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A Revision of Sex Competency Framework toward Digital Transformation and Covid-19 Pandemic

Nhung Nguyen Thi Phuong[a], An Chu Thi Thuy[b], Hien Nguyen Ngoc[c], Ly Tran Hang[d], Son Pham Xuan[e], [a,b,c,d,e]Vinh University, Vietnam, Email: [a]phuongnhungdhv@gmail.com, [b]anchuthithuy@gmail.com, [c]ngochiendhv@gmail.com, [d]lyxinh2006@gmail.com, [e]phamxuanson73@gmail.com

While the Covid-19 pandemic has affected all aspects of lives and forced some business operations to close due to social distancing, education must stay available in many countries. The migration of education to remote learning requires that teacher competency standards should be revised to accommodate the new normal world. This research aims to revise sex competency framework for teachers in primary and secondary schools in the context of digital transformation age and social distancing. The Delphi technique was used to obtain consensus from 12 panelists and 264 teachers. A confirmatory factor analysis was conducted to assess the adequacy of the standards. The change in ratings was marginal after two rounds, so the results were deemed consistent. Six standards were proposed including: be aware of gender issues, design a sex education plan, organise sex education activities, deliver sex content via remote learning, examine and evaluate sex education, and consult and support for gender issues. An Augmented Reality tool was provided to support teachers to meet the requirements of the new standards. The unified theory of acceptance and use of technology model was used to evaluate the developed tool. Results from the generalised structure component analysis largely confirmed the hypothesised model.

Key words: *Sex competency framework, digital transformation, Delphi method, augmented reality, unified theory of acceptance and use of technology*

Introduction

In recent years, the world has experienced tremendous disasters such as hurricanes, tornadoes, earthquakes, and, most recently, the Covid-19 pandemic. If a disastrous outbreak only impacts one region or area of a society, the Covid-19 pandemic has affected everyone on the planet. As a result, every nation must change its business in order to adapt to the "new normal" world. Although some economic operations, such as commercial airlines, travel, sports, and social activities, have been forced to close due to social distancing, education must stay available in many countries. Along with conventional classrooms, which are still used in some unaffected areas, most classes have moved to an online environment in which lectures are provided through emails, video calls, websites, or social network platforms. For the teachers, this migration has two folds: first, it encourages to teachers to learn how to use tools such as Microsoft Teams, Skype, and Zoom for delivering lessons more effectively rather than simple video calls; second it puts a high pressure on teachers to transform traditional paper lessons to an engaging digital format. The second fold is more challenging for non-technical lecturers because it requires some level of expertise in computer skills. For the education administrators, the migration requires that the evaluation of teachers' performance should also be changed to keep up with the new teaching and learning environment.

Sex education is critical in preventing adolescent pregnancy, unsafe abortions, gender-based abuse, trafficking, sexually transmitted diseases, and HIV. Comprehensive sexuality education (CSE) remains a pillar of promoting teenagers' sexual and reproductive wellbeing, and significant progress has been made in expanding CSE curricula scope and adoption. Many countries around the world have brought sex and reproductive health education into schools as a compulsory part of the educational program (e.g., France, Luxembourg, Czech, Norway, Sweden) especially in the Netherlands where sexuality education was delivered to children as early as age of 4 (Bell, 2009; De Melker, 2015; Gallard, 1991). Along with the sex content, many sex competency frameworks were also proposed for teacher evaluation (Barr et al., 2014; Cicchetti, 1994; Hirst, 2008; Tigelaar, Dolmans, Wolfhagen, & Van Der Vleuten, 2004; Uhlenbeck, Verloop, & Beijaard, 2002). However, these frameworks were proposed based on the assumption of "normal world" where teachers have a chance to interact, observe, and respond to their student in a face-to-face fashion.

Children are becoming more familiar with new media and moving online at a younger age all around the world. A report (Livingstone & Mason, 2015) showed that young people often use the digital world as a primary source of sexuality knowledge. Though there is a potential for harm online (for example, being exposed to pornography) the general view is that the digital age provides important tools for children and teenagers to read, interact, and express themselves. As such, there is a need to have frameworks to guide the development of comprehensive digital sexuality media for educating children. Existing tools and software pose many challenges for teachers (Budnyk et al., 2021), especially for aged teachers in creating,

authorising and delivering engaging media contents. In addition, young children (primary and secondary students) easily get distracted by entertainment contents, thus if educational sex materials are not engaging enough, children's focus will be decreased.

To alleviate the aforementioned issues, the goal of this paper is to revise the sex competency framework as well as to provide a supporting tool that helps teachers to carry out their task more efficiently in the context of digital transformation and social distancing. To meet this goal, this work uses the Delphi method to form a set of standards and block-based visual programming paradigm to support authorising media contents through Augmented Reality (AR). To the best of our knowledge, there has been no prior study in the literature focusing on this topic, making this work a unique contribution. In summary, this paper has made the following contributions:

- It revised the sex competency framework in the context of remote learning using the Delphi method. The new framework was supported by a digital transformation tool.
- It provided a visual programming tool to help teachers create and deliver engaging sexuality contents.
- It provided students an augmented reality interface to learn materials created by teachers.
- It evaluated the tool / interface utilising the unified theory of acceptance and use of a technology model.

The remainder of this paper is organised as follows: The theoretical section reviews existing research, followed by the materials and methods section. Findings will be analysed and reported in the Result and Discussion section. Finally, the paper is concluded with a future work direction.

Theoretical Review

In an analytical research on sex education in the United States, Netherlands, Sweden, Australia, France and Germany (Bell, 2009), the author reported that sex education is compulsory for all students in Sweden since 1955 (Lottes, 2002). Sweden adopts an open and liberal approach to sex education to promote accountability and respect for others. Sweden has a teenage birth rate of 7 per 1000, lower than that of the United States, France, Canada and the United Kingdom (Darroch, Singh, & Frost, 2001). The proportion of adolescents who do not use a contraceptive during sexual intercourse is only 7% in Sweden compared to 20% in the US. Sweden also has lower rates of adolescent abortion than the US: 17.2 per 1000 in Sweden compared to 29.2 per 1000 in the US (David, Skilogianis, & Posadskaya-Vanderbeck, 1999). In Australia, since 1999 the government has built a comprehensive sex education, "Talking Sexual Health" that includes units on drugs, sex and health, knowledge and action, and addressing diversity and exploring the powerful aspects of sexual relationships (Mitchell, Ollis, & Watson, 2000). The results showed that the birth rate among adolescents aged 15-19 in Australia was 40.5 per 1000,

significantly lower than the rate among American adolescents (112.4 per 1000) (Weaver, Smith, & Kippax, 2005). Australian adolescents aged 15-19 have an abortion rate of 3.9 per 1000 compared with 30.2 per 1000 for US adolescents etc.

In addition, some other studies (Batár, 2003; David et al., 1999; Gallard, 1991; Kirby, 2007; Pinkleton, Austin, Cohen, Chen, & Fitzgerald, 2008; Talib, Mamat, Ibrahim, & Mohamad, 2012) research gender education policy and practice in countries such as UK, France, USA, Germany, Netherlands, Australia, China, and Taiwan, Hong Kong, and Malaysia. Sex education (SE) is one of the factors associated with better sexual and reproductive health in young people and it contributes to their overall well-being (Bourke, Boduszek, Kelleher, McBride, & Morgan, 2014). The above studies also show that sexual risk behaviours and sexual ignorance are frequent in young people and they form factors that are vulnerable to negative sexual health, such as unwanted pregnancies, high rates of sexually transmitted diseases and HIV, and annual relationship abuse and forcing, exploiting and related to emotional problems (Hirst, 2008). Comprehensive sex education has a positive impact on social life, contributing to social development and minimising the tendency of unhealthy behaviours in adolescents. The most common pattern across European countries is for schoolteachers to provide sex education. In Germany, although sex education in schools is elective, all teachers receive training in sex education in professional schools (Bell, 2009). Sweden advocates an open and liberal approach to sex education that promotes accountability and respect for others. Teachers in Sweden are required to have a degree and or certificate in sex education to be provided with skills in dealing with gender education topics in the classroom. All teachers are trained in sex education as part of teacher training (McConaghy, 1979).

Materials and Methods

For the revision of the sex competency framework, this study utilised the Delphi technique (Gupta & Clarke, 1996; Linstone & Turoff, 1975) to obtain the consensus of the proposed framework. This popular technique has been widely used in the literature and applied in many different domains (Linstone & Turoff, 1975), including education (Green, 2014). Because the topic of this research necessitates the dynamic of a consensus phase, the final report must be viewed as a representation of expert agreement. In this regard, the Delphi approach is regarded as a valuable and reliable tool. In this analysis, an online Delphi approach was used, and experts were contacted via email. These traits are important in our research because face-to-face fashion is not an optimum strategy in the contemporary context due to the COVID-19 pandemic.

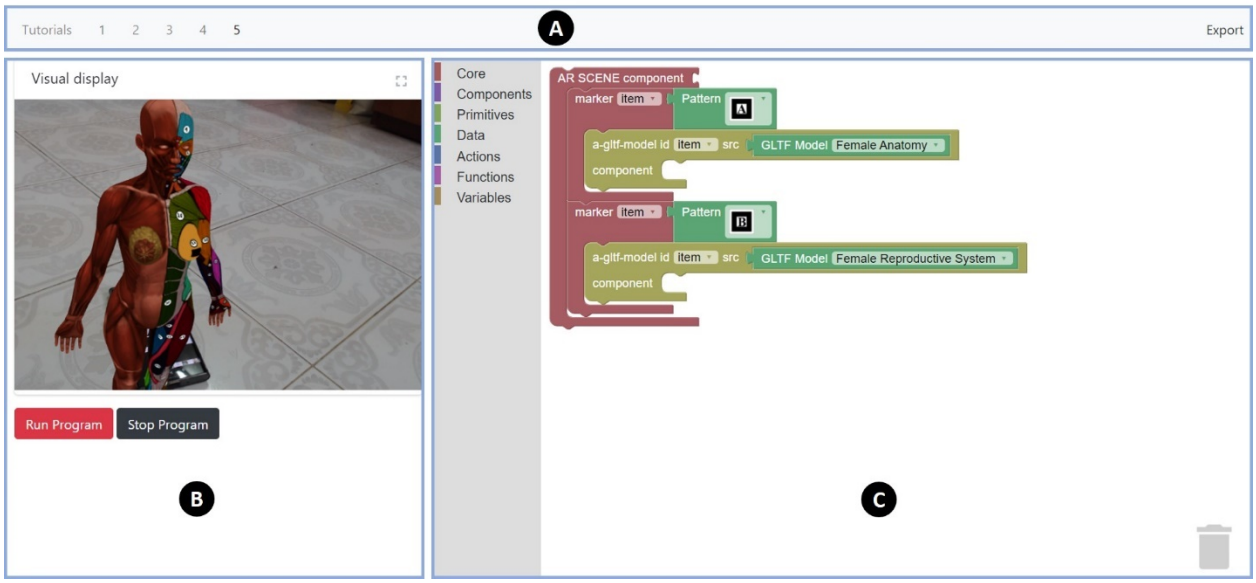
For the creation of the supporting content development tool, this research integrated three existing JavaScript libraries, including Blockly (Developers, 2021), A-Frame (Mozilla, 2021), and AR.js (Etienne, 2021). Blockly is a client-side library developed by Google for the development of block-based visual programming languages and editors. One intriguing aspect

of Blockly is that it can be used in a web browser. Blockly visual cues may be connected to make coding simpler. A-Frame is an internet platform for creating a personalized component to create VR experiences. It is constructed using HTML and can be read, understood, copied and pasted. A-Frame was designed to be accessible to everyone, including web-based programmers, fans, artists, designers, educators, and students from K-12. AR.js is a library open source embedded with A-Frame. The usefulness of the mentioned libraries has been largely confirmed in the studies (Jung, Nguyen, & Lee, 2021; Jung et al., 2020; Nguyen, Jung, & Dang, 2020; Nguyen et al., 2019). The tool was developed in accordance with the recommendation (Munzner, 2014), in which the application's specifications were divided into tasks and the graphic design was carried out to meet these tasks. The following high-level tasks are assigned to the tool:

- Task 1: It enables non-programmers to build and preview applications without having to memorise the syntax.
- Task 2: It supports a variety of content formats, including video, audio, and 3D models.
- Task 3: It allows teachers to deliver digital contents to students.

The visual programming tool was developed with three primary components based on the tasks described above: (A) the utility panel, (B) the previewing AR, (C) the coding editor. Figure 1 shows the graphical layout of the developed tool.

Figure 1 User interface of the tool. A) the utility panel, B) the previewing AR, and C) the coding editor



The utility panel: This panel includes three sections: the *tutorials link* introduces the user interface and its functionality, the *five guidelines link* provides basic steps to create an AR app (Task 1), and *export* button to export the current AR app for sharing (Task 3).

The previewing AR: This component allows teachers to preview the result of the AR app without opening a new window. They can maximise this panel to experience what their students see.

The coding editor: This component includes two sections: a toolbox and a workspace. The toolbox enables users to select available visual blocks and put them in the right order in the workspace. Figure 1 illustrates a use case when the AR application detects a marker (i.e., letter A), then a 3d female model was superimposed on top of that marker. As A-Frame supports multiple content types, so does this tool (Task 2). The visual blocks are defined and translated into A-Frame components through the Blockly engine.

Subjects

In this study, 402 experts were accepted to take part in the research, including 12 panel experts and 390 domain educators from the initial list of 500 invitations (acceptance rate of 78%). These professionals have been chosen because they are involved as decision makers, educators or investigators in primary and secondary education. Through diverse viewpoints, all these experts have ideas about what teaching skills are needed in higher education, and they serve many fields and institutions. In addition, the chosen specialists have at least five years of experience in the educational setting. The panelists will be responsible for forming the standards and the domain educators will vote for indicators of the proposed standards. In addition to their expertise, panel experts were chosen from various geographical locations to minimise language use bias and cultural differences. An official invitation letter was sent to these experts to ask them to join in the study. Google Form was used as an online data collection platform. Before administering the survey to participants, our study was authorised by the University's Institutional Review Board to select participants for the survey. The scope of this research focuses on proposing sex competency standards for teachers in primary and secondary schools.

Materials

A formal questionnaire was the primary tool in the formation of our sex competency framework. There are two types of questionnaires that will be administered to experts. The first questionnaire is an open-ended survey for the panel experts where we will be collecting a variety of standards from different viewpoints. The main question for this survey is “In your opinion, what competencies primary and secondary teachers are likely to have to meet the requirements of sex education for students? This may be existing competencies or your prediction for new competency'” which was consulted from Keeney, McKenna, & Hasson, (2011) where the authors suggested that the idea should be collected from 8 to 12 experts (this study includes 12 panel experts), and the number of qualifications should be around 5 to 10.

The second questionnaire was constructed based on the qualitative analysis of the first survey. In this regard, shared standards among experts will be kept with an agreement of 85%. The research team will prepare a set of indicators for each standard (5-7 indicators). The second survey will be administered to domain educators to rank the appropriateness of the proposed indicators for each standard. In this questionnaire, there are 34 questions including 7 questions for general information, and 27 questions for ranking the indicators with 5-point Likert scales (which ranged from “strongly disagree (1)” to “strongly agree (5)”). The general question for each indicator will be “How important are the following teaching competency indicators in this corresponding standard?” The indicators for each sex competency standard were derived from existing frameworks (Barr et al., 2014; Tigelaar et al., 2004; Uhlenbeck et al., 2002). Here, we do not follow the exact framework in each study; instead we only extract indicators corresponding to each standard and put them into our proposed framework. This is because existing studies were specific to higher education that may not be suitable for our target domains (i.e., primary and secondary education). Thus, our framework is adjusted to these domains. At the end of each question collection, participants were also asked to elaborate on or reword any statements that they thought required revision, as well as include any supplementary detail that they felt was necessary.

It is presumed that the application's potential will be determined by consumer acceptance and usage. Thus, this research adapted the unified theory of acceptance and use of technology model (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) to evaluate the AR tool. The UTAUT model highlighted the importance of four key constructs affecting the use of technology, i.e., performance expectancy, effort expectancy, social influence, and facilitating conditions. The degree to which a person assumes that using the system can assist each participant in achieving improvements related to something is referred to as Performance Expectancy (PE). The degree of ease associated with using the system is known as Effort Expectancy (EE). The degree to which a person believes important others believe each individual should use the new system is known as Social Influence (SI). The degree to which a person believes that an organisational and technological framework exists to facilitate the use of the system is described as Facilitating Conditions (FC). Figure 2 depicts the research framework for this study where PE, EE, SI are hypothesised to be the determinants of Behaviour Intention (BI) and BI and FC influence the behaviour of the AR tool usage.

Figure 2 Research framework of user's behavior using the UTAUT model

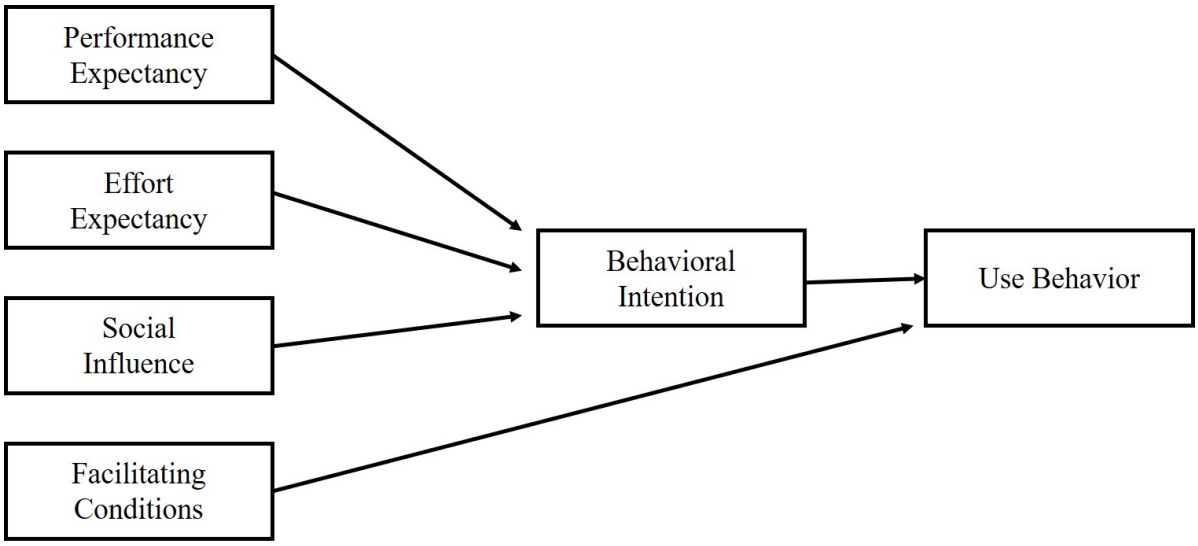


Table 1 provides a list of construct and items used to measure each variable.

Table 1 Construct and items

Construct, items were adapted in the study (Venkatesh et al., 2003)
Performance Expectancy
PE1. Using the AR app may help students get more information about the sex knowledge
PE2. Using the AR app may help students get information about the sex knowledge more quickly
PE3. Using the AR app may increase student interest in the sex topic
Effort Expectancy
EE1. I think that the AR tool is easy to use
EE2. I think that my interaction with the AR tool will be clear and understandable
EE3. It will be easy for me to become skillful at using the AR tool
Social Influence
SI1. People that are important to me (e.g., colleagues) think that I should use the AR tool
SI2. I am more likely to use the AR tool if people that are important to me use it as well.
SI3. I am more likely to use the AR tool if my colleagues use it as well.
Facilitating Conditions
FC1. I have the resources necessary to use the AR tool
FC2. I have the necessary knowledge to use the AR tool
FC3. The AR tool is compatible with other technologies I use
FC4. I can get help from others if I have difficulties using the AR tool
Use Behaviour
UB1. I would like to use the AR tool as soon as possible
UB2. I plan to use the AR tool applied to sex education in the future
UB3. I will always try to use the tool when teaching sex subjects

Procedures

There were no universal guidelines for a Delphi study as indicated in the study (Keeney et al., 2011), so this study followed the procedures that were published in the literature with some modifications. In this regard, there are 8 steps in the workflow of a Delphi study which can be briefly described as follows.

- Step 1: Check indications. There are 3 indications recommended to meet before applying the Delphi technique (needs, scarce resources, and time). Due to the Covid-19 pandemic, social distancing and remote learning, students have to study in a new way and teachers have to prepare lessons in a new format. Thus, the evaluation of teacher competency framework should be adjusted.

- Step 2: Select experts. It is generally suggested that 8-12 experts are included in the panel to achieve a more holistic view of the community (Keeney et al., 2011). If the study involves more than 12 panelists, diminishing returns were often observed. This study had 12 experts, satisfying the recommendation of the published work. All experts are representative of regional sectors, (i.e., Northern, Middle, and Southern of Vietnam), domains (i.e., policy makers, educators), and a variety of working experience. Thus, they have knowledge, capacity, and effective communication skills. An invitation was sent to all experts stating the purpose of the study, reasons to be chosen, information to be collected, how the data is used, and rights to opt in/out.

- Step 3: Round 1. The first round of our study consists of an open-ended question that asks “In your opinion, what competencies primary and secondary teachers are likely to have to meet the requirements of sex education for students? This may be existing competencies or your prediction for new competency”. The number of answers was limited from 5 to 10. The goal of this round is to get the idea generation that can be used as a springboard for the remaining rounds.

- Step 4: Qualitative Analysis. Data gathered from the previous round will be extracted, classified, and grouped based on the meaning and frequency. The same ideas are worded, and only the opinions that have at least 50% of occurrences were kept. The goal of this step is to create statements or standards that can be used as starting points to create ranking questions in the subsequent rounds. Results and ranked standards will be sent back to panel experts for the consensus. Panel experts were asked to re-rate or affirm each item’s original ranking.

- Step 5: Next Round. Upon having the standards from step 4, the research team will prepare a set of indicators for each standard.

- Step 6: Assess Consensus. The prepared indicators were sent out to domain experts who will rank the importance of each indicator belonging to the corresponding standards.

- Step 7: Repeat until consensus is obtained. In this step, the study was either moved to the next round if the consensus is obtained or go back to step 6 if there is a big gap in the ranking. It is noted that participants also have the option to give comments for the indicators.

- Step 8: Rank and Inference. The indicators were ranked based on the agreement from highest to lowest. The study in (Keeney et al., 2011) suggested that the agreement should be from 51% to 80%. In this study, a minimum percentage of consensus on any given item was set at 75%.

Analysis methods

For the sex competency framework, two techniques were used to build the standards, namely as descriptive analysis and confirmatory analysis. For descriptive analysis, the interquartile range (IQR) was used as a measure for the agreement, that is IQR<1. For confirmatory analysis, the intraclass correlation coefficient (ICC) (McGraw & Wong, 1996) was utilised to assess the degree of agreement among domain experts, where each expert is a rater, and the predictor is the subject of measurement. As opposed to other metrics such as Cohen's Kappa or Fleiss Kappa (Nichols, Wisner, Cripe, & Gulabchand, 2010), ICC is commonly used in the literature because it is straightforward to understand, can be used to determine both relative and absolute consensus, and can handle a wide variety of testing scenarios. In the study (Cicchetti, 1994), the author defined inter-rater agreement metrics, which can be briefly described as poor (less than 0.40), fair (between 0.40 and 0.59), good (between 0.60 and 0.74), excellent (between 0.75and 1.00). Here, this research did not use ANOVA (Analysis of Variance) method to affirm the null hypothesis that the means of the expert responses represented by the groups are identical since there is an imbalance in terms of participants across groups. The proposed framework's validity was refined and guaranteed before agreement was reached. Similarly, the method's reliability was proven by the agreement of experts in the study. The R psych education package was used as a statistical tool in our analysis.

For examining the hypothesised model (UTAUT), the generalised structure component analysis (GSCA) (Hwang & Takane, 2004) was used to estimate parameters and complementary analyses (e.g., internal consistencies, correlations). GSCA is a method for component-based structure equation modeling (SEM) that works well with limited sample sizes and does not rely on static distributional assumptions (e.g., normality assumption)

Results and Discussion

Table 2 shows a summary of participants' demographic information: 27.7% of the participants were male, and 72.3% were female. Nearly all participants had bachelor's degrees for teaching primary and secondary students (78%) and more than half of them (64%) have been teaching for over 15 years. Many of the participants were working in high schools (93.6%), only few subjects work in university (3.8%) and public administration (2.6%). As such, a large portion of experts are teachers (89.4%) and more than half of them live in rural areas (56.1%). Although 390 domain teachers agreed to take part in the study, there were only 264 valid responses after cleaning the data.

Table 2 General information about the participants

Variables	**Category**	**Number**	**Percentage**
Gender	Male	73	27.7
	Female	191	72.3
Level of education	Graduate	19	7.2
	Undergraduate	206	78
	Vocational training	39	14.8
Years of experience	Less than 5	21	8
	From 5 to 10	23	8.7
	From 10 to 15	51	19.3
	More than 15	169	64
Workplaces	High schools	247	93.6
	Colleges/ Universities	10	3.8
	Public administration	7	2.6
Locations	Cities	69	26.1
	Towns	47	17.8
	Rural areas	148	56.1
Job positions	Policy makers	28	10.6
	Teachers	236	89.4
Total		**264**	**100**

After the first round, the research team collected 23 unique standards required for teachers in sex education from 12 panel experts as: Examination and evaluation (16 occurrences), Design the courses (12), Consulting (14), Awareness (17), Use of Information Technology (15), Organising (11), Supporting (7), Sex knowledge (7), Coordinating (3), Social knowledge (2), Environment (2), Propagating knowledge (2), Friendliness (2), Grasping circumstances (1), Planning (1), Improving (1), Laws (1), Situating (1), Media (1), Developing (1), Mobilising resources (1), Presentation (1), Educational psychology (1). These competencies filtered out the least occurrences (less than five times appeared). The remaining items are grouped into six categories and reworded based on the panel expert feedback as: Be aware of gender issues, Design a sex education plan, Organise sex education activities, Deliver sex content in remote learning, Examination and evaluation of sex education, Consultation and support for gender issues.

Out of 27 indicators administered to domain experts, only 19 items were kept after round 3 of the survey. The descriptive statistics of the 19 indicators are shown in Table 2. All means are above the Likert scale of agree (4). The standard deviations range from 0.84 to 0.92, indicating a narrow spread around the mean.

Table 3 Sample mean (M) and Standard Deviation (SD) of the indicators rated by domain experts with IQR<1

Indicators	**M**	**SD**
Describe gender issues	4.32	0.91
Analyse issues of sex education	4.55	0.86
Study the needs of learners	4.12	0.92
Define appropriate sex education goals and requirements	4.14	0.88
Determine sex contents, educational program	4.17	0.87
Plan for sex education	4.34	0.86
Prepare the conditions and means for sex education	4.36	0.84
Organise the implementation of educational activities according to the proposed plan	4.15	0.88
Guide and manage individual / group activities to complete educational goals	4.18	0.85
Use facilities, equipment, and materials to support educational activities	4.21	0.84
Convert lessons that can be delivered via an online learning tool	4.56	0.77
Create and use a variety of sexual materials in digital format	4.43	0.81

Transform conventional sex format into engaging materials	4.15	0.89
Develop a plan, test, and assessment that is appropriate for its educational goals and student audience	4.08	0.91
Design and use methods and tools to examine and evaluate gender education activities	4.12	0.89
Use student learning outcomes in adjusting, directing and encouraging students	4.11	0.91
Connect and share empathy with students' difficulties and problems	4.30	0.86
Implement support, counselling to help students solve problems and difficulties	4.30	0.89
Coordinate with other educational forces, such as students' parents to support and help students	4.24	0.87

Outputs from the statistical software provide results that domain experts are highly agreed with their rates with the agreement score ICC (264) = 0.854, F (11, 557) = 17.8, p-value = 1.99e-30, and 95% and the confidence interval for ICC population values ranges between 0.731 and 0.946. Similarly, participants are also consistent in their opinions as ICC (C,264) = 0.944, F (11,2893) = 17.8, p-value = 1.11e-34, and 95%-Confidence Interval for ICC Population Values falls between 0.888 and 0.981. Both agreement and consistent scores are in the excellent range (Cicchetti, 1994).

Table 4 shows a summary of the competencies along with their indicators after being ranked and grouped.

Table 4 Sex competency framework for primary and secondary teachers

Standard	Indicators
Be aware of gender issues	1.1 Describe gender issues. 1.2 Analyse issues of sex education
Design a sex education plan	2.1 Study the needs of learners 2.2 Define appropriate sex education goals and requirements 2.3 Determine sex contents, educational programs 2.4 Plan for sex education 2.5 Prepare the conditions and means for sex education
Organise sex education activities	3.1 Organise the implementation of educational activities according to the proposed plan. 3.2 Guide and manage individual/group activities to complete educational goals. 3.3 Use facilities, equipment, and materials to support educational activities.
Deliver sex content in remote learning	4.1 Convert lessons that can be delivered via an online learning tool. 4.2 Create and use a variety of sexual materials in digital format 4.3 Transform conventional sex format into engaging materials
Examination and evaluation of sex education	5.1 Develop a plan, test, and assessment that is appropriate for its educational goals and student audience. 5.2 Design and use methods and tools to examine and evaluate gender education activities. 5.3 Use student learning outcomes in adjusting, directing and encouraging students
Consultation and support for gender issues	6.1 Connect and share empathy with students' difficulties and problems. 6.2 Implement support, counseling to help students solve problems and difficulties 6.3 Coordinate with other educational forces, such as students' parents to support and help students

In order to facilitate the formation of the sex competency framework, the scoring rubric (Barr et al., 2014) was utilised which described the corresponding competency levels for each manifestation. To assess ability, it is not feasible to rely solely on parameters, but rather on behavioural measures, that is, indicators that can be assessed and quantified. As a result, the definition of behavioural metrics is critical in determining competence. For any competency, behavioural indicators may be defined in several ways. Three levels were adapted for teacher evaluation:

- Level 1. Teacher's qualification of an indicator is NOT fully met.

- Level 2. Teacher's qualification of an indicator is met, and it should be fostered and developed.
- Level 3. Teacher's qualification of an indicator is fully met, and it should be fostered, maintained, and developed.

Table 5 shows the internal consistency and convergent validity metrics for each UTAUT construct. The internal consistency reliability criteria for each construct were assessed using Dillon- Goldstein's rho. All of the values for each construct are greater than 0.7, above the suggested reliability estimates in Hwang & Takane (2014). We looked at the Average Variance Extracted value of each latent variable to see if it was convergent. All AVE values are greater than 0.5, meaning that the convergent validity is rational.

Table 5 Internal consistency and convergent validity.

Variables	**Items**	**Dillon-Goldstein's rho**	**Average Variance Extracted**
Performance Expectancy	3	0.771	0.534
Effort Expectancy	3	0.762	0.518
Social Influence	3	0.779	0.552
Facilitating Conditions	4	0.866	0.662
Use Behaviour	3	0.854	0.663

Table 6 shows the loading estimates for the items, as well as their standard errors (SEs) and 95 percent bootstrap percentile confidence intervals (CIs) with lower (LB) and upper bounds (UB), estimated from 100 bootstrap samples. If the CI does not contain the value zero, a parameter approximation is statistically significant at the 0.05 alpha level. All estimates were statistically significant, meaning that the items were all strong measures of the constructs.

Table 6 Estimates of loadings.

	Estimate	Std.Error	95%CI_LB	95%CI_UB
PE1	0.841	0.024	0.791	0.888
PE2	0.526	0.074	0.349	0.635
PE3	0.792	0.031	0.724	0.850
EE1	0.712	0.039	0.620	0.795
EE2	0.806	0.031	0.745	0.871
EE3	0.631	0.096	0.342	0.746
SI1	0.499	0.092	0.325	0.652
SI2	0.807	0.042	0.699	0.875
SI3	0.869	0.019	0.822	0.902
FC1	0.840	0.025	0.785	0.879
FC2	0.722	0.033	0.659	0.780
FC3	0.854	0.021	0.815	0.891
FC4	0.831	0.026	0.769	0.875
UB1	0.862	0.021	0.824	0.897
UB2	0.861	0.020	0.813	0.894
UB3	0.712	0.051	0.616	0.795

Table 7 presents the estimates of the structural model's directional path coefficients (i.e., the testing hypotheses), along with their standard errors and 95 % confidence intervals. Results showed that Effort Expectancy had statistically significant and positive influences on Use Behaviour (E = 0.4312, SE = 0.0577, 95% CI = 0.3247–0.5344). Social Influence had a statistically significant and positive influence on Use Behaviour (E = 0.2106, SE = 0.0608, 95% CI = 0.1032–0.3262). Moreover, Facilitating Conditions had statistically significant and positive effects on intention to use (E = 0.3017, SE = 0.0789, 95% CI = 0.1462–0.4349). However, the hypothesis that Performance Expectancy will influence Use Behaviour was not supported due to the inclusion of zero values in CIs.

Table 7 Estimates of path coefficients.

	Estimate	Std.Error	95%CI_LB	95%CI_UB
PE → UB	-0.1632	0.0632	-0.2767	0.0194
EE → UB	0.4312*	0.0577	0.3247	0.5344
SI → UB	0.2106*	0.0608	0.1032	0.3262
FC → UB	0.3017*	0.0789	0.1462	0.4349

While developing the AR tool to support teachers in delivering sensitive contents to students, it is challenging to find or design 3d models that are applicable to primary and secondary students. This is not a technical issue but to what extent the fidelity of the model should be achieved. If the fidelity is too high, students may feel embarrassed or their parents are not happy with this (e.g., due to cultural differences), if the fidelity is too low it may not be a good

representative. As such, general 3d models of human anatomy will be used for the introductory lessons. For sensitive contents, approved/credited official YouTube videos will be used to overlay on the marker. One big advantage of the AR tool is that it cannot only be used in delivering gender topics but also in other subjects as well. The most critical issue with non-technical teachers is how to create authorised digital contents. Although some 3d contents can be downloaded from the internet, they somehow do not fit all lessons. It is anticipated that machine learning would come into play to generate digital contents based on model specifications.

Conclusion and Future Work

This paper revised the sex competency framework for teachers in primary and secondary schools in the context of digital transformation and remote learning. The Delphi methodology was used to reach a consensus across 12 panelists and 264 teachers. To assess the adequacy of the standards, a confirmatory factor review was undertaken. After two rounds, the difference in scores was marginal, so the findings were considered consistent. The criteria on which less than half of the panelists voted were excluded, left only six items, including: be aware of gender issues, design a sex education plan, deliver sex content via remote learning, examine and evaluate sex education, and consult and support for gender issues. From 27 suggested items, 264 valid responses from 390 participants were analysed to extract 16 competencies metrics. Furthermore, the results of the intraclass correlation coefficient metric reveal that domain experts were firmly agreed with their rates, and the opinions of the participants were consistent. The findings from GESCA analysis for the UTAUT showed that all determinants had statistically significant influence on Use Behaviour, thus confirmed the existing model.

As a result of using the Delphi technique, this study encountered some limitations. For instance, it cannot produce accurate or incorrect answers because the replies are based on expert opinions. As such, it is not a substitution for robust empirical methods. In this respect, it is necessary to include all views and published findings while establishing our criteria. Second, since opinion is a view that may or may not be true, consensus does not necessarily imply the right response. This is more of an issue for regional teachers, the majority of whom live in rural areas. It is anticipated that more evidence and reviews will be gathered, and the model will be improved after 2-3 years of putting our proposed framework into practice.

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Conflicts of Interest
The authors declare no conflicts of interest.

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