# Cognitive Assessment on the Use of Widescreen Television Set and LCD Projector as an Educational Tool in Classroom Learning at School X

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## Abstract

When School X shifted from the use of LCD projector to widescreen television set, students were apprehensive as most of them preferred the use of the LCD projector than widescreen television set. Would there be a difference in learning if widescreen television set is used instead of LCD projector in classroom teaching?

The study was conducted to compare the learning of students when LCD projector and widescreen television set is used; and determine if there is a relationship between the student's response time and score on the quiz when LCD projector and widescreen television set is used. A questionnaire survey was used to assess the visual display of the learning media. The use of either LCD projector or widescreen television set made it easier for students to see clearly what was flashed in the screen. Also, the scores of the students were higher when the LCD projector was used. Based on the results, students preferred the use of LCD projector in classroom learning and there is a relationship between student's response time and score on the quiz.

*Keywords***:** *cognitive factors, LCD projector, widescreen television set*
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## 1. Introduction

Improvement of educational outcomes has always been the quest of educational institutions. The learning process of any student whether young or adult is affected by different factors. Rosenshine and Furst (1973) study identified the factors that influence learning as follows: clarity, task orientation, student opportunity, variety and enthusiasm.

Most academic studies investigated factors on socio-economic background on internal motivation to influence different teaching styles. Scott-Webber (2014) pointed that the role of classroom design or workplace environment was often overlooked and/or underemphasized.

Workplace environmental factors such as lighting, noise, temperature, vibration and other elements including the use of multi-media and other ICT (Information and Communication Technology) can affect the overall cognitive reception of students to classroom teaching. Classroom education has evolved from the use of chalk and blackboard, to projector with acetate and whiteboard, to LCD projector connected to a desktop computer and/or laptop. These days' widescreen television sets are also used as an alternative. Suleman (2011) found that educational technology was very useful in the effective learning process at primary school level in District Karak, Pakistan. Likewise, Mashhadi and Kargozari (2011) found that digital classrooms were considered as a vital element in promoting and improving the traditional methods of teaching and learning.

The use of technological tools such as projector, PowerPoint software, video and the internet in education in the recent years had become popular. The use of PowerPoint presentations is considered as a dynamic communication tool in both oral and visual senses and in terms of reading and writing. Can (2010) found that students tend to believe that the use of overhead projector and projector brought some kind of change and variety to teaching, saving it from being monotonous and contributed in establishing lively, colorful and smooth setting for teaching and learning. Lari (2014) investigated the effectiveness use of technology on teaching the English (TEFL) process, and found that using PowerPoint presentations had significant positive effect on learners' scores. Del Campo (2013) focused on the study and analysis on the impact in the process of teaching and learning using slides show presentations and web pages, and its positive and negative influence on the student's learning process especially to the consequences on the level

of attention within and outside the classroom. Some weaknesses of multimedia materials were presented including the difficulties of students to study them due to many distractions, insignificant content and shallowness of the studies due to wrongly formulated presentations. Apperson, Laws and Scepansky (2006) findings suggested that organization and clarity, entertainment and interest, professor likeability, and good professor behaviors were enhanced with PowerPoint but not the final grades.

Most of the studies focused on the use of projector and PowerPoint presentations in the classroom setting with varied outcomes. Some studies showed that the use of projector and PowerPoint presentations supported positive learning outcomes. Results of Savoy (2009) study indicated that students who attended either one of the lecture presentations (PowerPoint or traditional) performed better than those who did not attend. While Vecdi Can (2012) study revealed that there was a significant difference between the teaching methods and the grades students got in accounting education when using PowerPoint presentation lectures.

Other studies had negative outcomes while others were inconclusive. Abdelrahman, Attaranb and Hai-Lengc (2013) study showed that participants have opposite feelings toward PowerPoint as it does not support face-to-face interaction in the classroom. On the other hand, the result of Howell (2007) concluded that a constructivist educational approach was not closely linked to early technology adoption, but to the participants' individual educational beliefs. The study of Szabo and Hastings (2000) investigated the efficacy of PowerPoint lecturing in undergraduate classrooms and the result revealed that lecture and not the method of lecturing contributed to the grade difference and suggested that the efficacy of the PowerPoint lecturing may be case specific rather than universal. Uz (2010) study examined the prospective teachers' opinions of the PowerPoint presentations used in their courses and the result showed that presentations which were prepared without following the appropriate principles had negative effect on learning. Sedler (2009) study was conducted to determine whether equipping classrooms with technology components had a positive impact on student achievement in Mathematics but found that the outcomes were varied similar to its literature review.

Studies on the use of television sets in classroom learning were mostly focused on using it in playing video or film presentations and television shows rather than using it to view PowerPoint presentations. The study of Bligh (2000) found that over half of the students benefited when TV and conventional methods were mixed. While, Susskind (2005) study found that using PowerPoint presentations at any point in the course helped as long as it was continuously used during the duration of the course. The result in Kadzera (2006) study revealed that there was infrequent use of higher order instructional technologies i.e. overhead projectors, videos and computers which was attributed to lack of training, unavailability of the technologies and lack of maintenance. Lin (2009) study focused on improving legibility of display and reducing users' visual fatigue. Mackiewicz (2006) examined 10 common and popular fonts displayed in projected PowerPoint text slides. According to Marshall (2002), poorly designed programs that lack instructional foundation; casual, purposeless use of technology in the classroom; and lack of alignment between desired learning outcomes and application of educational technology all threatened the success of any learning-by-technology endeavor. Ni (2006) designed a controlled experiment to evaluate the individual and combined effects of display size and resolution on task performance in an Information-Rich Virtual Environment (IRVE) and result showed that users working with large displays became less reliant on wayfinding aids to form spatial knowledge. Oshinaike and Adekunmisi (2012) revealed that among the mostly used of the multimedia resources, television and transparencies were the least used as compared to internet and its facilities as well as computers and CD-ROMs. Phosuwan (2013) study showed that picture, graphics and multimedia projectors were the most often used by nursing instructors. The result of Wecker (2012) study indicated that "speech suppression effect" of regular slides at the expense of oral information can be avoided by concise slides. Results of Rice and Fels (2004) study indicated that people's visual acuity, contrast sensitivity and color perception differences affected their ability to comprehend the displayed information making it difficult to have a standard set of interface designs that would accommodate the large variety of needs. Pociask, DiZazzo-Miller, and Pellerito (2011) described that the process of learning was normally associated with relatively short-term classroom or university experiences described in terms of credit hours and grades. Clark (2007) cited that research evidence indicated that training materials that accurate identification of expert's cognitive processes were

substantially more effective than other means. Pate, Du and Harvard (2004) mentioned that cognitive learning theories that dominate the current instructional design practices emphasized on the internal factors of the learner rather than the external factors of their environment. A study that focused on the use of widescreen television to view PowerPoint presentations for classroom learning was needed since there were no studies conducted yet on the said topic.

When School X shifted from the use of LCD projector to widescreen television set (monitor size 45"), students were apprehensive as most of them preferred the use of LCD projector than the widescreen television set. Would there be a difference in learning if a widescreen television set is used instead of LCD projector in classroom teaching? To address this gap, a study on the use of widescreen television set in classroom setting was conducted using a survey instrument to determine students' attitude towards learning.

Research questions sought were as follows: Will there be a significant difference in the response time of students in answering the quiz when using LCD projector and widescreen television set? And, will there be a difference on the scores in the quiz of the students using the different learning media?

## 2. Objectives

The objectives of the study were the following:

1. To compare the learning of students when LCD projector and widescreen television set is used; and

2. To determine if there is a relationship between the student's response time and score on the quiz when LCD projector and widescreen television set is used

The study would give school administrations information on the effectiveness of the use of widescreen television set (e.g. for viewing PowerPoint presentations) and LCD projector as educational tools in classroom learning. Teachers would be able to teach their lessons to students more effectively and efficiently when using the appropriate media. It would also aid students in understanding the importance of using educational tools in the classroom setting. The study would be an additional resource and reference for similar studies in the future.

The focus of the study was the comparative assessment of the effectiveness of using widescreen television set and LCD projector in the classroom. The study used PowerPoint presentations in weighing the effectiveness of these learning media. Variations and differences of skills and aptitude of students were not considered in the study. Workplace environmental factors such as lighting, noise, temperature, vibration and other elements such as color of the classroom, sound, screen size and placement of learning media were also not considered.

## 3. Materials and methods

The research instrument used in this study was the questionnaire-survey method. The survey had a 5-point Likert Type scale aimed in soliciting the effectiveness of using the LCD projectors and widescreen television set in the classroom learning. Part of the questionnaire was adapted from previous study (Can, 2010), where its reliability and validity were already tested. The scale was composed of 25 items to solicit the students' attitudes towards the effects of using LCD projectors and widescreen television set in learning.

The study was carried out to selected engineering students at School X. The three (3) classes selected were under one teacher so as to ensure that respondents of the study would be the same when the study was made. The respondents' size was 121 students composed of three (3) classes with 40 students made as subjects for the experimental design study. After a lecture using LCD projector, a short quiz and survey was conducted right after to measure the students' learning. After a week, the same setup was done using widescreen television set. The quizzes were a combination of multiple choice and/or true or false questions with a total of 10 items.

Visual display elements can have an effect on the learning process of the students. The survey questionnaire regarding the visual display elements for widescreen television set and LCD projector were identified and grouped into the following: clarity (Questions 1 to 5), task orientation (Questions 6 to 10), student opportunity (Questions 11 to 13), variety (Questions 14 to 18) and teacher's enthusiasm (Questions 19 to 25).

Factor analysis (FA) was used to analyze the structure of the interrelationships among the different variables by defining a set of common underlying dimensions. FA was used to reduce the information contained in a number of original variables into smaller set of variates with minimum loss of information. These significant factors were extracted using principal component analysis. Scree Test Criterion was used to identify the optimum number of factors that can be extracted before the amount of unique variance begun to dominate the common variance structure.

The relationship between the significant variables identified from the learning media and the respondent's response time in answering the quiz and performance on the quiz. The scores on the quizzes of students were gathered, together with the response time of randomly selected students. The result of the scores and response time on the quizzes were analyzed using multivariate analysis to determine the attitude of the students towards the use of the different media.

The response time of the sampled students while answering the quiz were taken to see whether there is relationship between the response time and the correctness of the answers. Fitts' Law described this relationship by applying information theory of physical communication systems to the sensory-motor system.

Multivariate Analysis using General Linear Model was used to assess the differences between group means. The analysis was selected to analyze a dependence relationship represented as the differences in a set of dependent measures across a series of groups formed by one or more categorical independent measures. Independent t-Test was used to check whether there was a significant variation of attitude based on the student's gender. A t-Test for Dependent Means was also used to determine whether there was difference in means between the used of Widescreen TV Set and LCD Projector.

The results of the score on the quizzes were compared with the results of the survey questionnaire on perception to check whether there was a relationship between the two. The results of the students' scores were categorized according to gender and level of intelligence. The level of intelligence was based on the previous results of quizzes and examinations of the students prior to the experiment. The sub-categories of intelligence were as follows: high, low and middle, respectively.

## 4. Results and Discussion

Table 1 showed that thirty-six percent (36%) of the participants were female and sixty-four percent (64%) were male. Thus, majority of the sample consisted of male participants.

**Table 1** Distribution of students according to gender

| Gender | Frequency | Percentage |
|--------|-----------|------------|
| Female | 42 | 36 |
| Male | 74 | 64 |
| Total | 116 | 100 |

The t-Test results for both media presented on Table 2 and Table 3 showed that there were no significant difference between the scores among the female and the male students.

**Table 2** *t*-Test results according to ender (LCD projector)

| Gender | F | x̄ | Variance | df | T | P |
|--------|---|-----|----------|-----|-------|------|
| Male | 74 | 3.85 | 1.28 | 86 | -0.46 | 0.64 |
| Female | 42 | 3.95 | 1.27 | | | |

**Table 3** *t*-Test results according to gender (widescreen television set)

| Gender | F | x̄ | Variance | df | T | P |
|--------|---|-----|----------|-----|------|------|
| Male | 68 | 4.24 | 0.81 | 75 | 0.08 | 0.94 |
| Female | 41 | 4.22 | 1.08 | | | |

Using Multivariate Analysis, specifically by General Linear Model, the result for LCD projector showed that variables 6, 3 and 11 had high significance as shown on Table 4. On the other hand, there were

no significance among the variables for widescreen television set as shown on Table 5. Only the top five variables were showed.

**Table 4** Variables for LCD projector

| Variables | Significance |
|---|---|
| Variable 6 – Task Orientation 1 | 0.670 |
| Variable 3 – Clarity 3 | 0.515 |
| Variable 11 – Student Opportunity 1 | 0.511 |
| Variable 25 – Teacher's Enthusiasm 7 | 0.464 |
| Variable 9 – Task Orientation 4 | 0.355 |

**Table 5** Variables for widescreen television set

| Variables | Significance |
|---|---|
| Variable 18 – Variety 5 | 0.104 |
| Variable 2 – Clarity 2 | 0.017 |
| Variable 3 – Clarity 3 | 0.006 |
| Variable 13 – Student Opportunity 3 | 0.003 |
| Variable 16 – Variety 3 | 0.003 |

Using Factor Analysis in the survey reduced the variables to five (5) in both learning media (widescreen television set and LCD projector). The extraction method used was principal component analysis and the significant variables for LCD projector shown on Table 6 were variables 1, 14, 17, 18 and 23, respectively. On the other hand, for the widescreen television set the variables shown on Table 7 were 1, 2, 6, 15 and 24, respectively. Note that variable 1 was significant in both surveys. Thus, the use of any of the learning media (LCD projector and widescreen television set) made it easier for students to see clearly what was flashed on the screen.

**Table 6** Significant variables for LCD projector

| Significant Variables | Extraction |
|---|---|
| Variable 1 – Clarity 1 (Students can see clearly what is flashed on the screen. Show clear and easy to see/readable information and icon.) | 0.769 |
| Variable 14 – Variety 1 (Makes teaching more lively and clear by bringing variety and change.) | 0.716 |
| Variable 17 – Variety 4 (Light, color, movement and sound features help student to constantly focus attention on the information presented.) | 0.775 |
| Variable 18 – Variety 5 (Student prefers lesson taught with traditional chalk and blackboard.) | 0.744 |
| Variable 23 – Teacher's Enthusiasm 5 (Makes lessons easier to encode the information in student's mind.) | 0.716 |

**Table 7** Significant variables for widescreen television set

| Significant Variables | Extraction |
|---|---|
| Variable 1 – Clarity 1 (Students can see clearly what is flashed on the screen. Show clear and easy to see/readable information and icon.) | 0.737 |
| Variable 2 – Variety 2 (The screen projection is located directly in front of the room.) | 0.713 |
| Variable 6 – Task Orientation 1 (Student is engaged to the task by giving clear instructions on what has to be done.) | 0.746 |
| Variable 15 – Variety 2 (Eliminates the monotony in class and provides colorful, lively and interesting learning-teaching environment.) | 0.736 |
| Variable 24 – Teacher's Enthusiasm 6 (Teacher is effective in engaging the students in learning.) | 0.740 |

The variables were further analyzed using correlation and the results for both media are shown on Table 8 and Table 9, respectively. For the LCD projector, the significant variables were 1, 14, 17, 18 and 23. While for the widescreen television set, the significant variables were 5, 6, 15, 23 and 24. However, for both media variable 23 was significant. Thus, the use of either medium made the lessons easier for students to encode the information.

**Table 8** Significant variables for LCD projector

| Significant Variables | Extraction |
|---|---|
| Variable 1 – Clarity 1 (Students can see clearly what is flashed on the screen. Show clear and easy to see/readable information and icon.) | 3.8879 |
| Variable 14 – Variety 1 (Makes teaching more lively and clear by bringing variety and change.) | 4.0345 |
| Variable 17 – Variety 4 (Light, color, movement and sound features help student to constantly focus attention on the information presented.) | 4.1034 |
| Variable 18 – Variety 5 (Student prefers lesson taught with traditional chalk and blackboard.) | 2.7500 |
| Variable 23 – Teacher's Enthusiasm 5 (Makes lessons easier to encode the information in student's mind.) | 4.0172 |

**Table 9** Significant variables for widescreen television set

| Significant Variables | Extraction |
|---|---|
| Variable 5 – Clarity 5 (Students can see clearly, see, hear and understand what is being said by the teacher.) | 4.1560 |
| Variable 6 – Task Orientation 1 (Student is engaged to the task by giving clear instruction on what has to be done.) | 4.2477 |
| Variable 15 – Variety 2 (Eliminates the monotony in class and provides colorful, lively and interesting learning-teaching environment.) | 3.9083 |
| Variable 23 – Teacher's Enthusiasm 5 (Makes lessons easier to encode the information in student's mind.) | 4.0000 |
| Variable 24 – Teacher's Enthusiasm 6 (Teacher is effective in engaging the students in learning.) | 4.0550 |

The outcomes of the scores in the quizzes for the randomly selected ten (10) students for each class are shown on Tables 10, 11 and 12, respectively. For each class, ten (10) names of students were drawn at random. For the EMGT101-A01 class, five out of the ten selected students got better scores when LCD projector was used. Except for one student, the rest answered faster using the LCD projector. In the case of EMGT101-A31 class, six students got better scores and eight students answered faster when LCD projector was used. As for SAF101-A31 class, seven students got higher scores when LCD projector was used. However, only three students answered faster using the said medium.

**Table 10** EMGT101-A01 class quizzes results

| Student | | | Quiz 1 (Widescreen TV Set) | | Quiz 2 (LCD Projector) | |
|---|---|---|---|---|---|---|
| | | | Score | Ave. Time (in seconds) | Score | Ave. Time (in seconds) |
| High | A | M | 10 | 18.70 | 9 | 11.27 |
| | B | M | 9 | 12.40 | 10 | 6.49 |
| | C | F | 9 | 12.74 | 9 | 9.66 |
| Middle | D | M | 7 | 13.02 | 7 | 5.67 |
| | E | F | 8 | 17.00 | 6 | 9.20 |
| | F | M | 6 | 20.80 | 8 | 8.50 |
| | G | F | 8 | 6.64 | 6 | 12.06 |
| Low | H | M | 4 | 16.40 | 6 | 14.30 |
| | I | M | 4 | 19.90 | 6 | 2.92 |
| | J | M | 2 | 20.13 | 5 | 16.57 |

**Table 11** EMGT101-A31 class quizzes results

| Student | | | Quiz 1 (Widescreen TV Set) | | Quiz 2 (LCD Projector) | |
|---|---|---|---|---|---|---|
| | | | Score | Ave. Time (in seconds) | Score | Ave. Time (in seconds) |
| High | A | M | 9 | 3.50 | 10 | 3.00 |
| | B | M | 10 | 6.06 | 9 | 19.85 |
| | C | F | 9 | 14.39 | 10 | 12.14 |
| Middle | D | M | 6 | 21.86 | 9 | 14.01 |
| | E | F | 7 | 24.00 | 8 | 15.72 |
| | F | M | 9 | 30.70 | 6 | 21.00 |
| | G | F | 7 | 21.73 | 8 | 12.69 |
| Low | H | M | 5 | 14.74 | 7 | 15.00 |
| | I | M | 6 | 23.11 | 5 | 19.97 |
| | J | M | 7 | 19.16 | 4 | 18.30 |

**Table 12** SAF101-A31 class quizzes results

| Student | | | Quiz 1 (Widescreen TV Set) | | Quiz 2 (LCD Projector) | |
|---|---|---|---|---|---|---|
| | | | Score | Ave. Time (in seconds) | Score | Ave. Time (in seconds) |
| High | A | M | 6 | 14.46 | 7 | 18.70 |
| | B | M | 7 | 11.28 | 7 | 20.70 |
| | C | F | 7 | 16.70 | 7 | 14.30 |
| Middle | D | M | 4 | 21.28 | 7 | 14.19 |
| | E | F | 3 | 11.10 | 7 | 15.60 |
| | F | M | 5 | 17.78 | 5 | 14.52 |
| | G | F | 3 | 13.91 | 7 | 15.23 |
| Low | H | M | 3 | 16.26 | 4 | 27.39 |
| | I | M | 4 | 4.21 | 7 | 6.90 |
| | J | M | 2 | 10.29 | 5 | 12.95 |

To validate the results of the quizzes, *t*-Test for Dependent Means was used to analyze the data. Table 13 showed the entire *t*-test analysis. The *t* Stat value obtained was - 2.4969 which was more extreme than the needed *t* Critical two-tail value of ± 2.0484. Thus, the scores of the students were better when LCD projector was used.

**Table 13** *t*-Test for dependent means of widescreen TV set & LCD projector

| | Widescreen TV Set | LCD Projector |
|---|---|---|
| Mean | 6.068965517 | 6.965517241 |
| Variance | 5.42364532 | 2.891625616 |
| Observations | 29 | 29 |
| Pearson Correlation | 0.577793974 | |
| Hypothesized Mean Difference | 0 | |
| Df | 28 | |
| t Stat | -2.496901901 | |
| P(T<=t) one-tail | 0.009341648 | |
| t Critical one-tail | 1.701130934 | |
| P(T<=t) two-tail | 0.018683295 | |
| t Critical two-tail | 2.048407142 | |

The scores of the selected students showed that their performance were better when the LCD projector was used. This means that students were able to understand the information faster when the lessons presented to them were organized and their attention were directed towards the learning task.

## 5. Discussion

The result of the study showed that there was no significant difference between the response time of female and male students for both LCD projector and widescreen television set.

Using Multivariate Analysis, the result for LCD projector showed that variables 3, 6 and 11 had high significance but there were no significance among the variables for widescreen television set.

The five (5) significant variables in both learning media (widescreen television set and LCD projector) when Factor Analysis was used were variables 1, 14, 17, 18 and 23, respectively for LCD projector. While for the widescreen television set the significant variables were 1, 2, 6, 15 and 24, respectively. Variable 1 was significant in both widescreen television set and LCD projector. Thus, the use of any of the learning media (LCD projector and widescreen television set) made it easier for students to see clearly what was flashed in the screen.

Using correlation, the variables were further analyzed and the results showed that variable 23 was significant in both media. Thus, the use of either medium made the lessons easier for students to encode the information.

The $t$-Test for Dependent Means showed that there was a statistically significant mean difference between the use of Widescreen Television Set and LCD projector. These show that students performed better when LCD projector was used in classroom learning. Results of the scores on the quiz for the selected students showed that their performance were better when LCD projector was used.

## 6. Conclusion

Based on the results of the study, visual display elements had an effect on classroom learning. LCD projector has better quality visual display than widescreen television set.

Results showed that students responded faster and scores on their quizzes were higher when LCD projector was used. Therefore, the study shows that there is a direct relationship between response time and performance in terms of scores in the quiz.

## 7. Acknowledgements

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