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# Exploring the ICT Literacy Competence Standard for Teachers

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*ICT transformation in education around the world began in the 17th century; since then, technology education has adopted various methods to help teachers in classroom. Now, in the 21st century, the education system requires teachers and school administrators to apply new information and communication technologies that provide knowledge to practice their abilities and skills. This paper aims to discuss the use of Delphi technique in identifying ICT literacy competencies for teachers in Malaysia. Delphi technique is an approach that is used to get a consensus from experts and this technique involved several rounds of questionnaires. The Delphi technique process provided an effective methodology for identifying the complex series of events needed to explore. This study comprised a total of 20 experts included officials from the State Education Department, officers from the District Education Office, lecturer from Institute of Teacher Education, primary school teachers and secondary school teachers in Terengganu. Two rounds of the Delphi process were needed to satisfy the criteria for consensus in this study. It is hoped that the proposed standards could be serve as guidance as well as the basis for training programs for teachers in Malaysia.*

***Keywords***: *ICT, Literacy competency, Consensus, Delphi technique*

## Introduction

Study on recent teaching and assessment theories show that, teaching is rather a complex and it is shaped by the teaching context (Darling-Hammond, 2000). In these modern approaches to teaching, teachers need to integrate technology into teaching so that student will gain benefit. Debate on the integration of technology in education began in the 1990s, about what has been done and prospects of integration of technology in education (Kayfulilo, 2010). However, for a real change to take place in ICT education, leaders need to be trained among educators and among teachers (Doyle, 2012). Teachers are also a great source to build an analytical thinking, critical and creative so that they can adjust to any changes in the education system at any time. Therefore, teachers should have literacy competencies to carry out the job (Sufean, 1993).

In chapter six of Malaysian Education Blueprint (2013-2025), Ministry of Education has outlined provisions to

ensure that all teachers are competent in ICT literacy by the end of 2015 (Ministry of Education, 2012).

Based on studies conducted by Algozzine, Bateman, Flowers, Gretes, Hughes and Lambert (1999) and Toker (2004) found that there were two general groups of ICT literacy competencies called basic competency and advanced competency. Basic competency is an entry-level skill which involves the basic operations of computers. It also requires the use of different kind of software to supports and enhances the professional productivity. Likewise, advanced competency involves expanding applications for teaching the basic competencies, administration and counselling; also other professional activities. ICT literacy competency in the use of ICT is the core that includes computer literacy, knowledge, information skills, analyse data, knowledge about legal and moral right that encompass usage of ICT (Shapiro and Hughes, 1996).

*ICT Literacy*

According to UNESCO's Literacy Assessment and Monitoring Programme (LAMP), literacy is defined as the ability to identify, understand, interpret, create, communicate and compute, using printed material and writing related to a variety of contexts. Literacy also includes continuous learning that enables an individual to achieve their goals, develop knowledge and potential including participation in the broader community (UNESCO, 2005). Hence, ICT literacy is often defined as the ability to search, select, critical evaluation and use information to solve problems in a variety of contexts, such as independent project at school (Limberg et al., 2012). However, Calvani et al. (2008) define ICT literacy as the process of integration and complex cognitive dimension and also a mythological awareness and ethics.

*ICT Literacy Competency*

Literacy competence defined as knowledge, skills and personal characteristics, prerequisite for the successful action in specific areas which can be influenced by training and learning also as an indicator to success in the role of life events or life-role activities (Spady, 1977; Mandl and Kraus, 2003; Klein, Spector, Grabowski and de la Teja, 2004). There are studies upon previous work that argues ICT literacy competence is the ability of a teacher to explore and deal with the situation of new technologies in a flexible way, to analyse, select and critically evaluate data, to exploit the potential of technology and solve problems by build knowledge and share the knowledge. Teachers also need to foster awareness of responsibility and respect for ethics and obligations that must be observed in the use of technology to complete their task.

*ICT Literacy Competency Standard*

ICT literacy competency standard is a standard used to evaluate the skills of teachers needed to teach, work and learn, especially in the global and digital society requires their constant contact (ISTE, 2008). National ICT Competency Standards (NICS) for teachers defines the competencies and knowledge to support the skills needed to use ICT in performing tasks related to teaching environment

(Commission on Information and Communication Technology, n.d). In general, this competency set is to provide teachers to solve problems and help them to benefit from the technology.

## Research Design

### *Delphi Technique*

In 1950, the United States Air Force recognizes the need to predict the ability of American defence technology (Rowe & Wright, 1999). Since then, the RAND project was developed during 1950-1960s by Olaf Helmer, Norman Dalkey and Nicholas Rescher (Dalkey & Helmer, 1963). Although Dalkey and Helmer who is believed to develop Delphi technique at the RAND Corporation, however Theodore Jay Gordon and Olaf Helmer said to be the first to apply the technique (Dalkey & Helmer, 1963; Gordon & Helmer, 1964; Gordon & Hayward, 1968).

One of the arguments against the Delphi technique that it is mostly overlooks reliability measurements and scientific findings validation (Sackman, 1975). It has been recorded that the Delphi technique application in the project mainly to access the direction of science and technology and its impact on society. This is because the existing prediction method is not sufficient to provide the required reports, as there is no existing data on this subject were stored. In the project, experts have been asked to give an opinion on the probability, frequency and intensity of attacks from enemies.

The study contains six topics, namely the inclusion of scientific, space successes, avoid war and weapons system. In other words, the first Delphi technique was designed to determine the future expectations of new discoveries; new technologies and the impact of technological change on socioeconomic (Gordon & Helmer, 1964). Up to now, the Delphi technique has its own position in the American business community and has been widely adopted for research in various sectors; including health, defence, education, information technology, transportation and engineering.

Besides, the clear decision trait that explains the appropriateness of the method in order to address a problem, choice of expert panel, data collection procedures, identification of justifiable consensus levels and implementation; are features that determine the credibility of Delphi (Thangaratinam & Redman, 2005). The selections of the Delphi technique to this study are because:

1) *Confidentiality*: While the Delphi technique is carried out, the panel of experts are not aware of any experts that propose particular view. The process of interaction between the expert panel did not involve a face to face situation but still through the use of questionnaires, whether written or computerized. This confidentiality can provide the advantage of which is to prevent the possibility of panel members of influence the opinion of the other panel members. This can prevent the panel members to change their

opinion just to satisfy other panel members.

2) *Interaction regulated*: Interaction between a panel of experts conducted in groups without face to face and moderator extract information based on the relevant issues and presented in the form of questionnaires. Each member of the panel will only be informed about the views of other panel members for the current round and the arguments supporting the views of each panel member. Each member of the panel also does not rely on the same argument to prevent them from trying to take personal objectives in this study. Regulated interaction is intended to ensure that a panel of experts to focus on the main objectives of this study without trying to win their personal opinion.
3) *Statistics of the feedback*: Normally, the face to face group will come out with prediction that will involve majority opinion. Hence, this will only affect the view which must be agreed by the majority. Any indication of the difference of opinion between members of the group face to face, will not be reported. However, this varies with Delphi group that will report any feedback statistic involving the views of all members of the expert group.

*Identifying Experts*

The selection member of panel for Delphi study is a critical process. Panel size for Delphi study is different because the Delphi technique depends on the dynamic of the group rather than statistical sample (O'Neill, Scott & Conboy, 2009). The minimum size of the corresponding panel in the Delphi technique is a total of seven to 10 experts (Dalkey & Helmer, 1963; Delbecq, Van de Ven & Gustafson, 1975).

In addition, one of the most important requirements in achieving the Delphi technique is the selection of qualified experts (Taylor, Judd & Mourinho, 1989). Panel of experts in the Delphi technique must meet four criteria of "expertise" as mentioned by Adler and Ziglio (1996):

i. Have knowledge and experience on issues to be studied,
ii. Have the ability and willingness to participate in the study,
iii. Have sufficient time to take part in Delphi,
iv. Have effective communication skills.

For the Delphi study, educational experts that involved in teaching as policy maker, trainer in teacher education institutes and also teachers in primary and secondary schools. All there experts have ideas on what are the teaching competencies required from different perspectives as there were all represent their disciplines and institutions. These experts also selected based on their experience and knowledgeable in educational area and resulted in a list of 18 experts.

*Materials*

For the design of the proposed framework, the questionnaire was based on existing frameworks from other country. The questionnaire contains a list of literacy competence collected from five standard literacy competence from abroad, including International Society for Technology in Education (ISTE) National Education Technology Standards for Teachers (ISTE, 2008), Minimum Standards of Learning Technology for Teachers Queensland (Education Queensland,1999), National Competency Standards for Teachers (NICS) and UNESCO ICT Competency for Teachers (UNESCO, 2008) and France Competence Reference Framework: Computing and Internet Certificate (C2i) (French Ministry of Higher Education and Research, 2012). There are nine domains to be identified and 65 items that needed to be measured. Based on this first questionnaire, the experts will be asked to indicate the importance of literacy competence to be measured using 7-point Likert scale. The questionnaire was sent to six teachers in order to evaluate if there were any changes need to be done. These included the paraphrase and meaning of sentences.

*Procedure*

*Round 1*

The initial questionnaire will be sent on the same day that an expert agreed to participate on the Delphi panel as recommended by Okoli and Pawlowski (2004). The questionnaire will be sent through email or printed copy. The experts asked to rate the importance of literacy competence for teachers. They were also asked to propose additional competencies that need to be measured other than those already listed. Experts will be given two weeks to complete the questionnaire before it is retrieved for analysis.

*Round 2*

In this round, the experts will be asked again to indicate the importance of literacy competence to be measured including the additional competencies. The previous questionnaires that they answered will be sent back along the second round of questionnaire. This allows them to refer the previous answer. The second questionnaire will ask experts to:

1) Verify that the interpretation made for each domain are accurate and items placed in each domain is the correct item
2) Confirm and refine the categorization of each item in the correct domain.

The obtained data for every round will be analysed using SPSS v.22 to get the consensus of expert. Value for consensus determined using the Kendall's Coefficient of Concordance where the consensus is high when the coefficient greater than W= 0.7. If the coefficient is less than 0.7, the next round of the questionnaire will be given to the experts. Based on Schmidt et al., (2001), the rounds stopped if either:

i. the value of the Kendall's coefficient of concordance is (W>0.70) or
ii. the degree of consensus for the panel levelled off in two successive rounds

## Analysis

The degree of importance and consensus for items will be determined based on the median value of group feedback and interquartile range (Fong, Ch'ng & Ping, 2013; Norizan, 2003; Saedah & Azdalida, 2008; Ahmad Sobri, 2009). The consensus analysis of items will be done by the median, interquartile range and quartile deviation for the round 1, round 2 and round 3.

After the median, interquartile range and quartile deviation values were obtained, the next analysis is to classify items based on the degree of consensus and the degree of important. For this study, the consensus is determined by the value (high, middle or no consensus) and the degree of importance is determined by the value (high or low).

To determine the degree of consensus is high (if quartile deviation is less than or equal to 0.5), middle (if quartile deviation is between 0.5 till 1) or no consensus (if quartile deviation is more than 1). The degree of importance is determine by the high (if the median value is 4 and above) or low (if the median value is less than 3.5)

The items that have high value of consensus and high degree of importance will be used to build ICT literacy competency standard (Fong et al., 2013). The quantitative data was analysed using Statistical Package for Social Sciences (SPSS) v.22.

## Results

Beginning of the study, the number of experts that agreed to participate was 20 out of 25 (80%). After round one, 20 completed questionnaires were returned (100%). The median and interquartile range computed. However, 18 out of 20 experts returned the round two questionnaire (90%). It was found out that, this study required two rounds before consensus plateaued at the moderate level ($W$>0.60). Therefore, it was not necessary to do a third round.

**Table 1. Items that rated as high important and high consensus by panel experts (median more than 4 and quartile deviation less than 0.5)**

| Domain | N items | N Items reach high important/high consensus | Percentage (%) |
|---|---|---|---|
| 1) Understanding ICT's operational | 8 | 5 | 63 |
| 2) Policy | 4 | 1 | 25 |
| 3) Planning and designing learning environments for digital | 7 | 2 | 29 |
| 4) Digital teaching and learning | 6 | 2 | 33 |
| 5) Evaluation | 5 | 2 | 40 |
| 6) Resources | 12 | 3 | 25 |
| 7) Communication and technology | 5 | 0 | 0 |
| 8) Professional improvement | 11 | 4 | 36 |
| 9) Ethics and responsibility | 7 | 2 | 29 |
| **Total** | **65** | **21** | |

As shown in table 1 above, 21 items out of 65 items selected by experts as the most important and have high consensus. All these items are listed under 7 domains such as Understanding ICTs operational, Policy, Planning and designing learning environment for digital, Digital teaching and learning, Evaluation, Resources, Professional Improvement and Ethics and responsibility. It was found that there are 44 items which achieved high importance rating with moderate consensus level.

Table 2. Items list rated as high important and high consensus by panel experts

| Domain | Items with quartile deviation less than 0.5 and median more than 4 (high importance value and high consensus level) |
|---|---|
| Understanding ICT's operational | Demonstrate continuous development of knowledge and technology skills in order to stay abreast of the latest ICT<br>Demonstrate knowledge and skills in data management<br>Demonstrate knowledge and skills in information management<br>Have knowledge of the standard curriculum on subjects taught; knowledge of standard evaluation and strategy; able to integrate the use of technology in curriculum<br>Know the various tools and applications for the use of any flexible situation |
| Policy | Understand policy and able to articulate how classroom practices correspond and support these policies |
| Planning and designing learning environments for digital | Find and identify ICT's component and evaluate the use of ICT to accommodate with teaching and learning<br>Use ICT tools to design learning course in classroom |
| Digital teaching and learning | Managing student learning activities in technology–enhanced environment<br>Leading a learning situation, taking advantage of existing ICT's potential (class assignments, individual assignment, group assignment)<br>Anticipating technical problems and know how to handle it |
| Evaluation | Using ICT to facilitate the strategies for assessment and evaluation to recognize the students diversity |
| Resources | Evaluate ICT for accuracy and suitability<br>Designing technology resource management in the context of learning environment<br>Planning strategy to manage student learning in technology improvement situation |
| Professional improvement | Adopting a virtual learning environment to connect experts and society in learning<br>Using ICT to enable staff to contribute their knowledge and share information and resources that can support learning, research and professional development<br>Evaluate the use of ICT in career for continuous innovations' |

| | |
|---|---|
| | development<br>• Applying various evaluation methods to determine the appropriate use of technology for learning purpose |
| Ethics and responsibility | • Facilitate the equal ICTs' access in learning to deal with diversity, social and cultural<br>• Sensitive to the legislation and requirements associated with the use of ICT professionals, especially involving the protection of individual liberty and public, personal safety, child protection, privacy, intellectual property and image. |

## Discussion and conclusion

The aim of this study was to develop and validate a framework of teachers ICT's competence literacy. The Delphi study is a tool used to elicit expert opinion, without having to hold a 'face-to-face' interaction, when information about the existing problem is restricted. After two rounds, the results were stable. Out of 20 experts participated in the first round, only 18 experts returned the questionnaire after second round.

The items rated high importance with high consensus used as standard competency literacy ICT for teachers in Malaysia. However, the items rated high importance with moderate consensus were omitted. It was found that the experts had reached consensus on 21 out of 65 ICTs' competency literacy items.

One domain also omitted which was communication and technology domain because none of the items in that domain achieved high consensus. Even communication and technology domain rated with moderate consensus, the experts still acknowledged that it is important for teachers to possess the competency. Only a few of them slightly have different opinion on this domain, and it might be because they were in different position at their workplace.

The experts of this study agreed that teachers should be competent to understand the ICTs' operational by demonstrate continuous development of knowledge and technology skills in order to stay abreast of the latest ICT. The experts also affirmed that teachers should be competent in applying latest study on technology in learning environment, using ICT to access and communicate, using ICTs' tool to create learning activities and create learning situation and introduce distance learning system components. However, these have only achieved moderate level of consensus based on analysis report of the expert consensus views.

There was one item that achieved very high consensus which was 0.25. That item was under ethic and responsibility domain; which was, be sensitive to the legislation and requirements associated with the use of ICT in professionals, especially involving the protection of individual and public right, personal safety, child protection, privacy, intellectual property and image. Looking at the situation today, this competency is really important

considering there are many crimes involving all the above circumstances.

Based on the results of this study, there was no item that achieved quartile deviation of more than 1 or the value of median less than 4. This also proved that, there was no item rated not important or no consensus by the experts.

Even it is a time consuming, Delphi technique quite simple in application and allows interaction. This paper hopefully will help the Ministry of Education to improve the level of ICT literacy competency among teachers in Malaysia. It is also expected to help future researchers to generalize the selected expert among student and teachers in training. This also hopefully will support the existing theories and models based on a theoretical framework in the literature review.

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