# Students' Learning Experience in Online Games-Based Sex Education in Thai Secondary Schools

**Nashwa Ismail[1] , Gihan Ismail[2], On-Anong Thammajinda[3] and Kanyapat Chaeye[3]**
**[1]School of Education, Durham University, UK**
**[2]School of Education, Bath University, UK**
**[3]Payap University, Chiang Mai, Thailand**
nashwa.ismail@durham.ac.uk
gnmi20@bath.ac.uk
onanongth@gmail.com
kanyapatchaeye@gmail.com

**Abstract**: In sex education, traditional teaching approaches that place the teacher in the centre of learning provide little opportunity for promoting the development of students' sexual knowledge, maturity, self-confidence, communication skills, and well-rounded personalities. In Thailand, this traditional approach has an impact on teenage students' effective learning for the Comprehensive Sex Education (CSE) curriculum through their behaviours and attitudes about sex-related topics. Moreover, CSE does not cover many approaches such as discussions and debates to promote students' analytic and critical-thinking skills related to sexual-related topics. (MSDHS, 2019 ; UNESCO, 2021 & UNICEF, 2016). This study investigates students' learning CSE through embedded digital Games-Based Learning (GBL) module that is delivered to Grade 7 (age 12-14) secondary school students in the north of Thailand. Researchers in this study developed a game that aims at encouraging and stimulating students' skills to analyse and critique their understanding of CSE. The purpose of this paper is to investigate how the levels of Bloom's Taxonomy have been manifested with students' learning using GBL. In the course of the study, 1152 students responded to answer pre and post-tests. The statistical findings show that students' scores in the post-test were significantly higher than those of the pre-test (withought GBL). This paper concludes that, GBL facilitated opportunities for students to conceptualize, apply, analyse, synthesize, evaluate and create their learning actively and skilfully. However, the statistical data highlights that the development measured after the use of CSE gamified syllabus does not occur at the same rate and that some skills developed at a higher rate than others. Importantly, the study found that GBL is not a standalone approach to teach CSE, other pedagogical approaches (e.g., enquiry-based learning) need to be embedded. These approaches can be implemented with or without technology, but they need to be planed ahead. Final study conclusion is that, efficient teaching of CSE is not down to students only, collective efforts of other stakeholders (e.g., parents, policy makers, etc), are needed.

**Keywords:** Gamification, Bloom, Learning, Sex Education, Technology, Teenage

## 1. Study Background

Thailand has the highest teenage pregnancy rate in South-East Asia. Infection rates for sexually transmitted diseases are rising while the age of first sexual intercourse has decreased (Panyayong, 2010). According to the Ministry of Social Development and Human Security (MSDHS, 2019), young people are particularly at risk of unsafe sexual behaviour, as about 39.5 out of 1,000 teenage girls between 13-19 become pregnant, a ratio that is higher than that of the global average. The main consequences of adolescent pregnancy and parenthood are economic and social in nature, as adolescent parents face increased barriers to educational achievement and social stigma in their public and private lives. Consequently, it is well-documented that sex education can have beneficial effects on teen's sexual behaviour (UNICEF, 2016; MSDHS, 2019).

According to Boonmongkon, *et al*. (2019) CSE provided in most schools in Thailand, but its implementation is incomprehensive and inconsistent across different types of schools. Pedagogy was found to be heavily lecture-based, while the class environment was not comfortable for many students. Researchers stated that strategies are needed to address implementation shortcomings to have sex education more comprehensive in Thailand. Findings from a UNICEF study (2016) indicate that many students lack the understanding and awareness about contraception as well as opportunities to develop communication and negotiation skills that they need in their sexual lives. In addition, the study reveals that there is lack of classroom engagement and interaction in the teaching methods and a need to provide children and young people with critical thinking skills to counteract their negative sexual attitudes. To this end, the MSDHS (2019), one of the main solutions that rely on education to educate teens about safe sex, initiated different projects (e.g., radio programmes and social media) to deliver sex education to young people and give them a forum to discuss sexual issues. Moreover, the Thai Ministry of Public Health and non-governmental organizations like the PATH Thailand Foundation (https://www.teenpath.net) recommend that CSE needs to be designed and delivered through activity-based

instruction methods and exchanges of opinions between students using activities that stimulate critical thinking and a dialogic.

UNICEF study (2016) recommends embedding a greater variation of learning activities into the teaching, such as discussions and debates, role-playing, drama, games and in general activities that require interactions and engage learners. According to UNESCO (2021), teachers are teaching the content which they themselves have received training in, and for which they have been provided teaching resources, such as textbooks and teaching plans. The study recommended to create online learning materials such as games to provide alternative channels for learning about sexuality and related topics, both for students and for teacher training. Last and not least merit of GBL is that it includes knowledge transfer from the virtual to a real-world environment, provides immediate feedback in response to mistakes, and offers a learning pace tailored to individuals (Prensky, 2003; Van Eck, 2016). In addition, according to Cicchino (2015) GBL intervention and cycles of gameplay are effective in promoting higher levels of critical thinking, including the development of independent beliefs, prior to engaging in collaborative discourse and providing opportunities for guided reflection. Nevertheless, as the new national education plan of Thailand, which has been implemented from 2017 to 2036, aims to equip Thai students with skills necessary for the 21st century such as critical thinking (Saengpassa 2017). Using technology in teaching and the affordance of online learning is an essential part of educational reform in Thailand will allow Thai students to become self-learners and will hopefully move Thailand in the direction of student cantered´ learning,

This research manifests students' learning in CSE in Thailand using digital gamified content. Student's experience is portrayed through the six levels of Bloom's Taxonomy models (Armstrong, 2010), which is used for classification of educational learning objectives to define and distinguish different levels of human cognition—i.e., thinking, learning, etc.

## 2. Literature review

### 2.1 Bloom's Taxonomy

In education, Bloom's Taxonomy of learning is still one of the most modern and central models of developing cognitive skills (Bloom, 1956). The Taxonomy captures the nature of thinking and builds the base for learning through its six different levels of interaction with knowledge. The pyramid-shaped classification demonstrates key skills at both lower (remembering, understanding and applying) and higher (analysing, evaluating and creating) planes of reasoning knowledge. Intrinsically hierarchical, Bloom's Taxonomy uses the levelling of thinking skills ascendingly which, arguably, attributes to the controversy from traditional educational patterns. At the bottom of Bloom's Taxonomy (see figure 1 below) lies retention which is a foundational level in understanding core knowledge that can facilitate thinking about the subject (Mhlolo, 2015). Despite its relevance to learning, the over-reliance on lower order thinking skills may feature rote learning and traditional classroom instruction in schools (Ananiadoui and Claro, 2009). Arguably, this may also hinder the learners' critical engagement and creativity in the 21st century classroom.

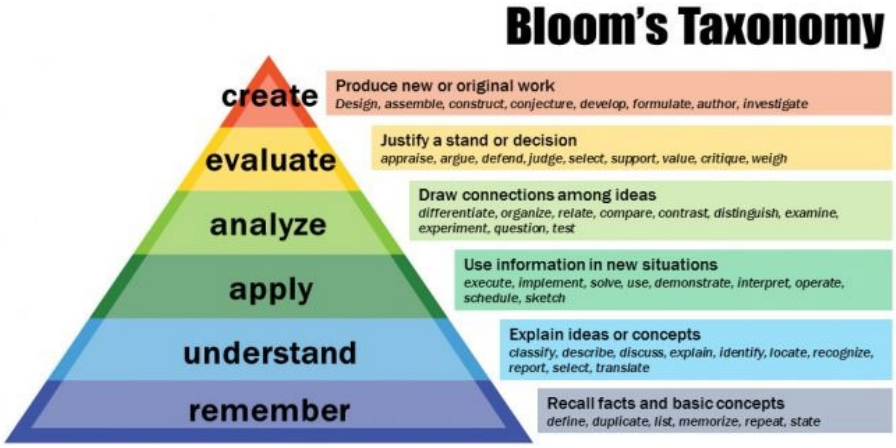



**Figure 1**: Bloom's Taxonomy (Armstrong, 2010)

In a cordial context, the teaching, as well as learning, developing reasoning through analytical, problem-solving, critical thinking and micro-skills such as classifying, summarising, inferring, interpreting and explaining have been recognised as key indicators of the quality of students' learning and should be integrated in the curricula to

nurture the learners' 21st Century capabilities (Conklin, 2005). Developing these skills requires a factual knowledge domain to be taught through (Ananiadou and Claro, 2009), hence the need of the integration between lower and higher order thinking skills. Equally, they need a medium in which teaching can be effective and learning meaningful. We argue that gamification (gamified content) is the best agentic environment to activate these skills. Therefore, as the purpose of this student is to manifest students' learning experience in using digital games to learn CSE module. Bloom's Taxonomy classified model including both levels of order thinking; High Order Thinking (HOT) (analyse, evaluate and create) and Low Order Thinking (LOT) (remember, understand and apply) would help this study to answer its question and differentiate different levels of students

### 2.2 Gamification versus Games-Based Learning (GBL)

GBL and gamification are two concepts that have been used interchangeably in literature. Therefore, in this study we differentiate between them and clarify our standing point. GBL is the use of digital games with educational objectives as tools that support learning processes in a significant way. GBL is aimed at teaching a discrete skill or specific learning outcome, rather than being a complete pedagogical system (Fernandez-Antolin *et al*., 2020). Gamification is digital game in a non-gaming context for the purpose of engaging learners, motivating activities, enhancing learning, and solving problems (Haruna *et al*., 2018) and to foster their interest in a certain area that may enhance learning (Haruna *et al*., 2018; Dominquez *et al*., 2013). Gamification increases motivation and engagement in the learning task, encourages student participation; improves learning outcomes and soft skills (Melville *et al.,* 2018; Huang *et al.,* 2020). Therefore, in the study context with gamification, learners are expected to apply their learning, solve problems and synthesize their decisions. Although gamification has shown great potential in sexual health education, little is known about its application and effectiveness when embedded in teaching methods (Haruna *et al*., 2018). In Thai CSE, the game scenarios are situationally experienced quoted from real life experience, and facilitate relating existing knowledge to newly acquired knowledge, looking for meaning and making connections between facts. Therefore, in the gamified module design for this study, we turned the entire learning process into a game. (1) narratives that amend the setting for a certain task that includes problem solving and decision making (2) design of dialogic approach between learners and avatars (3) provision of gameplay elements (achievement badges, points and progress bars) to motivate and engage learners (Hanus and Fox, 2015).

The reason that gamification is underpinning this study refers to the study research questions about student's achieved learning objectives, as according to Arnab *et al*., (2018), game design and computational process support the thinking skills based on Bloom's Taxonomy. Gamification is often associated with HOT and constructivist approaches to learning that offers a chance to focus class time on the higher forms of cognitive work (application, analysis, synthesis, and/or evaluation) (Charsky and Mims 2008 and Marinensi *et al*., 2020). Higher-order thinking is defined as the group of skills that occupy the upper end of Bloom's Taxonomy which include, from lower to higher order: knowledge, comprehension, application, analysis, synthesis and evaluation. The final three skills fall within the domain of higher order thinking skills and are particularly valuable for deep learning (Bloom, *et al*. 1956). A constructivist approach suggests that learning occurs as part of an active process of constructing ideas and relationships in the learner's mind rather than simply being exposed to information (Piaget, 1967). Learner's further their knowledge and understanding through their own observations and experiences gained through experimentation. Applying an experimental approach to learning about bacteria in the real world could carry the risk of dangerous outcomes such as contamination or infection, especially in a healthcare setting. A game, however, provides a safe 'sandbox' (Gee 2003) environment for experimenting with bacteria, as well as the ability to accelerate natural processes so that they can be more easily visualised, and experiments undertaken. Therefore, we developed the module gamified activities (achievement badges, points and progress bars) in correlation with the 6 levels of the Bloom's Taxonomy.

### 2.3 Game Design and instructions to play

Based on the selection of CSE tutors from the CSE syllabus, the game focuses on two agreed CSE-related topics; sexual harassment and sexual abuse. It is worth noting that the game language is the students' and teachers' native spoken Thai.


**Figure 2**: Game home screen

*2.3.1 Part 1 – Making Robot (Topic: Sexual Harassment)*
In this part, each player needs to construct a robot out of eight different parts.

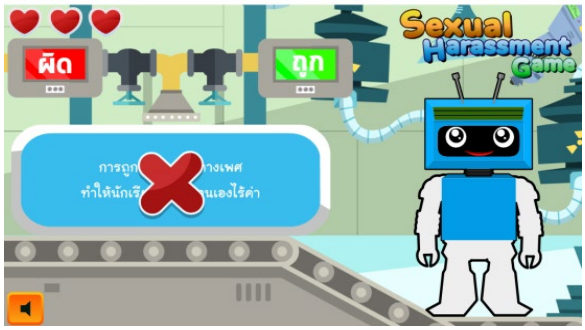



**Figure 3**: Part 1 – Making Robot (topic: sexual harassment)

**2.4 Game Instructions**
To collect the parts, a statement which may be right or wrong will be flagged and the student needs to think and decide whether this statement is 'correct' or 'wrong'. If the statement selected by the student is 'correct', it will build one part of the robot. If it is 'wrong', the student will lose one of the five red hearts above, and no parts will be added to the robot shape. The student has a maximum of five 'wrong' selections, and then the game will be over. The selected statements illustrate different real-life scenarios related to topics within the Grade 7 CSE syllabus. All statements challenge the student to think critically before making a decision. Some examples of statements are as follows:

Scenario: I am shy to report sexual harassment.

- Option 1: I will keep silent, it may not happen again.
- Option 2: Bad people get an emotional payoff from seeing others afraid and upset.

Students will complete the game if they build the whole robot without exceeding the five wrong answers.

*2.4.1 Part 2 – Perfect Pair (Topic: Sexual Abuse)*
In contrast to the Making Robot game, the Perfect Pair game has awards, bonuses, levels and the teacher allows it to be played in groups (as a group competition game). Each player tries to climb to the top of the building and conquer each level by answering one question. Other obstacles include bombs to penalize the players if they answer the questions wrongly. The winner is the one who reaches the top of the building first.

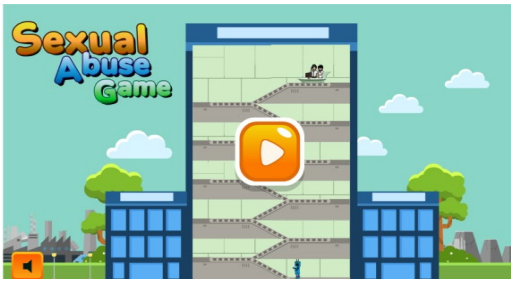



**Figure 4:** Part 2 – Perfect Pair (topic: sexual abuse)

### 2.5 Game Instructions

- In floor 1, players select one question by pressing one of the boxes:
- If the answer is right, the player goes to the second level and gets a trophy.
- If the answer is wrong, the player goes down one floor, or uses one of the awarded trophies to avoid going down.
- There is a bonus level, represented by the heart symbol where the right answer will boost a player two levels up.
- There is a bomb level – here, the wrong answer takes players two levels down.
- The winner reaches the top level first. (Ismail *et al*., 2019)

## 3. Methodology

This research investigates the development of critical thinking skills of secondary school (Year 7) students while studying their CSE module using gamified module that is embedded within the syllabus. The research questions guiding this study is: how the six Bloom's Taxonomy levels have been manifested in students' learning using GBL?

### 3.1 Participants

Addressing the research questions and context, this study used randomized controlled trials (RCT) that were collected from six secondary schools in Chiang Mai province in Northern Thailand. Initially the research invitation was addressed to 1,500 Thai students from year 7 in the 6 schools. The target sample were identified as Year 7 students who are taught the national Comprehensive Sex Education (CSE) course and receive the same content and subject timetabling (2 classes of 45 minutes each) across the two semesters and within the same academic year 2018/2019. The invited schools were sent consent forms to communicate to their teachers, students, and parents as well as an agreement to liaise the logistics of the research procedures with them. Once the consent forms were completed, a school visit was arranged to conduct the study; meet the teacher, agree on the intervention plan, and explain the procedures. The actual number of student participants was 1152 out of the 1500 invited students from 6 schools and the students were informed that the participation was optional and in no way affecting their subject grading. The study ethics were reviewed and approved by the Institutional Review Board (IRB).

### 3.2 Research Design

The research team developed a gamified content of the CSE test in the Thai language to compare the effect of the game on the students' results in each semester. The pre- and post-test models were used on the same set of students at different time-periods (the end of the semester 1 and semester 2). The pre-test (non-gamified) and post-test (gamified) were both undertaken under the existing traditional teaching approach (Bonate, 2000). This is to say, in the first semester, the CSE subject content was taught through face-to-face class teaching by lecturing and the use of PowerPoint slides and some contextual YouTube videos. There was no gamified content at this stage. In the second semester, the teachers continued to teach the subject - new topic- through face-to-face class teaching, together with PowerPoint slides and YouTube videos, and added the gamified content as an extra practice in class and at home to facilitate the students' independent learning via the game. The teachers' intervention was limited to monitoring the students' game access (i.e., login, selected sectional and final scores) remotely. The Figure 1 illustrates the applied steps for data collection in this study.

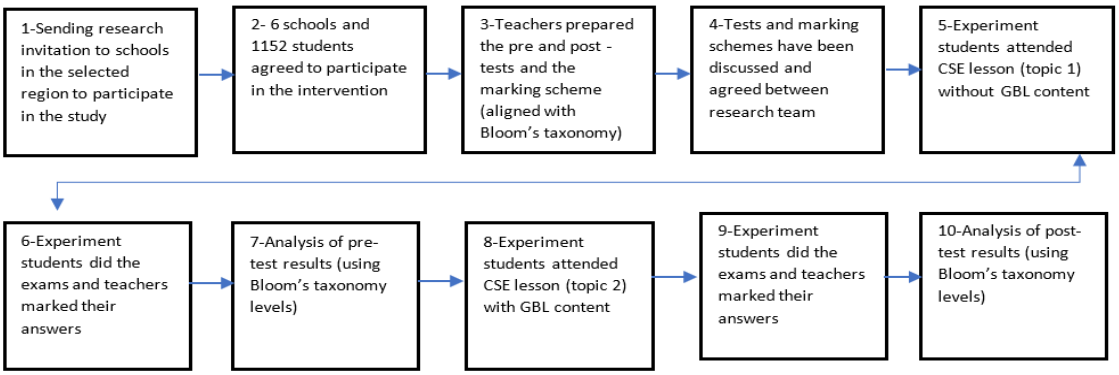



**Figure 5**: Research steps

The research team conducted several group meetings with the CSE teachers in each of the 6 schools to agree the intervention plan, prepare for the test questions and marking schemes that are aligned with Bloom's Taxonomy for both tests (before and after the introduction of the gamified content).

### 3.3 Data Analysis

The study used SPSS Version 24.0 to obtain quantitative evidence to explore the difference between pre and post-tests' results which was identified in each level of the Bloom's Taxonomy. The average mark for each question in the relevant level of Bloom's Taxonomy was calculated for the post-test and then compared to the average mark of the pre-test result of the same level of the taxonomy. This is further validated by the calculated standard deviation for each question level. Calculated standard deviation values across the different Bloom's Taxonomy levels tests the accuracy of the calculated mean and used as a representation of the level data set.

## 4. Findings

To answer the research question, the teachers developed six questions that were aligned with Bloom's Taxonomy to gauge the students' learning in the taught module before and after the introduction of the gamified content. The research team and the teachers worked collaboratively to pedagogically polish and finalise the questions and marking scheme and ensure that each question correlates with the six levels of thinking skills in Bloom's Taxonomy. It is worth noting that the wording of the pre- and post-test questions were slightly different to match the design of the game themes, yet they remained aligned to the six thinking levels of the taxonomy. Moreover, the Multiple-Choice Questions (MCQs) were used to offer the students alternative options to choose from, hence no open-ended questions were offered to the students. Table 1 below lists the pre and post-test questions.

**Table 1**: Pre- and Post-test questions aligned with Bloom's Taxonomy

| Bloom's Taxonomy | Pre-test | Post-test<br>**In Q 2,3,5;** students are given screenshots from the game in a list to select from. |
|---|---|---|
| **Remember** | Q 1- What is sexual harassment? | Q 1 - What is game 2 about? |
| **Understand** | Q 2- The correct order to report "sexual abuse" situation is…… | Q 2- From the below screenshots, order the steps to report "sexual abuse" situation? |
| **Apply** | Q 3- What have you learned from the lesson that you can apply in your daily life? | Q 3- From "sexual harassment" game, select form the given screenshots a situation that you need to avoid in your daily life? |
| **Analyse** | Q 4- Reporting sexual harassment is;<br>• Easy because<br>• Uneasy because | Q 4- Reporting sexual harassment is;<br>• Easy because<br>• Uneasy because |
| **Evaluate** | Q 5- Give an example of a situation that you consider it as sexual harassment. | Q 5- In game 2, sexual harassment was found in the following situations… (select from the given screenshots) |
| **Create** | Q 6- To raise awareness about sexual abuse, I will……..? | Q 6- In game 1 about "sexual abuse", I will create ……. to raise awareness.?" |

A total of 1152 pre- and post-test results were received and analysed statistically. To answer the research question, for each question aligned with a level in the Bloom's Taxonomy, we calculated the average and standard deviation of the pre and after test results. Mean was used to calculate the average score before and after using the game. Standard deviation is used in conjunction with the mean to summarise continuous data, not categorical data. In addition, the standard deviation, like the mean, is normally only appropriate when the continuous data is not significantly skewed or has outliers.

Question 1 (remember) and question 6 (create) in post-test results show an improvement in student marks with a higher average grade of 4.24 compared to 3.65 (question 1) and 2.75 compared to 3.75(question 6) for pre results. Furthermore, there is a decrease in standard deviation of student grades for post games-based learning results of 0.85 compared to 1.05 (question 1) and 1.07 compared to 1.13 (question 6) for pre results. Low standard deviation means data are clustered around the mean (central tendency). As a result, it can be said that embedding GBL for question 1 and question 6 showed a clear improvement in student results to remember and being creative compared to results without GBL.

Question 2, Question 3, Question 4 and Question 5 in post-test results show an improvement in student marks with a higher average grade of 4.08 compared to 2.79 (question 2), 4.03 compared to 3.18 (question 3), 4.21

compared to 3.32 (question 4), 3.92 compared to 3.32 (question 5) (respectively) for pre results without GBL. There is no/minor change in the calculated standard deviation of 1.09 for both pre and post games-based learning results (question 2), 1.06 for pre and 1.07 for post-test results (question 3), 1.01 for pre to 1.19 test-results (question 4) and 1.04 for pre to 1.13 post-test results (question 5). In these four questions (understand, apply, analyse, evaluate), there is an increase in the average score of post-test results and low standard deviation. However, compared to question 1 and 6 (remember and create levels in the Bloom) data is more dispersed from the symmetrical bell curve (average).

Table 2 below demonstrates the figures of average and standard deviation capturing the change, if any, in the pre- and post-test average of each question and its corresponding level of the Bloom's Taxonomy thinking skills.

**Table 2:** pre-and post-test results aligned with Bloom's Taxonomy

| Question number | Bloom's Taxonomy Level | Average: Pre-GBL | Average: Post-GBL | Standard Deviation: Pre-GBL | Standard Deviation: GBL |
|---|---|---|---|---|---|
| **Question 1** | Remember | 3.65 | 4.24 | 1.05 | 0.85 |
| **Question 2** | Understand | 2.79 | 4.08 | 1.09 | 1.09 |
| **Question 3** | Apply | 3.18 | 4.05 | 1.06 | 1.07 |
| **Question 4** | Analyse | 3.32 | 4.21 | 1.13 | 1.04 |
| **Question 5** | Evaluate | 3.32 | 3.92 | 1.06 | 1.07 |
| **Question 6** | Create | 2.75 | 3.70 | 1.13 | 1.07 |

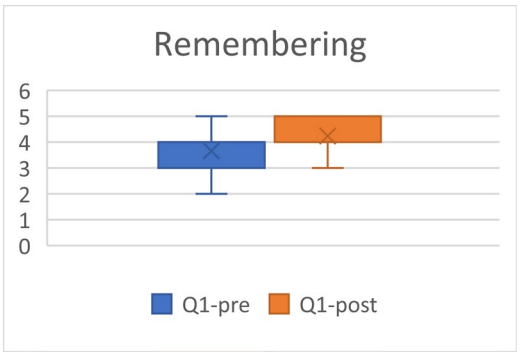
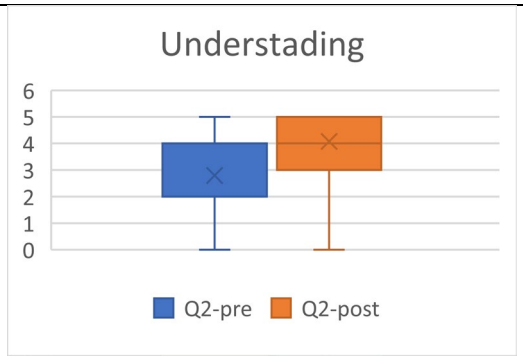
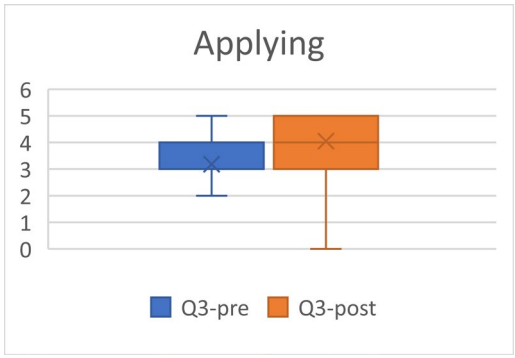
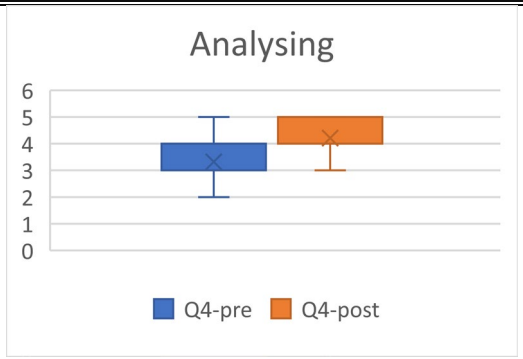
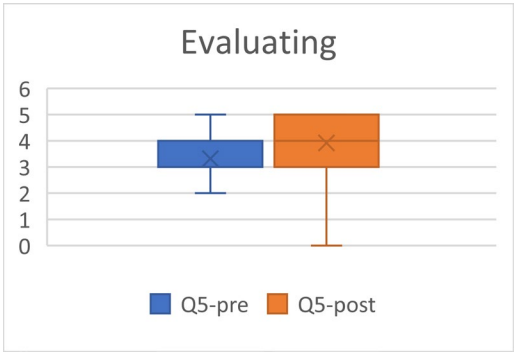
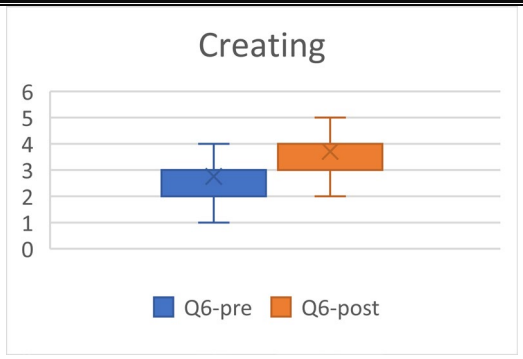
Table 2 above indicates overall statistical evidence of the development of the students' thinking skills following the use of GBL in the CSE curriculum for Year 7 students in the six participating schools. As illustrated, the development in the students' thinking skills was either significant or marginal and none of the skills remained stagnant. In other words, using the same means of comparison across all 6 levels in Bloom's Taxonomy, the average mark for each question in the relevant level of Bloom's Taxonomy was higher in the results of the post-test result compared to the pre-test results. This is further validated by the calculated standard deviation for each question level which was either similar to or lower than those calculated for the pre-test results. As seen in table 2, the calculated standard deviation values are low across the different Bloom's Taxonomy levels which indicates that the calculated mean is an accurate representation of the level data set and there is a limited variation in the question marks allocated for both the pre- and the post-test results. Aligned with the increased average of post-test scores across the 6 questions, questions 1 and 6 recorded less standard deviation than question 2, 3, 4 and 5, which indicates higher tendency of data around the average score for these two questions and that validates the accuracy of the improvement of students' results in these 2 questions after using the game.

Besides, box plots have been used to graphically show overall patterns of responses, see table 3 below.

From table 3, it is noted that, in post -test results, the minimum results are higher than post-test results in remembering, applying and creating levels. However, they are lower than the pre-test results in applying and remembering levels. However, the maximum results in post-test results are higher in all levels. Moreover, the pre-test results box is more condensed (more consistent and less variant data) compared to post-test results larger box plot.

In summary, the data provides a strong indication that the use of gamification can have a positive impact on the development of the students' critical thinking skills about CSE and that this development can show at various degrees. However, the statistical data also highlights that the development measured after the use of gamification of CSE syllabus does not occur at the same rate and that some skills developed at a higher rate than others. This is further discussed in the coming section.

**Table 3:** Box plots to compare pre and post-test results

| Box Plots | |
|---|---|
|  |  |
|  |  |
|  |  |

## 5. Discussion

The study results indicate that embedding GBL in CSE module has a significant positive impact on the 6 levels of Bloom's Taxonomy. Students' learning process begins with knowledge/memory and slowly pushes students to seek more information based upon a series of levels of questions and keywords that brings out an action on the part of the student. In this study, GBL facilitated opportunities for students to conceptualize, apply, analyse, synthesize, evaluate and create their learning actively and skilfully. However, the statistical data highlights that the development measured after the use of gamification of CSE syllabus does not occur at the same rate and that some skills developed at a higher rate than others. Figure 2 above shows that there is an evident significance in remembering, average difference in analysing and creating levels and the least difference is in understanding, applying and evaluating levels, the following section highlights the differences between these measures.

According to Sasidharan and Eng (2013); using digital gaming helps students to remember the taught content. For example, in learning a foreign language, one common problem is for students to remember and use the vocabulary they have learnt to achieve fluency. For Lantavou and Fesakis (2019), GBL helps in memorizing what students learn in English vocabulary in the classroom. However, information retention in the Thai context may not be the optimal goal in learning, as traditionally students remember the taught content based on the repetition. Many examinations in Thai mainstream education largely assess students' memorised knowledge.

Therefore, students have been encouraged to memorise the contents of books, and their critical thinking abilities to reflect on the taught information have rarely been cultivated (UNICEF (2016); Prommak, (2019)).

In sex-related topics, many students still lack a correct understanding of a range of sexuality-related issues. When asked to self-assess their knowledge, students indicated that they had a good understanding of contraception and menstruation, but only a minority gave correct answers to multiple-choice questions about menstruation or the menstrual cycle (Kunchon, 2012). Consequently, there is a need to apply the knowledge of elements of HOT skills in teaching school students in Thailand. Hence, findings in this research confirmed the affordance of GBL to increase remembering, but this increase is in conjunction with increased is aligned with increased in other learning objectives (understanding, analysing, etc) across the Bloom.

With regards to creativity, according to the study findings, it is statically significant that GBL helps students develop their creativity. This claim is confirmed by (Behnamnia *et al*., 2020) where through GBL, students will get the chance and space to define their own problems and conduct a self-assessment of their own efforts and outcomes, rather than always having work both structured, delivered and evaluated by teachers.

Figure 2 above may question why some levels (understanding, applying and evaluation) have not been increased as others (remembering, applying and creating). Hassan (2015) explains that to improve students learning when using technology, hands-on experience is recommended to improve their understanding. According to Smith *et al*, (2006), implementing technology needs to be aligned with different pedagogical approaches such as enquiry-based learning to help students understating. Therefore, GBL is not a standalone approach; it is integrated within the curriculum with another teaching approaches such as situated learning, role play.

For future development in the GBL module, deep learning that relates different knowledge across courses and link them with life skills is recommended. This is aligned with แก้วดำเกิง น (2012), suggesting life skills and the link with CSE need more portion within the content in curriculum. Also, learning activities that enhance the understanding of CSE is needed.

## 6. Conclusion and Recommendations

This paper concludes that digital GBL facilitated opportunities for students to remember, understand, apply, analyse, evaluate and create their learning actively and skilfully. However, the statistical data highlights that the development measured after the use of GBL in CSE syllabus does not occur at the same rate and that some skills developed at a higher rate than others. In details, remembering recorded the highest increase, followed by analysing and creating, where understanding, applying and evaluating recorded the least increased levels. The study found that integrating GBL in CSE syllabus should not be a standalone teaching approach, other pedagogical strategies (e.g., enquiry-based learning, situated learning, etc) need to be aligned with using digital gamification in learning and teaching. Moreover, to achieve higher scores in HOT levels, there is a need to embed real-life learning and hands- on applied strategies in classroom teaching.

Final recommendation is that in this study participants were secondary school students, however in sex-related topics, where sexual health is a state of physical, emotional, mental and social wellbeing in relation to sexuality, other stakeholders need to get engaged in CSE teaching and learning. These stakeholders include parents, educators, health policy makers, and religious leaders who play a key role in the adolescents' sexual cultural and social interaction to varying degrees. Therefore, planning the teaching and delivery of CSE curriculum needs to ensure the participation from all stakeholders in supporting a comprehensive sexuality education agenda that addresses the understanding and acceptance of gender and sexual diversity. Final thought for further work is that CSE teachers and their content, pedagogical and technological competence to embed GBL in CSE in their teaching practice, is an essential success factor that needs further work to complement the full picture about students' experience in learning digital gamified CSE syllabus.

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*แก้วดำเกิง น, เลิศพิริยสุวัฒน์ ช, กล่ำวิจิตร ก.* Attitude and Concept of AIDS, Sex Education and Life Skills Management Learning for Youth in Academic Institute. Dis Control J [Internet]. 2012 Dec. 31 [cited 2022 Aug. 2];38(4):326-38. Available from: https://he01.tci-thaijo.org/index.php/DCJ/article/view/155352