DEVELOP AND VALIDATE OF ICT COMPETENCY FOR LECTURERS AT THE NATIONAL UNIVERSITY OF LAOS USING THE DELPHI TECHNIQUE

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ABSTRACT

ICT has become an indispensable tool for modern educators, by integrating ICT in the classroom has brought significant improvements. The Delphi technique is widely used and recognized as a research methodology for gathering opinions from a group of experts through a series of questionnaires. This study intends to gattering a consensus opinion from the experts on developing a valid, reliable and evaluate the level of agreement on the ICT competency standard for lecturers at the National University of Laos. The Delphi technique was used to establish the content validity of the preliminary instrument by 17 experts, and connoisseurship meetings were conducted with 10 experts to examine the degree of the agreement on the ICT competency standard. The quantitative data was analyzed using Statistical Package for Social Sciences (SPSS) v. 26 and Google Spread Sheet to obtain the median, interquartile range, mean, and standard deviation. The developed competency standard using the Delphi technique is valid and reliable, with four domains and 44 indicators. Additionally, the overall degree of agreement was strongly agreed on the ICT competency standard.

Keywords: ICT, ICT competency, lecturer, Delphi technique

1. INTRODUCTION

Living without Information and Communications Technology (ICT) might seem challenging in today's world, but ICT integration in education can bring improvements in many aspects and make the teaching-learning process effective and interesting [1]. With the advent of newer and more effective teaching methods, information and communication technology can have a significant impact on education itself [2]. Teachers in the classroom should be knowledgeable about ICT and have the ability to create innovative, so-called ICT-rich learning environments [3]. The internet and computers stand out among the various information and communication technologies as superior tools for learning and teaching because they allow for improved pedagogical practices and quick and widespread exposure to the outside world [4], while [1] emphasizes that four points need to be considered in order to use ICT in education: 1) competency and performance-based curriculum will be supported by emerging technologies, 2) information literacy, 3) constructivism, 4) learner center, learning environment.

In the context of Lao PDR, the Ministry of Education and Sport had established the vision that " In 2030, ICT will become an effective tool and widely used to promote and support education to archive the visions and goals efficiently and effectively" [5]. In response, many education institutions planned and implemented ICT training programs to strengthen teachers from the ministry to the school level including the National University of Laos. However, previous studies found that most of the ICT training programmes did not achieve the expected outcomes set by the organisers [6] and university annual report also reported that an implication of using ICT in the classroom after training remains low [7] (National University of Laos, 2020). Additionally, in order to provide a guide for the development of effective ICT in Education teacher training programme, Ministry of Education and Sport had developed ICT competency standard framework for Lao teachers consists of three level (Basic, Proficient, Advance) and six domains *1) Understanding ICT in Education Policy, 2) Curriculum and Assessment, 3) Pedagogy, 4) Application of Digital Skills, 5) Organization and Administration, and 6) Teacher Professional Learning.* Unfortunately [8] which mostly concentrate on in-service teaching at school level and some performance indicators might not be appropriate for lectures in higher education level. Thus, in the view of this phenomenon, this study aims to:

1) Develop a valid and reliable of main domains and indicators of the ICT competency standard for lecturers at the National University of Laos using Delphi technique

2) Evaluate the level of agreement of the domain and indicators of the ICT competency standard for lecturers at the National University of Laos

2. METHODOLOGY

The research design used to develop ICT competency standard for lecturers at the national university of Laos is shown in figure 1. It encompasses three stages, which are the stage of designing research instruments, the stage of developing and validating instruments and the stage of implication of ICT competency standard.
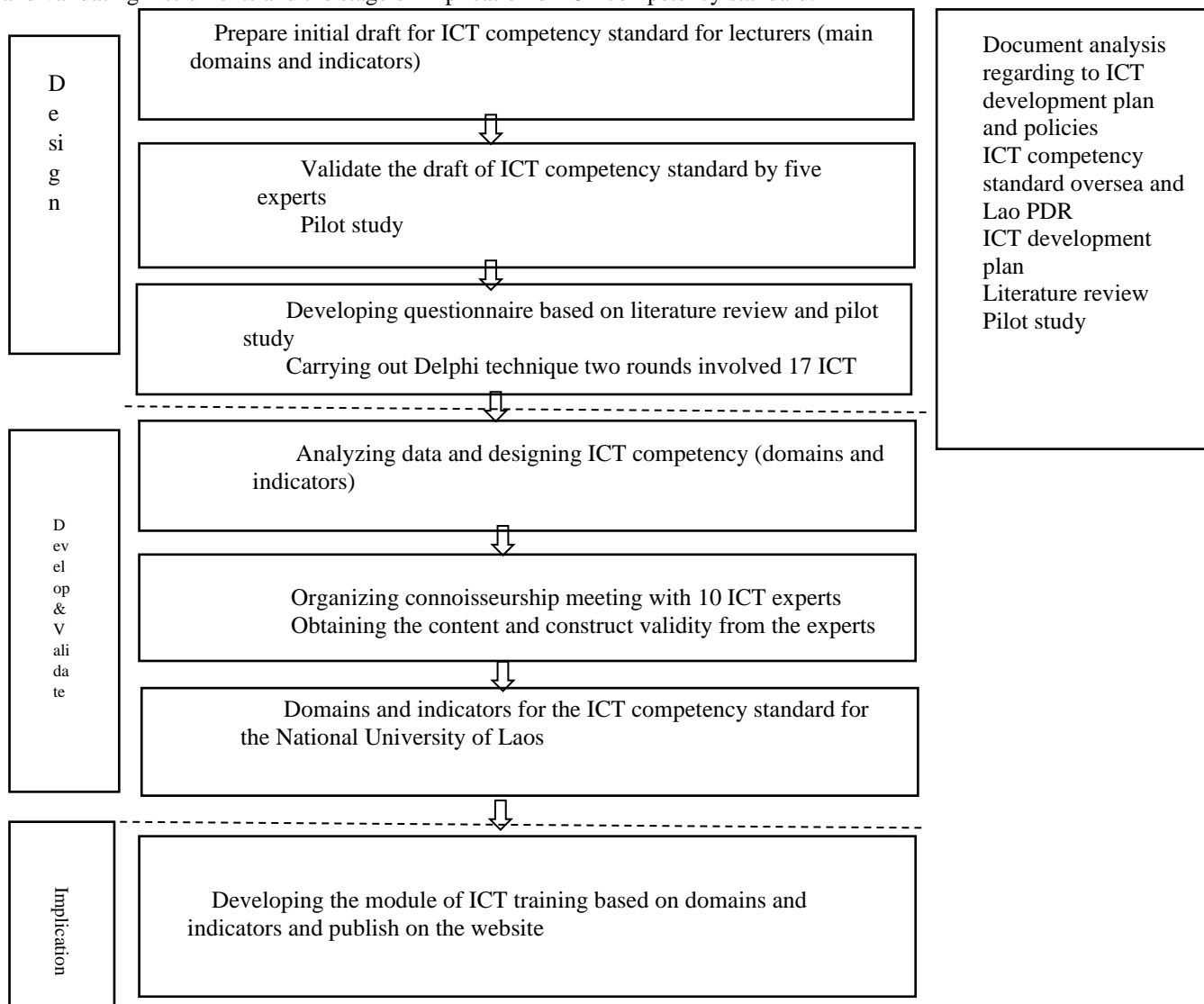

Figure 1: Research Design of Developing the ICT Competency Standard

The Delphi method was primarily developed at the Rand Corporation in the 1950s by Dalkey and Helmer . Basically, the objective of most Delphi applications is the reliable and creative exploration of ideas or the production of suitable information for decision-making [9]. Delphi is used to support judgmental or heuristic decision-making, or, more colloquially, creative or informed decision-making [10]. Delphi may be characterized as a technique for organizing a group communication process that makes it possible for the group as a whole to solve a complicated problem. A method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem [11]. Additionally, The Delphi method is a mature and a very adaptable research method used in many research arenas by researchers around the world [9]. There are two forms of Delphi technique that have been used include, paper-and-pencil version which is commonly referred to as a "Delphi Exercise" and another form called "Delphi Conference" replaced by a computer which has been programmed to carry out the compilation of the group results [11]. Theoretically, the Delphi process can be continuously iterated until consensus is determined to have been achieved. However, [12] and [13] point out that three iterations are often sufficient to collect the needed information and to reach a consensus in most cases. In this study, the Delphi process had been conducted in two rounds.

In fact, Delphi technique has widely used and already been applied to solve problems in education field, for instance, it was used to determine university teachers' ICT competencies in online learning [14], to determine Development of ICT Competency Standard Using the Delphi Technique [3] and so on.

2.1 Designing main domains and indicators

The structure of the ICT competency standard for teachers applied in this study generally follows from the structure of the ICT competency standard framework. It comprises the following sections: Main domains referred to the general aspects of the teachers' knowledge and skills of ICT, and indicators referred to items that illustrate the ICT performance skill in each domain in practice.

1) Designing main Domain of ICT competency standard for lecturers

According to the structured ICT competency standard for teachers, the author has been analyzing seven sets of ICT competencies standard guidelines. These include ICT competency framework for Lao teachers [8], UNESCO ICT competency framework for teachers version 3, International Society of Technology in Education, Philippine ICT competency standard for Pre-Service Teachers, Nepal's National ICT Skills Standards, Mongolia's ICT Competency Requirements for General Education School Teachers, ISTE Standards for Educators, EU Digital Competence Framework for Educators [15]. Furthermore, these also include, Lao education development plan 2021-2025 [16], Lao digital economic development plan 2021-2025 [17], 21st Century Skills [18] , National University of Laos development plan 2021-2025[19]. Based on the result of comparing these documents approximately more than six domains or categories were listed. However, document analysis was conducted as a step to determine the important domain which is appropriate to lecturers. Therefore, the author decided to focus the scope of this study on four main domain in designing the draft of ICT competency standard for lecturers in National University of Laos, they include: (1) ICT literacy skills, (2) ICT tools for teaching , (3) ICT for professional development, (4) Ethnic of using ICT.

2) Designing items of ICT competency standard for lecturers

The indicators in each domain were designed from literature review, previous studies and compared with the ICT competency standard. These include: [3], [19], [20], [21], [22], [23], [24] to outline the statements for ICT competency standard to lecturers in this study. Finally, the author chooses to add 18 indicators into ICT literacy skills domain, 16 indicators into ICT tools for teaching domain, 14 indicators into ICT for professional development, and 14 indicators into Ethnic of ICT usage.

2.2 Pilot study

A pilot study was carried out at the National University of Laos, Vientiane, Lao PDR. The objective of the pilot study was to identify the weakness of the instrument. There are 30 lecturers from three faculties in Dongdok campus who were selected randomly. The questionnaire has been developed based on reviews from documents, theoretical framework, ICT national policies, related studies, ICT competency standard framework for Lao teachers and overseas. The research instrument was a 5-point Likert scale questionnaire conceptualized in terms of four domains, including (1) ICT literacy skills, (2) ICT tools for teaching skills, (3) ICT for professional development, (4) Ethnic of using ICT; it consists of 66 items in total, and open-ended questions were included. The respondents were asked to assess the suitability of main domains and indicators to convert into ICT competency standard for lecturers while open ended questions were asked to write their perceptions and comments on the statements contained in the questionnaire. The respondents' comments in the pilot study were taken after that the author has been modifying and eliminating the list of items to ultimately develop the Delphi technique research instrument.

2.3 Developing Round 1 Questionnaire

The draft of the ICT competency standard was generated from the concepts of theories and the results from pilot study which were identified according to the step mentioned in earlier. The first stage of Delphi process is essential if the respondents miss understanding the objective of the Delphi exercise they might be answered inappropriately and lack of interest [10]. Moreover, selecting panelists who are unfamiliar with the Delphi technique may prevent them from completing the task that is required by the technique [9].

2.4 The Delphi Panel Group

In this study, the members of the Delphi panel are from various institutions in Vientiane, Lao PDR who have extensive experience and expertise in managing and teaching ICT for more than five years while the details of the experts working place are shown in table 1. There are 17 ICT experts who were purposely selected to identify the qualified member to be invited and appointed as the Delphi panel of this study. According to [9] indicated that the sample size varies in the study approximately from 4 to 171 "experts" while [25] mentioned that 15 experts and above can maximize dependability and reduce group error regarding consensus level. In addition, the selected experts affirmed their full commitment to this study using the Delphi technique. Moreover, the members of the Delphi panel should meet four conditions such as, (1) knowledge and experience with the related field; (2) Ability and willingness to join the panel; (3) sufficient time to participate; and, (4) proficient communication skills [26] . For this study, all experts listed below had met the given criteria.

Table 1. List of experts involved in Delphi participation

SN.	Institution	Position	Number of experts
1	IT Center, National University of Laos	Director and Vice director	2
2	Faculty of Science, National University of Laos	Vice-dean, Deputy head of division	3
3	Faculty of Engineering, National University of Laos	Head of Unit and senior Lecturer	4
4	Faculty of Education, National University of Laos	Head of Unit	1
5	Academic Affair office, National University of Laos	Deputy Head	1
6	Digital Department, Ministry of Technology and Communication	Deputy Head, Head of Division	3
7	ICT center, Ministry of Education and Sport	Director	1
8	Lao-Japan Human Resources Institute, National University of Laos	Director	1
9	Dongkhamxang Teacher College	Senior Lecturer	1
	Total		17

2.5 Procedure of Modified Delphi Technique

After forming the Delphi panel, all members of the Delphi panel were contacted to send invitation letters via WhatsApp. Each panelist was informed and given a brief explanation regarding the research objectives and the expectation from them. A questionnaire was available in paper based or online link so each member can choose according to their convenience which means the expert panel has the flexibility to give their responses online using printed questionnaires or using online questionnaires link. The Delphi panel was given ten days to answer the questionnaires for Round 1. Two days before the due date of giving Round 1 response, a reminder message through WhatsApp was sent by the author to remind the panel members about their incomplete tasks. However, in case the panelist members are unable to return the questionnaire on time they are allowed to extend the deadline for a few days. The data collected in pilot study analyzed and adopted to develop a questionnaire in Round 1. Items having mean value below the total mean value were removed from the questionnaire and new items were included based on comments and suggestions of the respondents. Similarly, the data collected in Round 1. was also analyzed and adopted to develop a questionnaire in Round 2 in which new items were added based on the suggestions given by the experts in Round 1 while in Round 2. Delphi panel individual feedback together with the data analysis of group feedback were prepared in additional links by the author in Round 2 questionnaires so the panelist can refer to comments of other experts to the group median value, inter quartile range and personal rating in Round 1. They then justified whether the values in the earlier round were significant or whether some changes needed to be made upon their respective ratings in this Delphi round. In this round all members were given one week to respond and return to the author with a few days extension if needed. As an example of this study, pilot study and two rounds of the Delphi technique were practiced. Pilot and Round 1 were performed to collect additional input and comments from the respondents and experts about the initial list of ICT competencies. Round 2 was conducted to obtain validation for items in Round 1 and to obtain consensus from the experts, and to distribute new items and suggested ideas from the panel in Round 1 and finally, the result of the analysis in two rounds of Delphi reveals that the number of items were validate and the items were reduced from 62 to 49 indicators in Round 1 and there are 44 indicators in Round 2.

2.6 Connoisseurship meeting

In order to confirm that the domains and indicators of the ICT competency standard are appropriate to lecturers at the national university of Laos, the author has conducted a connoisseurship meeting to examine the degree of agreement with ICT experts with working or teaching experiences from different institutions. Ten ICT experts were purposely selected to participate in this study. A research instrument was a questionnaire consisting of four domains, including *ICT literacy skills, ICT tools for teaching, ICT for professional development, Ethnic of using ICT* and 44 indicators in total.

3. ANALYSIS

A questionnaire was sent to the respondents using paper-based and online after time given all of the respondents returned the questionnaire on time in each round. However, the duration was extended for a few days to wait for the responses from the respondents who were unable to return the questionnaires in time. All the feedback and comments collected in pilot study and Delphi rounds were recorded. The quantitative data was analyzed using Statistical Package for Social Sciences (SPSS) v. 26 and Google SpreadSheet. The degree of importance and consensus are justified after each Delphi round before making an interpretation. The analysis of consensus and important data of the experts were done based on median, inter quartile range on Round 1 data, Round 2 data. For this study, the consensus and important level are categorized below:

Level of consensus		*Meaning*
Quartile deviation range	<= 0.5	High
Quartile deviation range	Between 0.5-1	Medium
Quartile deviation range	>1	No consensus
Level of important		*Meaning*
Median range	<4	Low
Median range	4 and above	High

In this study, items which obtained a high consensus level were used to develop ICT competency standards for lecturers. On the other hand, this study also aims to evaluate the degree of agreement on main domains and indicators of the ICT competency standard for lecturers. The quantitative data was analyzed using SPSS to find out frequency, percentage, mean and standard deviations. The experts were asked to fill out the questionnaire to rate the level of agreement on ICT competencies standard for lecturers using Likert scale format: (1) strongly disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, and (5) strongly agree and the author has divided the criteria into five levels include: strongly disagree (Mean: 1.00 - 1.49), disagree (Mean: 1.50 - 2.49), neither agree nor disagree (Mean: 2.50 - 3.49), agree (Mean: 3.50 - 4.49), and strongly agree (Mean: 4.50 - 5.00) (Best, 1981).

4. RESULTS AND DISCUSSION

In Round 1. of the Delphi process, the questionnaire contained 51 items for evaluation and it was sent out to the 17 panel members. A total of 17 questionnaires were returned in the first round and consensus was reached in 46 items. Besides, in Round 2. of the Delphi process after new items were added based on comments from the panel members, the questionnaire consisted of 49 items and it was sent to the same group of 17 experts to answer and returned a questionnaire in time and consensus was not reached in 5 items. Finally, there were 44 items in the questionnaire. The Delphi results of the study are shown in table 2. indicate main domains and indicators statements found to achieve a high importance and consensus level. These are items that achieved median and quartile deviation (Q.D) value of less or equal to 0.5 with median of 4 and above.

Table 2: Result of Delphi Round 2. items with high consensus level

SN.	Domain & indicator	Median	Q1	Q3	IQR	QD
1.	*ICT literacy skill*	4	4	5	1	0.5
1.1	Advanced Word Processing skill	4	3	5	1	0.5
1.3	Designing profession presentation	5	4	4	1	0.5
1.4	Using email for communication purposes	5	4	5	1	0.5
1.5	Analyze data using statistical application	4	4	5	1	0.5
1.6	Data management using cloud on internet	4	4	4	1	0.5
1.7	Sharing information on social media platform	4	4	5	1	0.5
1.8	Accessing video streaming online	4	4	5	1	0.5

1.9	Using video conferencing application	4	4	5	1	0.5
1.10	Using application to write bibliography	4	4	5	1	0.5
1.11	Designing online questionnaire	4	4	5	1	0.5
1.12	Accessing online database to search research article	4	4	5	1	0.5
1.13	Using generative AI in daily life	4	4	5	1	0
1.15	Create personal blog or website	4	4	5	0	0
2.	*ICT tools for teaching*	4	4	4	1	0
2.1	Applying ICT in lesson planning	4	4	5	1	0.5
2.2	Integrating ICT into assessment process	4	4	5	1	0.5
2.4	Designing electronic teaching material	4	4	5	1	0.5
2.5	Designing teaching-learning activities	4	4	5	1	0.5
2.6	Applying appropriate tools and multimedia	4	4	5	1	0.5
2.7	Applying blended learning concept into the subject	4	4	5	1	0.5
2.8	Using learning management system (LMS)	4	3	5	1	0.5
2.9	Applied generative AI to support teaching and research	4	4	5	1	1
2.11	Applied generative AI to design lesson plan	4	4	5	1	0.5
3.	*ICT for professional development*	4	4	4	1	0.5
3.1	Providing learning environment for learners to support learning anywhere and anytime	4	4	5	1	0
3.3	Using online resources to improve research skill	4	4	4	1	0.5
3.4	Improve teaching methodology to support learner diversity	4	3	5	1	1
3.5	Joining lecturers' community group on social media	4	4	5	1	0
3.6	Publish academic work on internet	4	4	4	1	0.5
3.7	Publish research article in online journal	4	4	5	1	0.5
3.8	Develop an e-learning content and publish	4	4	5	1	0.5
3.9	Sharing teaching material to other colleague	4	4	5	1	0
3.10	Encourage other lecturers to use blended learning concepts to appropriate subjects.	4	4	9	1	0
4.	*Ethnic of using ICT usage*	4	4	5	1	0.5

4.1	Understanding ICT policy, Cyber Law, and ICT usage guidelines	4	4	5	1	0.5
4.2	Proper behavior and digital well being in online world	4	4	5	1	0.5
4.3	Understanding copyright and intellectual property	4	4	5	1	0.5
4.4	Selecting appropriate information sharing on internet	4	4	5	1	0.5
4.5	Use appropriate social media platform	5	4	5	1	0.5
4.6	Understanding Media Information Literacy (MIL) and avoid being involved in cybercrime	5	4	5	1	0.5
4.7	Follow community guideline and avoid harassing or cyberbullying	5	4	5	1	0.5
4.8	Understanding online financial transactions	5	4	5	1	0.5
4.9	Use relevance and safety information sources	5	4	5	1	0.5
4.10	Understanding personal privacy protection	5	4	5	1	0.5
4.11	Applied analyzing and critical thinking skill to difference	5	4	5	1	0.5
4.12	Promoting ethical digital citizenship	4	4	5	1	0.5
4.13	Participate in promoting cyberlaw and digital safety	4	4	5	1	0.5

According to table 2. A total of 4 domains achieved high importance rating and high consensus level. It was found that all domains (1) ICT literacy skills, (2) ICT tools for teaching, (3) ICT for professional development, (4) Ethnic of using ICT were rated at high importance and high consensus level with the median equal to 4 and Quartile deviation was 0.5. It is appropriate to use a variety of consensus metrics that are available [27]. Based on the 44 indicators listed in table 2. the finding show that 42 indicators were rated at high importance and high consensus level with median: 5 (9 indicators), median:4 (35 indicators), quartile deviation range from zero to 0.5 were 44 indicators and only two indicators such as applied generative AI to support teaching and research under domain *ICT tools for teaching*, improve teaching methodology to support learner diversity under domain *ICT for professional development* was rated as high important and medium consensus (median:4, Q.D=1).

Table 3. Delphi Results: Items with no consensus level

SN.	Domain & indicator	Median	Q1	Q3	IQR
1.	*ICT literacy skill*				
1.2	Advanced SpreadSheet application skill	4	3	5	2
1.14	Design a database system	4	3	5	2
2.	*ICT tools for teaching*				
2.3	Using function in Ms.Excel to manipulate students' score	4	3	5	2
2.10	Design an basic education game application	4	3	5	2

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3.	*ICT for professional development*				
3.2	Using digital resources to improve technology skill	4	3	5	2

Base on table 3. reveals that there are 5 indicators with no consensus level. All these indicators are listed under 3 main domains such as *ICT literacy skill* (2 indicators), *ICT tools for teaching* (2 indicators) and *ICT for professional development* (1 indicators). The experts panel of this study agree that lectures should have "advanced SpreadSheet application skill" and "using function in Ms.Excel to manipulate students' score" but this item has achieved high importance with no consensus and the experts had claimed that these items should combine to another indicator. It was explained that the reason behind this circumstance is due to the fact that they are the same package of Office applications and some tools are eligible to use instead. On the other hand, the expert panel also agreed to "design a database system" and "Design an basic education game application" indicator at high importance but it received medium level of consensus due the comment from the experts indicating that having different ICT backgrounds of the lecturers may feel too complicated. It is also interesting to note that though the expert panel agreed on "using digital resources to improve technology skill" at the high importance with no consensus level. In contrast, another research found that teachers were highly needed to improve technology skills [20]. Inditonally, UNESCO ICT competency standard framework for teachers [28], ICT competency standard framework for Lao teachers [8] also added into domain 4. Application of Digital Skills.

Furthermore, The purpose of this study also intends to examine the degree of agreement level from the experts to confirm whether the domains and indicators are appropriate to the lecturers at the National University of Laos in four domains include *(i) ICT literacy skills, (ii) ICT tools for teaching, (iii) ICT for professional development and (iv) Ethnic of using ICT usage.* The connoisseurship had been arranged with 10 experts who specialize in ICT management and teaching with more than 10 years experience. Demographic data indicates that 5 experts or 50% were 46 years old and above, while 4 experts (40%) were between 41-45 years and only one youngest expert was 35-40 years old (10%). In terms of the expert's qualification, the majority of the respondents 70% were holding master degree and 30% and there are 4 of them (30%) are having working experience related to ICT more than 20 years, another 30% are having working experience between 16 years old to 20 years old and only 30% of them are having working experience between 10-15 years old. The degree of agreement is shown in the table. 4.

Table 4. Mean and standard deviation of the level of agreement level

SN	Domain	Level of agreement (N=10)		Meaning
		Mean	**S.D**	
1.	ICT literacy skill	4.70	0.48	Strongly agree
2.	ICT tools for teaching	4.80	0.42	Strongly agree
3.	ICT for professional development	4.70	0.48	Strongly agree
4	Ethnic of using ICT	4.70	0.48	Strongly agree
	Total	4.70	0.48	Strongly agree

Based on Table.3 it revealed that overall, the experts strongly agree with the ICT competency standard (mean: 4.70). Similarly, the experts also claim that the most agreement on domain number 2. *ICT tools for teaching* (mean:4.80) and for the other three domains were equal (mean:4.70). However, the top three indicators agreed by the experts in domain *ICT literacy skill* were 1) designing professional presentations (mean:4.80), 2) advanced Word Processing skill (mean: 4.70), 3) using email for communication purposes(mean: 4.70) while top three indicators on the domain *ICT tools for teaching* were Applying ICT in lesson planning (mean: 4.60), applied generative AI to design lesson plan (mean: 4.60) and designing electronic teaching material (mean: 4.60). In the mean times, the top three indicators agreed by experts on domain *ICT for professional development* were using online resources to improve research skill (mean: 4.60), follow by Joining lecturers' community group on social media (mean:4.50), providing learning environment for learners to support learning anywhere and anytime (4.40). In addition, the top three indicators agreed by experts on domain *Ethnic*

of using ICT were Understanding copyright and intellectual property (mean:4.80), understanding ICT policy, Cyber Law, and ICT usage guidelines and selecting appropriate information sharing on the internet (mean:4.60).

Although the selected Delphi panel members for this study were from various institutions in Laos, all members were considered as local Lao academics only. The number of Delphi rounds used for this study is only two rounds. Delbecq et.al suggest that a two or three iteration Delphi is sufficient for most research. Every round of the Delphi strategy is fixed to collected data from the experts not more than ten days. It is recommended to give Delphi subjects two weeks to react to each round, according to [10]. Thus, the results of this study might not be relevant for all lecturers in higher education.

5. CONCLUSION

This study presents the research method from preparing the initial draft of ICT competency standard for lecturers at the National University of Laos. The aim of this paper is to apply Delhi technique research in the development process of ICT competency standard to obtain consensus opinion from the panel members. Additionally, this study also aims to examine the degree of agreement on the main domains and indicators of the ICT competency standard which represent skills and competencies. Document analysis, literature review and pilot study are conducted for the purpose. The draft of ICT competency standard and measurement items are finalized and the validity is obtained through the Delphi technique. SPSS and Google Spreadsheet are used to analyze to find out the consistency of experts' responses between Delphi in each round. 17 experts were selected and invited to participate in the Delphi process and another 10 ICT experts were selected to participate to investigate the degree of agreement of the ICT competency standards. The result indicated that four main domains and 44 indicators were valid and reliable with high consensus while the ICT experts also strongly agreed to the ICT competency standards for lecturers at the National University of Laos.

6. ACKNOWLEDGEMENTS

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