A Gender Study On The Effects Of The “High Five Game” On The Math Learning Performance Of Children

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Abstract: Researches on educational games in the classroom which aim to enhance Math scores among children continue to enhance research literature. The card game “High Five Game” developed and utilized with the hope of improving the basic math performance and Math appreciation of children. Featuring the combined mechanics of UNO and Bingo Number Tower Game, this new card game was introduced among the 130 grader-respondents from Lingayen, Pangasinan, Philippines, whose profile were gathered and for whom the pre-test and post-test were administered. The acceptability of the game by various grader-respondents was measured and it was very highly acceptable. Differences between the male and female pupils on their game acceptability and test score performances were determined; there was no statistical difference for both. Finally, in terms of the effects of the game, findings in this study does not support the stereotype belief on ‘Math as a “male” subject’ among children.

Index Terms: gender study, high five game, Math learning performance of children, educational game, Mathematics for children

1. INTRODUCTION

There is a profound literature reporting gender difference favoring the male sex on Math problem-solving [5] among children in the world. It has been a stereotype belief that Math is a "male" subject. It is presently understood as the main factor behind the low performance of girls on the subject. African girls, received lesser quality and quantity in math and science education relative to their male counterparts [2]. Tanzanian, girls marked lower scores in Science, Math and Technology (SMT) subjects (Jones, 2016). It is believed that the female gender cannot excel in SMT areas [1]. American stereotyping occurs in formative years [3]. A huge gender gap for high achievers in Math favors males [4]. Countries like United States, Belgium, Chile Italy, , Lebanon, , Morocco, Tunicia, Ghana and Hungary were reported to have higher Math achievement among their eighth graders However, for countries with low gender gap such as Philippines, Moldova, Cyprus or Serbia, girls got higher performance than the male counterparts for the eighth graders [14]. Programme for International Student Assessment or PISA’s analysis on math achievement of males and females suggest no significant difference on countries with lesser or disappearing gender gap [6]. But alas, the Philippine educational system was considered underperforming when compared with its neighbors in Asia (World Bank report). Philippines, and other countries in Southeast Asia such as Thailand, Indonesia and Malaysia scored lower than the average in international exams under the PISA and TIMSS [14], [16]. Filipino students ranked third from the bottom list of the 38 countries in 2003. In this study, the researcher has improved a number game, now utilizing cards—the High Five Game — with hope to provide another instructional material that will enhance the learning performance of children in Math.

2 LITERATURE REVIEW

According to Liu and Chen, there is an increasing awareness among educators on the utilization of educational games in the classroom. And to enhance math performance among children, more and more researches on educational games as utilized inside the classrooms are published in international science journals [8]. Learning by doing [10], is an educational constructionism view instilling new knowledge and skills to the children playing those games. As they are freed with the tedious and highly structured conceptual or theoretical lessons, using educational games unleashes the thinking ability and potentials which provides benefits to children. Card or board games developed such as "Conveyance Go," has brought positive effects on the scientific knowledge of students specifically on transportation and energy [8]. The academic board game called "Larong Akademiko (L-Akad) para sa Pilipino" was very highly accepted by college students [9]. It was suggested by the research findings that when it comes to the effects of both the game, a significant increase of learning performance in the subjects Science and Economics, respectively, were found. Another study providing four 15-minute sessions of playing of simple numerical board game eliminated the differences in numerical proficiency between the low-income and middle-income children, to which the latter has affluent background [18]. The BINGO Number Tower Game has also enhanced the learning performance of children in basic mathematics [17].

3. OBJECTIVE OF THE STUDY

This study sought to know the profile of the grader-respondents, their level of acceptability on the game, if their exists a significant difference on the level of acceptability between the male and female children, their Math perfomance before and after the game was introduced, if a significant gender difference on their math performance exists, and the effects of the game on the math learning performance the children. The following null hypotheses were tested under 0.05 level of significance: 1) There is no significant difference on the game’s level of acceptability between the male and female children; 2) There is no significant difference on the math performance of the male and female respondents in before and after playing the High Five Game; and 3) There is no significant effects of the ‘High Five Game’ in enhancing the math learning performance betwen the male and female pupil-respondents.

4 RESEARCH METHODOLOGY

Research Design. This is a descriptive and quasi-experimental research. The level of knowledge of the grader-respondents on basic Mathematics was measured before and after the game was introduced and played by them. The study purposely chose 130 grade five and grade six pupils from two

public elementary schools in Lingayen, Pangasinan, Philippines. Procedure. After the permission was given by the school principals to conduct the research, the researcher explained to the classroom adviser the purpose of the study. A 20-item test was administered by the researcher to the children. The examination aimed to measure the level of knowledge of the respondents on the concepts such as odd/even numbers, multiples, factors, prime and composite numbers, addition, subtraction, multiplication, division, exponents, perfect square numbers and simple problem solving. The game mechanics of the High Five Game (HFG) was explained among the participating pupils with the presence of the classroom adviser. The class was divided into groups with 6 to 10 members, and were given the materials—HFG cards with three components: 1) cards numbered 1-100; 2) pictured cards; and 3) activating cards. Two game mechanics were introduced. The pupils then played the game. Thereafter, the researcher assisted the participating pupils in playing in the event they have questions. Two hours per class was utilized from administering pre-test, introducing and playing the game and conducting an acceptability survey. Each of the qualifying statements in the survey was explained to the children so they can fully understand the contents of the survey. On the first week, a survey questionnaire with 5-point scale was administered to determine the respondents' acceptability of the game. Then, two days after, a post-test exam was administered to them. Test scores were tabulated and statistically treated and results were interpreted. Design of the High Five Game. The High Five Game (HFG) is composed of 150 cards with three components: 1) cards numbered 1-100; 2) 20-pieces pictured cards; and 3) 30-pieces activating cards. Two game mechanics were introduced. For the first game mechanics, each pupil in a group had equally and randomly received cards and were instructed to hold and arrange the cards in a way they can see the numbers written on the card. The researcher used only one set of Activating cards for the groups for demonstration purposes. Rules are as follows: 1) A deck of the High Five Cards (HFC) is composed of 100 numbered cards and 10 picture cards. These will be distributed to all the players equally. For 10 players, each will receive 11 cards; for five (5) players, each will be given 22 cards. However, upon agreement, the complete deck of cards may not be distributed especially if there is a small number of players in the game, so that each player may receive a fewer number of cards; 2) The set of HAC or High-five Activating Cards will be placed at the middle of the players turned upside down. These will be drawn one at a time to activate the HFCs distributed to the players. Each player has to drop a card answering or satisfying the HAC equation/condition/ question. One at a time, each player takes turn, as long as he/she has the required card/s. For example, if the HAC says "All odd numbers", all cards with odd numbers will be dropped one at a time by each player. A player with no odd number shall say "Pass" so that the player to his/her left play next. If one player has more activated cards relative to others (say, one player has 5 odd numbers, and the rest have 4 odd numbers) that player is given the opportunity to get rid his/her unwanted card, if there is. The more a player has cards activated relative to other players, the more opportunity is given to him/her to drop unwanted picture cards. Another way of getting rid of the unwanted pictured card is that when a player has the sole answer to the HAC condition/question or equation. For example, the HAC card says "9 x 5 =", the player with the card "45" will drop the card numbered "45" and one unwanted card.(3) After a HAC card is drawn, shown to the players and all answer cards are dropped, another HAC card will be drawn and the process will be repeated. (4) The first player to drop all his/her cards win the round or game. For the second game mechanics, only the numbered and pictured cards were used. The pictured cards or Action cards has the following features: a) Stop. This disallows the player at the left or right (of the player who drop the picture card) depending on the direction of taking turn, to miss his/her turn of dropping; b) Reverse. The clockwise taking of turns by the players will become counter- clockwise or the other way around; c) Plus 3 or 4. This adds three or four HFCs to the next player (left or right depending on the direction of taking turn; 4) Switch. Once dropped, this allows the holder of this pictured card to switch all his/her cards to the HFCs of any player of his choice. However, this may be used as an ordinary card depending on the desire of the player holding this card. Any of these action cards can be dropped as long as it connects to the number of the last card dropped by other player. The action cards bear the numbers 1 to 10. If dropped, the player who dropped may changed and say the number to be continued as long as the single digit is written on that picture card. First, five (5) HFCs will be distributed by a dealer to each player. The undistributed HFCs will be placed at the middle of the players. The remaining deck of cards will be drawn by the players if they got no HFCs to drop to continue the number chain or connection; Second, the number chain or number connection can be one of the following: a) Multiple of the "dropped" number ; b) Chronological counting by 1, either in ascending or descending order; c) Factor of the 'dropped' number; d) If the last card dropped bears a 'prime number' any prime number may continue the number chain or number connection; and e) Number with similar last digit. Meanwhile, the following number connections are not allowed: a) Same odd number; b) same even number; and c) composite number. If the dropped number is "1" any card may be dropped as 'multiple' as long as it is in increasing sequence. Once interrupted by a non-increasing multiple or number, the connection will vary. Third, after the players received five HFCs each, one card from the deck of HFCs will be drawn and shown in the middle of the players. If an action card is chosen, it will be put back in at the deck of cards. A numbered card must be chosen. The player at the left of the dealer will drop a card to continue the number chain or number connection. For example, the first card show is "7", he/she may drop either 35 or 49, or 14. In case the player has no multiple of 7 HFC, he/she may drop "8" or "6" (chronological counting by 1). It can be any prime number, since 7 is a prime number, or any number ending in "7" such as 17, 27, 87, etc. Fourth, the next player will drop a card which continues the HFC dropped by the player before him/her following a number chain or connection. If the player got no HFC to drop, he/she draws one card at the deck of HFC. If the drawn card got no connection again with the latest dropped HFC, the next player takes turn. Finally, the process of dropping HFC and drawing continues until all cards are dropped by a player who wins the game. In case all the HFCs were drawn by the players and no one wins yet, the used HFC's will be reshuffled and will be placee again at the middle and the game will be continued. Statistical Analysis. A five-point Likert scale to measure the level of acceptability of the game based on the students' perception, from the scale of 1 (highly not acceptable) to 5

(very highly acceptable) was employed. Four constructs with five statements for each--perceived usefulness, ease of use, attitude towards usage, and intention to use—were used. T-test analysis was used in determining the existence or non-existence of significant difference between the boys' and girls' level of acceptability of the game. The pre-test questions were duly validated by Elementary Math teachers. It was administered to the participating pupils to determine the effectiveness of the High Five Game in the learning performance in Mathematics before the game was introduced to them and before the game was played by them. A post-test was administered two days after playing the game. T-test analysis was used to test the mean difference of scores at an alpha level of 0.05.

5 DATA ANALYSIS & INTERPRETATION

5.1. Profile of the male and female children-respondents. There are more female children with majority of them age 11. Four sections from the fifth and sixth graders participated in the study. More than half or 55.4% came from the Magsaysay Elementary School of Lingayen, Pangasinan.

5.2. Level of acceptability of the respondents on the High Five Game. Positive responses for all the four constructs, were given by the respondents. Perceived usefulness received the highest mean score i.e. 4.62 with a descriptive rating of very highly acceptable. All other acceptability indicators such as intention to use, ease of use, and intention to use the game received very highly acceptable mean scores of 4.34, 4.47 and 4.46, respectively.

5.3. Significant difference on the level of acceptability of the game by the male and female children. In order to measure if a significant difference exists between the perception of male and female respondents, mean scores were compared.

Table 1.

Construct	Sex	Mean	t-value	p-value
Perceived Usefulness	Male	4.6100	-.273	.786
	Female	4.6313		
Ease of Use	Male	4.3700	.386	.701
	Female	4.3250		
Attitude towards Usage	Male	4.4650	-.037	.971
	Female	4.4688		
Intention to Use	Male	4.4650	.107	.915
	Female	4.4531		

The p-value at the fifth column of the table above shows no significant difference between the male and female respondents' acceptability of the game as indicated by the p-value .786 for perceived usefulness, .701 for ease of use, .971 for attitude towards usage and .915 for intension to use.

5.4. Math performance and significant difference between the male and female respondents for their pre-test and post-test.

Table 2

Math Performance of Male and Female Children to their pre-test and post-test (N= 130)

Math Performance	Sex	Mean	t-value	p-value
Pre-test	Male	6.36	-.855	.395
	Female	6.81		
Post-test	Male	10.20	-.625	.534
	Female	10.61		

It can be gleaned from the table that the mean score of the female children is higher for both the pre-test (6.81 vs. 6.36) and post-test (10.61 vs. 10.21). The p-values show that the difference between their pre-test score (i.e. .395) and post-test score (.534) are not significantly different.

5.5. Effects of educational game on High Five Game on the achievement among the male and female children

Table 3

Effects of the Game among Male and Female Children on their Math Learning Performance (N= 130)

Math Performance	Mean	Std. Dev.	t-value	p-value
Pre-test	6.64	2.978	-15.868	.000
Post-test	10.45	3.600		

Over-all, the table above shows a significant improvement on the test scores of both the male and female children after playing the educational card game as indicated by the p-value of .000. The mean for pre-test is 6.64 and the post-test mean score is 10.45.

Table 4

Effects of the Game for Male and Female Children on their Math Learning Performance (N= 130)

Sex	Test	Mean	t-value	p-value
Male (n=50)	Pre-test	6.36	-9.716	.000
	Post-test	10.20		
Female (n=80)	Pre-test	6.81	-12.471	.000
	Post-test	10.61		

The table above shows a significant improvement on the test score of male children after playing the High Five Game. Same applies to female children. This finding is clearly indicated by the p-value of .000.

4 CONCLUSION

This study sought to know the profile of the respondents, to measure the acceptability of the educational card game called High Five Game and whether this game-based learning could help fifth and sixth graders in learning or mastery of knowledge pertaining to the subject Math. It also aimed to determine if gender difference exists between their acceptability of the game and their performance. The participants showed positive attitudes in playing the game. They rated the game with a 'very high' level of acceptability to all the four constructs. Their level of acceptability to the game has no significant difference. The mean score of female children for both the pre-test and post-test is higher than boys, but the difference is not significant. The research was intended to measure the effectiveness of the new educational game for children. This game was developed by the researcher with the hope of helping children to appreciate math as a subject in the elementary level. It seems to appear that the educational game has contributed to the respondents' improved learning performance in grade five Mathematics, as measured by their pre-test and post-test scores. The use of the game might have improved the learning effectiveness among the respondents. Both the male and female respondents' scores for pre-test and

post-test have no significant differences. The result of this study does not support the gender difference on mathematics performance among children [2], [3] & [5]. But the result of this study suggests to support PISA's analysis. It is therefore suggested that the "High Five Game" be used as learning material in enhancing the Math learning performance of children in the elementary level. Further, higher concepts in Mathematics may be used as activating cards to cater to the level of high school students. The result of this study may be used as future reference for researches looking on the effects of educational game in learning performance.

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