***Knowledge, Perceptions and Attitudes Towards Using Digital Games for Teaching and Learning***

Joana DG. Quinto, De La Salle University, Philippines

The Asian Conference on Education 2021
Official Conference Proceedings

**Abstract**
Digital game-based learning has evolved into a novel mode of instruction that increases both students' and teachers' motivation to acquire competencies. It aims to engage students and teachers in the classroom context and to pique their interest. The purpose of this study was to construct and verify a Survey Instrument on the Game-Based Learning Approach in order to characterize teachers' and students' knowledge, views, and attitudes toward game-based learning. The Content Validity Index, the Content Validity Ratio, and the Kappa Statistic Coefficient were used to validate the SIGBLA. Principal component analysis with orthogonal varimax rotation was utilized to further assess the instrument's reliability. Bartlett's sphericity test found that correlations between items were adequate for PCA when $X^2$ (174) = 17301.04, p.001, and $X^2$ (285) = 2145.64, p.001. Due to the huge sample size and convergence of the questionnaire's scree plot and Kaiser's criterion, the final analysis kept three components: knowledge, perceptions, and attitudes. The Survey Instrument on Game-Based Learning Approach (SIGBLA) utilized in this study was valid, trustworthy, and adequately exhaustive for diagnosing game-based learning approach-related aspects. Over 90% of the 274 students of which age ranges from 12 to 16 years old and 185 mathematics teachers who consented to participate in this study were knowledgeable about game-based learning and had extremely positive views and perceptions about it. Respondents perceived that incorporating game-based learning into both teaching and learning will help them develop a stronger grasp of mathematics.

Keywords: Game-Based Learning, Improving Knowledge, Attitudes, Students’ and Teachers’ Perception

## Introduction

In educational contexts, digital game-based learning has gotten a lot of attention. The beneficial association between Digital Game Based Learning (DGBL) and motivation has changed instructors' focus to acquiring these approaches as a substitute for more traditional methods (Alsawaier, 2018). Iten and Petko (2016), for example, conducted empirical study on the links between game enjoyment, learner motivation, and test scores. The study discovered a positive association between gaming enjoyment and motivation in an educational setting. Similarly, a study established the impact of digital games on students' mathematics achievement. The children had increased their level of engagement in the classroom as a result of the activities (Smith, 2018).

By providing students with opportunities to learn while having fun, digital game-based learning helps students maintain their concentration on their studies. Math classes incorporated digital game-based learning. It demonstrated students' good attitudes toward digital games, as they aid in attention while also providing enjoyment (Wang & Lieberoth, 2016). As a result, it is a powerful predictor of students actively participating in lectures.

Additionally, digital game-based learning can assist teachers in properly planning courses and assessing students' learning progress. According to Wang and Lieberoth (2016), DGBL benefits teachers by motivating students to participate in class activities and enhancing their learning performance. As a result, teachers can utilize digital games as a reflecting tool to assess students' learning and help them improve their performance. Additionally, it was said that digital games assist students in being active and energetic during lectures (Licorish et al., 2018), resulting in the formation of a successful learning environment.

Despite the growing number of teachers that include digital games into the classroom, many educators remain unaware of the educational potential of digital games. The explanation for this could be that they are unaware of or unfamiliar with games that promote contextual learning and 21st-century abilities. Schrader et al. (2006) discovered that the majority of teachers in their survey were unfamiliar with or had limited experience with massively multiplayer online games and were unaware of their educational usefulness.

Similarly, Gaudelli and Talyor (2011) revealed that teachers were typically skeptical of the instructional benefits of video games, mainly due to their lack of knowledge with the genre, and they remained cautious even after playing a variety of titles. Takeuchi and Vaala (2014) discovered that the majority of teachers who employ games do so through shorter-form genres such as drill-and-practice games. While drill-and-practice games can assist kids in memorizing facts and developing necessary skills, they are incapable of teaching complex content or higher-level skills. While current game researchers have created and developed breakthrough digital games or game-based learning environments with the potential to enhance 21st-century abilities, teachers continue to struggle with selecting appropriate games.

One strategy for overcoming this obstacle is to include teachers in the game design process. Collaboration between teachers, researchers, instructional designers, and game developers would result in the development of effective digital learning games for use by classroom teachers. It is critical to understand the views of teachers and students when developing such games. Thus, this study examined teachers' and students' knowledge, views, and attitudes about game-based learning in order to close this gap.

## Methods

A mixed-methods approach was used, combining a qualitative investigation with a quantitative procedure. Participants in both the qualitative and quantitative studies were informed in writing about the study's purpose and procedures, as well as their ability to withdraw at any time. The researchers told participants that their names would not be utilized and that their information would be kept confidential. Each participant provided informed consent prior to data collection. The participation was entirely optional.

## Participants

98 (56.3 percent) of the 174 instructors who completed questionnaires were male, while 76 (43.7 percent) were female. The average age of participant teachers is 26. (33.3 percent). In terms of time spent playing, 98 (56.3 percent) spent less than an hour per day and 76 (43.7 percent) spent 1-3 hours per day. Additionally, more than half of respondents routinely incorporate games into their classrooms 96. (56.3 percent). Additionally, the majority of respondents were engaged in digital educational games 156. (96.6 percent).

Additionally, 60 (21.1 percent) of the 284 students who completed surveys were male, while 224 (78.9 percent) were female. The average age of student participants is sixteen years and twelve months (43.7 percent). In terms of time spent playing, 80 (31.1%) spent 1-3 hours every day on digital games. Additionally, the majority of respondents preferred games in class 31 (10.9 percent) frequently, 55 (19.4 percent) frequently, 134 (47.2 percent) occasionally, 32 (11.3%) seldom, and 32 (11.3%) for those who did not favor GBL in class. Additionally, the majority of respondents were engaged in digital educational games 267. (94.01 percent).

## Data Collection and Analysis

### Questionnaire

Two parallel instruments have been developed to satisfy the research objectives for teachers and students. Both instruments are made up of two pieces. The first component contains demographic information about respondents, such as their gender, age, years of teaching experience, the frequency with which they employ digital games in mathematics class, and their acquaintance with certain mobile educational games. The second section of the Survey Instrument on Game-Based Learning Approach utilized a four-point Likert scale (1-Strongly Disagree 2-Disagree 3-Agree 4-Strongly Agree), which was used to assess respondents' knowledge, attitude, and perceptions of game-based learning. The SIGBLA consists of twenty components classified into three categories. Items 1-10 elicit responses addressing respondents' perceptions of game-based learning; items 11-14 elicit responses regarding respondents' attitudes toward the game-based learning method; and items 15-20 elicit responses regarding respondents' understanding of the game-based learning approach.

A thorough assessment of the literature was undertaken to identify the content domain for measuring students' and teachers' knowledge, views, and attitudes toward game-based learning. The literature review assisted the researchers in identifying numerous research gaps in the construct's base.

The researchers chose six domain experts—from the fields of science education and game-based learning—to examine the created items' content validity. The experts made suggestions and opinions on whether certain items should be added, removed, or adjusted. According to six experts' comments and reactions, no further items were added to the face and content validity validation processes, no items were deleted, and the SIGBLA was not modified further.

The Content Validity Index (CVI), the Kappa statistic, and the Content Validity Ratio were used to quantify the domain experts' perspectives (CVR).

**Content Validity Index (CVI)**

The researchers solicited expert feedback on the items developed for the construct of game-based learning. CVI values were determined for each individual item. (I-CVI) and on a broader scale (S-CVI). For CVI, an expert panel was asked to score each scale item's relevance to the underlying construct. To prevent a neutral point, a four-point scale was utilized. On the item rating continuum, the four points were as follows: 1 = not relevant, 2 = slightly relevant, 3 = fairly relevant, and 4 = extremely relevant. I-CVI was calculated for each item by dividing the number of experts who gave a rating of 3 or 4 by the total number of experts. For instance, an item that receives a rating of 3 or 4 from four out of five experts has an I-CVI of 0.80. It is recommended that I-CVI be 1.00 in the event of five or fewer judges and 0.78 in the case of six or more judges. The S-CVI was calculated to ensure the total scale's content validity. It can be conceptualized in two ways: as S-CVI (universal Agreement) or as S-CVI (universal Agreement) (Average). The S-CVI (Universal Agreement) metric indicates the percentage of items on an instrument that received a rating of 3 or 4 from all of the panel's experts. S-CVI (Average) is a liberal interpretation of the Scale Validity Index that is calculated by averaging the I-CVI values. S-CVI (Average) places a premium on average item quality rather than expert performance. A minimum S-CVI of 0.8 is recommended for content validity (Lynn, 1986; Polit & Beck, 2006; Rubio, Berg Weger, Tebb, Lee, & Rauch, 2003).

I-CVI values ranged from 0.83 to 1 for all three dimensions' items. The S-CVI (Average) value for all SIGBLA elements was 0.983 (Table 1) and 0.975 (Table 2). The S-CVI values for the two 20-item scales were 0.90 and 0.85, respectively, indicating that the items had a high level of content validity for the construct of game-based learning.

**Kappa Statistic Coefficient**

CVI is frequently used by researchers to determine the content validity of their findings. It does not, however, take into account the exaggerated values that may emerge as a result of the likelihood of accidental agreement. Thus, computing the Kappa coefficient facilitates comprehension of content validity by removing any chance agreement. The Kappa statistic is a consensus indicator of inter-expert agreement that is used in conjunction with the CVI to confirm that expert agreement is not due to chance. Kappa scores more than 0.74 are considered exceptional, those between 0.6 and 0.74 are considered good, and those between 0.4 and 0.59 are considered decent (Polit & Beck, 2006; Zamanzadeh et al., 2014). Kappa scores varied between 1 and 1.032 for the majority of the questions, indicating strong agreement across raters.

## Content Validity Ratio (CVR)

CVR is computed according to the Lawshe test to determine if an item is required to operate a construct in a set of items or not. The expert panel was asked to assign a score of 1 to 3 to each item, ranging from necessary to useful but not necessary.
CVRs were calculated for each item based on the percentage of panelists who rated it as "essential." The CVRs for both measures varied from 0.67 to 1, indicating that at least half of the panelists regarded these elements as vital to the concept of game-based learning.

## Exploratory Factor Analysis

The SIGBLA's validity and reliability were examined as follows: Exploratory factor analysis was used to establish construct validity (EFA). Kaiser–Meyer–Olkin (KMO) values were used to determine sample adequacy, and Bartlett's test of sphericity (ideally significant) was performed to determine the data's appropriateness for factorization. Using SPSS 20.0, EFA was performed to discover common components in the latent variable. PCA was chosen for this study since it wanted to investigate the theory of training transfer systems rather than data reduction. The number of variables to extract was determined using parallel analysis, and relevant components were discovered using the varimax rotation method. The loading and cross-loading threshold was set to 0.4, and items with loading less than 0.4 and cross-loading greater than 0.4 were eliminated. This procedure was continued until a simple structure was obtained in which loadings on putative factors were maximized and loadings on others were minimized. Cronbach's alpha coefficients were used to determine internal consistency. The Statistical Package for the Social Sciences (SPSS) version 20.0 and Monte Carlo PCA were used for statistical analysis.

## Factorability

Two instruments with a total of twenty items were exposed to EFA in order to determine the scale's factorial validity. Along with the sample size, the correlation matrix between items was examined to evaluate whether factor analysis was appropriate. The bulk of items exhibit intercorrelations greater than 0.30, indicating that they are acceptable for factor analysis (Field, 2009; Tabachnick & Fidell, 2007).

Factor analysis was additionally supported by the KMO and Bartletts Sphericity tests. The KMO value was more than the minimum value of 0.60. The values.817 and.932 were deemed "meritorious" and "marvelous," respectively, indicating their suitability for factor analysis (Kaiser, 1974). Additionally, Bartlett's Test of Sphericity found a highly significant value (P =.000), indicating that the correlation matrix differs significantly from the identity matrix.

Finally, we analyzed communalities and factor loadings to determine scale factorability. Additionally, the communality value is used to determine whether to include or omit a variable from the factor analysis. Items with a value of less than 0. 5 were eliminated. Initial data examination revealed that one item on each survey had a communality of less than 0.50 and was thus eliminated.

## Factor Extraction

Principal Component Analysis (PCA) was chosen as the primary extraction method due to the non-normal distribution of the data. Regarding the rotation strategy, an early EFA revealed that several inter-factor correlations were more than 0.32. This information gave sufficient justification for using varimax rotation.

Additionally, an approach for factor retention was utilized to estimate the amount of factors to retain, such as Monte Carlo PCA for parallel analysis. Visual examination of the scree plot revealed a five-factor solution for teachers and a six-factor solution for students. However, the parallel study conducted using Monte Carlo identified three underlying causes for each instrument. Additionally, only three components were maintained. Components 4 and 5 were not maintained as factors because their estimated eigenvalue was not exceeded in parallel analysis.

Additionally, demonstrated that three components were preserved. Components 4,5 and 6 were not maintained as factors because they did not exceed the eigenvalue suggested by parallel analysis.

**3 Factor Solution**

After removing the problematic item(s) from the study, the most condensed and theoretically applicable answer was a three-factor approach. The three-factor solution was consistent with the results of parallel analysis and explained roughly 66.92 percent (for a student instrument) and 72.81 percent (for a teacher instrument) of the total variation. Knowledge, Perceptions, and Attitudes were the three variations.

Cronbach's Alpha values for the remaining 19 items and each subscale of the Survey Instrument in game-based learning above the acceptable level of 0.70 for both teachers and students (see Table 13 and 14). The three subscales all have an alpha value within the "acceptable" range of internal consistency (George & Mallery, 2003).

**Results and Discussion**

Teacher and student participants revealed interesting results regarding the use of GBLA.

Table 1. Percentage of Item Frequencies in the SIGBLA for Teachers (N= 174)

| **Statements** | SD (1) | D (2) | A (3) | SA (4) |
|---|---|---|---|---|
| **Component 1: Knowledge** | | | | |
| I can determine the disciplinary content embedded in a game/ what content is being taught | 1 | 3 | 53 | 43 |
| I can use strategies that combine content, games and teaching approaches | 1 | 5 | 32 | 62 |
| 3. I can repurpose an existing game for educational use | 2 | 2 | 27 | 69 |
| I can use my knowledge of a game to ascertain what students are learning during play in a game-based classroom | 1 | 2 | 31 | 66 |
| I can develop curricular activities to support students in inquiring into concepts related to the learning objectives of a game-based classroom. | 4 | 1 | 25 | 70 |
| I can adapt my teaching style to different learners in a game-based learning classroom | 5 | 1 | 28 | 66 |
| I find it more interesting to teach the subjects through online competitive games. | 1 | 1 | 43 | 55 |
| I think digital games can be applied in many learning contexts. | 2 | 1 | 22 | 75 |
| **Component 2: Perceptions** | | | | |
| I think GBL can enhance students' motivation to learn | 1 | 3 | 55 | 41 |
| I believe GBL can help students develop higher-order thinking skills | 1 | 5 | 32 | 62 |
| Digital games can help students develop problem-solving skills | 2 | 2 | 25 | 71 |
| Game-based Learning Approach are an effective way to teach lower level factual and procedural knowledge | 3 | 3 | 29 | 65 |
| Digital games are an effective way to teach basic skills | 2 | 2 | 27 | 69 |
| I think learning shouldn't have fun as a necessary requirement. | 1 | 2 | 31 | 66 |

Table 2. Percentage of Item Frequencies in the SIGBLA for Students (N= 274)

| Statements | SD (1) | D (2) | A (3) | SA (4) |
|---|---|---|---|---|
| **Component 1: Knowledge** | | | | |
| I just need a short time to know how the game is functioning | 15 | 8 | 23 | 54 |
| These educational games help me to think critically. | 4 | 3 | 33 | 60 |
| I feel competent and effective when playing | 1 | 3 | 29 | 67 |
| Solving the given problems/tasks in games is very interesting. | 1 | 4 | 43 | 52 |
| These educational games challenge my understanding of the subject. | 1 | 5 | 36 | 58 |
| My ability to play the game is well-matched with the game's challenges. | 1 | 2 | 34 | 63 |
| I find it more interesting to learn the subjects through competitive online games. | 1 | 6 | 27 | 66 |
| **Component 2: Perceptions** | | | | |
| I think learning should not have fun as a requirement. | 3 | 2 | 30 | 65 |
| Online competitive games enable continuous learning. | 5 | 37 | 7 | 51 |
| The points-based incentive system in games is also a contributing factor to continuous learning. | 2 | 16 | 43 | 57 |
| Game-Based Learning could help me learn the knowledge on mathematics. | 2 | 6 | 17 | 75 |
| This "game-based learning" could help me apply what I learned. | 7 | 6 | 9 | 78 |
| I believe that GBL could extend my knowledge about mathematics. | 3 | 3 | 45 | 49 |
| I think activities/ tasks in educational games give me lots of benefits. | 2 | 2 | 54 | 42 |
| I wish I have more opportunities to learn using this game approach. | 1 | 4 | 50 | 36 |
| **Component 3: Attitudes** | | | | |
| I prefer using games to learn compared to traditional methods in the class. | 5 | 2 | 47 | 46 |
| I would like to learn all education subjects using the educational game. | 3 | 1 | 63 | 33 |
| I hope these educational games will be available online for easy access. | 7 | 3 | 28 | 62 |
| I can learn according to my own pace and sequence. | 11 | 2 | 34 | 53 |

## Knowledge on Game-Based Learning Approach

Four-point Likert-scale items were used to assess participants' knowledge of the Game-Based Learning Approach (responses to this set of items were determined to be reliable, Cronbach's = 0.83). 98 percent of participants expressed an interest in teaching courses via online competitive games. Additionally, 97 percent of participants believe that they may utilize their understanding of a game to deduce what children are learning during the game and that digital games can be used in a variety of learning scenarios. 96% of participants answered that they are capable of determining the disciplinary material embedded in games and repurposing current games for instructional purposes. Additionally, 95% are capable of developing curricular activities that encourage students to inquire about concepts connected to the game-based classroom's learning objectives. In a game-based learning classroom, 94% of teachers said that they can integrate content games and teaching approaches and adapt their teaching style to various learners. demonstrating that teachers were conversant with game-based learning. These findings countered Gaudelli and Talyor's (2011) findings that teachers were generally suspicious of video games' pedagogical utility, mainly due to their lack of knowledge with games, and remained skeptical of utilizing games in teaching even after playing a variety of games.

In terms of students' understanding of the Game-Based Learning Approach, 97 percent of participants' ability to play the game is well-matched to the game's obstacles. 96% of participants reported feeling knowledgeable and effective while participating in educational games. Additionally, 95% stated that educational games help students think critically and that they find completing provided problems/tasks in games extremely engaging. Additionally, 94% of respondents agreed that instructional games test their knowledge of the subject. 93 percent expressed an interest in studying the subjects via competitive online games. Finally, 78 percent of student players require only a brief explanation of how the game works. It is reasonable to assume that students who participate in this study have a high level of expertise and interest in game-based learning.

Consistent with other recent studies and reports (Sáez-López et al. 2015), this study contributes to the body of knowledge regarding game-based learning in school settings, noting that educational applications enable a variety of benefits and advantages centered on pedagogies that promote student activity, motivation, and involvement.

**Perceptions on Game-Based Learning Approach**

A four-point Likert scale was used to assess teacher participants' impressions of the game-based learning strategy. Additionally, responses to this collection of items were determined to be reliable for the sample mentioned in this study (i.e., Cronbach's alpha = 0.93). The majority of participants (96%) agreed that GBL may increase students' enthusiasm to study, can assist students in developing problem-solving skills, and is an effective method of teaching basic skills. Around 94 percent of respondents agreed that GBL may assist students in developing higher-order thinking skills and was an effective method of imparting lower-level factual and procedural knowledge. Around 4% of participants stated that learning should not be required to be enjoyable.

In terms of student perspectives of game-based learning, 96 percent of participants agreed that educational games provide numerous benefits. Ninety-four percent of respondents believed that GBL could help them expand their knowledge of mathematics, whereas 92 percent believed that GBL could help them expand their understanding of mathematics. Additionally, the majority of participants (87 percent) believe that game-based learning can help them apply what they've learned and desire additional opportunities to learn using a game-based method. Additionally, 82% of participants agree that games' point-based incentive system contributes to continual learning. Additionally, more than half of participants (58%) believe that online competitive games facilitate continual learning. On the other hand, just 5% of respondents agreed that learning should be devoid of fun as an essential condition.

**Attitudes on Game-Based Learning Approach**

Four Likert-scale items were used to assess teachers' attitudes toward the usage of instructional computer games in the classroom (responses to this set of items were determined to be reliable, Cronbach's alpha = 0.76). Ninety-eight percent of participants expressed an interest in and comfort with the use of digital games in the classroom. 97 percent of faculty in higher education feel that game-based learning will be a critical teaching tool in the coming years. Additionally, 96% of participants' report being more adaptable in measuring their students' learning when they use educational digital games in the classroom, and 95% report feeling competent when they use computer games in the classroom.

In terms of student attitudes toward game-based learning, 96 percent of participants expressed a desire to learn all subjects through the use of an educational game. Ninety-three percent prefer to study through games rather than through traditional classroom techniques, and 92 percent of participants anticipate that these educational games will be made available online for convenient access. Additionally, the majority of participants (87 percent) stated that they could learn at their own pace and in their own sequence.

Thus, both quantitative and qualitative findings indicate that "GBL positively impacts" teaching/learning processes, which is consistent with the findings of Biffi et al. (2016), Chen, Kuo, Lou, & Shih (2012), Kalloo & Mohan (2012 a & b), Kirikkaya, Iseri, & Vurkaya (2010), and Pinder (2013 & 2008).

**Conclusions**

The SIGBLA is a valid and reliable tool for evaluating these variables. Although additional research is necessary to bolster the SIGBLA's future growth, preliminary data indicate that this instrument is a well-validated and reasonably complete tool for identifying the elements that affect knowledge, perceptions, and attitudes. The stability of factors was tested in this study, and all factors demonstrated a high level of internal consistency and reliability. As can be observed from the study, useful insights can be gleaned that can serve as a foundation for the researcher's development of an Interactive Mobile-Based Digital Game for Mathematics Learning. The study's findings can be used to improve understanding of student and teacher preferences and attitudes toward educational games.

The participants in this study possessed an exceptional understanding of game-based learning. Additionally, they had favorable attitudes regarding GBL and believed that by incorporating it into teaching and learning, they could broaden their knowledge of mathematics. The findings were consistent with the teacher and student participants' knowledge, views, and attitudes regarding game-based learning. The study's findings will help policymakers make informed decisions about how to invest in such instructional game applications. As a result, more in-depth research is required for this type of decision-making process.

## References


An, Y., & Bonk, C. J. (2009). Finding that SPECIAL PLACE: Designing digital game-based learning environments, TechTrends, 53(3), 43-48.

Field, A. P. (2009). Discovering statistics using SPSS (3rd ed.). Los Angeles, CA: Sage.

Gaudelli, W., & Talyor, A. (2011). Modding the global classroom? Serious video games and teacher reflection. Contemporary Issues in Technology and Teacher Education, 11(1), 70–91.

Gee, J. P. (2005). Good video games and good learning. Phi Kappa Phi Forum, 85(2), 33–37.

George, D., & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference, 11.0 update (4th ed.). Boston, MA: Allyn & Bacon

Lynn, M. (1986). Determination and quantification of content validity. Nursing Research, 35, 382-386.

Polit, D., & Beck, C. (2006). The content validity index: Are you sure you know what's being reported? Critique and recommendations. Research in Nursing & Health, 29, 489

Rubio, D., Berg Weger, M., Tebb, S., Lee, E., & Rauch, S. (2003). Objectifying content validity: Conducting a content validity

Sáez-López JM, Miller J, Vázquez-Cano E, Domínguez-Garrido MC (2015) Exploring application, attitudes and integration of video games: MinecraftEdu in middle school. Educ Technol Soc 18(3):114–128. Retrieved from http://www.ifets.info/journals/18_3/9.pdf

Sancar Tokmak, H., & Ozgelen, S. (2013). The ECE pre-service teachers' perception on factors affecting the integration of educational computer games in two conditions: Selecting versus and redesigning. Educational Sciences: Theory & Practice, 13(2), 1345–1362.

Schrader, P. G., Zheng, D., & Young, M. (2006). Teachers' perceptions of video games: MMOGs and the future of pre-service teacher education. Innovate: Journal of Online Education, 2(3), 1–10.

Shaffer, D. W., Squire, K., Halverson, R., & Gee, J. P. (2005). Video games and the future of learning. Phi Delta Kappan, 87(2), 104–111.

Squire K. (2005). Changing the game: What happens when video games enter the classroom? Innovate, 1(6). Retrieved from http://www.academiccolab.org/resources/documents/ChangingThe%20Game-final_2.pdf.

Takeuchi, L M., & Vaala, S. (2014). Level up learning: A national survey on teaching with digitalgames. Retrieved from http://www.joanganzcooneycenter.org/wp content/uploads/2014/10/jgcc_leveluplearning_final.pdf.

Patterson R. R. (2011). Using the theory of planned behavior as a framework for the evaluation of a professional development workshop. Microbiology education, 2, 34–41.

Tabachnick, B. G., & Fidell, L. S. (2007). Using multivariate statistics (5th ed.). Boston, MA: Pearson. Takatalo, J., Häkkinen, J., Komulainen, J., Särkelä, H., & Nyman

Zamanzadeh, V., Rassouli, M., Abbaszadeh, A., Majd, H., Nikanfar, A., & Ghahramanian, A. (2014). Details of content validity and objectifying it in instrument development. Nursing Practice Today, 1, 163

**Contact email:** joana_quinto@dlsu.edu.ph