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Designing the open-badges guideline based on the fuzzy Delphi method

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Abstract: This study aims to obtain expert consensus on the appropriate elements of open badge learning guidelines. The Fuzzy Delphi Method (FDM) was used to reach a consensus from 20 experts with different backgrounds. These guidelines were designed and developed based on the Fuzzy Delphi Method (FDM) as well as the integration of the ASSURE instructional design model by Heinich, Molenda, and Russell (1993). The guidelines were evaluated by selected experts using several criteria, and data were collected through questionnaires. Based on the results of the study, all items meet the requirements in the number of three fuzzy triangles and pass the de-fuzzing process (more than Alpha α – cut-off value 0.5). Therefore, the findings of the study show that the experts agree that this module is suitable to be implemented according to the six themes set. The findings highlight key constructs for OBL guideline development included several key constructs related to OBL guideline content, state guideline objectives, method, media/tool, and material selection, as well as recommendations for use and participation based on the ASSURE instructional design model. Further research can incorporate insights from fields such as psychology, sociology, and educational policy. The focus should be on technical aspects and use qualitative and quantitative methods to ensure that all students, regardless of background, receive fair qualifications and recognition.

Keywords: *Fuzzy Delphi Method, Instructional design, Open education, Open-badges learning.*

1. Introduction

The landscape of distance education has undergone rapid change along with advances in information, communication, and technology (ICT) in this digital age. Open Distance Learning (ODL), formerly known as Distance Education (DE) since the early 1980s, is now one of the fastest-growing forms of global education. The merging of the concepts of "open learning" and "distance education" in the term "open and distance learning" emphasizes the importance of providing unlimited access to education as well as flexible learning opportunities, which eliminate time and location restrictions. The main principle of open and distance learning is to promote an educational system that is "open," which supports the sustainability of distance education practices. In theory, strategies for open and distance learning offer the possibility of learning with the separation of time or space between teachers and students, or a combination of both, and are implemented by various institutions or agencies. In the context of ODL, it is important to integrate the views and expectations of both sides, namely teachers and students, because today's students are more dependent on technology than previous generations. According to (1) the hope is that as technology advances, education will also evolve by leveraging technology to enhance the learning process. Apart from planning content and imparting knowledge, teachers are also expected to play a role as teaching designers, guiding and facilitating students throughout their education process (2; 3).

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2. Literature Review

Open badge learning (OBL) has been integrated as an innovative pedagogical approach in ODL, reflecting a modern educational model that offers alternative ways to increase the standard of instruction and learning. This model extends the learning experience beyond the confines of the traditional classroom, allowing students to control their educational journey and develop at their own pace. Besides focusing on providing access to technology or tools for students, it also explores innovative teaching methods where technology benefits both teachers and students in the learning environment (4). OBL is an innovative pedagogical approach to display students' knowledge, skills, and achievements, which are appropriate and competitive in the Industrial Revolution 4.0 (IR4.0) environment.

Although the concept of open learning has grown rapidly in recent years, research on how to apply this new learning approach in the education system is still limited (5;6). Research that investigates the changing educational needs of students in the context of open badge learning, especially in Malaysia, is still lacking. Therefore, (7) emphasized the need for more studies on open learning, especially in the aspects of evaluation and learning experiences, because it is very necessary to meet the demands of the workforce in the era of the Industrial Revolution 4.0. In Malaysia, previous studies on open education focused more on MOOCs (8; 9). Although there are guidelines for micro-qualification practices issued by the Malaysian Qualifications Agency (MQA) in 2019 and 2020, no specific guidelines have been introduced by MQA for open learning. In addition, so far, there are no models, modules, guidelines, or frameworks that study in-depth open learning that can be used as a reference by higher education institutions to build and implement open badges in their programs. Therefore, this study aims to address those shortcomings by designing guidelines that help practitioners understand the concept of open learning as a future qualification that is flexible and accessible online.

(10) stated that open badges have been used to guide learning, increase engagement, and encourage learning experiences, both in the context of skills, knowledge, and formal or informal learning activities. Therefore, according to (11) as well as (12), more research is needed in open education, especially in aspects such as OBL design, assessment, and learning experiences. This is important because alternative qualifications are essential in the workforce to meet the demands of Industrial Revolution 4.0 (13; 14). Thus, the purpose of this research is to determine the constructs and elements in designing the OBL guideline. The research questions guiding the study are 'What are the constructs and elements in designing the OBL guideline?'

3. Method

3.1. Research Design

Based on their opinions regarding the appropriateness of the suggested guideline, an analysis is conducted. Therefore, this study uses the fuzzy Delphi method to gather expert opinions that invalidate the guideline to design and develop it during this phase. The Delphi technique and fuzzy set theory are combined to create fuzzy Delphi (15). (16) developed this analytical approach to decision-making, which combines fuzzy theory with the conventional Delphi method.

Three features contribute to the Delphi technique, an expert opinion survey method: statistical group response, iteration and controlled feedback, and anonymous response (17). As per (18), the approach facilitates the amalgamation of viewpoints obtained autonomously from every specialist via repeated questionnaire cycles for forecast results. To put it succinctly, the fuzzy Delphi method is employed to ascertain the expert consensus acting as respondents through the application of quantitative methods.

3.2. Sampling

Through purposive sampling, a panel of experts were selected for this phase to provide their consensus on the guideline. The process of choosing the appropriate sample for the FDM is not a non-probability sampling (19). This method was used because the samples are chosen based on their expertise and background in the subject matter, rather than at random. Choosing a suitable panel of experts is the most crucial step in the Delphi method because it influences the quality of the study's output (20).

(21) states that lecturers with more than five years of experience are considered experts because they have continuous experience in both managing and instructing. Apart from that, according to (22) a person with more than five years of experience in a particular field is considered an expert in the field of education. The expert panel was chosen based on several criteria, including the presence of professors or senior lecturers with more than ten years of experience working with technology and communication in a variety of academic fields as researchers or educators. According to (23), a panel of five to ten experts is necessary for the study to meet its specific goals. However, according to (24), to ensure thorough and trustworthy research findings, a typical number of experts selected is between 15 and 35 experts. Given the high importance of consistency, multiple experts ranging from 10 to 50 are advised (25). Taking into account the relevant variables, a panel of 20 experts from diverse academic fields will be formed to assess and validate the model during this Fuzzy Delphi phase. They will be chosen to acquire knowledge and consensus from experts regarding the rationale behind the creation of guidelines. The evaluation is predicated on answers to a professional survey with a 7-language Likert scale.

The ASSURE instructional design model serves as another foundation for the guideline. In 1999, (26) created the ASSURE model. This served as a manual for creating lessons and providing instruction using instructional technology. The ASSURE acronym stands for these important components: A- Analyze Learners, S- State Objectives, S- Select Instructional Methods, Media/Tools, and Materials, U- Utilize Media/Tools and Materials, R- Require Learner Participation, and E-Evaluate. Since it represents one of the instructional designs in a more structured method of instruction in the teaching and learning process, the ASSURE model was used in this study (27). This explains why this model was chosen for the study because it meets the objective of creating the guideline efficiently and methodically.

3.3. Instruments

The instrument is organised into two sections: (a) background demographics and (b) content for creating the guidelines. It is created using the results of needs analyses, interviews with experts, and systematic literature reviews. Part A is the demographic information with 7 questions and Part B is the design content guideline consisting of 6 parts based on ASSURE instructional design model and of 55 questions with 7 Likert scales (1-Very Strongly Disagree, 2- Strongly Disagree, 3- Disagree, 4-Neither Agree nor Disagree, 5- Agree, 6- Strongly Agree and 7- Very Strongly Agree).

3.3.1. Validity of the Instruments

Three experts participated to validate the instruments for the FDM survey (design) and interview (development). Table 1 shows the list of the experts involved in this study.

Table 1.
Background of experts for validity of instruments.

Experts	Post	Expertise
1	Lecturer	Expert in language & e-learning
2	Lecturer	Expert in curriculum & instructional technology
3	Instructional designer	Apps and system development

3.4. Data Collection and Analysis

This study uses the FDM template to analyze the data, which has been developed by (28) experts in FDM analysis. Data from all items were analyzed based on the level of agreement between experts, where the threshold value (d) was ascertained by measuring the difference between two fuzzy numbers in the following approach:

$$d\left(\tilde{m},\tilde{n}\right)=\sqrt{\frac{1}{3}\left[(m_1-n_1)^2+(m_2-n_2)^2+(m_3-n_3)^2\right]}.$$

The expert agreement was evaluated using defuzzification values a priority score was assigned to each item. Every item was examined, and the study's findings showed that the experts reached an agreement, with a threshold value (d) exceeding 0.2 and the probability of agreement reaching or exceeding 75%. To measure expert agreement on each item on the guideline has a priority score based on its defuzzification value.

The following are the actions suggested by (28) and (29):

1. As indicated in Table 2, an expert is asked to assess the significance of the evaluation criteria for the variables assessed using linguistic variables.

Table 1. Likert Scale and Fuzzy Scale

Table 2.
Representation of Likert scale and fuzzy scale.

Linguistic variables	Fuzzy scale
1	0.9,1,1
2	0.7,0.9,1
3	0.5,0.7,0.9
4	0.3,0.5,0.7
5	0.1,0.3,0.5
6	0,0.1,0.3
7	0,0,0.1

2. Every linguistic variable is transformed into fuzzy triangular numbers. Fuzzy numbers represent variables for each criterion for experts e.g.

$$i=1,\ldots,m,\ j=1,\ldots,n,\ k=1,\ldots,K.$$

and

$$\tilde{r}_{ij}=\frac{1}{K}\left[\tilde{r}_{ij}^{1}\oplus\tilde{r}_{ij}^{2}\oplus\cdots\oplus\tilde{r}_{ij}^{K}\right]$$

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3. The distance between fuzzy numbers is calculated using the peak method (30) with the condition that the threshold value d (m, n) must be less than or equal to 0.2 (31) based on the formula:

$$d\left(\bar{m},\bar{n}\right) = \sqrt{\frac{1}{3}\left[(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2\right]}.$$

4. If the group consensus percentage exceeds 75% (32;33), the following step can now be taken. Otherwise, it is best to apply the second round of the Fuzzy Delphi Method.

5. Fuzzy evaluation is combined using the appropriate formula:

$$\bar{A} = \begin{bmatrix} \bar{A}_1 \\ \bar{A}_2 \\ \vdots \\ \bar{A}_m \end{bmatrix} \qquad \bar{A}_i = \bar{r}_{i1} \otimes \bar{w}_1 \oplus \bar{r}_{i2} \otimes \bar{w}_2 \oplus \cdots \oplus \bar{r}_{in} \otimes \bar{w}_n,$$

$$i = 1, \cdots, m$$

6. For each alternative, defuzzing is performed using a specific formula, and the position of the alternative is determined based on the value obtained. Acceptance of expert consensus also requires an α cut-off rate of 0.5 or higher (34; 35) such as:

$$a_i = \frac{1}{4}(a_{i1} + 2a_{i2} + a_{i3}).$$

The instrument was distributed in hardcopy forms and 20 experts from Malaysian higher learning institutions (government and private Universities), International institutions and industry were involved in this study. The list of experts participating in this study is presented in Table 3.

Table 3.
Background of experts for the validity of instruments.

Experts	Post	Expertise	Working experience
1	Lecturer	Curriculum and instructional design	20 years
2	Lecturer	Curriculum development & future studies	30 years
3	Lecturer	Educational technology	20 years
4	Lecturer	Educational technology	10 years
5	Lecturer	TVET curriculum development	10 years
6	Lecturer	Instructional technology	15 years
7	Lecturer	Curriculum and instruction	10 years
8	Lecturer	Open education & technology	15 years
9	Lecturer	Instructional technology	15 years
10	Lecturer	Curriculum & language	15 years
11	Lecturer	Curriculum and instruction	30 years
12	School principal	Curriculum and educational technology	30 years
13	Lecturer	Science computer & educational technology	15 years

Experts	Post	Expertise	Working experience
14	Lecturer	Curriculum and educational technology	10 years
15	Lecturer	Instructional technology	10 years
16	Lecturer	Distance learning	8 years
17	Lecturer	Curriculum and e-learning development	25 years
18	Assistant director	TVET curriculum	30 years
19	Industry professional	Training industry	20 years
20	Industry Professional	Learning and development industry	15 years

4. Results

The researcher has designed an initial instrument for the FDM assessment survey and shared it with 3 experts to validate the instrument before distributing it to 20 experts. 20 experts have been identified and have analyzed data via the FDM template. The procedures outlined in (28) should be followed to calculate the fuzzy Delphi Method. such as selection of expert, selection of scale, findings mean, identifying 'd-value- threshold value', achieving 75% consensus, calculating fuzzy evaluation value and defuzzification. The report is based on the design and development in Phase 2 which includes FDM findings based on ASSURE model as follows:

4.1. Part 1: Analysis Requirement for Guideline Content

In this section, the sub-components consist of the target focus and target audience. These components are important to identify the theme requirement to design the guideline content.

4.1.1. Target Focus

For target focus, employing a threshold value calculation where $d \leq 0.2$, 2 elements were found to be accepted which showed a consensus percentage of more than 75%. However, 2 elements were rejected since the Triangular Fuzzy Numbers requirements weren't fulfilled such as suitable for communities and practitioners. The results are shown in Table 4.

Table 4.
Target focus.

Target focus						
Sub-components		**Triangular fuzzy numbers requirements**		**Defuzzification process requirement**		**Rank**
		Threshold value (d)	**Consensus percentage (%)**	**Fuzzy evaluation**	**Fuzzy score**	
1	Suitable for higher learning students	0.158	100	15.733	0.874	1
2	Suitable for communities	0.250	50	13.600	0.756	R
3	Suitable for practitioners	0.249	52	15.667	0.770	R
4	Suitable for trainers	0.174	80	15.567	0.865	2

4.2. Target content

When calculating the threshold value for target content, all accepted components were kept when the value of $d \leq 0.2$ of consensus percentage of more than 75% for the first rank which is education, instructional design, curriculum development and emerging technologies. However, the expert panel rejected the technical aspect. Table 5 tabulated the findings.

Table 5.
Target content.

Target content						
Elements		**Triangular fuzzy numbers requirements**		**Defuzzification process requirement**		**Rank**
		Threshold value (d)	**Consensus percentage (%)**	**Fuzzy evaluation**	**Fuzzy score**	
1	Education	0.158	100	15.733	0.874	1
2	Curriculum development	0.165	95	15.367	0.854	3
3	Emerging technologies	0.184	94	15.300	0.850	4
4	Technical aspect	0.222	50	14.267	0.793	R
5	Instructional design	0.123	100	15.633	0.869	2

4.2. Part 2: State Guideline Objectives

For state guideline objectives, threshold value analysis retaining d ≤ 0.2 as the remained value of 5 elements was accepted out of 6 elements and a consensus percentage of greater than 75%.

The experts' panel determined that the most important component to have in the guideline would be to explore the understanding of the OBL concept. This was succeeded by a readiness to implement OBL and focus on OBL instructional mapping in the third rank. Theme element based on understanding the digital skills in OBL practice was ranked fourth and understanding the recognition of informal learning ranked fifth. One element was rejected since the Triangular Fuzzy Numbers requirements weren't fulfilled which is to recognize the technical aspect of utilizing OBL. Table 6 tabulated the findings.

Table 6.
State guidelines objectives.

State guidelines objectives						
		Triangular fuzzy numbers requirements		**Defuzzification process requirement**		**Rank**
Elements		**Threshold value (d)**	**Consensus percentage (%)**	**Fuzzy evaluation**	**Fuzzy score**	
1	Explore knowledge of the OBL concept	0.163	100	15.500	0.861	1
2	Readiness to implement OBL	0.168	100	15.267	0.848	2
3	Understand the recognition of informal learning	0.172	100	14.733	0.819	5
4	Understand the digital skills in OBL practice	0.192	100	14.767	0.820	4

State guidelines objectives						
Elements		Triangular fuzzy numbers requirements		Defuzzification process requirement		Rank
		Threshold value (d)	Consensus percentage (%)	Fuzzy evaluation	Fuzzy score	
5	Focus on OBL instructional mapping	0.168	100	15.000	0.833	3
6	Recognize the technical aspect of utilizing OBL	0.291	57	11.600	0.644	R

4.3 Part 3: Selection of Method, Media/Tools and Materials

In this section, the sub-components consist of selection of method, selection of media/tools and selection of materials. These components are important to identify the theme requirement to select of method, media/tools and materials to design the guideline.

4.4. Selection of Method

For the selection of method, threshold value analysis retaining d ≤ 0.2 as the remained value of 4 elements were accepted out of 6 elements and a consensus percentage of greater than 75%, has only demonstrated 4 elements accepted out of 5. The expert panels ranked game-based learning in the first rank, followed by microlearning and project-based learning in the third rank. Experiential learning is placed at fourth rank. One element was rejected since the Triangular Fuzzy Numbers requirements weren't fulfilled which is social learning. Table 7 tabulated the findings.

Table 7.
Selection of method.

Selection of Method						
Elements		Triangular fuzzy numbers requirements		Defuzzification process requirement		Rank
		Threshold value (d)	Consensus percentage (%)	Fuzzy evaluation	Fuzz y score	
1	Game-based learning	0.165	100	15.133	0.841	1
2	Microlearning	0.166	100	14.600	0.811	2
3	Project-based learning	0.179	94	14.567	0.809	3
4	Experiential learning	0.159	94	14.533	0.807	4
5	Social learning	0.322	67	11.133	0.619	R

4.5. Selection of Media/Tools

This element of selection of media/tools referred to any learning materials that should be included to design the OBL guideline. 8 of the elements were retained after applying the threshold value calculation with a value of d ≤ 0.2, and the second requirement with a consensus percentage of greater than 75% was satisfied. Mobile apps received the highest ranking from the expert panels, followed by

Video Tutorials and Artificial Intelligence (AI) in the third rank. Augmented Reality (AR) and Virtual Reality (VR) are placed at fourth rank, followed by Podcasts and Audio Resources, Interactive Chatbots, Interactive Simulations and Personal Websites. One element was rejected since the Triangular Fuzzy Numbers requirements weren't fulfilled which is Community Forums. Table 8 tabulated the findings.

Table 8.
State guidelines objectives.

Selection of media/Tools						
Elements		**Triangular fuzzy numbers requirements**		**Defuzzification process requirement**		**Rank**
		Threshold value (d)	**Consensus percentage (%)**	**Fuzzy evaluation**	**Fuzzy score**	
1	Mobile apps	0.090	100	16.333	0.907	1
2	Personal websites	0.182	94	14.400	0.800	8
3	Interactive simulations	0.179	94	14.967	0.831	7
4	Artificial intelligence (AI)	0.102	95	15.700	0.883	3
5	Podcasts and audio resources	0.117	100	15.533	0.863	5
6	Augmented Reality (AR) and virtual reality (VR)	0.165	95	15.900	0.872	4
7	Video tutorials	0.114	100	15.900	0.899	2
8	Interactive chatbots	0.138	100	15.467	0.859	6
9	Community forums	0.221	50	13.467	0.748	R

4.6. Selection of Materials

For the selection of materials, when d ≤ 0.2 in the threshold value calculation retained all the elements with a consensus percentage greater than 75%. The panel of experts agreed that Open Educational Resources (OER) to be placed in the first place. This is followed by Infographics and Visual Aids and Multimedia Integration. At the fourth rank are Case Studies followed by suitable E-books. However, the expert panel rejected the Online Resource Communities. Table 9 tabulated the findings.

Table 9.
Selection of materials.

Selection of materials						
Elements		**Triangular fuzzy numbers requirements**		**Defuzzification process requirement**		**Rank**
		Threshold value (d)	**Consensus percentage (%)**	**Fuzzy evaluation**	**Fuzzy score**	
1	Case studies	0.192	100	14.767	0.820	4
2	Infographics and visual aids	0.168	100	15.267	0.848	2
3	E-books	0.172	100	14.733	0.819	5
4	Multimedia integration	0.168	100	15.000	0.833	3

Selection of materials						
Elements		Triangular fuzzy numbers requirements		Defuzzification process requirement		Rank
		Threshold value (d)	Consensus percentage (%)	Fuzzy evaluation	Fuzzy score	
5	Open educational resources (OER)	0.163	100	15.500	0.861	1
6	Online resource communities	0.244	45	12.533	0.696	R

4.6. Part 4: Utilize Method, Media/Tools and Materials

For utilising method, media/tools and materials content, the threshold value calculation with the value of d ≤ 0.2 was kept, as well as the acceptance of four elements in the content with an agreement percentage of more than 75%. The fuzzy score ranked explore interactive demos and tutorials provided by open badge platforms in the first place. The second place was to discover how open badges can incorporate multimedia elements. It is followed by providing brief training sessions on digital literacy skills and sharing examples of digital badges earned by others to motivate learners. One element was rejected since the Triangular Fuzzy Numbers requirements weren't fulfilled which is to collaborate in online communities or forums related to open badges. Table 10 tabulated the findings.

Table 10.
Utilize method, media/tools and materials.

Utilize method, media/tools and materials						
Elements		Triangular fuzzy numbers requirements		Defuzzification process requirement		Rank
		Threshold value (d)	Consensus percentage (%)	Fuzzy evaluation	Fuzzy score	
1	Explore interactive demos and tutorials provided by open badge platforms	0.168	100	15.600	0.867	1
2	Discover how open badges can incorporate multimedia elements	0.170	94	15.467	0.859	2
3	Provide brief training sessions on digital literacy skills	0.170	94	15.467	0.859	3
4	Share examples of digital badges earned by others to motivate learners	0.165	94	15.367	0.854	4
5	Collaborate in online communities or forums related to open badge	0.291	50	11.733	0.652	R

4.7. *Part 5: Require Participation*

For required participation, when d ≤ 0.2 in the threshold value calculation, all the components were retained. Additionally, the second requirement of a consensus percentage of more than 75% was met, accepting 8 out of 9 elements. Expert panels reached a consensus to curate an open-source project to be placed at the first rank. This is followed by facilitating peer collaboration and providing collaborative projects. At the fourth rank is assigned hands-on projects, followed by creating an e-portfolio, incorporating peer reviews and integrating the interactive online modules and surveys. The panel experts ranked conduct industry guest webinar at the last place. However, the expert panel rejected the participation in discussion forums. Table 11 tabulated the findings.

Table 11.
Require participation.

Require participation						
Elements		**Triangular fuzzy numbers requirements**		**Defuzzification process requirement**		**Rank**
		Threshold value (d)	**Consensus percentage (%)**	**Fuzzy evaluation**	**Fuzzy score**	
1	Integrate the interactive online modules and surveys	0.147	100	15.200	0.844	7
2	Facilitate Peer collaboration	0.109	100	15.800	0.878	2
3	Provide collaborative projects	0.123	100	15.633	0.869	3
4	Assign hands-on projects	0.138	100	15.467	0.859	4
5	Curate open-source project	0.137	100	15.933	0.885	1
6	Incorporate peer reviews	0.127	100	15.267	0.848	6
7	Participate in discussion forums	0.259	45	8.667	0.481	R
8	Create E-portfolio	0.173	89	15.333	0.852	5
9	Conduct industry guest webinar	0.184	89	14.700	0.817	8

4.8. *Part 6: Evaluation*

For evaluation, threshold value analysis retaining d ≤ 0.2 as the remained value of 4 elements was accepted out of 6 elements and a consensus percentage of greater than 75%, which is the second required. According to the consensus of experts, continuous feedback mechanisms rank first, followed by reflection and journaling. It is followed by open-ended assessments and interactive assessments. Two elements were rejected since the Triangular Fuzzy Numbers requirements weren't fulfilled which are self-assessment tools and badges certification exam. Table 12 tabulated the findings.

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Table 12.
Evaluation.

Evaluation						
Elements		**Triangular fuzzy numbers requirements**		**Defuzzification process requirement**		**Rank**
		Threshold value (d)	**Consensus percentage (%)**	**Fuzzy evaluation**	**Fuzzy score**	
1	Open-ended assessments	0.178	94	14.833	0.865	3
2	Interactive assessments	0.174	100	15.100	0.839	4
3	Self-assessment tools	0.212	100	13.433	0.746	R
4	Badges certification exam	0.307	100	12.633	0.702	R
5	Continuous feedback mechanisms	0.155	94	15.633	0.869	1
6	Reflection and journaling	0.144	100	15.567	0.867	2

5. Discussion

The FDM findings highlight key constructs for OBL guideline development. The summarized results included several key constructs related to OBL guideline content, state guideline objectives, method, media/tool, and material selection, as well as recommendations for use and participation according to the ASSURE model of instructional design (26). For example, the analysis emphasised the importance of guidelines tailored to the needs of higher education students and trainers, and also instructional design, curriculum development, and emerging technologies in OBL. In addition, the findings addressed objectives such as investigating OBL concepts, improving readiness for OBL implementation, and emphasising instructional mapping and digital skills. Additionally, recommendations were made for the selection and use of various methods, media/tools, and materials to enhance the OBL experience, such as game-based learning, mobile apps, video tutorials, and open educational resources. Furthermore, strategies for encouraging active participation, such as facilitating peer collaboration, developing e-portfolios, and incorporating interactive online modules, were discussed. Overall, the FDM findings provide insight into the design and development of OBL initiatives, providing a comprehensive framework for future implementation efforts.

The findings recommended integration of diverse methods, media/tools, and materials can enrich the academic curriculum while also encouraging innovation and engagement in teaching practices. Learning institutions can use the study's findings to make strategic decisions about curriculum development and instructional design. (12) also agreed that the use of open badges able to motivate, scaffold and recognize leraning in education. The FDM findings offer a structured framework for developing OBL guideline that address the diverse needs of students and lecturers. This is because (36) believe that there are many opportunities and challenges with digital open badges for learning institutions Policymakers can take advantage of the findings of this study to formulate educational policies and initiatives that promote innovation and technology integration in higher education. FDM findings can be used to form guidelines and standards for the implementation of OBL initiatives in an educational context. By adapting policies to the needs and preferences of students and academics, policymakers can create an environment that supports the adoption of OBL practices and improves educational outcomes. Stakeholders, including industry partners, educational institutions, and community members, can benefit from the results of this study by taking an active role in the design and implementation of OBL initiatives. Through collaboration with academics, policymakers, and educational institutions, stakeholders can contribute to the development of innovative OBL practices that meet the changing needs of students and society.

The results of this investigation also have significant implications for the ASSURE instructional design model. The use of FDM shows the importance of a thorough and systematic methodological approach in research design. This study increases the data's validity by ensuring that the assessment instrument is validated by a panel of experts before use, which adds credibility to the study results. In addition, the structured approach in summarizing FDM findings emphasizes the importance of clear and concise data compilation and synthesis, facilitating interpretation and decision-making in the DDR process. Additionally, the findings are consistent with the principles of the ASSURE instructional design model, indicating that this model is useful in guiding the design and development of educational interventions such as the OBL initiative. This integration ensures that OBL initiatives are student-centred, use diverse teaching strategies, and align with learning objectives. Overall, this study emphasizes the importance of methodological rigour and transparency in the research process, in terms of how effectively instructional design model is employed such as ASSURE in guiding innovative development in education.

6. Conclusion

The guidelines offer a comprehensive approach, leverage innovative technologies and emphasize the importance of collaboration, making them a useful resource for educators and students. OBL's guideline approach, tailored for students and educators in higher education, is praised for providing educationally relevant content, instructional design, and new technologies. Its objectives from exploring the concept of OBL to emphasizing digital skills were effectively achieved through a variety of methods and materials. The findings of this study are inline with study by (37) that stated it is vital to use digital badges for professional development in higher education.

Future research may be more successful by involving a broader range of expertise and perspectives in analyzing these guidelines. Although the focus on instructional designers and industry professionals is very beneficial, it risks ignoring insights from other fields such as psychology, sociology, or educational policy. A study by (38) and (39) suggest that badges in social media be investigated from a social-psychological perspective as well as considering the impact of open badges in education. By combining insights from multiple disciplines, researchers can gain a more complete understanding of learning needs and qualifications. This inclusive approach can produce guidelines that are more comprehensive and able to meet the needs of different students and educators, as well as reduce the potential for bias due to a narrow focus on only one area. For example, views from underrepresented groups or fields, such as minority students or nontraditional educators, may offer important perspectives that can enrich the guideline development process and promote equity in eligibility. Future studies also need to focus on the technical aspects of the OBL guidelines. Although current guidelines have covered many aspects of pedagogical and instructional design, there may be shortcomings in addressing technical issues such as platform compatibility, data security, or badge issuance procedures. By focusing on these technical aspects, researchers can ensure that the OBL guidelines are not only pedagogically strong but also sound and technically applicable in various educational settings. This focus can help resolve implementation challenges and ensure the effective use of OBL initiatives.

Another suggestion for future research is to investigate how the guideline development process can encourage fair and inclusive credentialing practices. The evaluation of these guidelines can be done using qualitative and quantitative methods to ensure that qualifications and recognition are equitably accessible to all students. Researchers can examine issues such as transparency of eligibility criteria, access to badge opportunities, and inclusivity in assessment methods. It can help develop a more inclusive and fair credentialing system by identifying barriers to fair credentialing practices and formulating strategies to overcome them. (40) also agreed that digital badges able to unlock transformative potential in education perspectives. This emphasis on fairness and inclusion is consistent with larger efforts to promote social justice and equity in education and qualifications.

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