis, the elements in quadrant I are assignment (G), quiz (I) and discussion forum (E). With this position, it is clear that the three elements above are very useful for users, but they are disappointed because they are still difficult to realize, compared to other elements. Thus, these elements must be the first priority in efforts to improve the quality of e-learning in the health sector. If the improvement effort is successful, then of course the users will be satisfied, because something they find useful is easily realized.

Second priority (quadrant IV)

The elements that are in quadrant IV have a value of usefulness which is considered lower for the user (in the bottom position) and difficult to implement (in the left position). The

elements in this quadrant need to be prioritized to improve their performance, but attention to this quadrant is still below quadrant I which is considered more useful by the user.

In the presentation of the results of the analysis, the elements that are in quadrant IV are feedback (H) and survey (J). These elements need to be managed very seriously because user disappointment usually starts from the elements that are in this quadrant.

Third priority (quadrant II)

The elements that are in quadrant II have a high level of usefulness according to the user (in the top position) and are easily applied or realized (in the right position). In other words, these elements are seen as very useful for the user and are also easily implemented or realized. These elements are the strength of the information system. Therefore, these elements need to be maintained (they can always be implemented or easily realized), and can gradually be improved.

In the presentation of the results of the analysis, the elements in quadrant II are the link to resources (D) and book (C). With that position, it is clear that the elements above are important from the point of view of the user, and also easy to implement when compared with other elements. This group of elements has the highest ability to satisfy users, so performance must be maintained. The quality of information systems is highly dependent on the four elements above, therefore in addition to being maintained, these elements must also be improved gradually.

Fourth priority (quadrant III)

The elements in quadrant III have a lower level of usefulness when compared to other elements (in the bottom position), but the reality is easy to implement (in the right position). In other words, these elements are not very expected by the user, but instead have good performance. Therefore, the performance of these elements is considered to have exceeded the standard.

At the presentation of the analysis results, the elements in quadrant III are learning design (A), handout (B) and chatting (F). These elements are seen as elements that are not too important for the user to be provided by the system manager, but in fact the performance of these

elements is relatively high. In a simple statement we can say: "Why should we prioritize something that is currently considered less useful by users? Moreover, its performance is also good. Isn't it better if we focus more on other elements that are considered more useful for the user? Moreover, elements that are still difficult to implement. If we pay close attention to the questions above, then the elements in quadrant III should be the last order, in an effort to improve the performance of these elements, or even these elements need not be improved at this time.

Innovation

This research has produced a new method used for determining the initial steps for efforts to improve the quality of the management of e-learning in health. The 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 forum, chatting, assignment, feedback, quiz and survey, which are also used in DUP and DUP-We.[2,8]

The attributes chosen as the basis for determining priorities are difficulty and usefulness. This refers to the results of previous studies, namely DUP and DUP-We.[2,8] "Difficulty" is a negative attribute, so the more difficult an element is implemented, the lower the score obtained. Meanwhile, "usefulness" is a positive attribute, so the more useful an element is, the higher the score obtained. If presented in quadrant form, then the difficulty is placed on the horizontal axis, so the more difficult an element is to be implemented, the position is on the left and the easier an element is to be implemented, the position is on the right. Meanwhile, usefulness is placed on the vertical axis, so that the more useful an element is to the user, then its position is at the top, while the less useful an element is to the user, then its position is at the bottom.

The use of this quadrant is intended so that the results of the analysis can be understood quickly and easily. In this case, quadrants can be created manually or using statistical software such as SPSS. With a quadrant like this, drawing conclusions can be done easily and quickly because the results of data analysis are presented visually in a quadrant based on difficulty and usefulness. In this case, the elements in quadrant I are the first priority, then sequentially followed by the elements in quadrant IV, quadrant II, and the last sequence is quadrant III.

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Recommendations can also be conveyed easily because it simply refers to the order of priorities that have been obtained in the conclusions of the study. Based on these conclusions and recommendations, the managers of the health information system can immediately draw up a plan to improve the elements according to the characteristics of the elements.

The entire process above is an effort focused on improving the quality of ICT-based information systems. The focus of this new simple innovative method is the visualization of the results of data analysis in the form of "quadrants" so that it is very easy to understand in a quick time. Furthermore, this quadrant is introduced with the name "Quadrant of Difficulty-Usefulness" which is called by the short name "QoDU"

It should be noted that in this study, "e-learning in health" is only an example of an object that has become the target of quality improvement efforts, through enhancing the building elements. Therefore, there are wide open opportunities to implement the entire process above for other objects, such as health information systems, public health center information systems, hospital information systems, telemedicine, e-Health, and others. It should be noted that, researchers must first make the selection of elements in accordance with the system that will be the object of study. In addition to referring to previous established literature, the elements to be investigated can also be explored by the users of the related system. Many ways to explore the elements of users for example through interviews, brainstorming or focus group discussions.[14]

Conclusion

Based on the results of the study, conclusions can be drawn including:

1) The order of elements of e-learning in the health at Environmental Health Department of Magetan, Poltekkes Kemenkes Surabaya based on priority were assignment, quiz and discussion forum as the first priority; feedback and survey as second priority; link to resources and book as third priority; and learning design, handout and chatting as the last priority.

2) Through this research, an innovative and simple method is produced to select elements that are prioritized in efforts to improve e-learning in health.

Furthermore, several things are recommended, namely:

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1) It is expected that the managers of e-learning and other systems use this method in order to initiate efforts to improve the quality of the system.

2) It is expected that the managers of information systems in general try to implement this method in order to initiate efforts to improve and improve the performance of various types of information systems, even other systems outside the information system, by first making some adjustments, especially the selection of system elements.

Acknowledgments

Disclosure

The author reports no conflicts of interest in this work.

References

1. Nugroho HSW, Supriyanto S, Notobroto HB. The role of perceived organizational support, personal characteristic and perceived enjoyment in acceptance model of maternal and child health information systems [dissertation]. Surabaya: Airlangga University; 2016.

2. Nugroho HSW, Prayitno H, Budiono A. Sort Elements Based on Priority, in order to Improve the Quality of E-Learning in Health Using Difficulty-Usefulness Pyramid with Weighting (DUP-We). *Int J Emerg Technol Learn*. 2019;14(19):186–93.

3. Nugroho HSW. *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.

4. Naveed QN, Muhammed A, Sanober S, Qureshi MRN, Shah A. Barriers Effecting

Successful Implementation of E-Learning in Saudi Arabian Universities. *Int J Emerg Technol Learn*. 2017;12(6):94–107.

5. Daramola O, Oladipupo O, Afolabi I, Olopade A. Heuristic Evaluation of an Institutional E-learning System: A Nigerian Case. *Int J Emerg Technol Learn*. 2017;12(3):26–42.

6. El-seoud MSA, Seddiek N, El-khouly MM, Nosseir A. E-Learning and Students' Motivation: A Research Study on the Effect of E-Learning on Higher Education. *Int J Emerg Technol Learn*. 2014;9(4):20–6.

7. Tutorials Point. cPanel Tutorial [homepage on the Internet]. Tutorials Point, Simply Easy Learning; 2107. Available from: https://www.tutorialspoint.com/cpanel . Accessed January 3, 2018.

8. Nugroho HSW, Sillehu S, Handoyo, Suparji, Sunarto, Subagyo, et al. Difficultness-Usefulness Pyramid (DUP) as New Method to Select Elements Prioritized in Management of e-Learning in Health. *Indian J Public Heal Res Dev*. 2018;9(2):206–11.

9. Nugroho HSW, Suparji, Sunarto. *Quadrant of Difficulty-Usefulness (Qodu): Quadrant of Difficulty-Usefulness (Qodu): New Method for Setting Priorities for Improving Health Information System Elements (Metode Baru untuk Menyusun Prioritas Perbaikan Elemen Sistem Informasi Kesehatan)*. 1st ed. Bangli: Alliance of Health Activists (AloHA); 2019.

10. Davis FD, Bagozzi RP, Warshaw PR. User acceptance of computer technology: a comparison of two theoretical models. *Manage Sci*. 1989;35(8):982–1003.

11. Venkatesh V, Davis F. Theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. *Manage Sci*. 2000;46(2):186–204.

12. Venkatesh V, Bala H. Technology Acceptance Model 3 and A Research Agenda on Interventions. *Decis Sci*. 2008;39(2):273–315.

13. Surendran P. Technology Acceptance Model : A survey of literature. *Int J Bus Soc Res*. 2012;2(4):175–8.

14. Nugroho HSW. *Quality of health service according to consumer perception (Kualitas layanan kesehatan menurut persepsi konsumen)*. 2nd ed. Magetan: Forum Ilmiah Kesehatan (FORIKES); 2020.

Tabel 1 Mean score of each element

Mean Score of Difficultness	Elements	Mean Score of Usefulness
9.03	Learning design	7.10
9.00	Handout	7.02
8.58	Book	9.81
7.70	Link to resources	9.80
6.00	Discussion	8.68
8.56	Chatting	2.66
3.00	Assignment	9.00
4.00	Feedback	7.33
3.44	Quiz	8.28
6.41	Survey	7.32
6.57	**Total**	**7.70**

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

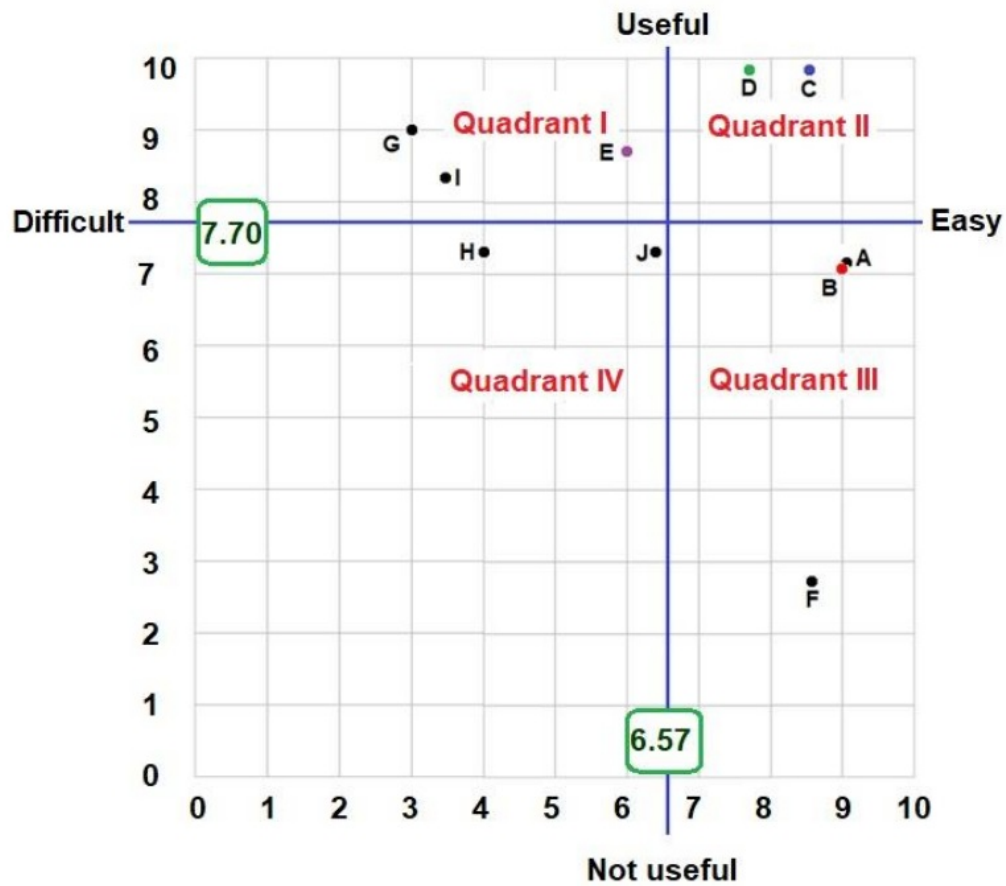**Figure 1** Questionnaires as instruments for selecting e-learning elements based on priorities

Figure 2 Analysis of the position of each element of e-learning in health in the four quadrants based on difficulty and usefulness (A = learning design; B = handout; C = book; D = link to resources; E = discussion forum; F = chatting; G = assignment; H = feedback; I = quiz; J = survey)

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