Mining through Maths: Minecraft Play and Mathematical Problem Solving

Laura Griffin

N00146573

Supervisor: Dr. Gráinne Kirwan

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Contents

Declaration

This dissertation is entirely my own work, and has not been previously submitted to this or any other third level institution.

Signed: _____ Date: _____

Laura Griffin

Abstract

Mining through maths: Minecraft play and mathematical problem solving abilities among children.

Given the history of the importance of play, it would seem that video games, particularly sandbox games such as Minecraft may have educational potential for the development of mathematical problem solving skills. In this research, performance on maths problem solving and non-verbal reasoning was compared between those who played Minecraft, and video games, and those who did not. Children aged 10 to 13 completed a survey outlining Minecraft and video gaming habits, as well as non-verbal reasoning tasks and mathematical word problems. Results indicated no benefit in playing Minecraft for problem solving, however, playing Minecraft with others younger than themselves had a positive impact on word problem solving scores. A positive correlation was also found between time spent playing video games and non-verbal reasoning scores. Implications for these findings, as well as recommendation for future research are discussed.

Keywords: Gaming; Minecraft; Sandbox games; Non-verbal reasoning; Skills Transference; Play

Introduction and Literature Review

Currently in Irish education, there is a focus on divergent maths problem solving both at primary and second level in an attempt to improve maths literacy. According to an OECD report in 2012 into creative problem solving, Irish students had an average score in problem solving abilities. Concurrently, countries which have high average times spent gaming scored higher on OECD problem solving tasks. Given the history of the importance of play, it would seem that video games, the modern play, may have educational potential. Sandbox games in particular, such as Minecraft, are virtualising traditional construction games. Minecraft's positive reputation relies on Froebel and Montessori based ideas about play through the genre of construction toys (Fanning & Mir, 2014; Schifter & Cipollone, 2013). This study aims to investigate the importance of play in developing problem solving skills, and analyse the potential for video games, with a view to investigating if video games, such as Minecraft, are having an impact on mathematical problem solving abilities.

Maths Problem Solving

Internationally, mathematical education includes an emphasis on problem-solving (NCCA, 2005). A problem is a situation in which in order to reach a goal, one must find a means to do so (Woolfolk, Walkup & Hughes, 2013), while problem solving is what occurs when no solution is immediately obvious (Mayer & Wittrock, 1996). Problem solving is imperative for developing higher-order thinking skills. These include the ability to analyse mathematical situations, to plan, monitor and evaluate solutions, to apply strategies, and to demonstrate creativity and self-reliance in mathematics (Department of Education and Science, 1991).

Schoenfeld (1987) highlighted the importance of metacognition and the cultural components of learning mathematics. According to him metacognition helps to keep the process of problem solving on track. This skill can only be developed through experience and rehearsal. Many of the situations that arise that hold potential to rehearse problem solving abilities are during play (Hutt, 1979).

Play

The importance of play has long been emphasised in the Irish educational context, particularly with Aistear in infant classes, where free play is specifically timetabled (NCCA, 2009). Play has the ability to motivate, stimulate, support, develop skills, develop concentration, develop positive attitudes, demonstrate awareness and use of recent learning and skills and consolidate learning (Welsh Assembly Government, 2008). According to Pepler and Ross (1981), play is key for developing creative problem solving skills. Vygotsky stated that "a child's greatest achievements are possible in play, achievements that tomorrow will become her basic level of real action" (1967, p100). However, Hutt's typology of play (1979) highlights that specific types of play are particularly important in the development of problem solving skills, with strong links to constructivist types of play.

There are also links to social interaction during play which develops problem solving behaviours. According to Vygotsky, the difference between what children are able to do on their own and what they can do while working collaboratively with others or with the support from a fellow peer or adult represents the zone of proximal development (Bodrova & Leong, 2007). However, play has changed in nature since Vygotsky's time. For example, in a traditional sense, social constructivist play would have meant playing with physical building blocks or materials, both alone and with others. However, in today's world, much constructivist play seems to take place on a virtual platform in video games (Brand, de Byl, Knight & Hooper, 2014). In contrast, research indicates that playing video games alone is more beneficial than taking part in collaborative online gaming (OECD, 2015). However, collaborative play is a broad term, and requires further research to determine what elements of collaborative play are disadvantageous.

Video Gaming

Gaming has become a ubiquitous part of life, with 97% of Americans playing at least one hour per day (Granic, Lobel & Engels, 2014). According to Wave One of the Growing Up in Ireland survey (2009), 87% of nine year olds surveyed played up to half

an hour of video games on an average weekday, while 42% played one hour or more. There has been a focus of interest on the subsequent potential repercussions of playing video games on student's cognitive learning (Begg, Dewhurst & Macleod, 2005; Squire, 2003). For example, Swing et al (2010) found that modern video games, with their visually rich and fast paced play are likely to place significant visuospatial and cognitive demands on a gamer, and will in turn leave its mark on the plasticity of their brain and on behaviour. However, the effects of one video game cannot be generalised to be said to be true of all games. Perceptions about video game playing range from celebration to paranoia (Buckingham, 2004). Much research in the past has focused on the negative impact of gaming, such as the presence of violence and aggression negatively impacting on psychological well-being (Jackson, Fitzgerald, Zhao et al., 2008) and academic achievement (Chiu, Lee & Huang, 2004). However, gaming has become a much more diverse, complex, realistic and social form of play in recent years (Granic, Lobel and Engels, 2014).

According to Kernan (2007), virtual play landscapes can provide a safe and authentic playing option. Virtual play can serve as adventure, freedom, mental and imaginative activities (Kane, 2005). However, it has been noted that qualitatively, virtual play can lack the capability to explore and develop skills which are developed through the interactions between players and the physical world (Scarlett, et al., 2005), such as fine and gross motor skills, a sense of physical space and interpersonal skills and communication. However, much of the literature that Aistear (NCCA, 2009) and play based learning in the Irish education system is based on is outdated, and does not account for the vast changes and improvements that have taken place in the design of video games that children are now engaging in. One such game which has been captivating children as well as infiltrating education systems around the world is Minecraft (Fanning & Mir, 2014).

Minecraft

Minecraft is one of the bestselling videogames of all time (Garrelts, 2014). Essentially, it is an endless pixelated world of blocks where the player is free to mine,

build and destroy as they please. Unstructured virtual play is in line with the freedom principle (Muller & Schneider, 2002), whereby children are free to choose their own tasks loosely facilitated by structures put in place by adults. According to Fanning and Mir (2014), Minecraft unites the active, open-ended concept of the adventure playground with the tradition of educative play promised by the manufacturers of constructive toys.

What is striking is that any descriptions of the multi-faceted domain of mathematics can also be mapped onto descriptions for Minecraft. For example, according to the NCCA (2005), primary school mathematics is about "the acquisition, understanding and application of mathematical knowledge and skills" (NCCA, 2005, p.8) through creative activities and communicating information. According to the Five Process Standards from Principles and Standards for School Mathematics, students should be enabled to develop mathematical heuristics through problem solving by applying and adapting strategies in various contexts (nctm.org, 2000). Minecraft may hold the potential to do this on an implicit level, such that gamers are not conscious that these thinking processes are at play, just as a child is unaware that they are discovering "formal properties of things, such as number, while playing alone with pebbles on the beach" (Youniss & Damon, 1992, p. 268). As indicated by results collected by the OECD (2004), students who are not anxious about maths, believe in their own abilities and efficacy are likely to do well in the subject. This disinhibition effect can take place within games such as Minecraft, as according to Liu, Cheng and Huang (2011), if a flow state is induced, tasks are viewed holistically rather than in the individual thinking processes that go into each task.

Impact of Gaming

In-game learning is not restricted to the virtual world. According to Schoenfeld (1982), "problem-solving skills include the ability to adapt relevant techniques from tasks only marginally related to the task at hand" (p. 43). Game transfer phenomena (GTP) explore how video game experiences are "transferred to the real world and consequential psychosocial, cognitive and physiological effects by exploring players'

mental processes, sensory perceptions and behaviours" (Ortiz de Gortari & Griffiths, 2012, p1). According to Ortiz de Gortari (2011), when players perceive or interpret the real world based on game content, they re-create, transform, and align elements from the game into the real world 'puzzle'. GTP is rooted in the classical conditioning theory of stimulus generalisation, exploiting the human tendency to create schema and for similar stimuli to evoke similar responses after the response has been conditioned, thus lessons learned through problem solving in games may be transferred to real life problems.

Evidence for GTP can be seen at a meta-analytical level in countries such as Singapore, Korea and Japan. While having the highest creative problem solving levels in the OECD (2012), these countries also show very high average national levels of video gaming (Choo et al, 2010). The USA and UK, both of which outperformed Ireland in problem solving, were found to spend 1.48 and 1.39 hours gaming every day respectively (statistica.com, 2011). Ireland fell into the average range of problem solving ability (OECD, 2012), while according to the 8, 568 nine year olds surveyed in the Growing Up in Ireland study (2009), 82% played between zero and one hour of video games on an average school day.

Chuang and Chen (2009) found that playing computer based video games was more effective in facilitating learning outcomes than text based computer assisted instruction. However, they also indicate that the amount of time for instruction should be taken into account for children's play theory. The amount of time that a student spends on play or practice could be a factor influencing children's motivation for learning and achievement (Chuang & Chen, 2009).

Schoenfeld (1982) subjected participants to problem solving classes, where the focus was on solving the problems presented. This facilitated implicit development and application of heuristics, rather than formally rehearsing heuristics prior to attempting to apply them to the problems. Schoenfeld (1982) found that following this intensive intervention, participant score increased. Similar trends were found among children by

Mackey, Hill, Stone and Bunge (2011). The implicitness of the instruction suggests that the participants were able to manipulate what they had learned to apply to the new problems. If this is the case, implicit reasoning skills developed in games over similar amounts of time may, depending on the game, improve problem solving skills. However, Schoenfeld's studies focus on third level undergraduate students. In upper primary classes, most children, according to Piaget, are approaching or have reached the concrete operational stage of development. This is where children can process thought on a theoretical and abstract level, skills required for problem solving, so an intervention could be done at that point (Piaget, 1952).

Piaget highlighted the constructivist approach, whereby children actively construct knowledge as they manipulate and explore their world (Piaget, 1952). Constructivist educators debate that "contemporary pedagogical practice, which breaks problems down into bite-sized, easy-to-learn pieces, often creates a sense of 'learned helplessness' in students (particularly high achieving students) who only encounter short, solvable problems with all necessary information laid out in front of them" (Squire, 2005, p3). Appropriate video games, on the other hand, present players with complex holistic problems (Gee, 2005).

In addition, failure functions differently in game-based learning environments. In traditional education settings, success or failure is determined by the answer produced. However, in video games a player starts with failure or a problem (Squire, 2005). Problem solving in-game does not end until a functioning solution has been generated, and any dysfunctional solutions prior to that point are considered part of problem solving process, rather than failure. This was echoed by Liu, Cheng and Huang (2011) who argue that video games stimulate students to allow them to engage in a discovery process, thereby learning by doing, as was traditionally a function of play according to Vygotsky (Piaget, 1952). They found that a game designed to help learn computational problem solving induced a greater level of flow than a lecture. They also found when in flow, students were more likely to engage in trial and error, learning by

example and analytical reasoning, whereas bored and anxious students displayed no in-depth problem solving.

According to Ventura, Shute and Zhao (2013), playing video games may also lead to greater perseverance when encountered with a problem. They found that those who frequently played video games spent longer on unsolved problems when compared to infrequent video game players (Ventura, Shute & Zhao, 2013). By allowing children to play video games, they would thereby become more aroused and be cognitively engaged for longer periods of time in the classroom. According to Olesen et al (2003), gaming also generates greater proficiency at multi-tasking. This ability to solve problems while keeping in mind multiple rules and information is further enhanced with the rehearsal for faster problem solving or the ability to juggle problems at a faster rate (Olesen et al, 2003).

Appelbaum et al (2013) also found that gamers have better visual memory. According to his study, gamers process the world differently from non-gamers. They can extract more information from a visual scene and need less information to quickly reach a probabilistic conclusion. The superior ability to extract small details, faster processing of rapidly presented information, higher capacity short term memory, increased capacity to process multiple objects simultaneously and flexible switching between tasks are all useful skills in a variety of precision demanding tasks, including mathematical problem solving (Greenfield, 2014).

In the Growing Up in Ireland survey (2009), teachers were asked to report on the mathematical performance and problem solving performance of participants. In both cases, performance decreased in children who played between three and five hours of video games on an average weekday. However, participants who played for five or more hours on an average weekday had the same level of performance as people who played between zero and three hours. This may suggest that by spending between three hours and five hours a day gaming that not enough time is spent consolidating through homework or other activities, yet not enough time is spent playing games to

compensate for learning missed. When in excess of five hours is spent playing games, learning may take place to the same extent through play as it does for people who spend less than three hours gaming, who compensate with homework and other activities. The OECD (2015) also found that in Ireland there is a statistically significant difference between boys and girls in maths performance, with boys outperforming girls, as well as a lack of self-confidence among girls towards maths. The OECD (2015) also suggests that playing video games may be able to mediate this effect.

While the Growing Up in Ireland survey (2009) was extensive, the data was collected between September 2007 and June 2008, meaning that the findings are slightly dated and may not map onto children today. The gaming culture of today has changed somewhat since then with the development of new games, new consoles and more immersive methods of playing. Although academic performance in problem solving was measured, it was measured by teacher observation on a scale of one to five rather than through a standardised assessment. In addition, time spent playing video games was measured as nominal data rather than interval data, which would give a more accurate measure of time.

This Study

This study aims to investigate if playing video games, particularly Minecraft, may be beneficial in the development of mathematical problem solving skills. According to Greenfield (2014), there is a need for more empirical evidence in relation to the impact of video games on cognitive functioning. This current study builds on the Growing Up in Ireland data and that of Schoenfeld to develop a more accurate, modern image of the relationship between video games and children's problem solving abilities. This study firstly hypothesises that children who play Minecraft will be better at non-verbal reasoning (NVR) and word problem (WP) solving than children who do not play Minecraft, and that amount of time spent playing Minecraft will impact on scores. Secondly, that children who play video games will be better at NVR and WP solving than children who do not play video games, and that amount of time spent playing video games will impact on scores. Thirdly, this study aims to investigate how different types

of collaborative play impact on problem solving scores. Finally, the interaction between playing video games and Minecraft, and attitude towards problem solving and maths will be examined.

Method

Design

Two 2x2 mixed factorial designs were employed. In the first instance, the independent variables were whether a participant played Minecraft or did not play Minecraft, and question context (Minecraft themed or non-Minecraft themed). In the second instance, the independent variables were whether a participant played video games or not, and question context. Dependent variables were the scores on each of the three maths tests: non-verbal reasoning, Minecraft themed questions and non-Minecraft themed questions.

Participants

Participants were sourced by purposive clustered convenience sampling of primary schools through professional connections. A sample of 5th and 6th class children, 59% males (N = 45), 41% females (N = 31), between the ages of 10 and 13 (*M* = 11.48) were approached to take part in the study. Of a possible 92 participants approached, 76 completed data sets were returned, thus there was an 82% response rate. The breakdown of those who play Minecraft and video games (Table 1), and average time spent gaming (Table 2) are seen below.

		Minecraft		Video Games		Total
		Play	Don't play	Play	Don't Play	
Gender	Male	19	26	38	7	45
	Female	15	16	21	10	31
Total		34	42	59	17	76

Table 1: Number of those who play Minecraft and video games based on gender.

Average time spent playing video games per weekday	87.89 minutes
Average time spent playing video games per weekend day	153.09 minutes
Average time spent playing video games per week	810.85 minutes
Average time spent playing Minecraft per weekday	22.83 minutes
Average time spent playing Minecraft per weekend day	39.70 minutes
Average time spent playing Minecraft per week	210.41 minutes

Table 2: Average Time Spent Gaming

Materials

Gaming Habits Survey

Participants were asked a number of demographic questions, such as age and gender, as well as information about their gaming habits. For example, whether they played video games or not, time spent playing video games, whether they played Minecraft or not, and time spent playing Minecraft (see Appendix A).

Attitude to Maths Survey

A maths survey (see Appendix B) developed by the Irish Professional Development Service for Teachers (PDST) to investigate attitudes to maths within primary schools to be used in conjunction with self-evaluation in Irish primary schools was used to investigate attitudes of participants in this sample. Examples of questions include “Do you like Maths?”, “Do you think you are good at maths?” and “Do you find maths easy?”, to which participants answered “Yes” or “No”.

Problem Solving Survey

A problem solving survey (see Appendix C) developed by the Irish PDST to investigate attitudes to problem solving within primary schools was implemented to

investigate the problem solving behaviour of participants in this sample. Questions asked included “Do you like problem solving?” and “Do you find problem solving easy?”.

Non-Verbal Reasoning

A series of 12 NVR problems were taken from the Bond Non-Verbal Reasoning Assessment Papers (Baines, 2012) (see Appendix D). The selection of problems used in this study focused on observing shapes and identifying the odd one out.

Maths Problems

A series of eight maths problems adapted from Minecraft Maths (2015), Planet Maths 5 and 6 (2012), and online maths problems (Weight It Up, 2016) were used to test problem solving abilities, appropriate to the academic level of the children (see Appendix E). Four of these questions was Minecraft themed, while the other four had comparable content but were non-Minecraft themed.

Procedure

A pilot study first took place with three participants, to ensure clarity of language and layout of instructions and questions. Subsequent amendments were made based on this pilot. This included reduction of content due to the amount of time it was taking to complete, and simplifying mathematical terms and language in questions, as some were phrased in a way that the children were not familiar with. Though the NVR tasks were pitched for nine to ten year olds, the pilot found these to be sufficiently challenging, as well as time consuming. A subsequent pilot was run and found that the amended materials made it possible for the problems to be completed within a more realistic time frame.

Written consent was first sought from primary school principals (see Appendix F). Following presentation of an information sheet (see Appendix G), consent was sought from parents and guardians by means of a written consent form (see Appendix H) sent home with children, which was also attached to the survey. The consent form outlined the purpose of the study, as well as the in-class activity the child would complete. Consent was also sought from the child in written format in the presence of a

parent or guardian (see Appendix I). All consent forms highlighted that participation was voluntary, and that participants were free to withdraw at any time. This survey investigated general demographic information such as age and gender, as well as whether they played video games or not, whether they played Minecraft or not, and for how long. This took approximately 20 minutes to complete.

A deadline was placed for the return of the completed parent and child survey (see Appendix J). Return of the written consent form with the completed survey signified consent to proceed with the in-class activity. Again, verbal consent was sought from the child as to whether they wanted to proceed at this stage of the study. The child was reminded that they were free to cease involvement in the exercise at any time. To ensure anonymity, the in class activity and survey was coded with the same matching number.

The class teacher was given a clear set of instructions regarding the implementation of the in class exercise (see Appendix K). The children were given a problem solving "booklet", containing the NVR problems, and mathematical WPs, along with space to do the problems. They first read the instructions for the NVR tasks, and proceeded to work through NVR tasks for 10 minutes. They then read the instructions for the mathematical WPs, and proceeded to spend 40 minutes working unaided on the problems, ensuring to show as much working out and rough work as possible on the booklet.

At the end of the exercise, the children placed their problem solving booklet into an envelope provided by the researcher with their parent and child survey and signed parent and child consent form, and given a debriefing form (see Appendix L). In exchange for taking part in the study, children were given a homework pass.

Ethics

In accordance with the Code of Professional Ethics of the PSI (2010), an ethical review of human rights issues for research involving vulnerable groups, such as children, was conducted by the IADT Department of Technology and Psychology Ethics

Committee before making a decision to proceed (see appendix N). Children were also assured that their participation or non-participation would not impact on their school reports in any way.

This sample consisted of children below 16 years and in an unequal relationship (power imbalance between teacher and child). According to the BPS Code of Human Research Ethics (2010), it is classified has having more than minimal risk. To reduce the risk, consent was sought from the child prior to participation in the study in the presence of a parent or guardian, as well as seeking the additional consent of parents or those with legal responsibility for the child. Teachers overseeing the data collection also closely monitored the participants and paid attention to "any signs, verbal or non-verbal, that they are not wholly willing to continue with the data collection" (BPS, 2010, p17). In this situation, the teacher was explicitly instructed to advise the child to cease participation and offer them alternative work.

In line with IADT ethics, written consent was sought from both parent and child. It was ensured that participants were given sufficient opportunity to understand the process, purpose and anticipated outcomes of participation in this research project, so that they could give informed consent.

Methods that maximised the understanding and ability to consent of such vulnerable persons to give informed consent were used whenever possible, for example, with simplified language, enlarged text and pictorial Likert scales. It was also ensured that parents or guardians were informed about the option to withdraw their child from the study if they so wished. Anonymity and confidentiality was maintained at all times, and after the surveys and in-class activities had been collected, children received a child and parent debriefing form to bring home.

Results

Scores on NVR and WPs in the overall sample (see Table 3 below), as well as distribution of scores on Minecraft themed questions (Figure 1), non-Minecraft themed questions (Figure 2), overall WPs (non-Minecraft themed and Minecraft themed

combined) (Figure 3) and NVR (Figure 4) across all participants were examined (see Appendix M).

	N	Min	Max	Mean	SD
Non-Verbal Reasoning Score (%)	76	25.00	100.00	67.3246	15.67985
Word Problem Score (%)	76	5.26	100.00	62.3269	18.57435

Table 3: Descriptive Statistics of Scores on Non-Verbal Reasoning and Word Problem Solving

A Mann-Whitney U Test revealed a significant difference in score on WPs of males (*Md* = 44.10, *N* = 45) and females (*Md* = 30.37, *N* = 31), *U* = 445.5, *z* = -2.678, p = .007, with a medium effect size, *r* = .3. A Mann-Whitney U Test revealed no significant difference in score on NVR score of males (*Md* = 39.56, *N* = 45) and females (*Md* = 36.97, *N* = 31), *U* = 650, *z* = -.510, *p* = .610.

Impact of playing Minecraft

Following preliminary analysis to assess assumptions of normality, linearity and homoscedasticity, overall WP score and NVR scores were found to be parametric. Scores on Minecraft themed and non-Minecraft themed problem solving scores were found to be non-parametric. Descriptive information on scores of those who play Minecraft (see Table 4) is outlined below.

An independent samples t-test was conducted to compare overall WP score and NVR score between those play Minecraft and those who do not play Minecraft. In the case of overall WP score, no significant difference was found in the scores for those who play Minecraft (*M* = 62.0743, *SD* = 18.811) and do not play Minecraft (*M*= 62.5313, *SD* = 18.606), *t*(74)= -.106, *p* = .659, two tailed. However, a significant difference was found in NVR between those who play Minecraft (*M* = 63.9706, *SD* = 18.771) and do not play Minecraft (*M* = 70.0397, *SD* = 12.21692), *t*(74)=-1.699, *p* = 0.027. The magnitude of the difference in the means (mean difference = 95% *CI*: 6.0691) was moderate (eta squared = 0.0375).

A Mann Whitney U test revealed no significant difference in Minecraft themed question scores between those who play Minecraft (*Md* = 72.7273, *N* = 34, *IQR* = 20.45) and those who do not play Minecraft (*Md* = 63.6364, *N* = 42, *IQR* = 36.36), *U* = 592.5, *Z* = -1.287, *p* = .198. No significant difference was found in non-Minecraft themed question scores between those who play Minecraft (*Md* = 50, *N* = 34, *IQR* = 37.5) and those who do not play Minecraft (*Md* = 62.5, *N* = 42, *IQR* = 37.5), *U* = 555, *Z* = -1.683, *p* = .092.

Impact of Time Spent Playing Minecraft

Following preliminary analysis to assess assumptions of normality, time spent playing Minecraft was found to be non-parametric. A Spearman rho was conducted to explore the relationship between total time spent playing Minecraft per week and problem solving scores. There was no significant correlation between time spent playing per weekday and score on NVR (r= .154, N= 34, p= .384), total WP solving (*r*= -.294, *N*= 34, *p*= .091), Minecraft themed problems (*r*= -.162, *N*= 34, *p*= .361) and non-Minecraft themed problems (*r*= -.267, *N*= 34, *p*= .127).

A Spearman rho exploring the relationship between time spent playing Minecraft per weekday and problem solving scores found no significant correlation between time spent playing per weekday and score on NVR (*r*= .068, *N*=34, *p*=.701), total WP solving (*r*= -.139, *N*=34, *p*=.434), Minecraft themed problems (*r*= -.073, *N*= 34, *p*= .681) and non-Minecraft themed problems (*r*= -.139, *N*=34, *p*=.432).

A Spearman rho exploring the relationship between time spent playing Minecraft per weekend day and problem solving scores found no significant correlation between time spent playing per weekday and score on NVR (*r*= .208, *N*= 34, *p*= .238), total WP solving (*r*= -.324, *N*=34, *p*= .062), Minecraft themed problems (*r*= -.189, *N*= 34, *p*= .285) and non-Minecraft themed problems (*r*= -.295, *N*= 34, *p*= .091).

	N	**Min**	**Max**	**Mean**	**SD**
Non-verbal reasoning score (%)	34	25.00	100.00	63.9706	18.77124
Word problem score (%)	34	5.26	100.00	62.0743	18.81129

Minecraft questions score (%)	34	.00	100.00	67.6471	21.01735
Non-Minecraft questions score (%)	34	.00	100.00	54.4118	23.41214
Total time per week spent playing Minecraft	34	3.00	2040.00	470.3235	518.53346
How many hours per school day playing Minecraft (Mon-Thurs)	34	0	240	51.03	64.123
How many hours per weekend day playing Minecraft (Fri-Sun)	34	0	360	88.74	96.124

Table 4: Scores on non-verbal reasoning and word problem of those who play Minecraft.

Impact of Minecraft by Gender

Of those who play Minecraft, a Mann-Whitney U Test revealed no significant difference in score on WPs of males (*Md* = 18.55, *N* = 19) and females (*Md* = 16.17, *N* = 15), *U* = 122.5, *z* = -.701, *p* = .484. A Mann-Whitney U Test revealed no significant difference in score on NVR score of males (*Md* = 16.95, *N* = 19) and females (*Md* = 18.2, *N* = 15), *U* = 132, *z* = -.368, *p* = .713.

Impact of Playing Style

Following preliminary analysis to assess assumptions of normality, data was found to be non-parametric, hence a series of Kruskal-Wallis Tests were performed. A between groups analysis of variance was performed to investigate the impact of playing style preferences on WP solving scores and NVR scores of those who play Minecraft.

A Kruskal Wallis Test revealed no statistically significant difference between those who play Minecraft alone, with others online, with others offline, with others the same age, with others older, with others whose ages they did not know (see Table 5 below).

	Non Verbal Reasoning Score	**Overall Word Problem Solving Score**	**Minecraft Themed Word Problem Score**	**Non-Minecraft Themed Word Problem Score**

Alone	Chi-Square Df Asymp.Sig	2.199 2 .333	Chi-Square Df Asymp.Sig	1.462 2 .482	Chi-Square Df Asymp.Sig	1.510 2 .470	Chi-Square Df Asymp.Sig	1.719 2 .423
Online with others	Chi-Square Df Asymp.Sig	2.641 3 .450	Chi-Square Df Asymp.Sig	3.967 3 .265	Chi-Square Df Asymp.Sig	6.226 3 .101	Chi-Square Df Asymp.Sig	1.766 3 .622
Offline with others	Chi-Square Df Asymp.Sig	4.920 3 .178	Chi-Square Df Asymp.Sig	6.797 3 .079	Chi-Square Df Asymp.Sig	4.895 3 .180	Chi-Square Df Asymp.Sig	6.465 6 .091
With younger	Chi-Square Df Asymp.Sig	5.563 3 .135	Chi-Square Df Asymp.Sig	10.041 3 .018	Chi-Square Df Asymp.Sig	8.713 3 .033	Chi-Square Df Asymp.Sig	6.589 3 .086
With same age	Chi-Square Df Asymp.Sig	1.115 3 .773	Chi-Square Df Asymp.Sig	3.603 3 .308	Chi-Square Df Asymp.Sig	2.026 3 .567	Chi-Square Df Asymp.Sig	6.084 3 .108
With older	Chi-Square Df Asymp.Sig	2.416 3 .491	Chi-Square Df Asymp.Sig	2.716 3 .438	Chi-Square Df Asymp.Sig	4.933 3 .177	Chi-Square Df Asymp.Sig	1.126 3 .771
Don't know age	Chi-Square Df Asymp.Sig	3.761 3 .288	Chi-Square Df Asymp.Sig	1.255 3 .740	Chi-Square Df Asymp.Sig	1.721 3 .632	Chi-Square Df Asymp.Sig	1.311 3 .726

Table 5: Interactions between playing style of Minecraft and performance on problem solving and non-verbal reasoning.

However, there was a statistically significant difference between those who play with other players younger than themselves in overall WP score χ^2 (3, N = 31) = 10.041, p = .018, and score on Minecraft themed problems χ^2 (3, N = 31) = 8.713, p = .033. Those who often play Minecraft with players younger than themselves had higher scores on overall WP (*Md* = 24.17) and Minecraft themed questions (*Md* = 23.67).

Impact of playing video games

Following preliminary analysis to assess assumptions of normality, overall WP score, Minecraft themed and non-Minecraft themed problem solving scores were found to be non-parametric, while NVR was found to be parametric. Descriptive information can be found in the table below (see Table 6).

A Mann Whitney U test revealed no significant difference in overall WP solving scores between those who play video games (*Md* = 68.4211, N = 59, *IQR* = 21.05) and those who do not play video games (*Md* = 57.8947, *N* = 17, *IQR* = 31.58), *U* = 440, *Z* = -.771, *p* = .441. No significant difference was found in Minecraft themed question score between those who play video games (*Md* = 72.7273, *N* = 59, *IQR* = 27.27) and those who do not play video games (*Md* = 63.6364, *N* = 17, *IQR* = 31.82), *U* = 397, *Z* = -1.321, *p* = .187. No significant difference was found in non-Minecraft themed question score between those who play video games (*Md* = 62.5, *N* = 59, *IQR* = 25) and those who do not play video games (*Md* = 62.5, *N* = 17, *IQR* = 37.5), *U* = 485, *Z* = -.208, *p* = .835.

An independent samples t-test comparing NVR score between those play video games and those who do not play video games found no significant difference was found in NVR between those who play video games (*M* = 66.6667, *SD* = 16.738) and do not play video games (*M* = 69.6078, *SD* = 11.38849), *t*(74)=-.679, *p* = .499.

	N	Min	Max	Mean	SD
Non Verbal Reasoning Score	59	25.00	100.00	66.67	16.73835
Word Problem Score	59	5.26	100.00	63.2	19.12700
Minutes per week playing video games	59	.00	4320.00	1031.7	823.4733
Minutes per	59	0	540	111.19	111.839

school day playing video games (Mon-Thurs)					
Minutes per weekend day playing video games (Fri-Sun)	59	0	880	195.68	169.938
Minecraft Questions Score (%)	59	.00	100.00	65.7935	21.50898
Non Minecraft Questions Score (%)	59	.00	100.00	59.5339	24.49259

Table 6: Scores on non-verbal reasoning and word problem scores of those who play video games

Impact of Time Spent Playing Video Games

Following preliminary analysis to assess assumptions of normality, time spent playing video games was found to be non-parametric. A Spearman rho exploring the relationship between total time spent playing video games per week and problem solving scores found a significant correlation between time spent playing per week and score on NVR (r= .329, N= 59, p= .011), but no significant correlation on total WP solving (r= .104, N= 59, p= .434), Minecraft themed problems (r= .041, N= 59, p= .759) and non-Minecraft themed problems (r= .177, N= 59, p= .179).

A Spearman rho exploring the relationship between time spent playing video games per weekday and problem solving scores found no significant correlation between time spent playing per weekday and score on NVR (r= .182, N=59, p=.167), total WP solving (r= .087, N=59, p=.514), Minecraft themed problems (r= .101, N= 59, p= .447) and non-Minecraft themed problems (r= .057, N=59, p=.666).

A Spearman rho exploring the relationship between time spent playing video games per weekend day and problem solving scores found a significant correlation between time spent playing per weekend day and score on NVR (*r*= .323, *N*= 59, *p*= .013), but no correlation with total WP solving (*r*= .072, *N* = 59, *p*= .589), Minecraft themed problems (*r*= -.2, *N*= 59, *p*= .879) and non-Minecraft themed problems (*r*= .195, *N*= 59, *p*= .138).

Impact of Video Games by Gender

Of those who play video games, a Mann-Whitney U Test revealed no significant difference in score on WPs of males (*Md* = 32.38, *n* = 38) and females (*Md* = 24.88, *n* = 21), *U* = 291.5, *z* = -1.713, *p* = .087. A Mann-Whitney U Test revealed no significant difference in score on NVR score of males (*Md* = 31.21, *n* = 38) and females (*Md* = 27.81, *n* = 21), *U* = 353, *z* = -.737, *p* = .461.

Attitude

A Chi-Square test for independence indicated a significant association between playing video games and liking problem solving, χ^2 (1, *n* = 59) = .004, *p* = .011. Due to small cell sizes, Fisher's Exact was calculated = .007 (see Figure 5).

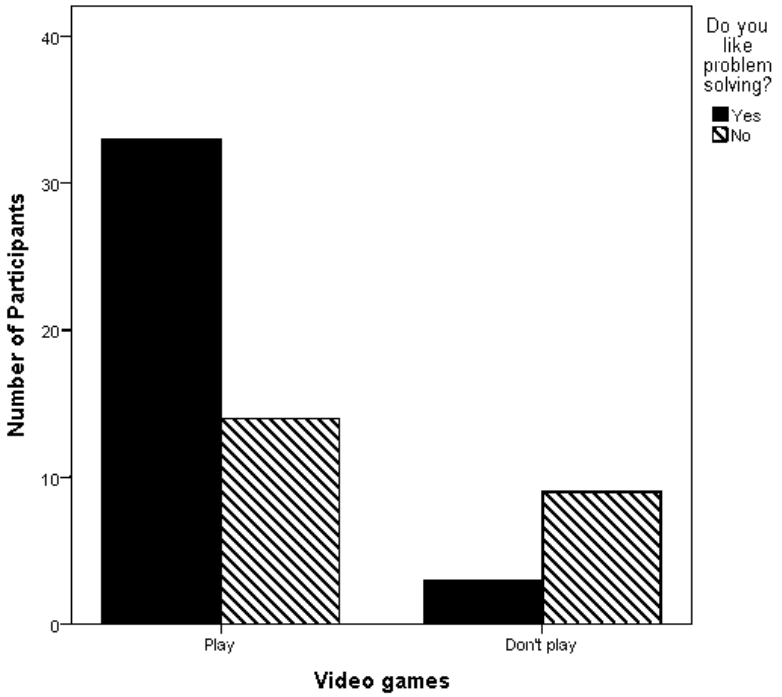


Figure 1: Interaction between playing video games and liking problem solving

A Chi-Square test for independence indicated no significant association between playing Minecraft and liking problem solving, χ^2 (1, n = 59) = .068, p = .121. Due to small cell sizes, Fisher's Exact was calculated = .103 (see Figure 6).

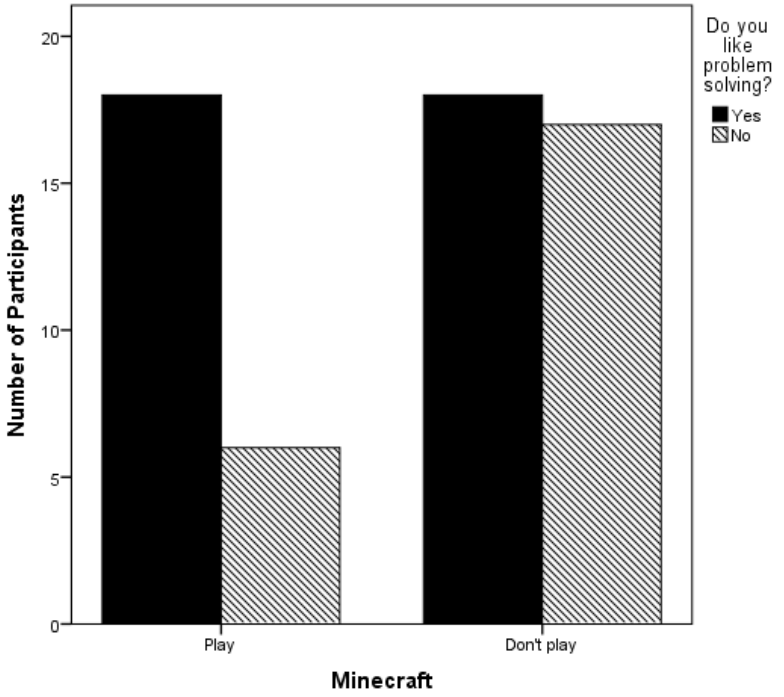


Figure 2: Interaction between playing Minecraft and liking problem solving

A Chi-Square test for independence indicated a significant association between playing video games and liking maths, χ^2 (1, *n* = 62) = .001, *p* = .005. Due to small cell sizes, Fisher's Exact was calculated = .004 (see Figure 7).

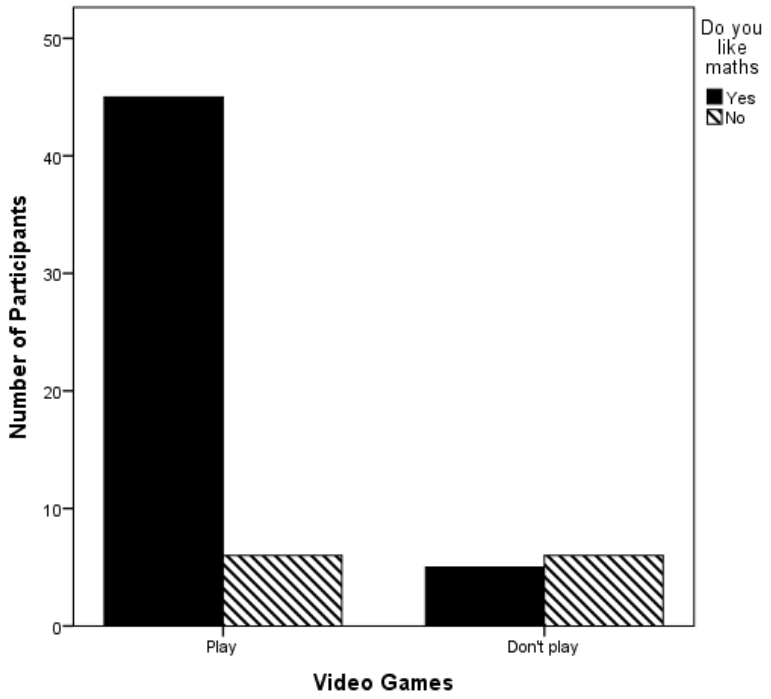


Figure 3: Interaction between playing video games and liking maths

A Chi-Square test for independence indicated no significant association between playing Minecraft and liking maths, χ^2 (1, *n* = 62) = .027, *p* = .059. Due to small cell sizes, Fisher's Exact was calculated = .05 (see Figure 8).

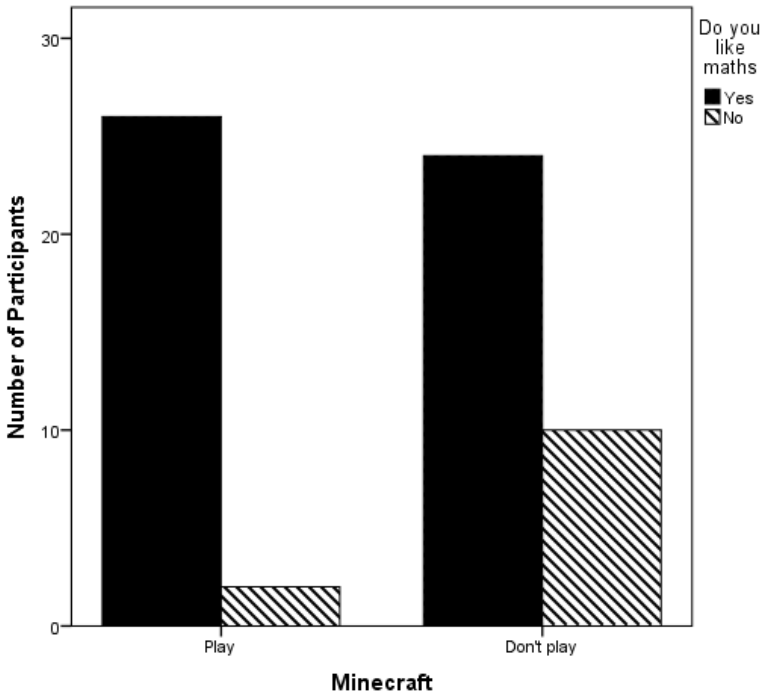


Figure 4: Interaction between playing Minecraft and liking maths

Discussion

Results indicate that Minecraft and video games are having varying degrees of interactions with WPs and NVR. Firstly, playing Minecraft was of no benefit to performance on WPs, and no difference was found between those who play video games and those who do not play video games on scores on overall WP solving and NVR. Those who play Minecraft scoring significantly lower on NVR, while in contrast, a positive correlation was found between time spent playing video games per week and NVR. This suggests support for Appelbaum et al (2013)'s statement that gamers have superior visual memory, with an increased capacity to process multiple objects, as well as Chuang and Chen (2009)'s indication that amount of time for instruction or play should be taken into account. The average amount of time spent playing video games on a school day was also higher than was found by the Growing Up in Ireland survey (2009). The negative impact of Minecraft may be due to the unrealistic pixelated and blocky nature of the landscape in Minecraft, being ungeneralizable to the NVR tasks

presented, and reflects Scarlett et al (2005)'s claim that virtual play can lack the capability to develop skills such as visual spatial skills.

It was also found that those who often play Minecraft with others younger than themselves had higher scores on WP solving. This may be due to language used when playing with someone younger than themselves that consolidates their own learning, just as peer tutoring is beneficial for both learner and tutor (Cassidy, 2008). Other playing styles (playing alone, with others the same age, with others older) had no impact on WP solving or NVR, counter to findings from the OECD (2015) which found that collaborative play had a negative impact on problem solving.

A positive association was also observed between playing video games and liking problem solving and maths, as well as a positive association between playing Minecraft and liking maths. This supports Chuang and Chen (2009)'s argument that time spent on practice can be influencing children's motivation for learning and achievement. An investigation into gender difference was also performed, and found an overall significant difference between boys and girls on problem solving, with boys outperforming girls, supporting findings from the OECD (2015). However, as was suggested in the OECD (2015), playing video games and Minecraft mediated this effect.

Hutt's typology of play highlighted the importance of constructivist play in developing problem solving heuristics (Hutt, 1979). However, Fanning and Mir (2015) may have over-estimated the impact of Minecraft as constructivist play. There is also the possibility that the benefits of playing Minecraft may not be generalizable to this age group. Nonetheless, these findings still indicate that play is not just important at a younger age, but also beneficial for older children, even if just to improve attitudes and motivation. It is also possible that play has a lesser impact in developing problem solving skills in this age group than in younger groups, as skills for problem solving have been rehearsed formally in school. The children are also at the concrete operational stage of development (Piaget, 1952). Though interactions between video games and scores on

NVR and attitudes were detected, further research may be required into the impact of modern versions of play on both younger and older children.

According to McDevitt and Ormrod (2004), motivation is a function of human cognition involvement. Based on these results, video games could be used to improve attitude towards maths and problem solving. Integrating some video game based learning activities may improve children's motivation for learning and achievement. This may also narrow the gap in performance on problem solving between males and females. In particular, these findings suggest that playing video games with younger people appears to have a positive impact on problem solving. This could be implemented across a school wide peer learning buddy system. This would be where older children could engage in problem solving tasks or challenges on a virtual game platform in collaboration with younger children.

There were many strengths to this study. It added much needed empirical evidence about the impact of video games on cognitive functioning (Greenfield, 2014). Unlike the Growing Up in Ireland study (2009), this study used testing of problem solving rather than teacher opinion on problem solving abilities. It also asked for nominal rather than interval data about time spent playing video games and Minecraft to get a more detailed account of time spent gaming than in the Growing Up in Ireland Study. There were equal cell sizes of those who played Minecraft and those who did not, which allowed a fair comparison of groups. The contextual impact of playing Minecraft was also done fairly, with balance of comparable Minecraft and Non Minecraft themed questions. The questions chosen were also well suited to the ability of the children, as there was no ceiling effect in any category.

There were also numerous limitations to this study. Firstly, although groups were matched, the sample was not a diverse population. All children were from the same classes in the same, middle class school. This was a generally homogenous sample. However, they were an easily accessible sample, and could potentially serve as a pilot study for a larger, more inclusive study on a broader sample. Secondly, there was

unequal distribution of those who played and did not play video games. However, as this was not the primary hypotheses, sample sizes for those who played Minecraft and did not play Minecraft took paramount importance. Thirdly, the testing of mathematical problem solving could have been more detailed, with more than eight questions required to properly investigate prowess in problem solving. The same can be said for the quantity of questions given to test NVR. However, additional questions would have taken a lot more time to complete, as well as causing additional stress to participants.

Because of the interactions that have become evident with these results, it would be beneficial to further investigate the value of play in older classes and extend literature in this area. There is a wealth of literature on the importance of play from birth to seven years (Whitebread et al , 2012), and in Ireland there is a play curriculum for early education with Aistear (NCCA, 2005). Future research could look at the potential of broadening structured play into older classes, or including older children in structured play with younger children, on both virtual and non-virtual platforms. This could be accompanied by observation of play between older and younger children, to examine language used in the course of encountering problems.

Further research could build upon this study by accessing a more diverse sample to investigate the interaction between socioeconomic background, playing video games and performance in school on maths and problem solving, as well as other subjects. A comparison could also be looked at between the impact of Minecraft and video games on younger children, where less formal education of problem solving has taken place, with older age groups. Further research may also investigate what games the current cohort are playing, as there is a difference between the impact of Minecraft and video games in general, particularly in relation to NVR. This investigation may also look at whether more realistic worlds are better for NVR than non-realistic, blocky environments.

Future research could investigate NVR and problem solving more extensively, using a standardised measure of NVR and maths reasoning ability in a staged approach,

asking more questions over a longer period of time, such as over a number of days. A fuller picture of ability could be found without excessively stressing or tiring out participants. Participants could also be timed completing these problems to investigate Appelbaum et al (2013)'s claims that players process problems more quickly.

A between-groups investigation could be done to compare problem solving behaviours within a virtual game environment and within a non-virtual environment. This could examine the impact of working in groups and working alone in game and out of game. This could overcome the possibility that those who play video games already like maths and problem solving. Examining problem solving within a game environment could also investigate Liu, Cheng and Huang's (2011) findings that different methods of problem solving are preferred to problem solving in a non-virtual environment. An adaptation of Schoenfeld (1982)'s intervention could be carried out to investigate if structured problem solving activities within a virtual environment may implicitly aid development of problem solving heuristics.

Also, further qualitative information would be required to determine the nature of associations between those who play video games and attitudes towards maths and problem solving. An assumption of a causational relationship between playing video games and attitudes to maths and problem solving may not be justified. It is possible that people play video games because they like maths.

There is another dimension of Minecraft play that was not fully investigated in this study. Observing exhibition play on Minecraft is a popular pastime among those who play Minecraft (MacCallum-Stewart, 2014). Future research may examine a qualitative analysis of content of Minecraft YouTube videos, and examine habits and effect of observing exhibition play.

Conclusion

In conclusion, the people with whom one plays video games appears to be an important factor. Playing Minecraft with younger people appears to increase scores on problem solving. In addition, playing video games has been shown to be associated with

positive attitudes towards maths and problem solving. However, playing Minecraft specifically was not as beneficial to mathematical problem solving and NVR as predicted. Nonetheless, a positive correlation was found between playing video games and NVR. Thus the effect of one video game cannot be generalised as the effect of all video games.

References

Appelbaum, L. G., Cain, M. S., Darling, E. F., & Mitroff, S. R. (2013). Action video game playing is associated with improved visual sensitivity, but not alterations in visual sensory memory. *Attention, Perception, & Psychophysics*,*75*(6), 1161-1167.

Baines, A. (2012). *Bond non-verbal reasoning assessment papers, 9-10 years*. Cheltenham: Nelson Thornes.

Begg, M., Dewhurst, D., & Macleaod, H. (2005). Game-informed learning: Applying computer game processes to higher education. *Innovate: Journal of Online Education*, *1*(6), 6.

Piaget, J. (1952). *The origins of intelligence in children* (Vol. 8, No. 5, pp. 18-1952). New York: International Universities Press in Berk, L.E. (2013). *Child Development (9th ed.)*. Boston: Pearson/Allyn & Bacon.

Brand, J. E., de Byl, P, Knight, S.J. & Hooper, J. (2014). Mining Constructivism in the University. In Garrelts, N. (Ed.) *Understanding Minecraft, (pp57-75),* McFarland & Company: Jefferson, North Carolina.

British Psychological Society. (2010). *Code of human research ethics*. Leicester: BPS.

Bodrova, E., & Leong, D. J. (2007). Play and early literacy: A Vygotskian approach. *Play and literacy in early childhood: Research from multiple perspectives*, 185-200.

Buckingham, D. X. (2004). New media new childhoods? Children's changing cultural environment in the age of digital technology. In: M. J. Kehily (Ed.), *An Introduction to Childhood Studies* (p108-122) Maidenhead: Open University Press.

Cassidy, A (2008). *JCSP Peer Tutoring Project Report Evaluation Report.* Curriculum Development Unit: Dublin.

Chiu, S. I., Lee, J. Z., & Huang, D. H. (2004). Video game addiction in children and teenagers in Taiwan. *CyberPsychology & Behavior*, *7*(5), 571-581.

Choo, H., Gentile, D., Sim, T., Li, D. D., Khoo, A., & Liau, A. (2010). Pathological video-gaming among Singaporean youth.

Chuang, T. Y., & Chen, W. F. (2009). Effect of computer-based video games on children: an experimental study. *Educational Technology & Society, 12(2),* 1–10.

Department of Education and Science (1999). *Primary School Curriculum*. Dublin: Government Publications.

ESRI (2009). Growing Up in Ireland National Longitudinal Study of Children: The Lives of 9 year olds. Dublin: The Stationary Office

Fanning, C. & Mir, R (2014). Teaching Tools: Progressive Pedagogy and the history of construction play. In Garrelts, N. (Ed.) *Understanding Minecraft, (pp38-56),* McFarland & Company: Jefferson, North Carolina.

Garrelts, N. (2014). *Understanding Minecraft : essays on play, community and possibilities.* McFarland & Company, Inc.: North Carolina.

Gee, J. P. (2005). Good video games and good learning. In *Phi Kappa Phi Forum* (Vol. 85, No. 2, p. 33). THE HONOR SOCIETY OF PHI KAPPA PHI.

Government (2008) *Play/Active Learning – Overview for 3 to 7- year-olds*, Cardiff: Department for Children, Education, Lifelong Learning and Skills, Welsh Assembly Government

Granic, I., Lobel, A., & Engels, R. C. (2014). The benefits of playing video games. *American Psychologist*, *69*(1), 66.Growing up in Ireland

Greenfield, S. (2014). Mind Change. *Rider, London*.

Hutt, C. (1979). Play in the under fives: Form, development and function. *Modern perspectives in the psychiatry of infancy*, *8*, 95.

Jackson, L. A., Fitzgerald, H. E., Zhao, Y., Kolenic, A., Von Eye, A., & Harold, R. (2008). Information Technology (IT) use and children's psychological well-being. *CyberPsychology & Behavior*, *11*(6), 755-757.

Kane, P. (2004), *The play ethic: a manifesto for a different way of living*. London: Pan Books)

Kernan, M. (2007). Play as a context for early learning and development. Dublin: National Council for Curriculum and Assessment

Liu, C. C., Cheng, Y. B., & Huang, C. W. (2011). The effect of simulation games on the learning of computational problem solving. *Computers & Education*, *57*(3), 1907-1918.

Mayer, R. E., & Wittrock, M. C. (1996). Problem solving transfer. In D. Berliner and R. Calfee (eds), *Handbook of Educational Psychology* (pp47-62). New York:Macmillan

Mackey, A. P., Hill, S. S., Stone, S. I., & Bunge, S. A. (2011). Differential effects of reasoning and speed training in children. *Developmental science*, 14(3), 582-590

MacCallum-Stewart, E. (2014). Someone off the YouTubez. In Garrelts, N. (Ed.) *Understanding Minecraft, (pp148),* McFarland & Company: Jefferson, North Carolina.

McDevitt, T. M., & Ormrod, J. E. (2004). *Child development: Educating and working with children and adolescents (2nd ed.).* Upper Saddle River, NJ: Pearson Prentice Hall.

Gameplay Publishing & Minecraft Library (2015). *Minecraft maths. (Ed 1)*. Gameplay Publishing.

Müller, T., & Schneider, R. (Eds.). (2002). *Montessori: Teaching Materials 1913-1935: Furniture and Architecture. Catalogue to an Exhibition*. Prestel.

National Council for Curriculum and Assessment (NCCA) (2005) *Review of Mathematics in post-primary education: a discussion paper*. Dublin: National Council for Curriculum and Assessment.

National Council for Curriculum and Assessment (NCCA) (2009). *Aistear: The early childhood curriculum framework.* Dublin: National Council for Curriculum and Assessment.

Nctm.org,. (2000). *Process - National Council of Teachers of Mathematics*. Retrieved 10 March 2015, from http://www.nctm.org/Standards-and-Positions/Principles-and-Standards/Process/

OECD (Organisation for Economic Cooperation and Development) (2004). *First results from PISA 2003; Executive summary.* Paris, OECD.

OECD (Organisation for Economic Co-operation and Development) (2012). *PISA 2012 Results: Creative Problem Solving. Students' skills in tackling real life problems Volume V.* Paris, France: OECD.

OECD (Organisation for Economic Cooperation and Development) (2015), *The ABC of Gender Equality in Education: Aptitude, Behaviour, Confidence,* PISA, OECD Publishing http://dx.doi.org/10.1787/9789264229945-en

Olesen, P, Westerberg, H, Klingberg, T.(2004). Increased prefrontal and parietal brain activity after training of working memory**.** *Nat Neurosci*, *7,* 75–79

Ortiz de Gortari, A. B., & Griffiths, M. D. (2012). An introduction to game transfer phenomena in video game playing. *Video game play and consciousness*, 223-250.

Ortiz de Gortari, A. B. O., Aronsson, K., & Griffiths, M. (2011). Game Transfer Phenomena in video game playing: A qualitative interview study. *IGI Global*, 15-33.

Planet Maths 5. (2012). Dublin: Folens.

Planet Maths 6. (2012). Dublin: Folens

Professional Development Service for Teachers (PDST) (2016). *Pupil Questionnaire Attitude to Maths*. *Cmsnew.pdst.ie*. Retrieved 16 April 2016, from http://cmsnew.pdst.ie/sites/default/files/Pupil%20questionnaire_Attitude%20to%20Maths_0.doc

Professional Development Service for Teachers (PDST) (2016). *Problem Solving Questionnaire*. *Cmsnew.pdst.ie*. Retrieved 16 April 2016, from http://cmsnew.pdst.ie/sites/default/files/Session%202%20-%20PS%20Assessment%20Resource%20Pack-1_0.doc

Pepler, D. J., & Ross, H. S. (1981). The effects of play on convergent and divergent problem solving. *Child Development*, 1202-1210.

Scarlett, W.G., Naudeau, S., Salonius-Pasternak, D. & Ponte, I. (2005), *Children's play*. Thousand Oaks: Sage

Schifter, C., & Cipollone, M. (2013). Minecraft as a teaching tool: One case study. In *Proceedings of Society for Information Technology & Teacher Education International Conference* (pp. 2951-2955).

Schoenfeld, A. H., & Herrmann, D. J. (1982). Problem perception and knowledge structure in expert and novice mathematical problem solvers. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *8*(5), 484.

Schoenfeld, A. H. (1987). What's All the Fuss About Metacognitlon. *Cognitive science and mathematics education*, *189*.

Squire, K. (2003). Video games in education. *Int. J. Intell. Games & Simulation*, *2*(1), 49-62.

Squire, K. (2005). *Game-based learning: Present and future state of the field*. Masie Center e-Learning Consortium.

Statista.com,. (2011). *Average game hours per day of video gamers 2011 | Statistic*. Retrieved 10 March 2015, from

http://www.statista.com/statistics/273829/average-game-hours-per-day-of-video-gamers-in-selected-countries/

Swing, E.L., Gentile, D.A., Anderson, C.A. & Walsh, D.A. (2010). Television and video game exposure and the development of attention problems. *Paediatrics, 126(2),* 214-221.

The Psychological Society of Ireland (2010). *Code of Professional Ethics.* Dublin: PSI.

Ventura, M., Shute, V., & Zhao, W. (2013). The relationship between video game use and a performance-based measure of persistence. *Computers & Education*, *60*(1), 52-58.

Vygotsky, Lev Semenovich (1967) "Play and its role in the mental development of the child." *Journal of Russian and East European Psychology* 5.3, 6-18.

Weight It Up. (2016). *Bgfl.org*. Retrieved 19 April 2016, from http://www.bgfl.org/bgfl/custom/resources_ftp/client_ftp/ks2/maths/weigh/index.htm

Welsh Assembly Government (2008). *Play/Active Learning. Overview for 3 to 7 year olds in Wales.* Cardiff: The National Assembly for Wales.

Whitebread, D., Basilio, M., Kuvalja, M. & Verma, M. (2012). *The importance of play.* Brussels, Belgium: Toys Industries for Europe.

Woolfolk, A., Walkup, V., & Hughes, M. (2013). *Psychology in education*. Longman.

Youniss, J., & Damon, W. (1992). Social construction in Piaget's theory. In Beilin, H. & Pufall, P.B. (Eds.), *Piaget's theory: Prospects and possibilities* (pp. 267–286). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Appendices

Appendix A – Demographic Questions

ID Number:

Please read the following questions carefully and answer as accurately and truthfully as possible.
Remember, all information you give will remain confidential and anonymous. This means that nobody else will know what you wrote except for you and your parent/guardian. When I get these pages back, I will not be able to match this information back to you.
Take your time!

Children's Questions

1. How old are you? _____ years old.

2. Are you
a boy ☐
a girl ☐

3. How many hours per week do you spend playing video games?
a. Per school day (Mon-Thurs): _____
b. Per weekend day (Fri-Sun): _____
c. I don't play video games (tick if this applies to you) ☐
If you don't play video games, skip to the question 5.

4. List your top 5 favourite video games to play, number 1 being your favourite, 2 being your second favourite, and so on.
1. _____

2. _____
3. _____
4. _____
5. _____

5. If you play Minecraft, approximately how many hours do you spend playing

a. Per school day (Mon-Thurs): _____
b. Per weekend day (Fri-Sun): _____
c. I don't play Minecraft ☐

If you don't play Minecraft, skip to the "<u>Problem Solving Questionnaire</u>"

6. How much do you like Minecraft?

Like a lot	Like	Neither like nor dislike	Don't like	Really don't like
				

Circle your answer below

7. Why do you like/not like Minecraft?

_____
_____
_____
_____

_____

_____

8. Do you feel like Minecraft teaches you anything that helps you in maths class? Give reasons for your answer.

_____

_____

_____

_____

_____

9. Please circle your answer to each of the questions below:

If you play Minecraft, do you play

Alone	Always	Often	Sometimes	Never
Online with others	Always	Often	Sometimes	Never
Offline with others	Always	Often	Sometimes	Never

10. Please circle your answer to each of the questions below:

When you play Minecraft, do you play with people

Younger than you	Always	Often	Sometimes	Never
The same age as you	Always	Often	Sometimes	Never
Older than you	Always	Often	Sometimes	Never
People whose ages you don't know	Always	Often	Sometimes	Never

11. How many hours per week do you watch Minecraft related videos on YouTube? _____

I don't watch Minecraft on YouTube ☐

If you do not watch Minecraft on YouTube, skip to the "<u>Problem Solving Questionnaire</u>".

12. Who are your favourite Minecraft YouTubers?

1. _____
2. _____
3. _____

Appendix B – Maths Survey

Attitude to Maths Questionnaire			
	Yes	**No**	**Don't Know**
1. Do you like Maths?			
2. Do you think you are good at maths?			
3. Do you find maths easy?			
4. What parts of maths do you like best?			
5. What parts of maths do you like least?			

Appendix C – Problem Solving Survey

Problem Solving Questionnaire

Answer these questions as honestly as you can. Try to think about word maths problems you have been doing this year in school to help you.

1) Do you like problem solving? (tick one box)
   Yes ☐ No ☐ Don't Know ☐

2) Do you find problem solving easy? (tick one box)
   a. All the time ☐ sometimes ☐ rarely ☐ never ☐

3) How do you solve problems?
   - ☐ Drawing a diagram to illustrate the problem
   - ☐ Making a chart or table of the information
   - ☐ Looking for patterns
   - ☐ Making a guess and testing it
   - ☐ Breaking the model down and solving each part
   - ☐ Writing a number sentence for the word problem
   - ☐ Solving a simpler version of the problem, for example, using smaller numbers

4) What parts of problem solving, if any, do you find difficult?
   _____

5) Why is it so difficult?
   _____

6) What usually helps you when it's a bit of a struggle to problem solve?
   _____

7) What could teachers do to make it easier for you to learn to problem solve?
   _____

8) Is there anything that encourages you to work hard, even when the work is difficult?
   _____

9) Is there anything else you would like to say about problem solving?
   _____

Thank you for completing this questionnaire ☺

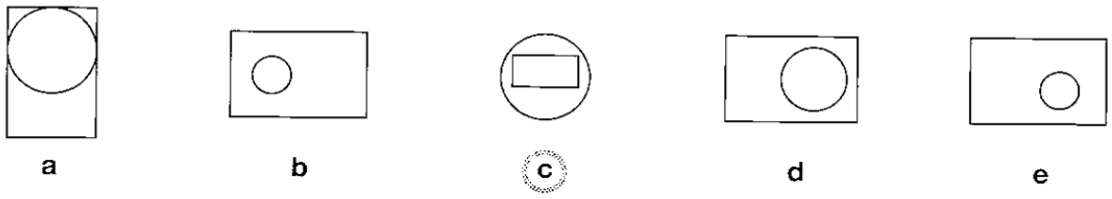
ID Number:

Appendix D – Non-Verbal Reasoning Task

Read the instructions that follow below, and circle your answer with **red pen.** Try to get through them as quickly as you can, and try not to skip any. If in doubt, take a guess. You have 10

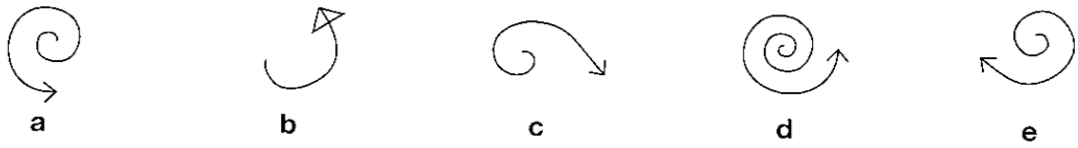
B 1 Which is the odd one out? Circle the letter.

Example



1

2



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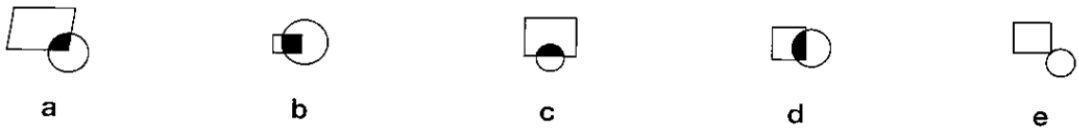

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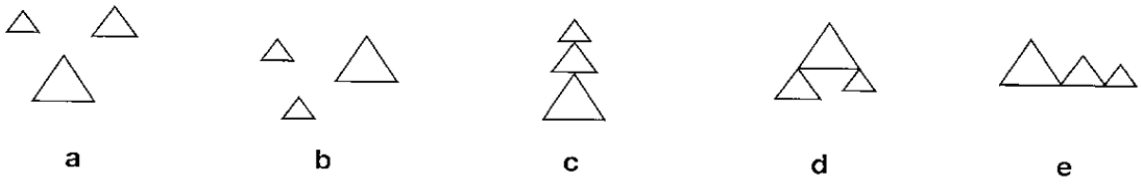

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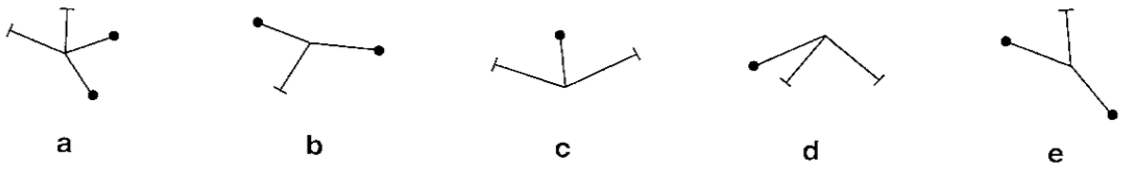

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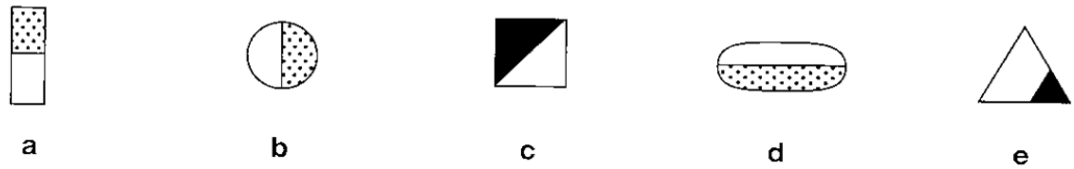


minutes to complete this part of the exercise.

7

a b

8

a b

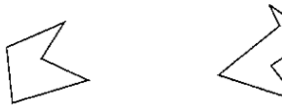
9

a b

10

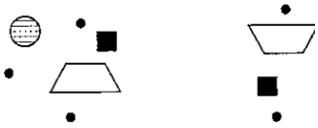
a b

11



a b

12



a b

ID Number:

You will now have 40 minutes to complete the following questions.

Please attempt every question. Getting the answer right is not the most important thing, the working out is as important! *I will not be able to award you marks for your answer unless there is evidence of working out.*

Here are some suggestions of methods you might use to help you work out the problems:

- ***Drawing a diagram to illustrate the problem***
- ***Making a chart or table of the information***
- ***Looking for patterns***
- ***Making a guess and testing it***
- ***Breaking the model down and solving each part***
- ***Writing a number sentence for the word problem***
- ***Solving a simpler version of the problem, for example, using smaller numbers***

Remember, you can stop doing these problems at any time. Just quietly raise your hand and your teacher will take your workbook.

If you are finished early, quietly take a look back over your solutions.

Again, do not worry. Just give it a try and see what you can do.
Good luck!

1

The scoutmaster has 2 large 6L containers of orange for the troop. There are 48 scouts at camp and each has a glass of orange for breakfast each morning. Each glass holds 200ml. Camp lasts for two days.

a. How much orange will be left after breakfast on the first day of camp?
b. How much orange will he need to buy for the second day?

x

An unenchanted fishing rod has an 85% chance of catching fish, a 10% chance of junk, and a 5% chance of treasure. Based on this,

a) How many pieces of treasure should Steve catch if he casts his unenchanted fishing rod 127 times?
b) How many pieces of junk should Steve catch if he casts his unenchanted fishing rod 82 times?
c) How many fish should Steve catch if he casts his unenchanted fishing rod 85 times?

N00146573

A gardener is laying down a lawn. The area of each square sod of grass $4m^2$.

a) If the area of the garden is $120m^2$, how many square sods will be needed to cover the entire garden?

b) The gardener plans to place a pond in the garden, which will be take the place of 4 square sods. What area of the garden will now be covered in grass?

Steve has been investigating an abandoned mineshaft. He found a chest with 57 units of different ores.

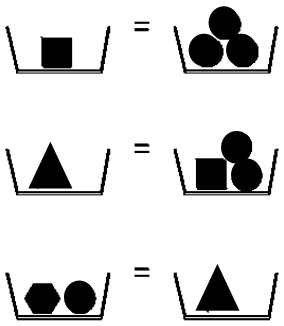
- He has 12 lumps of coal and 3 gold ingots
- He has 4 less diamonds than coal
- He has twice as much lapis lazuli as diamonds
- The number of iron ingots is equal to the number of coal lumps and gold ingots added together. The rest is redstone.

How much of each item did he find?

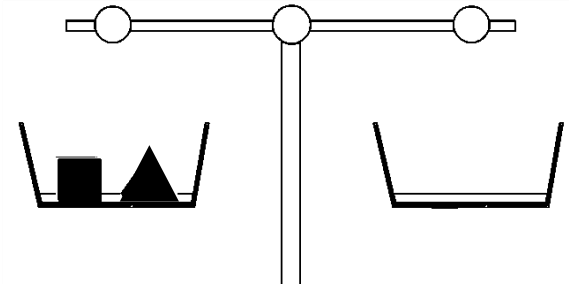
Steve knows that mobs don't spawn on glass, so he decided to use glass blocks to pave some areas within his living compounds. Each side of a class block and a glass pane is 1m.

a) If the area of Steve's house is half of 50 square meters, how many glass blocks does he need to get in order to pave the entire floor of the house with glass blocks?
b) Steve's house is located in the middle of a square yard with a perimeter of 100m. If Steve wants to pave just the yard, how many glass blocks will he need to use?

A scales will balance as follows:



How many balls will be needed to balance the following?



xv

N00146573

In a "spin-the-wheel" game, the wheel has 10 segments of equal size.

1. What are the chances of spinning a 6?
2. What are the chances of spinning a multiple of 3?
3. What are the chances of spinning an even number?

i. Steve will be journeying to the Nether for 60 minutes. How many 8 minute Fire Resistance potions should he bring to be protected from lava for the entire time?

ii. If Steve will fight the Wither for 15 minutes, how many 3 minute regeneration potions and 8 minute strength potions does he need to make in order to have strength and regeneration during the entire fight?

Appendix F – Principal Consent

16th January 2016

Dear Principal,

My name is Laura Griffin, a final year cyberpsychology masters student in the Institute of Art, Design and Technology, Dun Laoghaire. My research focuses on the impact of technology on children, in particular, how video games impact on mathematical problem solving abilities.

I am currently in the data collection stage of my research, and would greatly appreciate if your school could get involved. 6th classes would be given a survey to complete at home with their parents, detailing their gaming habits and attitudes towards maths and maths problem solving. In addition to this, they would complete a 50 minute maths problem exercise in class. Attached please find a sample of these documents. I am aware that time is valuable in school, particularly for maths in senior classes, so I aim for this to serve as a maths lesson for your class. Once data has been collected, I will provide aggregate data on the whole class performance.

Participation of each child would be voluntary pending parental and child permission. Children will also be free to withdraw at any time during the in class exercise. Ethical guidelines will be followed to ensure that all data collected is kept secure and anonymous. No personal or sensitive information will be gathered about any children in this study.

If you wish to take part in study, please return the attached form in the pre-stamped envelope by Friday 22nd January 2016. If you have any questions, I would be more than happy to answer them. You can contact me on N00146573@student.iadt.ie .

Kind regards,

_____

Laura Griffin

Please complete the following in BLOCK CAPITALS.

I, _____, principal of _____, hereby give consent for my school to take part in the above mentioned study.

Signed: _____.

Date: _____

Appendix G – Information Sheet

Information Sheet

Study Title: *Exploring and describing the nature of the relationship between passive and active engagement with Minecraft and divergent problem solving in children*

Purpose of the Research

Currently within Irish education, there is an emphasis on problem solving based mathematics, at both primary and secondary levels, to the extent of a re-developed state examination format with Project Maths. Simultaneously, children are playing sandbox games, such as Minecraft, which cite as their main the design features concepts which align closely with the aims and objectives of the maths curriculum. Already Minecraft is used increasingly as an education tool in America and many Scandinavian countries. This research aims to investigate if playing Minecraft alone can develop skills fundamental to problem solving.

Invitation

You are being invited to consider taking part in this research study. This project is being undertaken by Laura Griffin (B.Ed, B.A.), a qualified primary teacher, currently in pursuit of a qualification a M.Sc in Cyberpsychology from IADT. Before you decide whether or not you wish to take part, it is important for you to understand why this research is being done and what it will involve. Please take time to read this information carefully and discuss it with friends and relatives if you wish. Ask us if there is anything that is unclear or if you would like more information, please feel free to email me at N00146573@student.iadt.ie.This study has been approved by the IADT Department of Technology and Psychology Research Ethics Committee.

Do I have to take part?

You are free to decide whether you and your child wish to take part or not. If you do decide to take part you and your child will be asked to indicate your consent through completion of a short form attached to this sheet. You and your child are free to withdraw from this study at any time and without giving reasons. Please explain to your child that their decision to either take part or not take part in the study will have no impact on their marks, assessments, future studies, promotional prospects, performance reviews, or any other evaluation of their professional or academic life.

If I take part, what do I have to do?

There are a number of short parts to this study.

- Firstly, parents/guardians and children will be given a short and simple survey to complete based on video game usage and attitudes towards maths and problem solving. This will take part at home, and should take no longer than 20 minutes.
- Secondly, in class, children will complete a number of maths problems similar to those that they encounter on a daily basis. This will take no longer than 50 minutes. In return, children will be given one homework pass for their participation.

What are benefits and risks (if any) of taking part?

Participation in the study will help create a clearer picture of how concerned (or not as the case may be) parents and teachers should be about their children's gaming habits. In addition, it may indicate a method of teaching that can enhance problem solving ability in a way that is already enjoyed by children.

How will information about me be used and who will have access to it?

Data from the surveys, questionnaires and maths problems will be collected and examined to investigate if a relationship exists between amount of time spent playing video games and maths problem solving abilities, and problem solving abilities, along with general strengths and difficulties. General parental and child opinions of games and gaming will also be examined. Data collected may be retained for use in future research studies. Confidentiality of participant information and data will be safeguarded during and after the study in the following ways:

- Data will be stored securely in a locked filing cabinet and on a password protected computer
- All data collected will be coded and anonymous
- Data will be retained by the researcher for at least five years.
- Long term, data will be placed in a repository

It is the aim of the researcher that the findings of the study used in my thesis of my M.Sc in Cyberpsychology by Research in the Dun Laoghaire Institute of Art, Design & Technology and subsequently published in an academic journal. Details of how to access the published study will be passed on to the school.

What if there is a problem?

If you have a concern about any aspect of this study, you may wish to speak to the researcher who will do her best to answer your questions. You should contact Laura Griffin N00146573@student.iadt.ie or her supervisor Dr Grainne Kirwan at grainne.kirwan@iadt.ie.

Thank you

Appendix H – Parent Consent Form

ID Number:

Parent's Consent Form

Title of Project: *Exploring and describing the nature of the relationship between passive and active engagement with Minecraft and divergent problem solving in children*

Name of Researcher: *Laura Griffin*

Name of Supervisor: *Dr Gráinne Kirwan*

Please tick the boxes if you agree

I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.	☐
I understand that my child's participation is voluntary (of his/her own choice) and that he/she is free to withdraw at any time.	☐
I have reminded my child that their participation and score in this experiment will in no way affect their school scores	☐
I understand that my own participation in this survey is voluntary and that I am free to withdraw at any time	☐
I agree for my child's anonymised quotes to be published in a dissertation, presentation, academic publication, or online format	☐
I agree for my own anonymised quotes to be published in a dissertation, presentation, academic publication, or online format	☐
I agree that the data collected can be used for future research projects	☐
I agree to take part in this study.	☐
I agree that my child can take part in this study	☐

N00146573

ID Number:

Appendix I – Child Consent Form

Children's Consent Form

Title of Project: *Exploring and describing the nature of the relationship between passive and active engagement with Minecraft and divergent problem solving in children*

Name of Researcher: *Laura Griffin*
I am a both a psychology researcher and a primary school teacher. This is an experiment to examine if playing Minecraft and watching Minecraft videos might or might not help you learn how to do maths problems.
Name of Supervisor: *Dr Gráinne Kirwan*

Please tick the boxes if you agree
If there is anything you do not understand, you can refer to the information sheet attached again, or you can ask your teacher or parent/guardian to help you.

I have read and understand the information sheet for the study and have had the chance to ask questions.	
I understand that my participation is my choice and that I am free to stop taking part at any time.	
I understand that my participation and score in this experiment will in no way affect my school scores/records	
I agree for the sentences that I write as answers to be published anonymously[1] in a dissertation, presentation, academic publication, or online format[2]	
I agree that the data collected can be used for future research projects	
I agree to take part in this study.	

Some of the above phrases explained:

1. This means that nobody will know that it was you who wrote these sentences.

2. These are just different ways that this project might be presented, in an essay, a presentation in front of a group of people, and possibly in books on this topic both on and offline.

Appendix J – Deadline Cover Letter

25th Jan 2016

Dear parents/guardians,

Thank you for taking the time to take part in this study. This study examines the impact of playing video games on the mathematical ability of children in primary school.

The study takes place in two parts:

- Completion of questionnaires at home with parent or guardian
- Completion of 6th class level maths word problems in class.

Please read the following documents carefully.

- All documents must be filled in with **a blue or black pen**
- Please note that pages are printed **on both sides.**
- Please **return** all **purple** sheets in the envelope provided (consent forms, questionnaires). Please ensure that **both sides** of all pages are completed prior to putting in envelope.
- **DO NOT** seal the envelope. This will be done once children complete the in class exercise.
- Please **keep** all **white** sheets (information sheets).
- Please ensure that you or your child's name does not appear on any documentation to ensure anonymity throughout the data collection process.
- If, having read the documentation, you wish for you and your child to withdraw from the study, please feel free to do so.

Please return to class by _____.

Is mise le meas,

Laura Griffin

Appendix K – Teacher Instructions

Dear teacher,

I would like to take this opportunity to thank you for facilitating the data collection of this experiment. I am aware that time is valuable in school, particularly for maths in senior classes, so I aim for this to serve as a maths lesson for your class. Once data has been collected, I will provide aggregate data on the whole class performance.

Instructions

This is a very straightforward experiment in regards to carrying out the data collection.

1. Provide each child with an envelope, containing the parental and child consent forms, survey, and maths and problem solving questionnaires that will be completed at home by the parents and children. This envelope will be assigned a specific number that will correspond with their in-class assignment.

2. Set a deadline, at your own discretion, for when the surveys will have to be returned by. I recommend no more than one week.

3. Please note that participation is voluntary. Should a parent decide that they do not want their child to take part in the study, alternative work should be administered while other children are taking part in the experiment, such as free-writing or DEAR time. Failure to return the envelope with signed consent forms by the deadline will be accepted as non-participation

4. On the day of the deadline, ensure that all children taking part in the study have their envelope with consent forms, survey, and questionnaires. Provide each child with a problem solving booklet. **On the front, each child will write the number that is written on their envelope. The child's name should not appear on any sheet being submitted.** Please ensure that this is completed by all students prior to the commencement of the exercise.

5. Read through the instructions on the front page with the children. Should a child have difficulty with any phrasing, they may ask you for clarification. When you are ready, allow everyone to turn to the first page. Provide them with 10 minutes to complete the non-verbal reasoning task. At the end of 10 minutes, request that all children put their pencils down before continuing to the next stage.

6. For the problem solving stage, remind the children that it is not a test, that they will not be penalized for making mistakes. However, they may not confer with the person beside them at any stage, nor may they ask you, the teacher, any questions. These problems must be attempted alone, and **please emphasise that all working out must be shown on the page in the space provided**. Working out can include anything that may help decipher the problem, such as tables, graphs, pictures, etc. The children will have 40 minutes to complete these problems. They may not ask for or receive help at any point. Remind the children that if they wish to cease participation at any stage, they may do so without fear of repercussion.

7. While the children are completing this task, if you notice that a student is distressed, you may quietly remind them that they are free to cease participation at any time. If you notice a child is particularly distressed, or children with special educational needs that you think may struggle with the problems, you may make the executive decision to cease their participation in the task and tell them to begin the alternative task (e.g. free writing, DEAR time) instead.

8. Please ensure that these problems are completed independently and in silence. If anyone is finished before the end of the 40 minutes, remind them to look back over the solutions to the word problems (not the previous non-verbal reasoning task). At no point during the 40 minutes should any child converse with another child.

9. At the end of 40 minutes, tell the children to place their booklet into their envelope and seal it. Administer the attached homework passes to those who participated in the study. The conditions for use of this pass are at your own discretion. For

example, it can allow one piece writing homework off, or all homework off.

10. Once the tests have been completed and handed up, please feel free to use these problems as a teaching opportunity. The problems represent each of the strands of the Maths Eyes Problem Solving curriculum, so this may be used as a mid-year assessment/oral mathematical language/pair work task for assessment of and for learning.

It is important that these steps are adhered to as closely as possible, to ensure consistency and fairness when compared with other groups from other schools.

Once collected, please return by post in the pre-addressed envelope by _____.

Should you have any questions or queries at any time, please feel free to contact me on N00146573@student.iadt.ie.

Kind regards,
Laura Griffin

Appendix L – Debriefing Forms

Parent Debriefing Form

Debriefing Form

Thank you very much for taking part in this research study.

The study in which you just participated was designed to investigate if video games such as Minecraft has any impact on maths problem solving abilities.

If you have questions about this study or you wish to have your data or your child's data removed from the study, please contact me at the following e-mail address: N00146573@student.iadt.ie.

Alternatively, you may contact my supervisor: Dr Gráinne Kirwan at IADT, at *grainne.kirwan@iadt.ie*.

We thank you sincerely for contributing and assure you that your data and your child's data is confidential and anonymous, and if published the data will not be in any way identifiable as yours or your child's.

Laura Griffin

Child Debriefing Form

Thank you very much for taking part in this research study.

The study in which you just participated was designed to investigate if video games such as Minecraft has any impact on maths problem solving abilities.

If you have questions about this study or you wish to have your data (your surveys and maths problems) removed from the study, please contact me at the following e-mail address: N00146573@student.iadt.ie.

Thank you sincerely for taking part and I promise that your information is confidential and anonymous, and if published the data will not be in any way identifiable as yours.

Laura Griffin

Appendix M – Distribution of Scores on Problem Solving

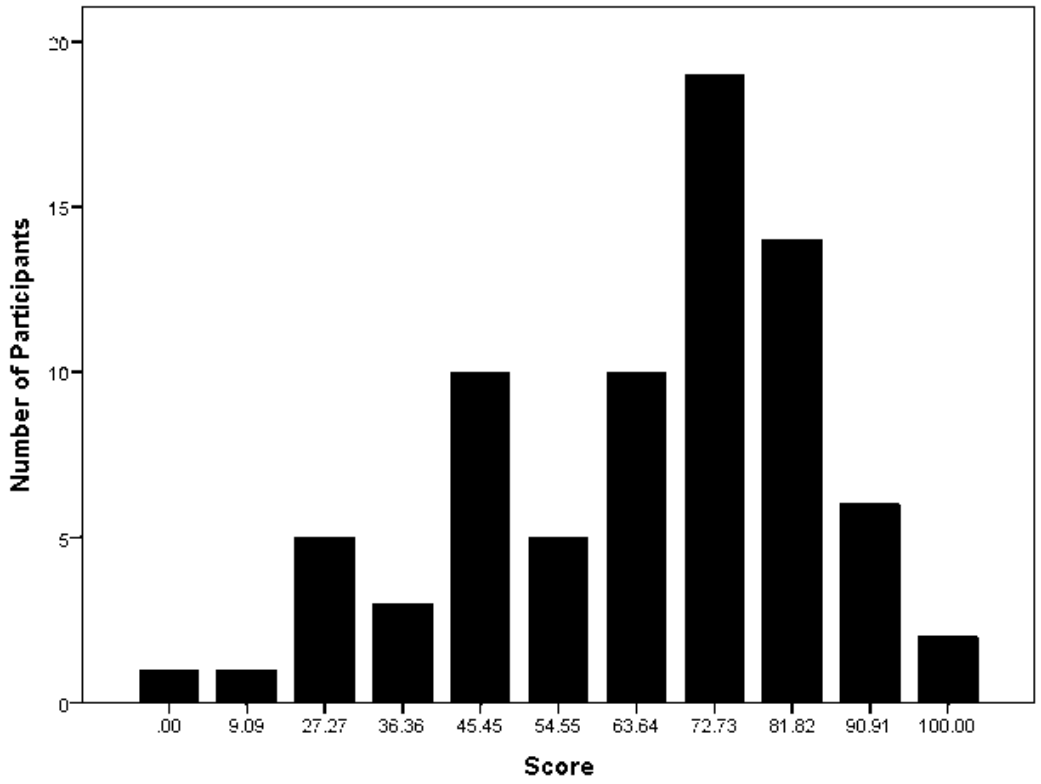


Figure 5: Distribution of Scores on Minecraft Themed Word Problems

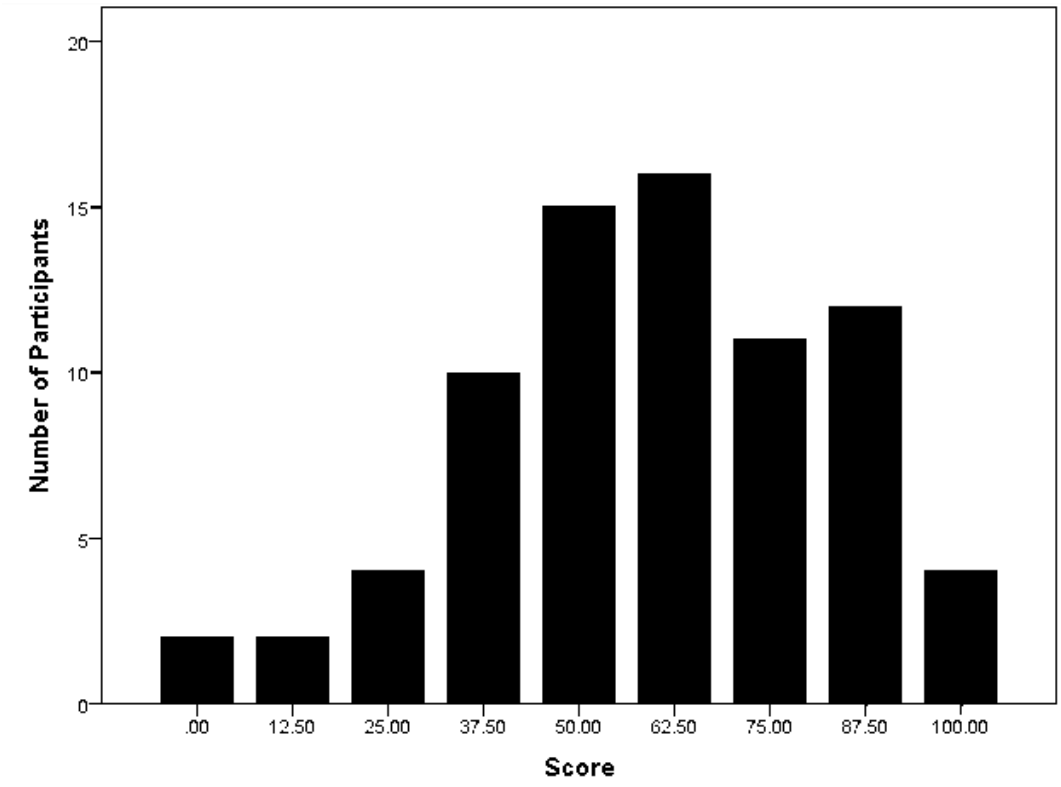


Figure 6: Distribution of scores on Non-Minecraft Themed Questions

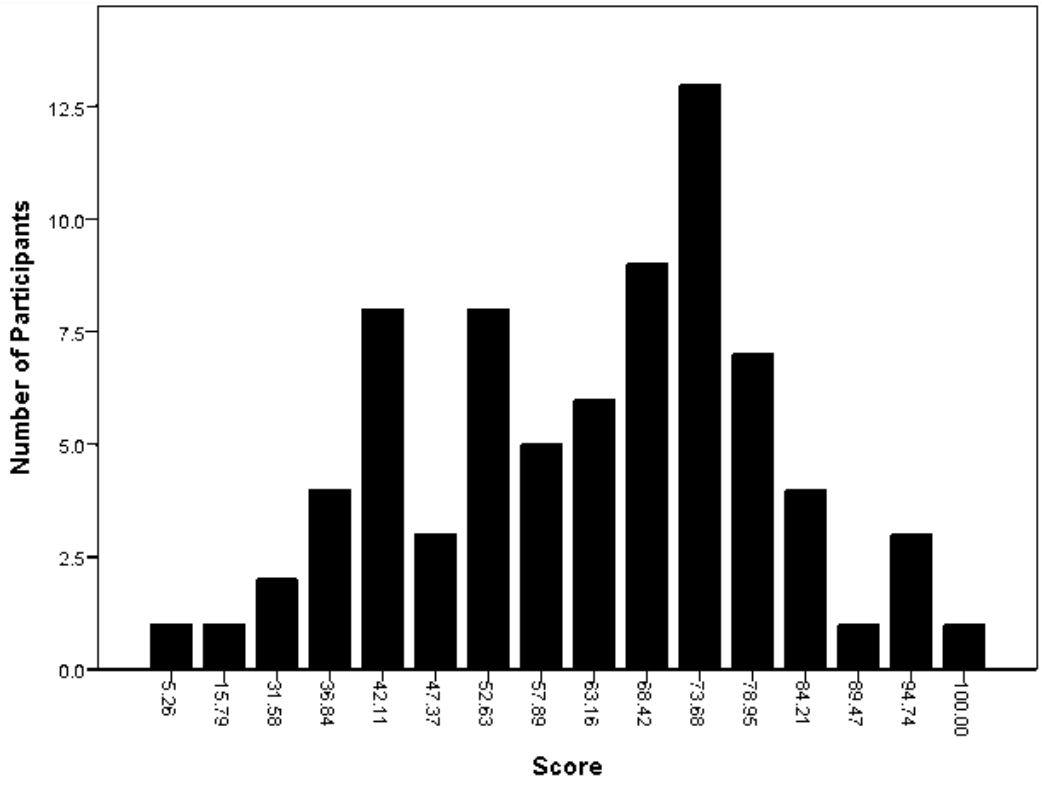


Figure 7: Distribution of Scores on Overall Word Problems

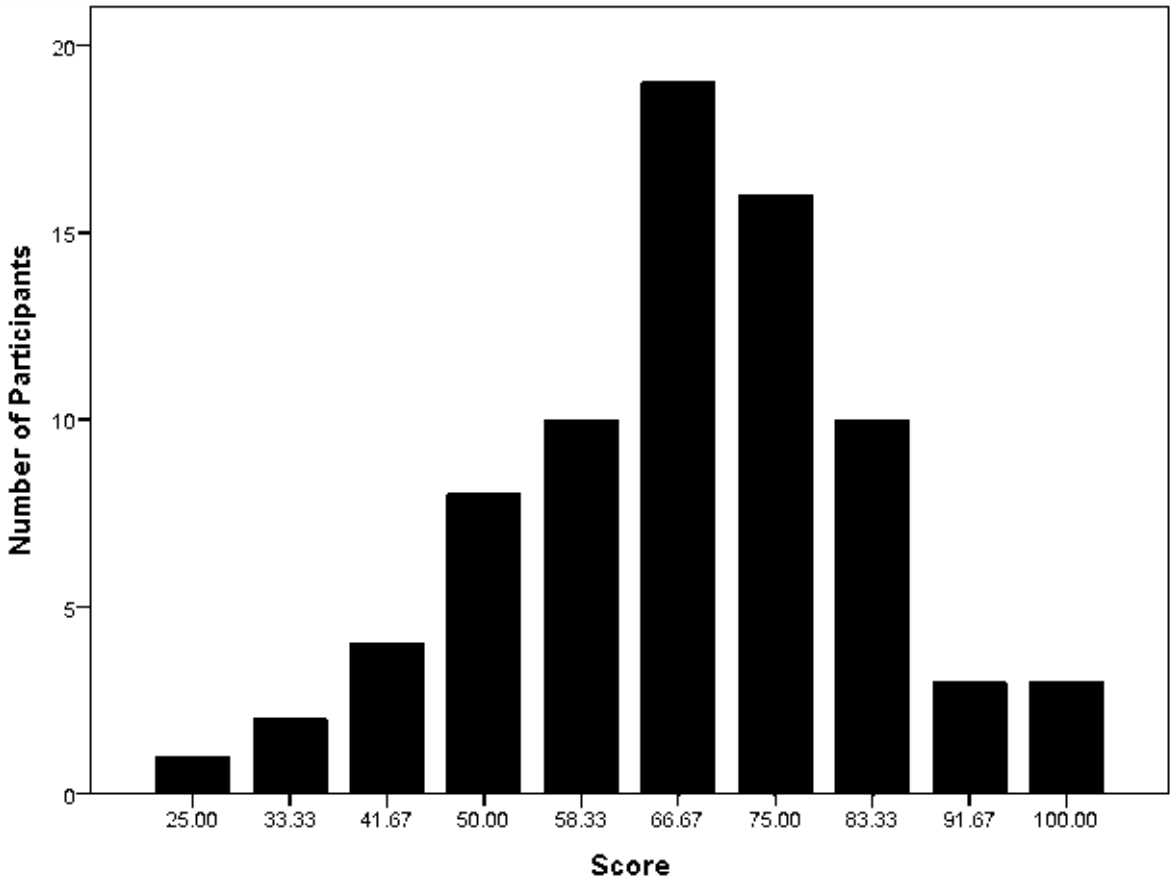


Figure 8: Distribution of Scores on Non-Verbal Reasoning Problems

Appendix N – Ethics Application

DEPARTMENT OF TECHNOLOGY AND PSYCHOLOGY ETHICAL APPROVAL FORM B*

Three printed copies of this form should be submitted to the chair of the ethics committee

Title of project **Exploring and describing the nature of the relationship between active engagement with Minecraft and divergent problem solving in children**

Name of researcher Laura Griffin

Email contact laura.m.griffin@myclick.ie

Name of supervisor To be assigned

		Yes	No	N/A
1	Will you describe the main research procedures to participants in advance, so that they are informed about what to expect?	✓		
2	Will you tell participants that their participation is voluntary?	✓		
3	Will you obtain written consent for participation (through a signed or 'ticked' consent form)?	✓		
4	If the research is observational, will you ask participants for their consent to being observed?			✓
5	Will you tell participants that they may withdraw from the research at any time and for any reason?	✓		
6	With questionnaires, will you give participants the option of omitting questions they do not want to answer?	✓		
7	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	✓		
8	Will you debrief participants at the end of their participation (i.e., give them a brief explanation of the study)?	✓		
9	If your study involves people between 16 and 18 years, will you ensure that passive consent is obtained from parents/guardians, with active consent obtained from both the child and their school/organisation?			✓
10	If your study involves people under 16 years, will you ensure that active consent is obtained from parents/guardians and that a parent/guardian or their nominee (such as a teacher) will be present throughout the data collection period?	✓		
11	Will your project involve deliberately misleading participants in any way?		✓	
12	Is there any realistic risk of any participants experiencing either physical or psychological distress or discomfort?	✓		
13	Does your project involve work with animals?		✓	
14	Do you plan to give individual feedback to participants regarding their scores on any task or scale?		✓	
15	Does your study examine any sensitive topics (such as, but not limited to, religion, sexuality, alcohol, crime, drugs, mental health, physical health)		✓	
16	Is your study designed to change the mental state of participants in any negative way (such as inducing aggression, frustration, etc.)		✓	

17	Does your study involve an external agency (e.g. for recruitment)?			✓	
18	Do participants fall into any of the following special groups?	People with learning or communication difficulties		✓	
		Patients (either inpatient or outpatient)		✓	
		People in custody		✓	

If you have ticked **No** to any of questions 1 to 10, or **Yes** to any of questions 11 to 18 you should refer to the PSI Code of Professional Ethics and BPS Guidelines. There is an obligation on the lead researcher to bring to the attention of the Department of Technology and Psychology Ethics Committee (DTPEC) any issues with ethical implications not clearly covered by the above checklist.

* This Ethics B form should be completed by researchers whose studies involve any ethically questionable practices.

I consider that this project **may** have ethical implications that should be brought before the DTPEC.	✓

Please provide all the further information listed below, adhering closely to the suggested word counts.

1. **Purpose of project with very clear and specific justification for the study [its potential benefits], given the acknowledged sensitivity of the topic of study or the methods used (approximately 100 words)**

Though anecdotally it can be said that gaming plays a large role in the lives of Irish primary school children, there is limited empirical research into the degree of impact this is having on the cognitive development of children, nor is there empirical evidence detailing the gaming habits of primary school children in Ireland. This research intends to focus specifically on divergent problem solving ability, as this is an area under great focus for improvement within the primary school system at the moment. This study also aims to examine specifically features of the sandbox game "Minecraft", the potential educational benefits or detriments of such a game, and the general impact the gaming habits of Irish primary school children on their general strengths and difficulties (~~see appendix E~~) in school.

According to Piaget, the age range chosen for this study (age 10-12 year) is that of children on the cusp of formal operational stage of development, meaning that abstract reasoning, along with theoretical, hypothetical and counterfactual thinking are developing, making strategizing for problem solving possible. There are also increases in information processing capacity, advances in metacognition, and development of rehearsal, organisation and elaboration.

In addition, at this age, children will have had experience on numerous occasion of standardized assessments, such as the SIGMA-T or Dromcondra tests, which are carried out in a similar fashion. Participants will also have had sufficient experience of all strands of the maths curriculum to complete the challenging problems presented before them. These elements combined attempt to incur as little psychological stress as possible.

2. **Proposed methodology (approximately 300 words). This must include:**
    a. **Participants: recruitment methods, number, age, gender, exclusion/inclusion criteria.**
    b. **Brief description of methods and measurements.**

Participants will be sourced by stratified random sampling of Waterford primary schools through professional connections. A sample of approximately 100 5th and 6th class children (10-12 year olds) from both urban and rural primary schools will be approached to take part in the study. A pilot study will first take place with at least one participant, to ensure clarity of language and layout of instructions and questions.

Written consent will be first sought from a number of primary school principals, and subsequently from relevant parents/guardians and children taking part in the study. Consent will be sought from parents and guardians by means of a written consent form (~~see appendix A-C~~) sent home with children, which will also be attached to the parent and child survey (~~see appendix D~~). The consent form will outline the purpose of the study, the survey, as well as the in-class activity the child will complete. This survey will investigate amount of time spent gaming and parental attitudes to children gaming. The first half of the survey will be done together with the child; the second half will be done by the parent alone. This should take no longer than 30 minutes to complete.

A deadline will be placed for the return of the completed parent and child survey. Return of the written consent form with the completed survey will signify consent to proceed with the in-class activity. Again, verbal consent will be sought from the child as to whether they want to proceed at this stage of the study to complete the questionnaire and problems. The child will be reminded that they will be free to cease involvement in the exercise at any time, without question. To ensure anonymity, the in class experiment and the parent and child survey will be coded with the same generic number.

The class teacher will be given a clear set of instructions regarding the implementation of the in class exercise (~~see appendix H~~). The children will be given a problem solving "booklet", containing the problems they will solving, room to do the problems, and the strengths and difficulties questionnaire. The children will be asked to complete the strengths and difficulties questionnaire first for 5 minutes (~~see appendix E~~). They will then proceed to spend approximately 25 minutes working unaided on the problems, ensuring to show all their working out and rough work on the booklet (~~see appendix F~~).

3. A clear but concise statement of the ethical considerations raised by the project and how you intend to deal with them (approximately 100 words).

Though this is classed as a vulnerable population, I am a qualified, actively employed primary school teacher, with a bachelor of education in education and psychology (2.1 honors degree), teaching council accreditation with Garda vetting clearance (see appendix J), hence have daily experience with working with children, and am trained and equipped to deal with most eventualities.

As the study will involve children under the age of 18, explicit written parental consent will be sought, as well as consent from the child. In both cases, the experiment will be clearly explained and both parties will be made aware that participation is voluntary, that the child at any stage of the experiment is free to not take part or cease participation, and there will be an alternative familiar exercise such as free writing or reading to engage in in its place. These are normal activities within a classroom, so the child will not feel ostracized or stand out as being different.

In addition, while the parent will be present for the completion of the questionnaire on gaming behavior at home, the class teacher will be present throughout the maths part of the experiment. They will know which children that may have an adverse reaction to a problem solving maths problem, and if they notice a child in distress, they can remind that they are free to cease participation, or in extreme cases, make the executive decision to tell the child to cease participation. There is no deception involved in this experiment.

There is a chance that participants may have a psychological distress reaction to having to complete a difficult maths problem. However, though a realistic risk, it would be unusual. In such a case, the participant will be aware that they can cease participation in the experiment without justifying their reasons. It is thought that the experiment should not cause any more discomfort than would be presented within a normal maths lesson or assessment which, at 5^{th} and 6^{th} class level, will be something they are used to on a weekly basis. As a qualified primary school teacher, I have experience in creating such lessons and assessment and am familiar with how to pitch the challenge at the correct level.

A number of people with mild learning difficulties may participate in the study. However, as the study targets mainstream primary children only, in accordance with the EPSEN Act 2004, these children will not be of a disposition where their presence in a mainstream classroom is not posing threat to themselves or others. If the learning difficulties are severe enough to merit the assistance of a special needs assistant, learning support or resource hours, they will still be welcome to take part in the study as it is representative of the population. However, it will be explained to them that they may not take part or cease taking part at any time without

4. Copies of all materials to be used in your study should be attached to this form. This must include consent and participant information arrangements and debrief forms. It should also include copies of all standardized and/or non-standardized questionnaires and instruments, as well as any interventions and/or audio-visual materials which will be used. Please note that these materials will not be returned to you, so you should ensure that you retain a copy for your own records. All loose materials (such as DVDs, handouts etc.) should be clearly labeled with your name. There is no word count limit on appendices, but no appendices should be included that will not be used as materials in your study.
Appendix A – Information Sheet Appendix B – Children's Consent Form Appendix C – Parental Consent Form Appendix D – Draft Survey Appendix E – Strengths and Difficulties Questionnaire Appendix F – Sample Maths Problems Appendix G - Debriefing Appendix H – Teacher Instructions Appendix I – Homework Passes Appendix J – Teaching Council Accreditation
Three copies of this form, along with all materials to be used in your study, should be submitted to the DTPEC for consideration. ***If any of the above information is missing, your application will not be considered at the DTPEC meeting, and your research may be significantly delayed.***

I am familiar with the PSI Code of Professional Ethics and BPS Guidelines (and have discussed them with the other researchers involved in the project). I have read and understood the specific guidelines for completion of Ethics Application Forms.

Signed:  Print Name LAURA GRIFFIN Date 13/5/2015

Applicant

Signed _____ Print Name _____ Date _____
Supervisor

SPSS Output

Descriptive Statistics on whole sample.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
wpscore_percent	76	100.0%	0	0.0%	76	100.0%
NVR_percent	76	100.0%	0	0.0%	76	100.0%
minecraft questions score	76	100.0%	0	0.0%	76	100.0%
normal questions score	76	100.0%	0	0.0%	76	100.0%

Descriptives

			Statistic	Std. Error
wpscore_percent	Mean		62.3269	2.13062
	95% Confidence Interval for Mean	Lower Bound	58.0824	
		Upper Bound	66.5713	
	5% Trimmed Mean		62.7732	
	Median		65.7895	
	Variance		345.007	
	Std. Deviation		18.57435	
	Minimum		5.26	
	Maximum		100.00	
	Range		94.74	
	Interquartile Range		25.00	
	Skewness		-.479	.276
	Kurtosis		.259	.545
NVR_percent	Mean		67.3246	1.79860
	95% Confidence Interval for Mean	Lower Bound	63.7416	
		Upper Bound	70.9076	
	5% Trimmed Mean		67.5195	
	Median		66.6667	
	Variance		245.858	
	Std. Deviation		15.67985	
	Minimum		25.00	
	Maximum		100.00	
	Range		75.00	
	Interquartile Range		16.67	
	Skewness		-.265	.276
	Kurtosis		.122	.545

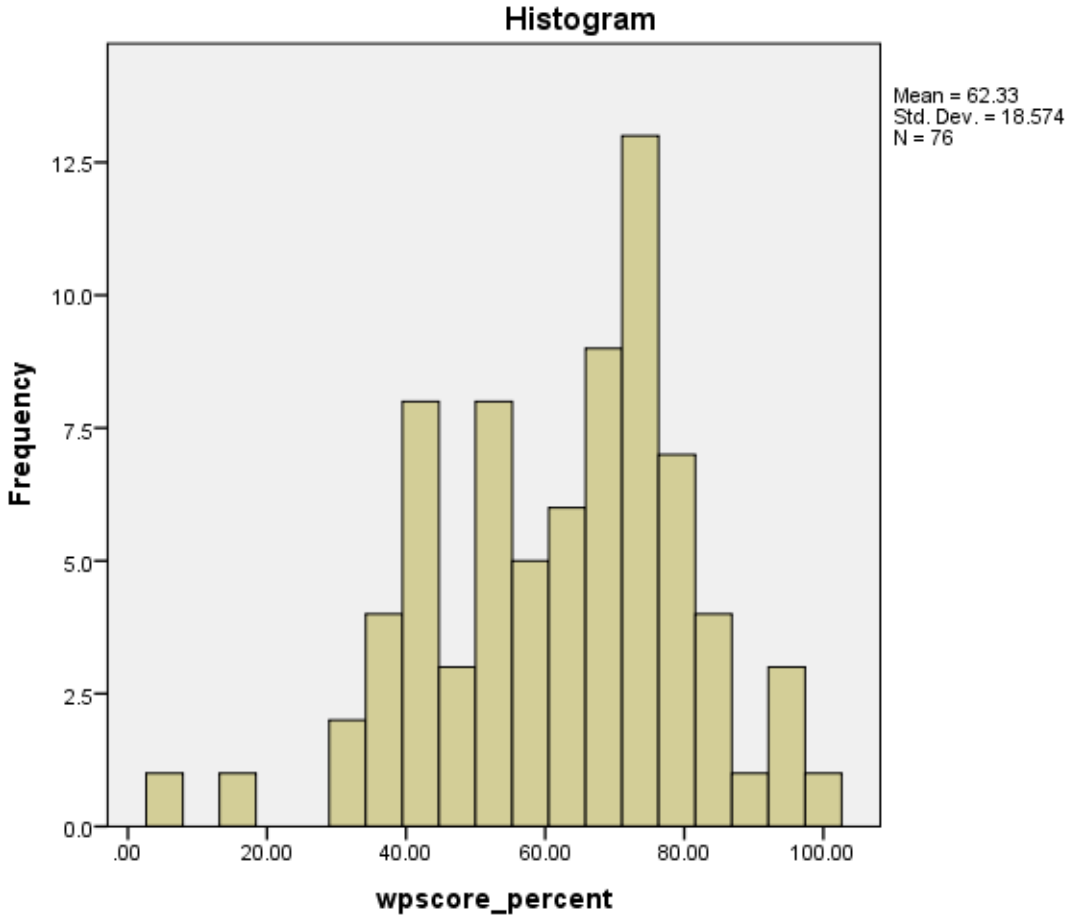
	Mean		64.3541	2.40078
	95% Confidence Interval for Mean	Lower Bound	59.5715	
		Upper Bound	69.1367	
	5% Trimmed Mean		65.3376	
	Median		72.7273	
	Variance		438.046	
minecraft questions score	Std. Deviation		20.92954	
	Minimum		.00	
	Maximum		100.00	
	Range		100.00	
	Interquartile Range		36.36	
	Skewness		-.806	.276
	Kurtosis		.392	.545
	Mean		59.5395	2.68880
	95% Confidence Interval for Mean	Lower Bound	54.1831	
		Upper Bound	64.8958	
	5% Trimmed Mean		60.2705	
	Median		62.5000	
	Variance		549.452	
normal questions score	Std. Deviation		23.44039	
	Minimum		.00	
	Maximum		100.00	
	Range		100.00	
	Interquartile Range		25.00	
	Skewness		-.369	.276
	Kurtosis		-.168	.545

Tests of Normality

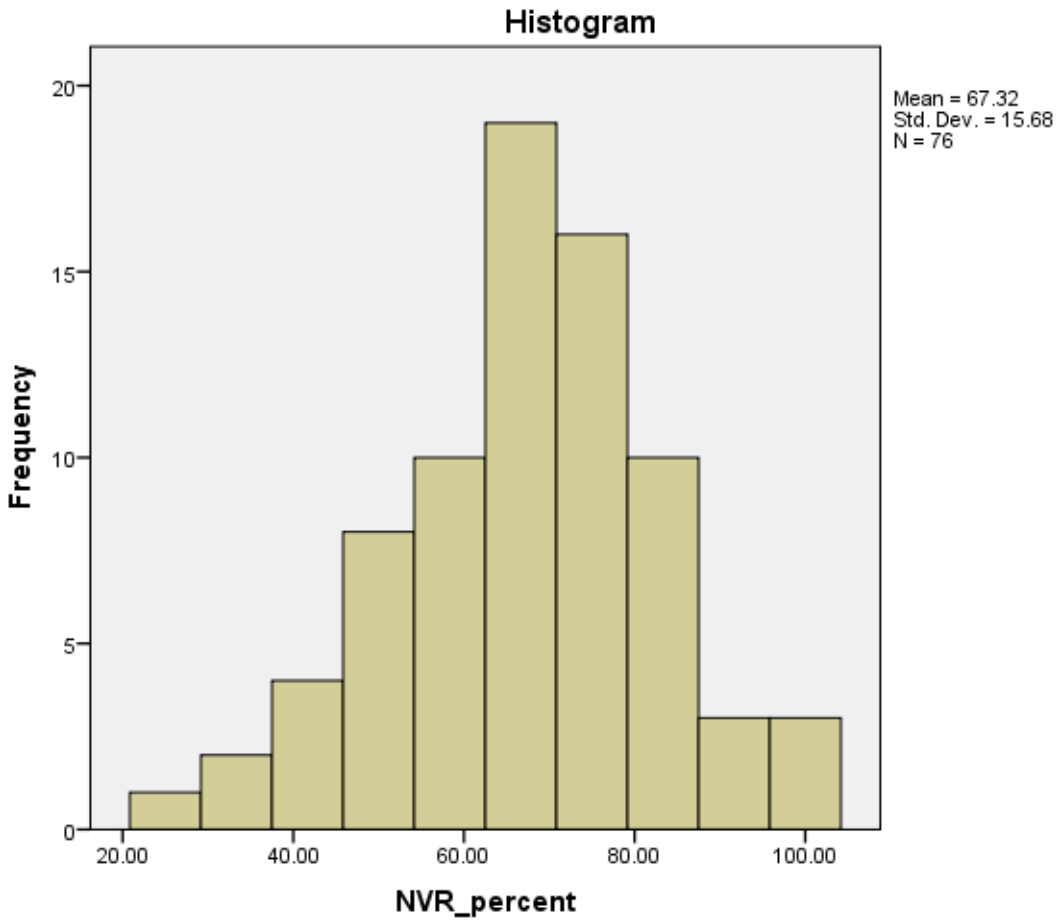
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
wpscore_percent	.129	76	.003	.970	76	.065
NVR_percent	.154	76	.000	.967	76	.045
minecraft questions score	.195	76	.000	.932	76	.001
normal questions score	.116	76	.013	.957	76	.012

a. Lilliefors Significance Correction

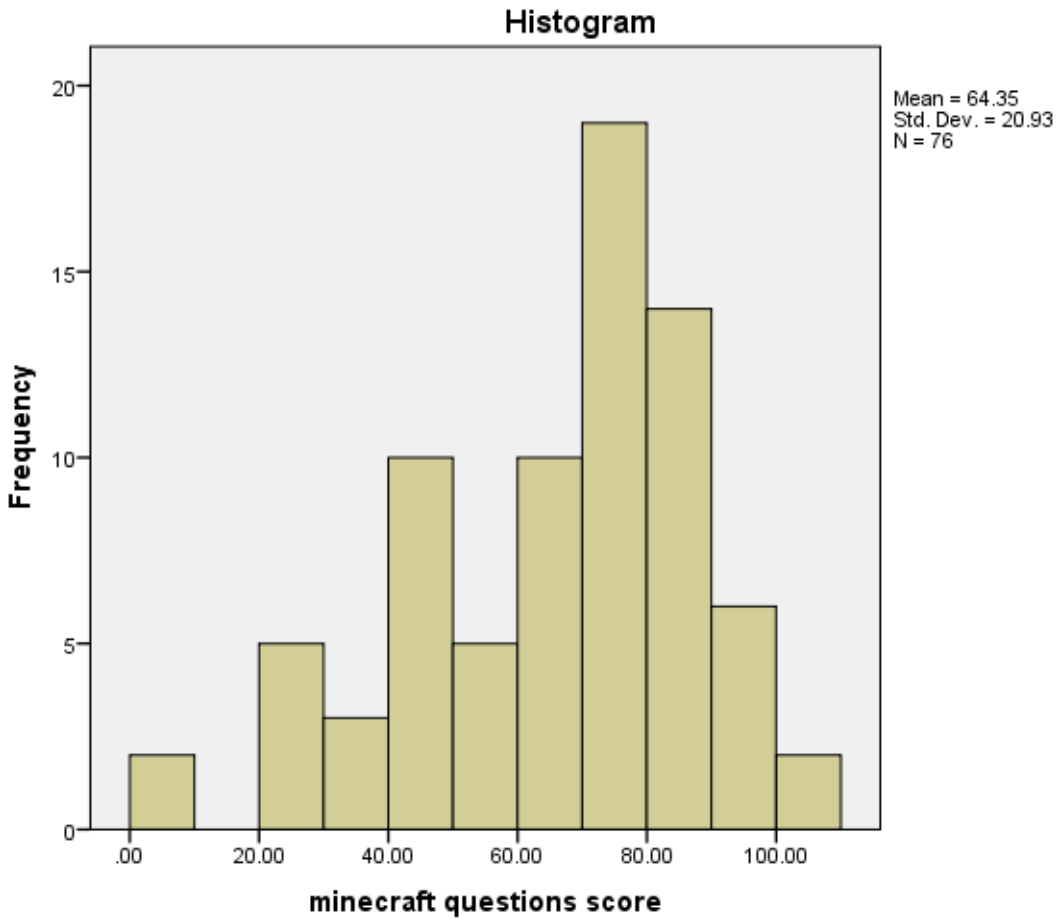
wpscore_percent


Histogram
Mean = 62.33
Std. Dev. = 18.574
N = 76
Frequency
12.5
10.0
7.5
5.0
2.5
0.0
.00
20.00
40.00
60.00
80.00
100.00
wpscore_percent

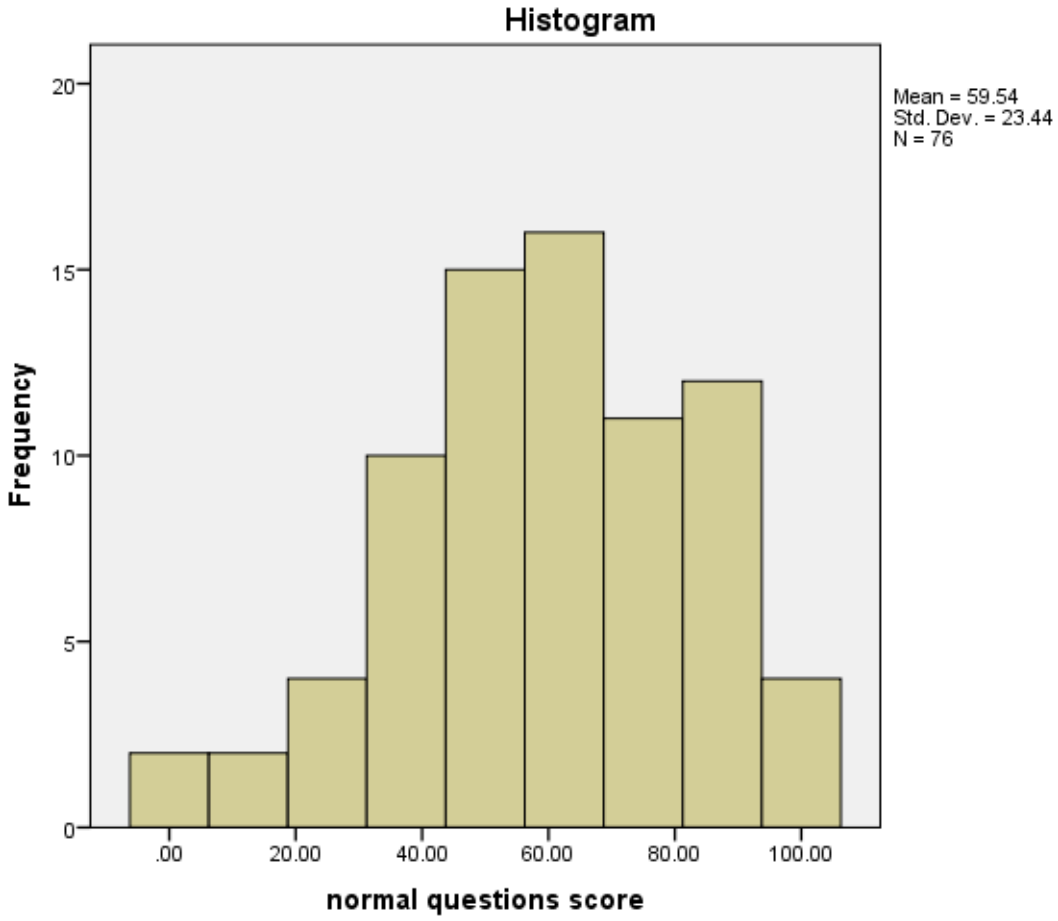
NVR_percent



minecraft questions score



normal questions score


Histogram
Mean = 59.54
Std. Dev. = 23.44
N = 76
Frequency
20
15
10
5
0
.00
20.00
40.00
60.00
80.00
100.00
normal questions score

Descriptive Statistics on those who do not play video games

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
wpscore_percent	17	100.0%	0	0.0%	17	100.0%
NVR_percent	17	100.0%	0	0.0%	17	100.0%
minecraft questions score	17	100.0%	0	0.0%	17	100.0%
normal questions score	17	100.0%	0	0.0%	17	100.0%

Descriptives

			Statistic	Std. Error
wpscore_percent	Mean		59.4427	4.05590
	95% Confidence Interval for Mean	Lower Bound	50.8446	
		Upper Bound	68.0409	
	5% Trimmed Mean		59.3223	
	Median		57.8947	
	Variance		279.656	
	Std. Deviation		16.72292	
	Minimum		36.84	
	Maximum		84.21	
	Range		47.37	
	Interquartile Range		31.58	
	Skewness		.000	.550
	Kurtosis		-1.539	1.063
NVR_percent	Mean		69.6078	2.76211
	95% Confidence Interval for Mean	Lower Bound	63.7524	
		Upper Bound	75.4633	
	5% Trimmed Mean		70.3976	
	Median		66.6667	
	Variance		129.698	
	Std. Deviation		11.38849	
	Minimum		41.67	
	Maximum		83.33	
	Range		41.67	
	Interquartile Range		12.50	
	Skewness		-.899	.550
	Kurtosis		1.229	1.063

	Mean		59.3583	4.48609
	95% Confidence Interval for	Lower Bound	49.8482	
	Mean	Upper Bound	68.8684	
	5% Trimmed Mean		59.8930	
	Median		63.6364	
	Variance		342.124	
minecraft questions score	Std. Deviation		18.49661	
	Minimum		27.27	
	Maximum		81.82	
	Range		54.55	
	Interquartile Range		31.82	
	Skewness		-.174	.550
	Kurtosis		-1.414	1.063
	Mean		59.5588	4.85656
	95% Confidence Interval for	Lower Bound	49.2634	
	Mean	Upper Bound	69.8543	
	5% Trimmed Mean		59.9265	
	Median		62.5000	
	Variance		400.965	
normal questions score	Std. Deviation		20.02411	
	Minimum		25.00	
	Maximum		87.50	
	Range		62.50	
	Interquartile Range		37.50	
	Skewness		.124	.550
	Kurtosis		-1.014	1.063

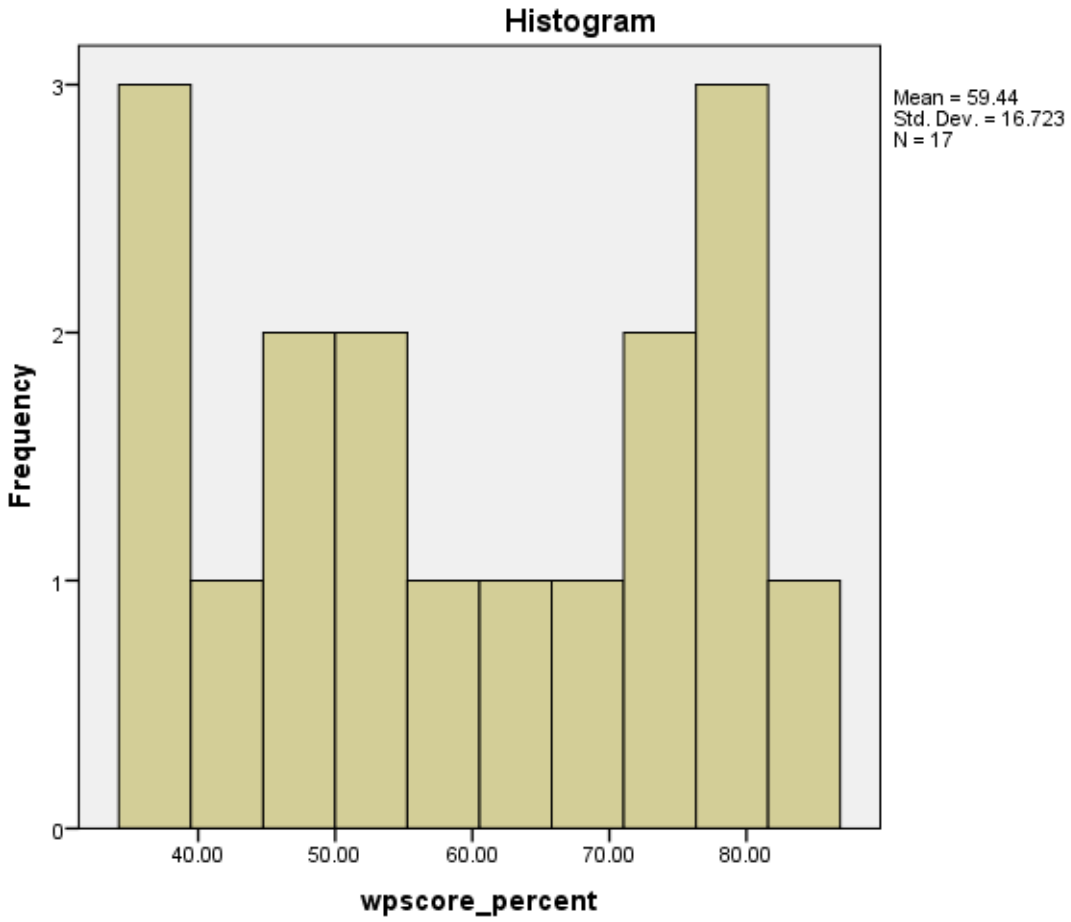
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
wpscore_percent	.156	17	.200*	.909	17	.096
NVR_percent	.280	17	.001	.848	17	.010
minecraft questions score	.186	17	.122	.901	17	.071
normal questions score	.154	17	.200*	.914	17	.119

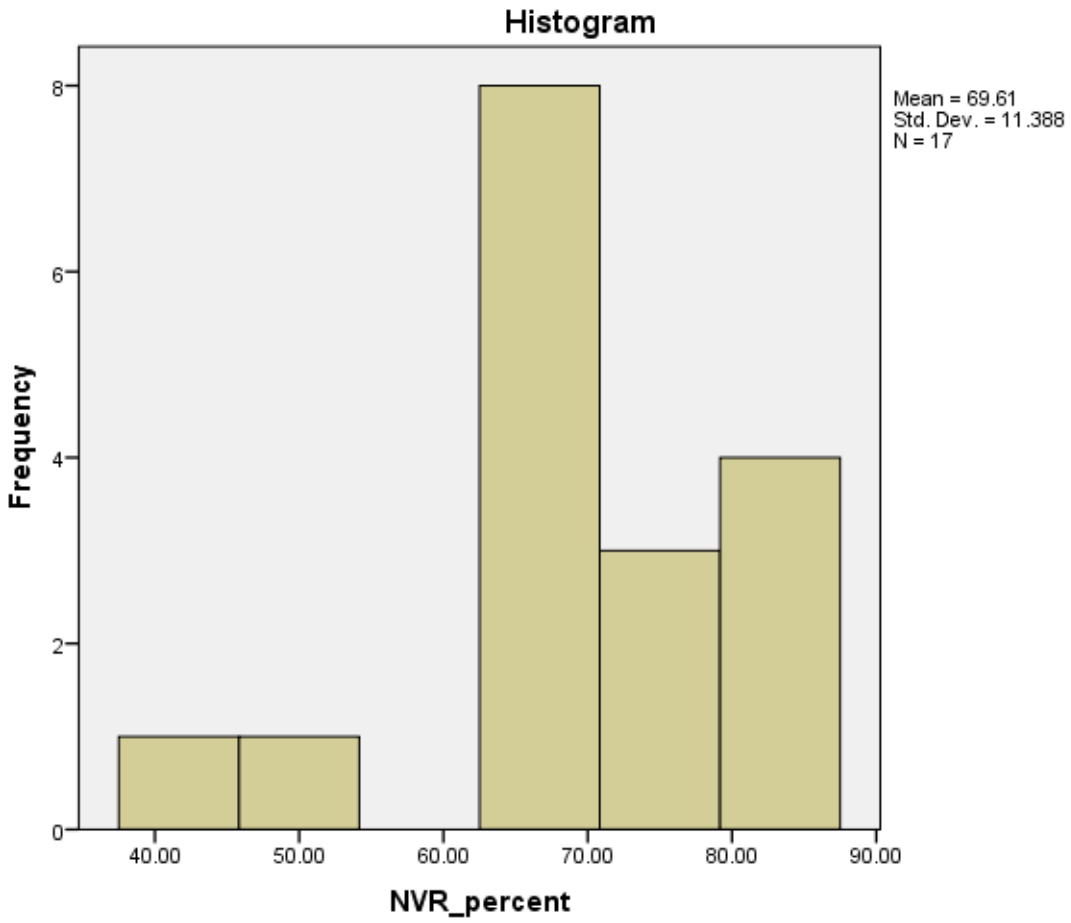
*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

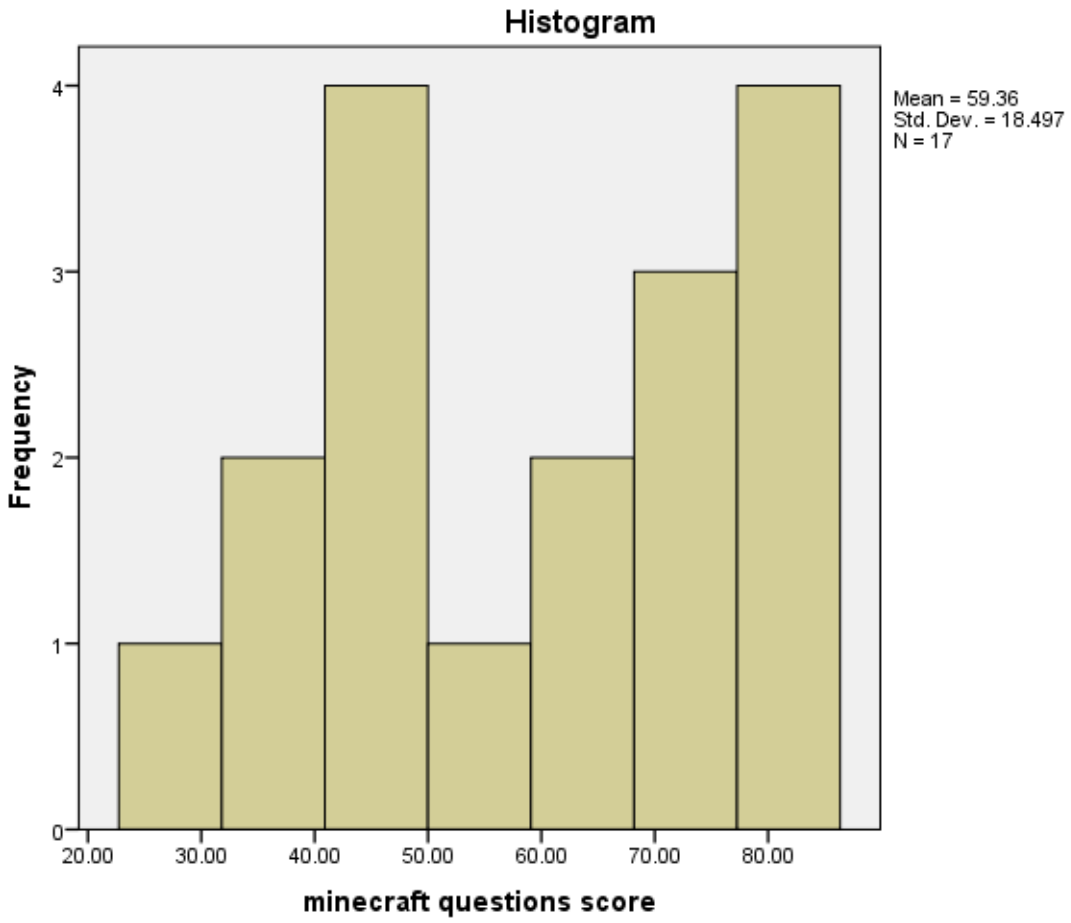
wpscore_percent


Histogram
Mean = 59.44
Std. Dev. = 16.723
N = 17
Frequency
0
1
2
3
40.00
50.00
60.00
70.00
80.00
wpscore_percent

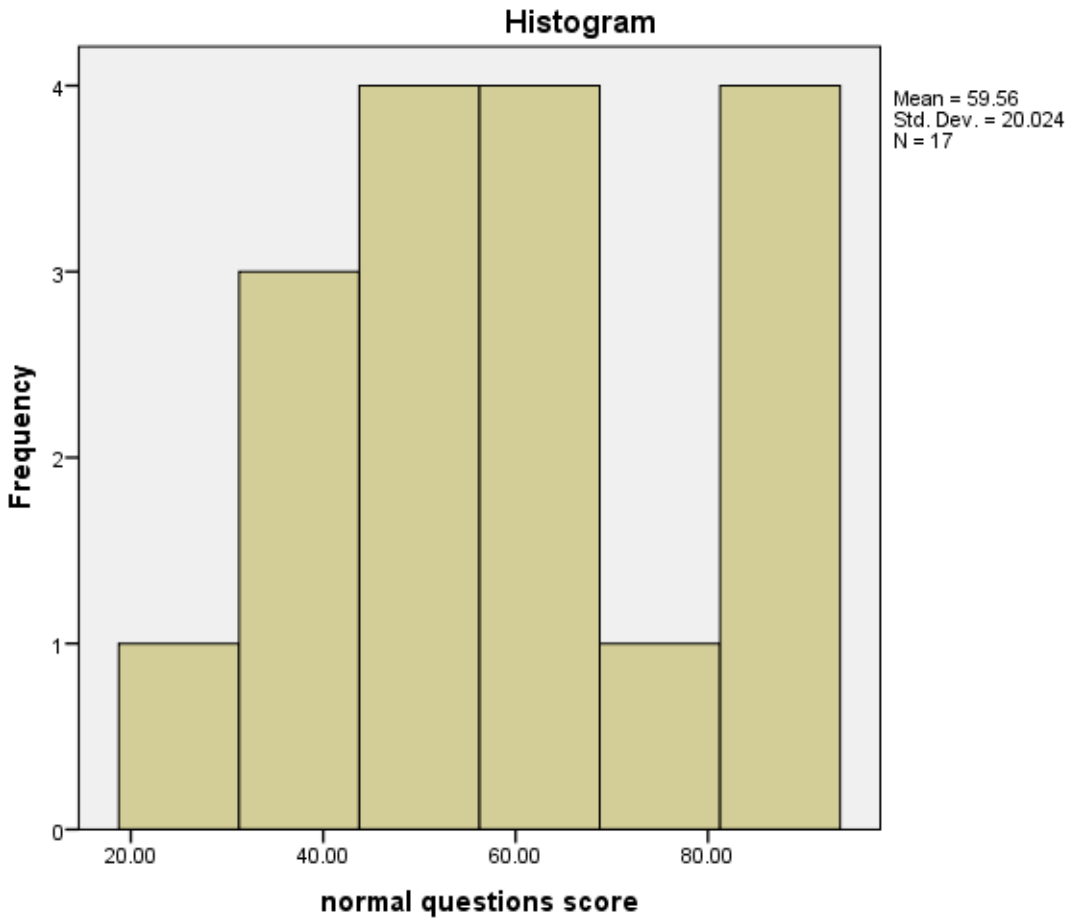
NVR_percent



minecraft questions score



normal questions score


Histogram
Mean = 59.56
Std. Dev. = 20.024
N = 17
Frequency
0
1
2
3
4
20.00
40.00
60.00
80.00
normal questions score

Descriptive Statistics on those who play video games

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
wpscore_percent	59	100.0%	0	0.0%	59	100.0%
NVR_percent	59	100.0%	0	0.0%	59	100.0%
minecraft questions score	59	100.0%	0	0.0%	59	100.0%
normal questions score	59	100.0%	0	0.0%	59	100.0%

Descriptives

			Statistic	Std. Error
wpscore_percent	Mean		63.1579	2.49012
	95% Confidence Interval for Mean	Lower Bound	58.1734	
		Upper Bound	68.1424	
	5% Trimmed Mean		63.8517	
	Median		68.4211	
	Variance		365.842	
	Std. Deviation		19.12700	
	Minimum		5.26	
	Maximum		100.00	
	Range		94.74	
	Interquartile Range		21.05	
	Skewness		-.607	.311
	Kurtosis		.629	.613
NVR_percent	Mean		66.6667	2.17915
	95% Confidence Interval for Mean	Lower Bound	62.3046	
		Upper Bound	71.0287	
	5% Trimmed Mean		66.8236	
	Median		66.6667	
	Variance		280.172	
	Std. Deviation		16.73835	
	Minimum		25.00	
	Maximum		100.00	
	Range		75.00	
	Interquartile Range		16.67	
	Skewness		-.145	.311
	Kurtosis		-.082	.613

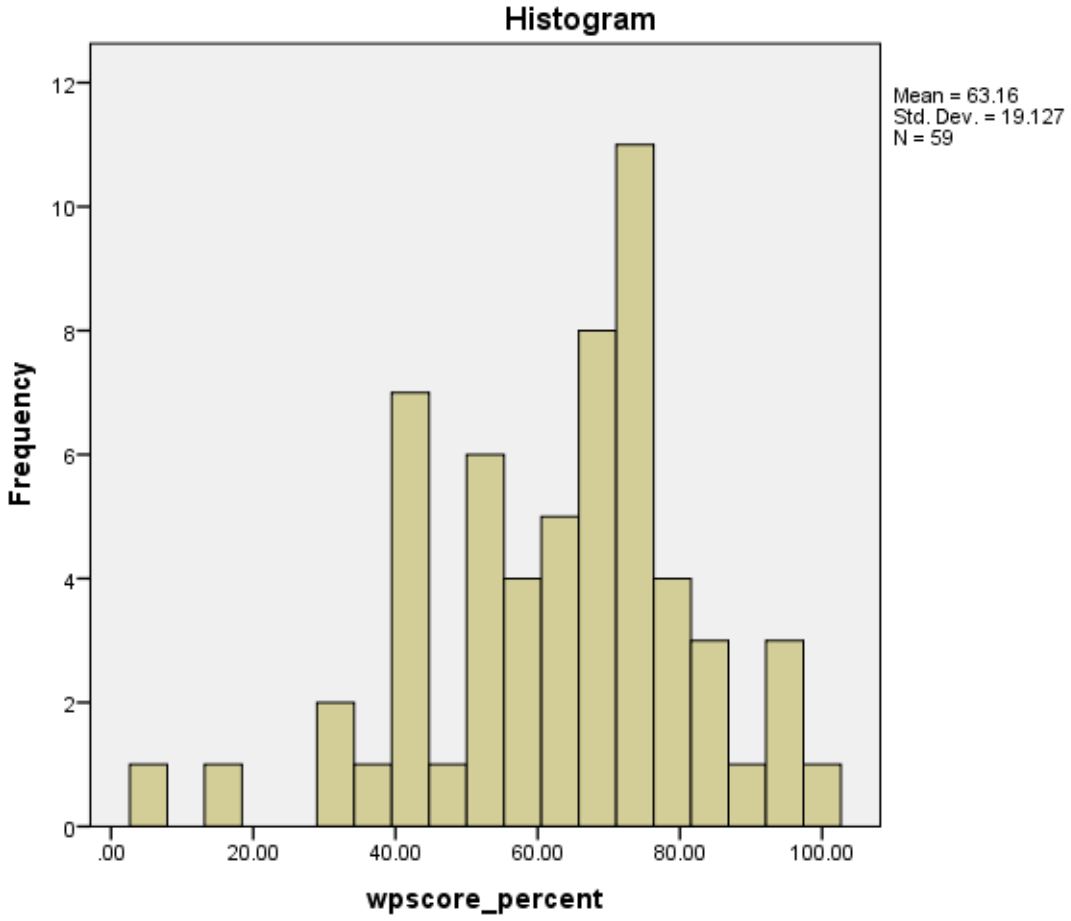
	Mean		65.7935	2.80023
	95% Confidence Interval for Mean	Lower Bound	60.1883	
		Upper Bound	71.3988	
	5% Trimmed Mean		67.0519	
	Median		72.7273	
	Variance		462.636	
minecraft questions score	Std. Deviation		21.50898	
	Minimum		.00	
	Maximum		100.00	
	Range		100.00	
	Interquartile Range		27.27	
	Skewness		-.997	.311
	Kurtosis		.907	.613
	Mean		59.5339	3.18866
	95% Confidence Interval for Mean	Lower Bound	53.1511	
		Upper Bound	65.9167	
	5% Trimmed Mean		60.3696	
	Median		62.5000	
	Variance		599.887	
normal questions score	Std. Deviation		24.49259	
	Minimum		.00	
	Maximum		100.00	
	Range		100.00	
	Interquartile Range		25.00	
	Skewness		-.438	.311
	Kurtosis		-.127	.613

Tests of Normality

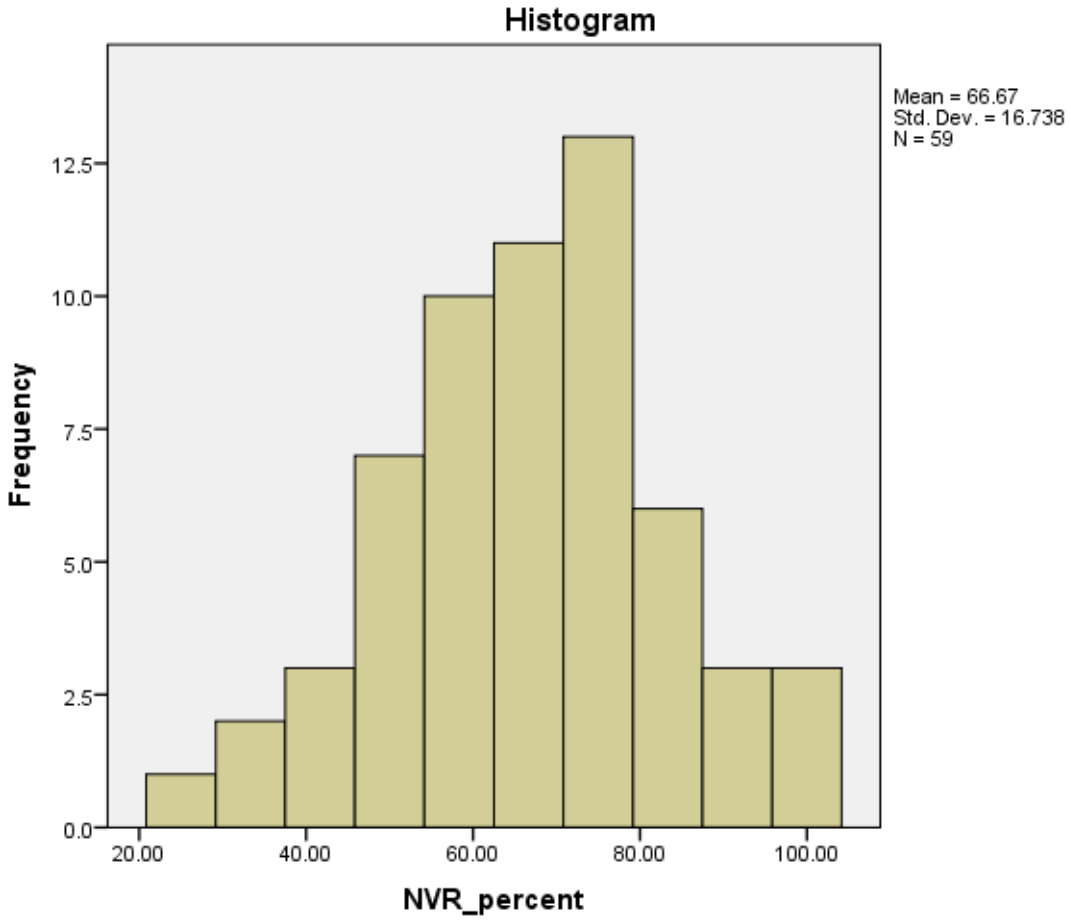
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
wpscore_percent	.134	59	.010	.963	59	.070
NVR_percent	.114	59	.053	.972	59	.199
minecraft questions score	.203	59	.000	.917	59	.001
normal questions score	.124	59	.024	.956	59	.033

a. Lilliefors Significance Correction

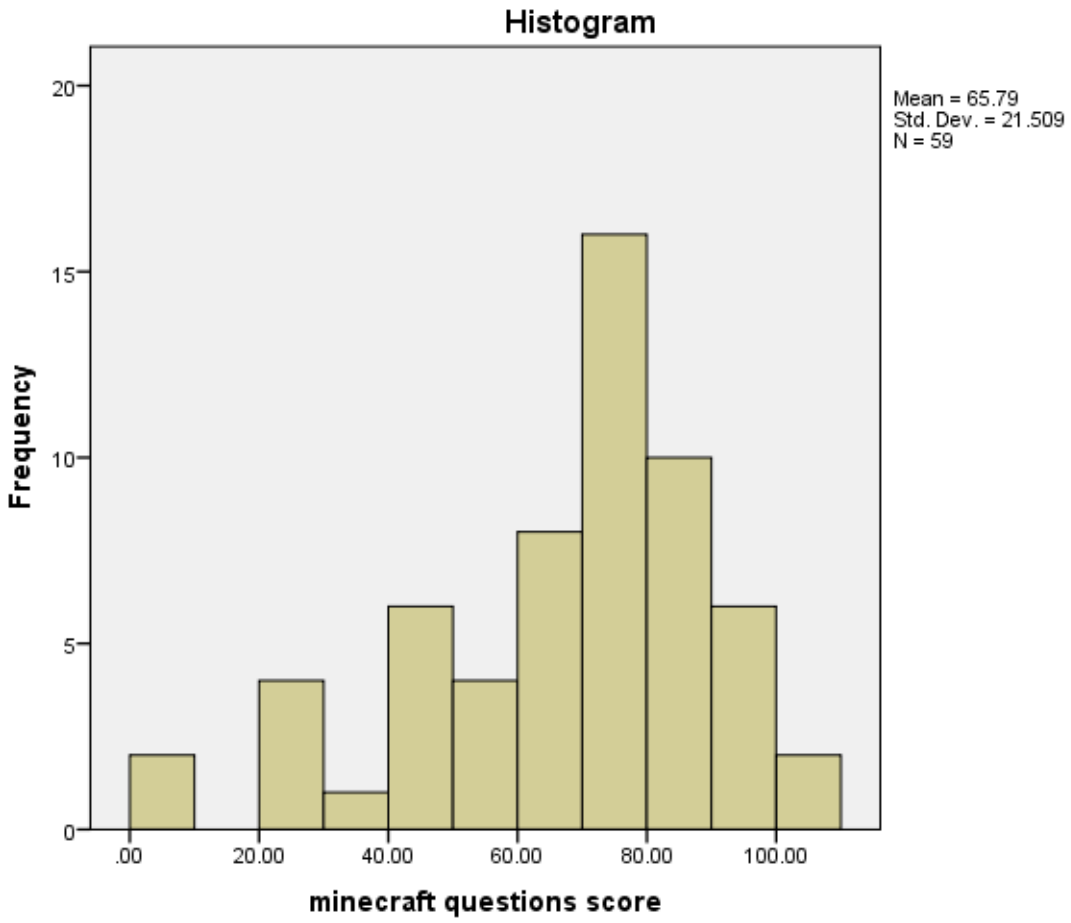
wpscore_percent


Histogram
Mean = 63.16
Std. Dev. = 19.127
N = 59
Frequency
wpscore_percent
0
2
4
6
8
10
12
.00
20.00
40.00
60.00
80.00
100.00

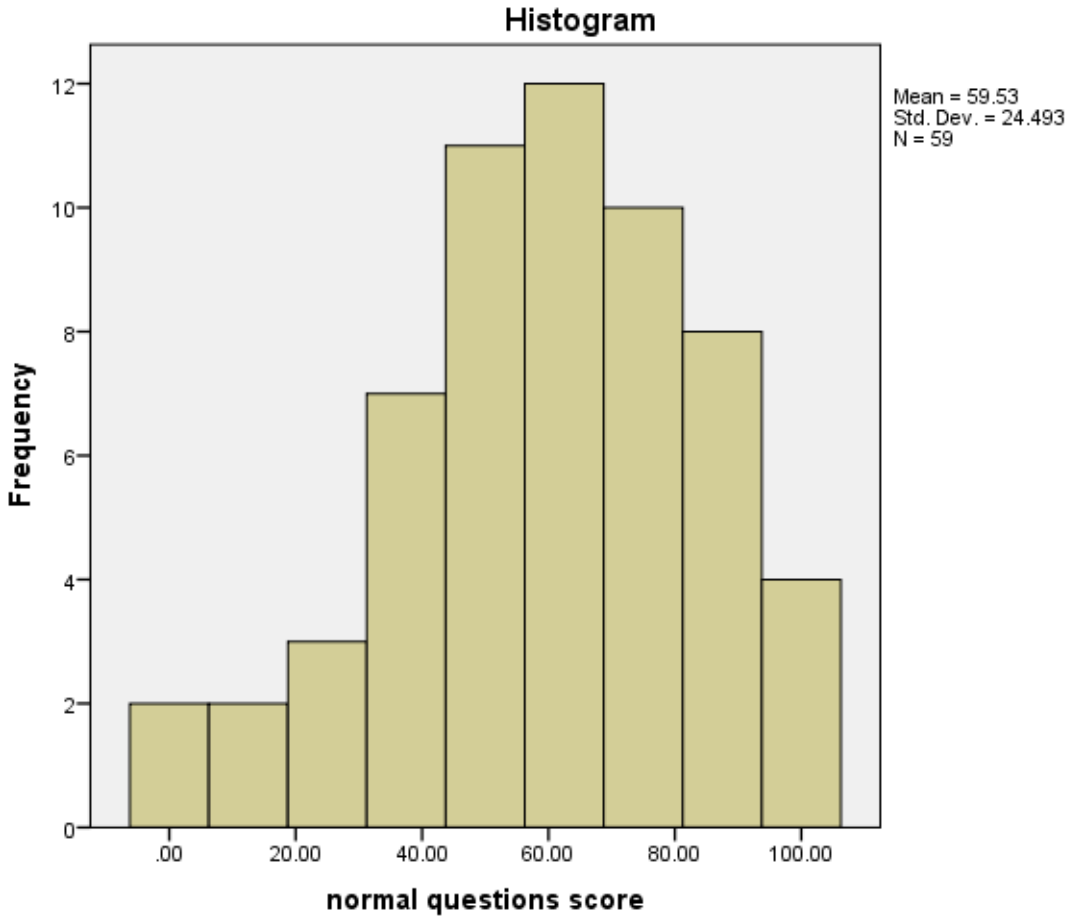
NVR_percent



minecraft questions score



normal questions score


Histogram
Mean = 59.53
Std. Dev. = 24.493
N = 59
Frequency
0
2
4
6
8
10
12
.00
20.00
40.00
60.00
80.00
100.00
normal questions score

Descriptive Statistics on those who play Minecraft

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
total time per week spent playing minecraft	34	100.0%	0	0.0%	34	100.0%

Descriptives

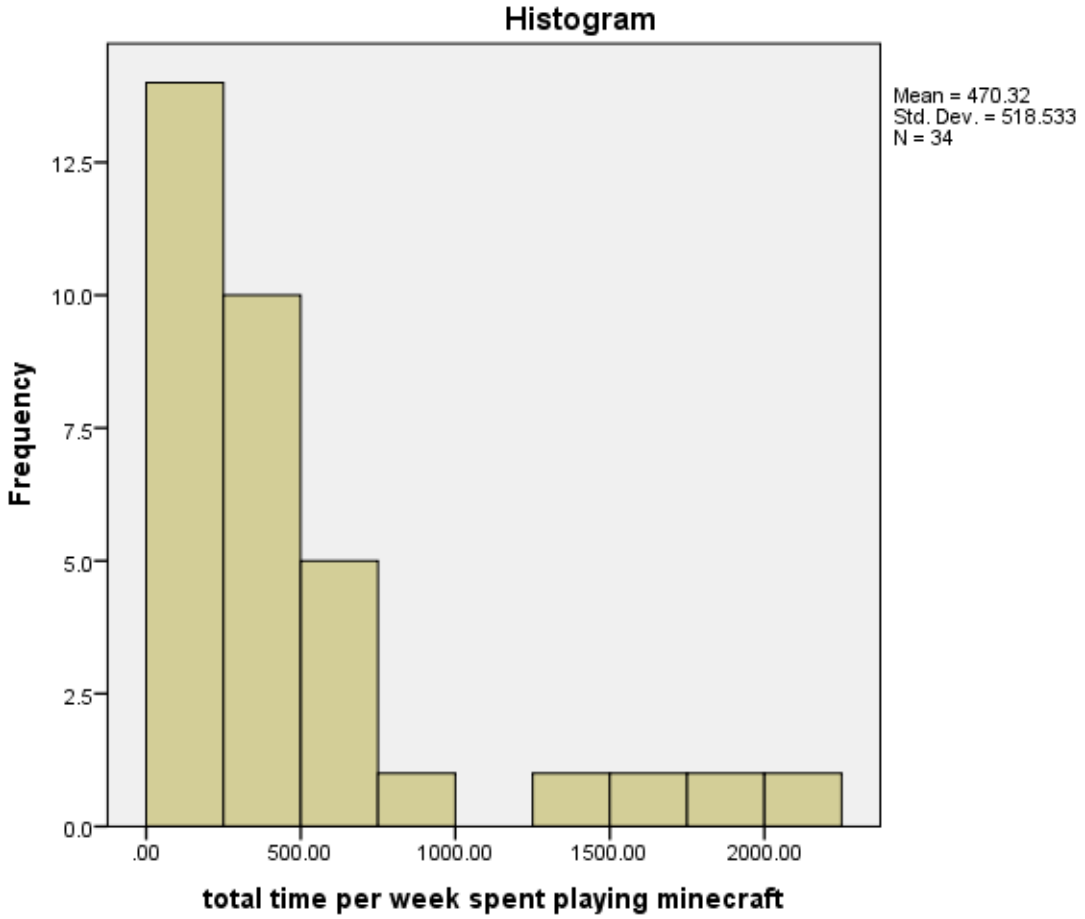
			Statistic	Std. Error
total time per week spent playing minecraft	Mean		470.3235	88.92776
	95% Confidence Interval for Mean	Lower Bound	289.3987	
		Upper Bound	651.2484	
	5% Trimmed Mean		413.4967	
	Median		300.0000	
	Variance		268876.953	
	Std. Deviation		518.53346	
	Minimum		3.00	
	Maximum		2040.00	
	Range		2037.00	
	Interquartile Range		438.75	
	Skewness		1.924	.403
	Kurtosis		3.014	.788

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
total time per week spent playing minecraft	.254	34	.000	.735	34	.000

a. Lilliefors Significance Correction

total time per week spent playing minecraft



Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
wpscore_percent	34	100.0%	0	0.0%	34	100.0%
NVR_percent	34	100.0%	0	0.0%	34	100.0%
minecraft questions score	34	100.0%	0	0.0%	34	100.0%
normal questions score	34	100.0%	0	0.0%	34	100.0%

Descriptives

			Statistic	Std. Error
wpscore_percent	Mean		62.0743	3.22611
	95% Confidence Interval for	Lower Bound	55.5107	

	Mean		Upper Bound	68.6379	
	5% Trimmed Mean			62.6419	
	Median			63.1579	
	Variance			353.865	
	Std. Deviation			18.81129	
	Minimum			5.26	
	Maximum			100.00	
	Range			94.74	
	Interquartile Range			21.05	
	Skewness			-.545	.403
	Kurtosis			1.423	.788
	Mean			63.9706	3.21924
	95% Confidence Interval for		Lower Bound	57.4210	
	Mean		Upper Bound	70.5202	
	5% Trimmed Mean			63.9434	
	Median			66.6667	
	Variance			352.359	
NVR_percent	Std. Deviation			18.77124	
	Minimum			25.00	
	Maximum			100.00	
	Range			75.00	
	Interquartile Range			25.00	
	Skewness			.075	.403
	Kurtosis			-.187	.788
	Mean			67.6471	3.60445
	95% Confidence Interval for		Lower Bound	60.3138	
	Mean		Upper Bound	74.9804	
	5% Trimmed Mean			68.9840	
	Median			72.7273	
	Variance			441.729	
minecraft questions score	Std. Deviation			21.01735	
	Minimum			.00	
	Maximum			100.00	
	Range			100.00	
	Interquartile Range			20.45	
	Skewness			-1.265	.403
	Kurtosis			2.316	.788
	Mean			54.4118	4.01515
	95% Confidence Interval for		Lower Bound	46.2429	
normal questions score	Mean		Upper Bound	62.5806	
	5% Trimmed Mean			54.9020	

	Median	50.0000	
	Variance	548.128	
	Std. Deviation	23.41214	
	Minimum	.00	
	Maximum	100.00	
	Range	100.00	
	Interquartile Range	37.50	
	Skewness	-.314	.403
	Kurtosis	-.164	.788

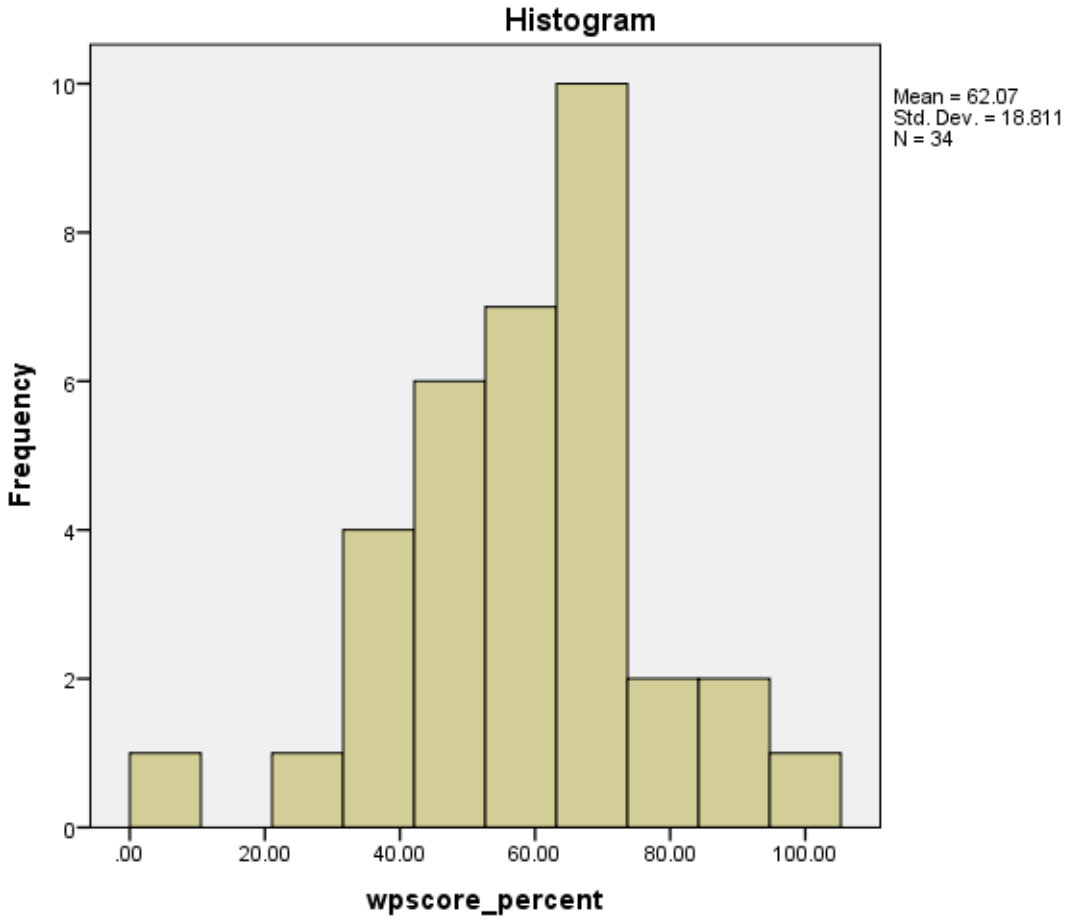
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
wpscore_percent	.121	34	.200*	.960	34	.236
NVR_percent	.119	34	.200*	.967	34	.384
minecraft questions score	.213	34	.000	.894	34	.003
normal questions score	.131	34	.148	.968	34	.397

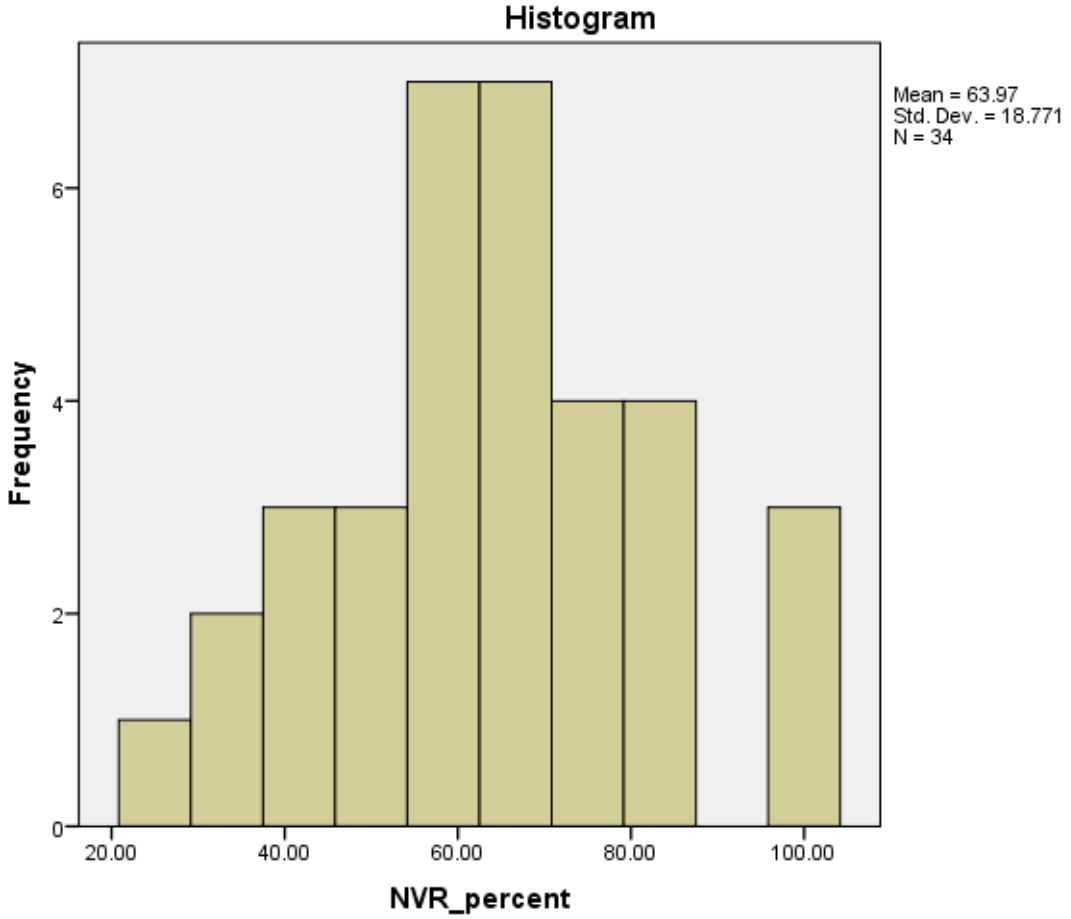
*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

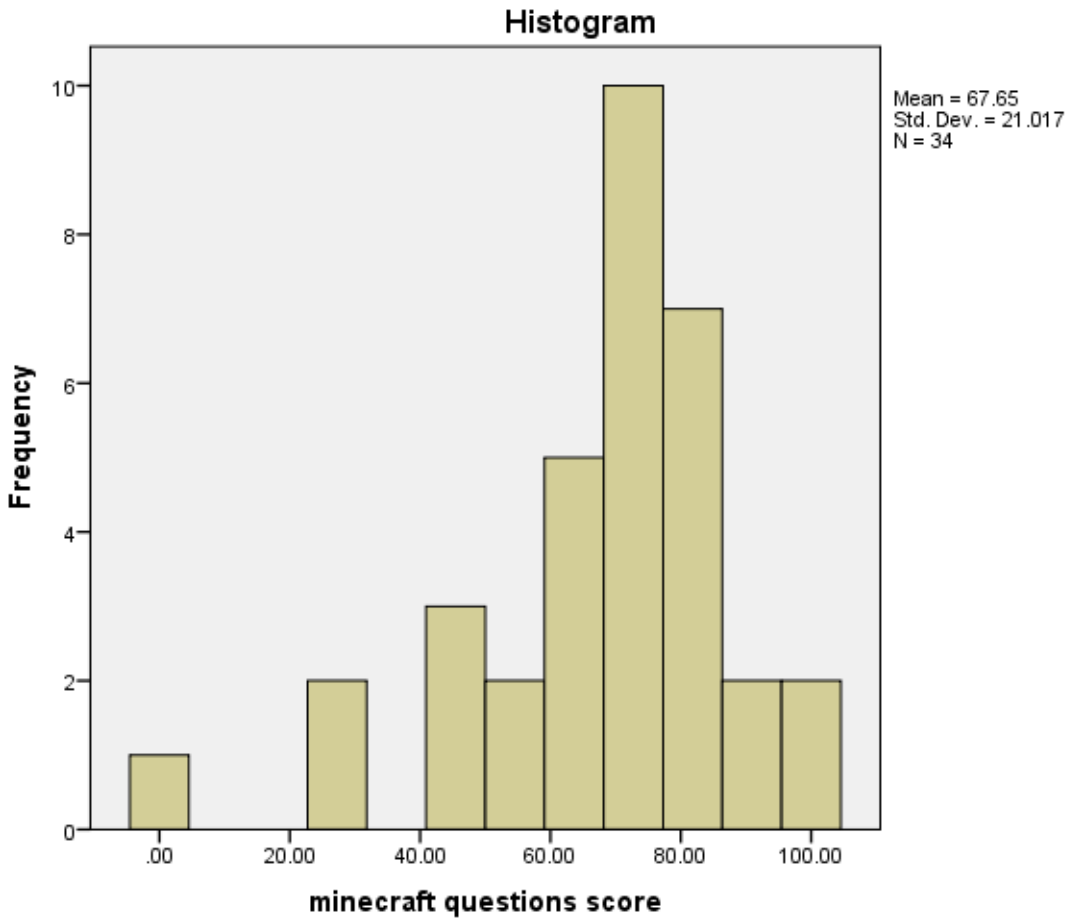
wpscore_percent


Histogram
Mean = 62.07
Std. Dev. = 18.811
N = 34
Frequency
0
2
4
6
8
10
.00
20.00
40.00
60.00
80.00
100.00
wpscore_percent

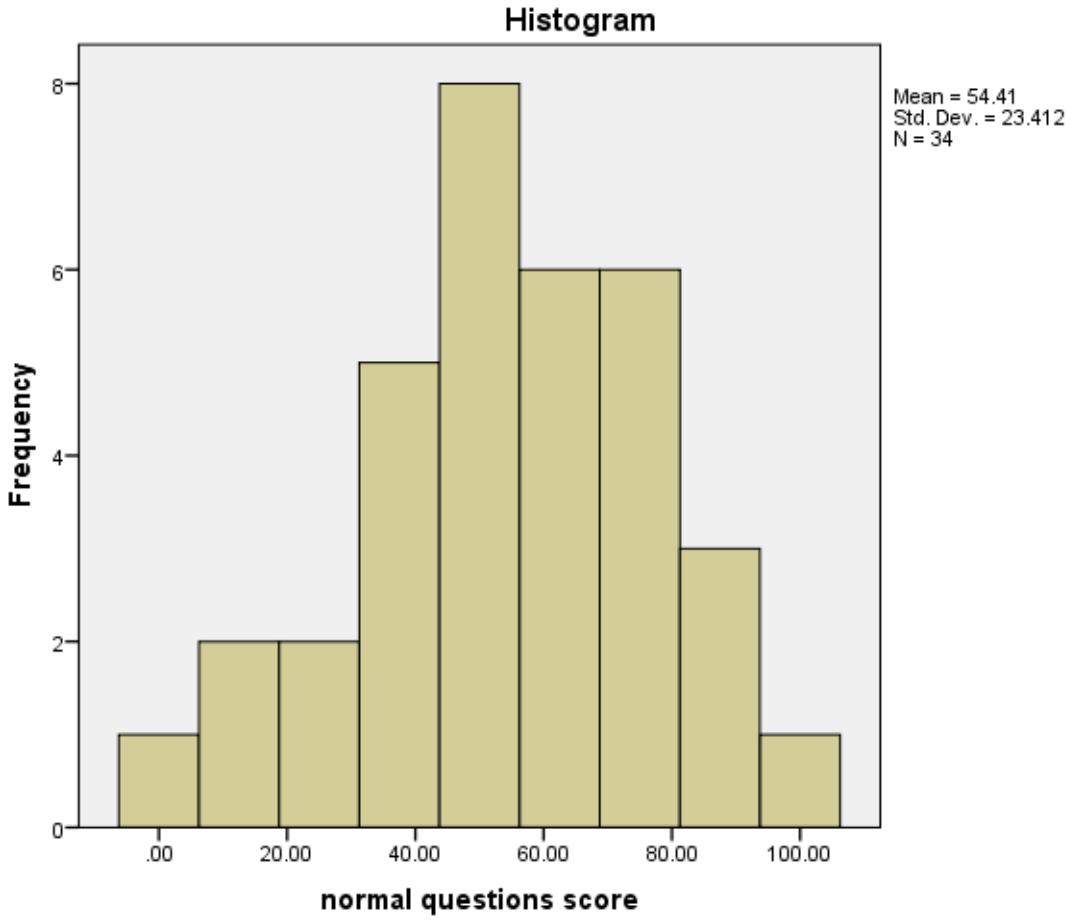
NVR_percent



minecraft questions score



normal questions score


Histogram
Mean = 54.41
Std. Dev. = 23.412
N = 34
Frequency
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2
4
6
8
.00
20.00
40.00
60.00
80.00
100.00
normal questions score

Descriptive Statistics on time spent playing Minecraft

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
How many hours per school day playing Minecraft (Mon-Thurs)	34	100.0%	0	0.0%	34	100.0%
How many hours per weekend day playing Minecraft (Fri-Sun)	34	100.0%	0	0.0%	34	100.0%
time spent playing minecraft on homework days	34	100.0%	0	0.0%	34	100.0%
time spent playing minecraft on non homeword days	34	100.0%	0	0.0%	34	100.0%
total time per week spent playing video games	34	100.0%	0	0.0%	34	100.0%

Descriptives

			Statistic	Std. Error
How many hours per school day playing Minecraft (Mon-Thurs)	Mean		51.03	10.997
	95% Confidence Interval for Mean	Lower Bound	28.66	
		Upper Bound	73.40	
	5% Trimmed Mean		43.37	
	Median		35.00	
	Variance		4111.787	
	Std. Deviation		64.123	
	Minimum		0	
	Maximum		240	
	Range		240	
	Interquartile Range		56	
	Skewness		2.003	.403
	Kurtosis		3.524	.788
How many hours per weekend day playing Minecraft (Fri-Sun)	Mean		88.74	16.485
	95% Confidence Interval for Mean	Lower Bound	55.20	
		Upper Bound	122.27	
	5% Trimmed Mean		78.59	
	Median		60.00	
	Variance		9239.776	

	Std. Deviation		96.124	
	Minimum		0	
	Maximum		360	
	Range		360	
	Interquartile Range		101	
	Skewness		1.610	.403
	Kurtosis		2.191	.788
	Mean		204.1176	43.98816
	95% Confidence Interval for Mean	Lower Bound	114.6231	
		Upper Bound	293.6122	
	5% Trimmed Mean		173.4641	
	Median		140.0000	
	Variance		65788.592	
time spent playing minecraft on homework days	Std. Deviation		256.49287	
	Minimum		.00	
	Maximum		960.00	
	Range		960.00	
	Interquartile Range		225.00	
	Skewness		2.003	.403
	Kurtosis		3.524	.788
	Mean		266.2059	49.45526
	95% Confidence Interval for Mean	Lower Bound	165.5884	
		Upper Bound	366.8234	
	5% Trimmed Mean		235.7843	
	Median		180.0000	
	Variance		83157.987	
time spent playing minecraft on non homeword days	Std. Deviation		288.37127	
	Minimum		.00	
	Maximum		1080.00	
	Range		1080.00	
	Interquartile Range		303.75	
	Skewness		1.610	.403
	Kurtosis		2.191	.788
	Mean		1071.6176	155.42804
	95% Confidence Interval for Mean	Lower Bound	755.3969	
		Upper Bound	1387.8384	
	5% Trimmed Mean		971.9608	
total time per week spent playing video games	Median		825.0000	
	Variance		821367.758	
	Std. Deviation		906.29342	
	Minimum		.00	
	Maximum		4320.00	

	Range	4320.00	
	Interquartile Range	900.00	
	Skewness	1.895	.403
	Kurtosis	4.388	.788

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
How many hours per school day playing Minecraft (Mon-Thurs)	.327	34	.000	.708	34	.000
How many hours per weekend day playing Minecraft (Fri-Sun)	.235	34	.000	.794	34	.000
time spent playing minecraft on homework days	.327	34	.000	.708	34	.000
time spent playing minecraft on non homeword days	.235	34	.000	.794	34	.000
total time per week spent playing video games	.229	34	.000	.823	34	.000

a. Lilliefors Significance Correction

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
total time per week spent playing minecraft	34	100.0%	0	0.0%	34	100.0%

Descriptives

			Statistic	Std. Error
total time per week spent playing minecraft	Mean		470.3235	88.92776
	95% Confidence Interval for Mean	Lower Bound	289.3987	
		Upper Bound	651.2484	
	5% Trimmed Mean		413.4967	
	Median		300.0000	
	Variance		268876.953	

	Std. Deviation	518.53346	
	Minimum	3.00	
	Maximum	2040.00	
	Range	2037.00	
	Interquartile Range	438.75	
	Skewness	1.924	.403
	Kurtosis	3.014	.788

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
total time per week spent playing minecraft	.254	34	.000	.735	34	.000

a. Lilliefors Significance Correction

total time per week spent playing minecraft

Correlations – Minecraft Players and Time Spent Playing

Descriptive Statistics

	Mean	Std. Deviation	N
total time per week spent playing minecraft	470.3235	518.53346	34
minecraft questions score	67.6471	21.01735	34
normal questions score	54.4118	23.41214	34

Correlations

		total time per week spent playing minecraft	minecraft questions score	normal questions score
total time per week spent playing minecraft	Pearson Correlation	1	.042	-.138
	Sig. (2-tailed)		.814	.435
	N	34	34	34
minecraft questions score	Pearson Correlation	.042	1	.453**
	Sig. (2-tailed)	.814		.007
	N	34	34	34
normal questions score	Pearson Correlation	-.138	.453**	1
	Sig. (2-tailed)	.435	.007	
	N	34	34	34

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			total time per week spent playing minecraft	minecraft questions score	normal ques score
Spearman's rho	total time per week spent playing minecraft	Correlation Coefficient	1.000	-.162	
		Sig. (2-tailed)	.	.361	
		N	34	34	
	minecraft questions score	Correlation Coefficient	-.162	1.000	
		Sig. (2-tailed)	.361	.	
		N	34	34	
	normal questions score	Correlation Coefficient	-.267	.441**	
		Sig. (2-tailed)	.127	.009	

	N	34	34

**. Correlation is significant at the 0.01 level (2-tailed).

Nonparametric Correlations

Correlations

			How many hours per school day playing Minecraft (Mon-Thurs)	How many hours per weekend day playing Minecraft (Fri-Sun)
Spearman's rho	How many hours per school day playing Minecraft (Mon-Thurs)	Correlation Coefficient	1.000	.463**
		Sig. (2-tailed)	.	.006
		N	34	34
	How many hours per weekend day playing Minecraft (Fri-Sun)	Correlation Coefficient	.463**	1.000
		Sig. (2-tailed)	.006	.
		N	34	34
	minecraft questions score	Correlation Coefficient	-.073	-.189
		Sig. (2-tailed)	.681	.285
		N	34	34
	normal questions score	Correlation Coefficient	-.139	-.295
		Sig. (2-tailed)	.432	.091
		N	34	34
	total time per week spent playing minecraft	Correlation Coefficient	.794**	.884**
		Sig. (2-tailed)	.000	.000
		N	34	34
	wpscore_percent	Correlation Coefficient	-.139	-.324
		Sig. (2-tailed)	.434	.062
		N	34	34
	NVR_percent	Correlation Coefficient	.068	.208
		Sig. (2-tailed)	.701	.238
		N	34	34

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Difference between those who play Minecraft and do not play Minecraft

T-Test

Group Statistics

	I don't play Minecraft	N	Mean	Std. Deviation	Std. Error Mean
wpscore_percent	Play	34	62.0743	18.81129	3.22611
	Don't play	42	62.5313	18.60634	2.87102
NVR_percent	Play	34	63.9706	18.77124	3.21924
	Don't play	42	70.0397	12.21692	1.88511

Independent Samples Test

		Levene's Test for Equality of Variances			
		F	Sig.	t	df
wpscore_percent	Equal variances assumed	.197	.659	-.106	74
	Equal variances not assumed			-.106	70.419
NVR_percent	Equal variances assumed	5.122	.027	-1.699	74
	Equal variances not assumed			-1.627	54.366

```
NPAR TESTS
  /M-W= minecraftqs normalqs BY cq5c(0 1)
  /MISSING ANALYSIS.
```

NPar Tests

Mann-Whitney Test

Ranks

	I don't play Minecraft	N	Mean Rank	Sum of Ranks
minecraft questions score	Play	34	42.07	1430.50
	Don't play	42	35.61	1495.50
	Total	76		
normal questions score	Play	34	33.82	1150.00
	Don't play	42	42.29	1776.00
	Total	76		

Test Statistics[a]

	minecraft questions score	normal questions score
Mann-Whitney U	592.500	555.000
Wilcoxon W	1495.500	1150.000
Z	-1.287	-1.683
Asymp. Sig. (2-tailed)	.198	.092

a. Grouping Variable: I don't play Minecraft

Descriptive Statistics on those who play video games

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
wpscore_percent	59	100.0%	0	0.0%	59	100.0%
NVR_percent	59	100.0%	0	0.0%	59	100.0%
minecraft questions score	59	100.0%	0	0.0%	59	100.0%
normal questions score	59	100.0%	0	0.0%	59	100.0%

Descriptives

			Statistic	Std. Error
wpscore_percent	Mean		63.1579	2.49012
	95% Confidence Interval for Mean	Lower Bound	58.1734	
		Upper Bound	68.1424	
	5% Trimmed Mean		63.8517	
	Median		68.4211	
	Variance		365.842	
	Std. Deviation		19.12700	
	Minimum		5.26	
	Maximum		100.00	
	Range		94.74	
	Interquartile Range		21.05	
	Skewness		-.607	.311
	Kurtosis		.629	.613
NVR_percent	Mean		66.6667	2.17915
	95% Confidence Interval for Mean	Lower Bound	62.3046	
		Upper Bound	71.0287	
	5% Trimmed Mean		66.8236	
	Median		66.6667	
	Variance		280.172	
	Std. Deviation		16.73835	
	Minimum		25.00	
	Maximum		100.00	
	Range		75.00	
	Interquartile Range		16.67	
	Skewness		-.145	.311
	Kurtosis		-.082	.613
minecraft questions score	Mean		65.7935	2.80023

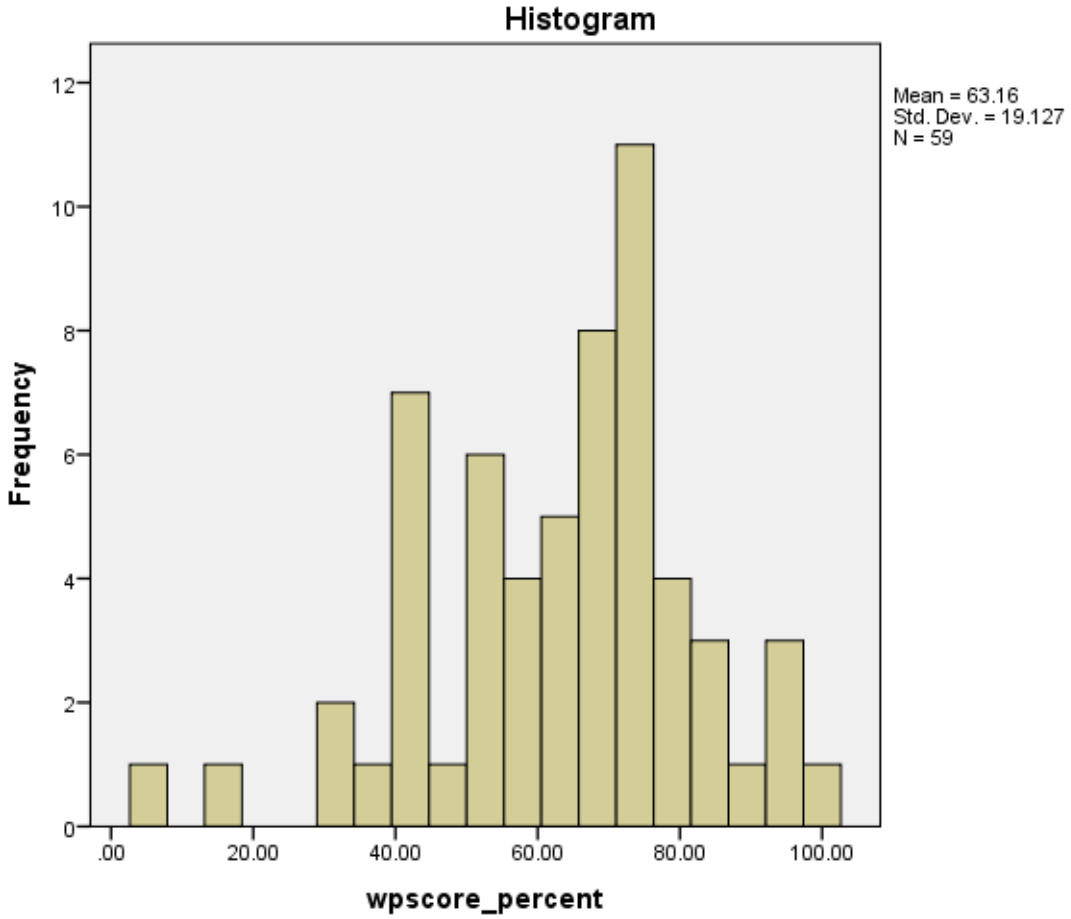
	95% Confidence Interval for Mean	Lower Bound	60.1883	
		Upper Bound	71.3988	
	5% Trimmed Mean		67.0519	
	Median		72.7273	
	Variance		462.636	
	Std. Deviation		21.50898	
	Minimum		.00	
	Maximum		100.00	
	Range		100.00	
	Interquartile Range		27.27	
	Skewness		-.997	.311
	Kurtosis		.907	.613
normal questions score	Mean		59.5339	3.18866
	95% Confidence Interval for Mean	Lower Bound	53.1511	
		Upper Bound	65.9167	
	5% Trimmed Mean		60.3696	
	Median		62.5000	
	Variance		599.887	
	Std. Deviation		24.49259	
	Minimum		.00	
	Maximum		100.00	
	Range		100.00	
	Interquartile Range		25.00	
	Skewness		-.438	.311
	Kurtosis		-.127	.613

Tests of Normality

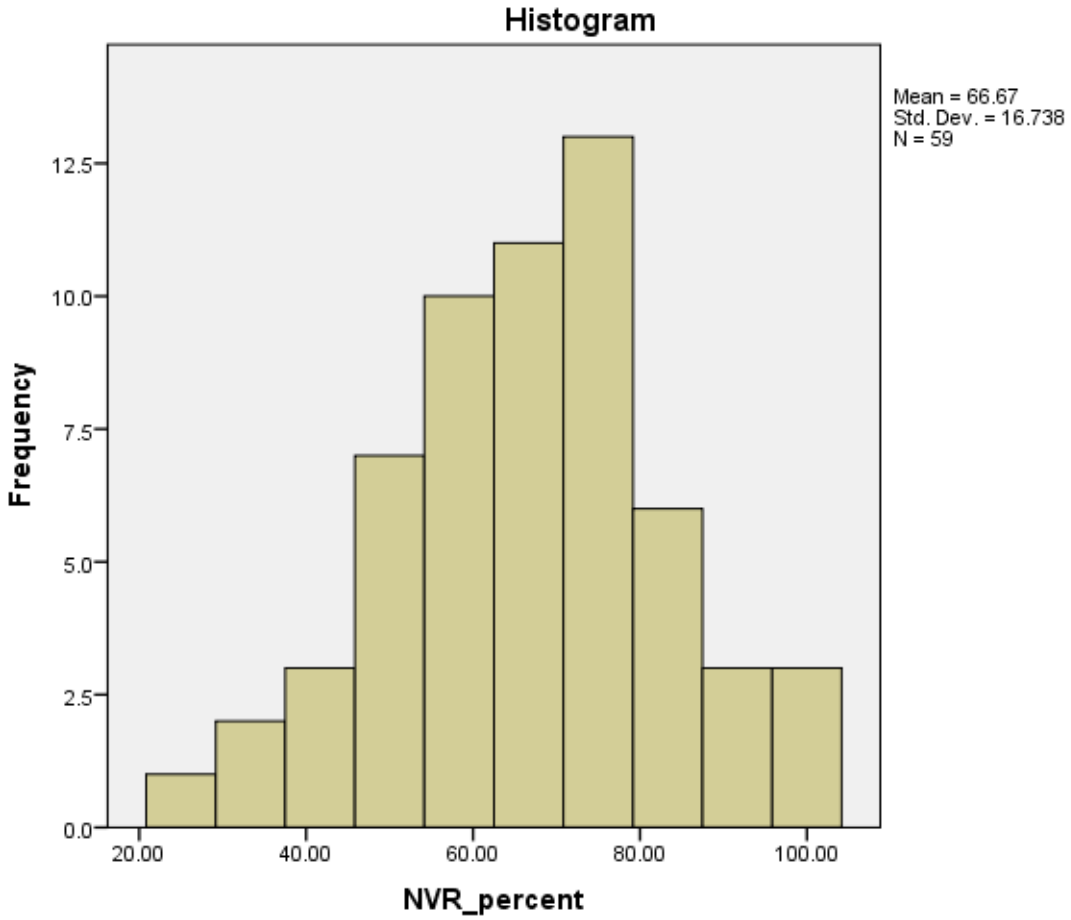
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
wpscore_percent	.134	59	.010	.963	59	.070
NVR_percent	.114	59	.053	.972	59	.199
minecraft questions score	.203	59	.000	.917	59	.001
normal questions score	.124	59	.024	.956	59	.033

a. Lilliefors Significance Correction

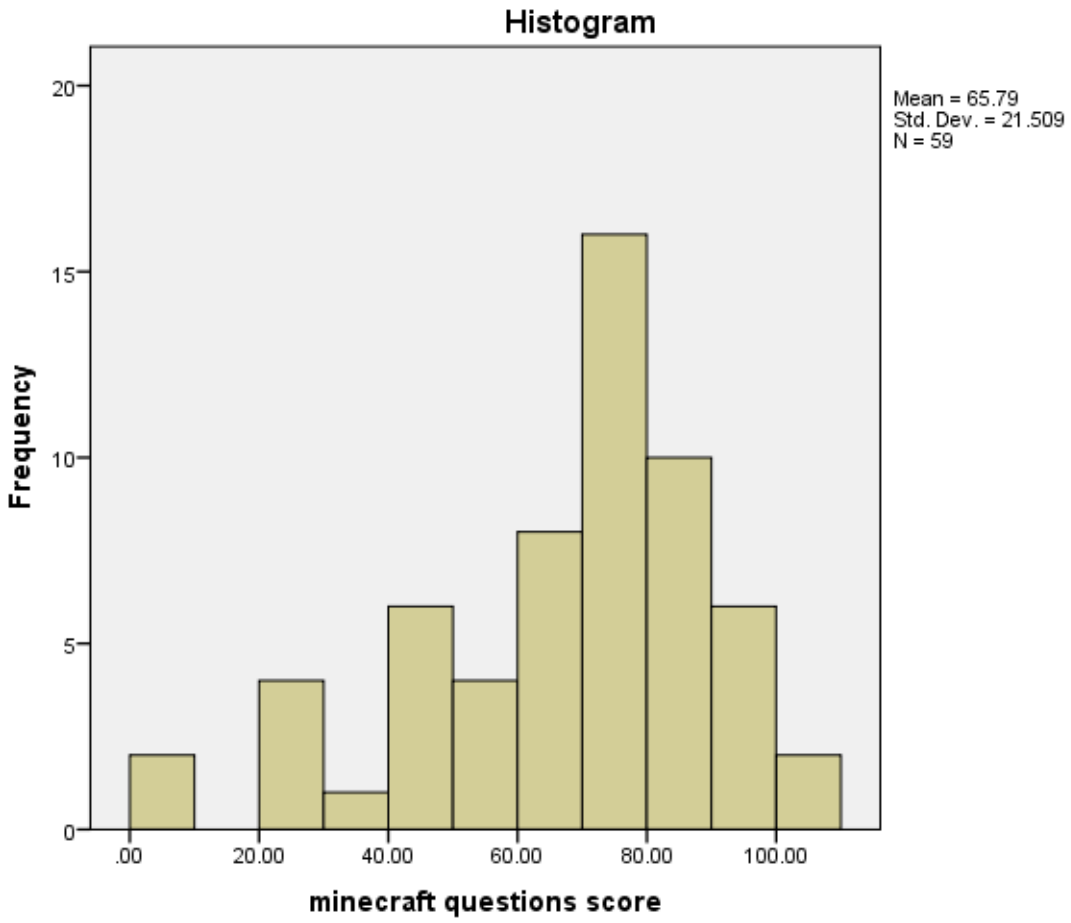
wpscore_percent


Histogram
Mean = 63.16
Std. Dev. = 19.127
N = 59
Frequency
wpscore_percent
0
2
4
6
8
10
12
.00
20.00
40.00
60.00
80.00
100.00

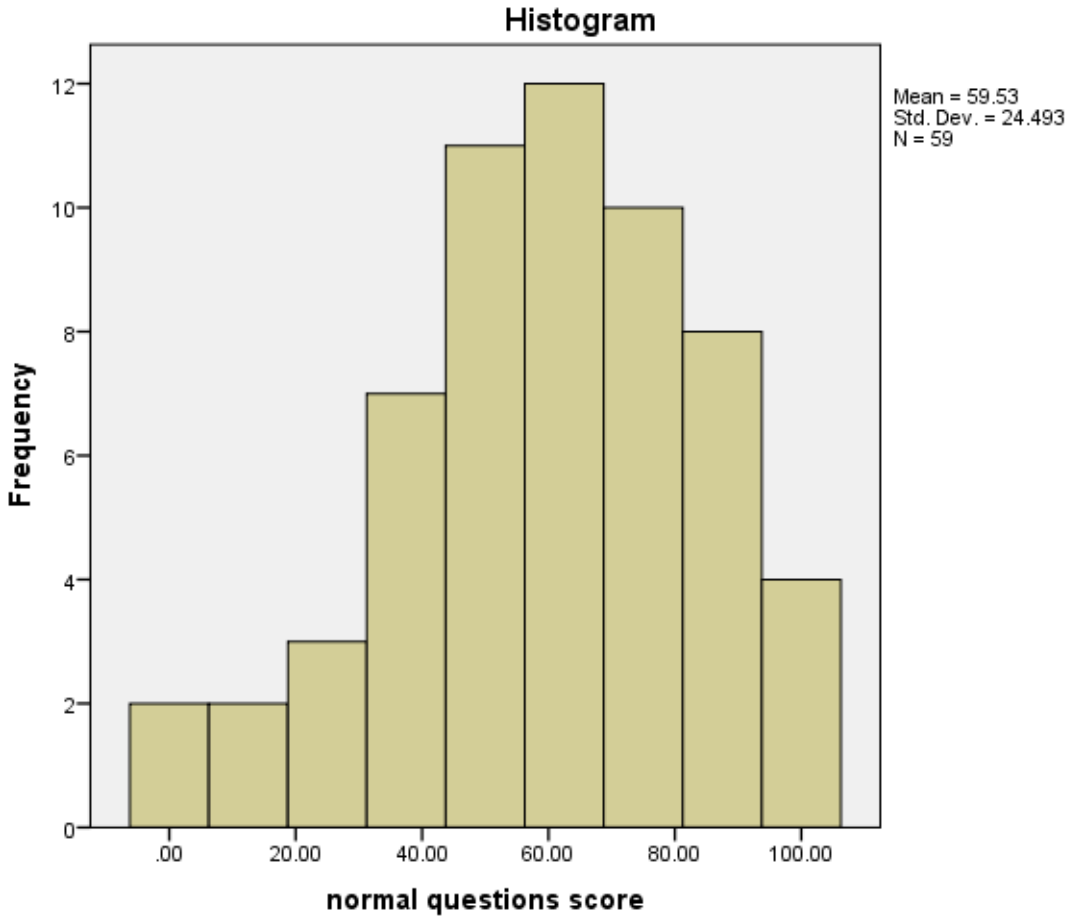
NVR_percent



minecraft questions score



normal questions score



I don't play video games

Case Processing Summary

	I don't play video games	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	P
minecraft questions score	Play	59	100.0%	0	0.0%	59	
	Don't play	17	100.0%	0	0.0%	17	
normal questions score	Play	59	100.0%	0	0.0%	59	
	Don't play	17	100.0%	0	0.0%	17	
wpscore_percent	Play	59	100.0%	0	0.0%	59	
	Don't play	17	100.0%	0	0.0%	17	
NVR_percent	Play	59	100.0%	0	0.0%	59	
	Don't play	17	100.0%	0	0.0%	17	

Descriptives

	I don't play video games		Statistic	Std. Error
minecraft questions score	Play	Mean	65.7935	2.80023

		95% Confidence Interval for Mean	Lower Bound	60.1883	
			Upper Bound	71.3988	
		5% Trimmed Mean		67.0519	
		Median		72.7273	
		Variance		462.636	
		Std. Deviation		21.50898	
		Minimum		.00	
		Maximum		100.00	
		Range		100.00	
		Interquartile Range		27.27	
		Skewness		-.997	.311
		Kurtosis		.907	.613
	Don't play	Mean		59.3583	4.48609
		95% Confidence Interval for Mean	Lower Bound	49.8482	
			Upper Bound	68.8684	
		5% Trimmed Mean		59.8930	
		Median		63.6364	
		Variance		342.124	
		Std. Deviation		18.49661	
		Minimum		27.27	
		Maximum		81.82	
		Range		54.55	
		Interquartile Range		31.82	
		Skewness		-.174	.550
		Kurtosis		-1.414	1.063
	Play	Mean		59.5339	3.18866
		95% Confidence Interval for Mean	Lower Bound	53.1511	
			Upper Bound	65.9167	
		5% Trimmed Mean		60.3696	
		Median		62.5000	
		Variance		599.887	
		Std. Deviation		24.49259	
normal questions score		Minimum		.00	
		Maximum		100.00	
		Range		100.00	
		Interquartile Range		25.00	
		Skewness		-.438	.311
		Kurtosis		-.127	.613
	Don't play	Mean		59.5588	4.85656
		95% Confidence Interval for	Lower Bound	49.2634	

		Mean	Upper Bound	69.8543	
		5% Trimmed Mean		59.9265	
		Median		62.5000	
		Variance		400.965	
		Std. Deviation		20.02411	
		Minimum		25.00	
		Maximum		87.50	
		Range		62.50	
		Interquartile Range		37.50	
		Skewness		.124	.550
		Kurtosis		-1.014	1.063
		Mean		63.1579	2.49012
		95% Confidence Interval for	Lower Bound	58.1734	
		Mean	Upper Bound	68.1424	
		5% Trimmed Mean		63.8517	
		Median		68.4211	
		Variance		365.842	
	Play	Std. Deviation		19.12700	
		Minimum		5.26	
		Maximum		100.00	
		Range		94.74	
		Interquartile Range		21.05	
		Skewness		-.607	.311
		Kurtosis		.629	.613
wpscore_percent		Mean		59.4427	4.05590
		95% Confidence Interval for	Lower Bound	50.8446	
		Mean	Upper Bound	68.0409	
		5% Trimmed Mean		59.3223	
		Median		57.8947	
		Variance		279.656	
	Don't play	Std. Deviation		16.72292	
		Minimum		36.84	
		Maximum		84.21	
		Range		47.37	
		Interquartile Range		31.58	
		Skewness		.000	.550
		Kurtosis		-1.539	1.063
		Mean		66.6667	2.17915
		95% Confidence Interval for	Lower Bound	62.3046	
NVR_percent	Play	Mean	Upper Bound	71.0287	
		5% Trimmed Mean		66.8236	
		Median		66.6667	

		Variance		280.172	
		Std. Deviation		16.73835	
		Minimum		25.00	
		Maximum		100.00	
		Range		75.00	
		Interquartile Range		16.67	
		Skewness		-.145	.311
		Kurtosis		-.082	.613
		Mean		69.6078	2.76211
		95% Confidence Interval for Mean	Lower Bound	63.7524	
			Upper Bound	75.4633	
		5% Trimmed Mean		70.3976	
		Median		66.6667	
		Variance		129.698	
	Don't play	Std. Deviation		11.38849	
		Minimum		41.67	
		Maximum		83.33	
		Range		41.67	
		Interquartile Range		12.50	
		Skewness		-.899	.550
		Kurtosis		1.229	1.063

Differences between those who play video games and those who do not

T-Test

Group Statistics

	I don't play video games	N	Mean	Std. Deviation	Std. Error Mean
NVR_percent	Play	59	66.6667	16.73835	2.17915
	Don't play	17	69.6078	11.38849	2.76211

Independent Samples Test

		Levene's Test for Equality of Variances				
		F	Sig.	t	df	Sig.
NVR_percent	Equal variances assumed	2.921	.092	-.679	74	
	Equal variances not assumed			-.836	38.050	

NPar Tests

Mann-Whitney Test

Ranks

	I don't play video games	N	Mean Rank	Sum of Ranks
wpscore_percent	Play	59	39.54	2333.00
	Don't play	17	34.88	593.00
	Total	76		
minecraft questions score	Play	59	40.27	2376.00
	Don't play	17	32.35	550.00
	Total	76		
normal questions score	Play	59	38.78	2288.00
	Don't play	17	37.53	638.00
	Total	76		

Test Statistics[a]

	wpscore_percent	minecraft questions score	normal questions score
Mann-Whitney U	440.000	397.000	485.000
Wilcoxon W	593.000	550.000	638.000
Z	-.771	-1.321	-.208
Asymp. Sig. (2-tailed)	.441	.187	.835

a. Grouping Variable: I don't play video games

Descriptive Statistics on time spent playing video games

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
How many hours per school day playing video games (Mon-Thurs)	59	100.0%	0	0.0%	59	100.0%
How many hours per weekend day playing video games (Fri-Sun)	59	100.0%	0	0.0%	59	100.0%
total time per week spent playing video games	59	100.0%	0	0.0%	59	100.0%

Descriptives

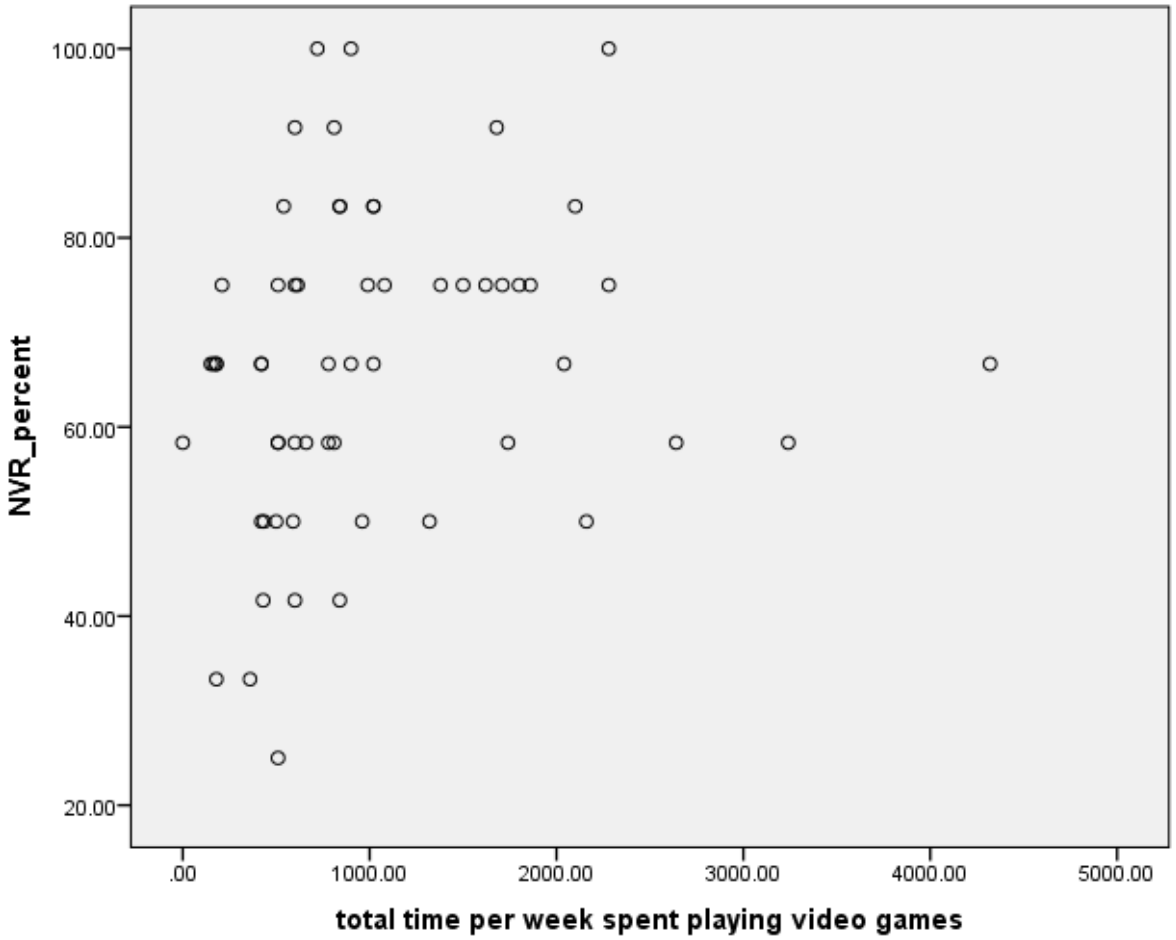
			Statistic	Std. Error
How many hours per school day playing video games (Mon-Thurs)	Mean		111.19	14.560
	95% Confidence Interval for Mean	Lower Bound	82.04	
		Upper Bound	140.33	
	5% Trimmed Mean		99.02	
	Median		75.00	
	Variance		12508.051	
	Std. Deviation		111.839	
	Minimum		0	
	Maximum		540	
	Range		540	
	Interquartile Range		75	
	Skewness		1.788	.311
	Kurtosis		3.424	.613

How many hours per weekend day playing video games (Fri-Sun)	Mean		195.68	22.124
	95% Confidence Interval for Mean	Lower Bound	151.39	
		Upper Bound	239.96	
	5% Trimmed Mean		175.73	
	Median		150.00	
	Variance		28878.843	
	Std. Deviation		169.938	
	Minimum		0	
	Maximum		880	
	Range		880	
	Interquartile Range		150	
	Skewness		2.005	.311
	Kurtosis		4.876	.613
total time per week spent playing video games	Mean		1031.7797	107.20710
	95% Confidence Interval for Mean	Lower Bound	817.1813	
		Upper Bound	1246.3780	
	5% Trimmed Mean		951.0405	
	Median		810.0000	
	Variance		678108.416	
	Std. Deviation		823.47339	
	Minimum		.00	
	Maximum		4320.00	
	Range		4320.00	
	Interquartile Range		990.00	
	Skewness		1.682	.311
	Kurtosis		3.647	.613

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
How many hours per school day playing video games (Mon-Thurs)	.265	59	.000	.799	59	.000
How many hours per weekend day playing video games (Fri-Sun)	.215	59	.000	.805	59	.000
total time per week spent playing video games	.201	59	.000	.849	59	.000

a. Lilliefors Significance Correction


NVR_percent
100.00
80.00
60.00
40.00
20.00
.00
1000.00
2000.00
3000.00
4000.00
5000.00
total time per week spent playing video games

Correlations – Video games and time

Nonparametric Correlations

Correlations

			total time per week spent playing video games	How many hours per school day playing video games (Mon-Thurs)	How many hours per weekend day playing video games (Fri-Sun)	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Spearman's rho	total time per week spent playing video games	Correlation Coefficient	1.000	.761**	.941**	.041	.177	.104	.329*
		Sig. (2-tailed)	.	.000	.000	.759	.179	.434	.011
		N	59	59	59	59	59	59	59
	How many hours per school day playing video games (Mon-Thurs)	Correlation Coefficient	.761**	1.000	.542**	.101	.057	.087	.182
		Sig. (2-tailed)	.000	.	.000	.447	.666	.514	.167
		N	59	59	59	59	59	59	59
	How many hours per weekend day playing video games (Fri-Sun)	Correlation Coefficient	.941**	.542**	1.000	-.020	.195	.072	.323*
		Sig. (2-tailed)	.000	.000	.	.879	.138	.586	.013
		N	59	59	59	59	59	59	59
	minecraft questions score	Correlation Coefficient	.041	.101	-.020	1.000	.383**	.813**	.401**

		Sig. (2-tailed)	.759	.447	.879	.	.003	.000	.002
		N	59	59	59	59	59	59	59
	normal questions score	Correlation Coefficient	.177	.057	.195	.383**	1.000	.819**	.490**
		Sig. (2-tailed)	.179	.666	.138	.003	.	.000	.000
		N	59	59	59	59	59	59	59
	wpscore_percent	Correlation Coefficient	.104	.087	.072	.813**	.819**	1.000	.529**
		Sig. (2-tailed)	.434	.514	.586	.000	.000	.	.000
		N	59	59	59	59	59	59	59
	NVR_percent	Correlation Coefficient	.329*	.182	.323*	.401**	.490**	.529**	1.000
		Sig. (2-tailed)	.011	.167	.013	.002	.000	.000	.
		N	59	59	59	59	59	59	59

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Statistics on Gender

Case Processing Summary

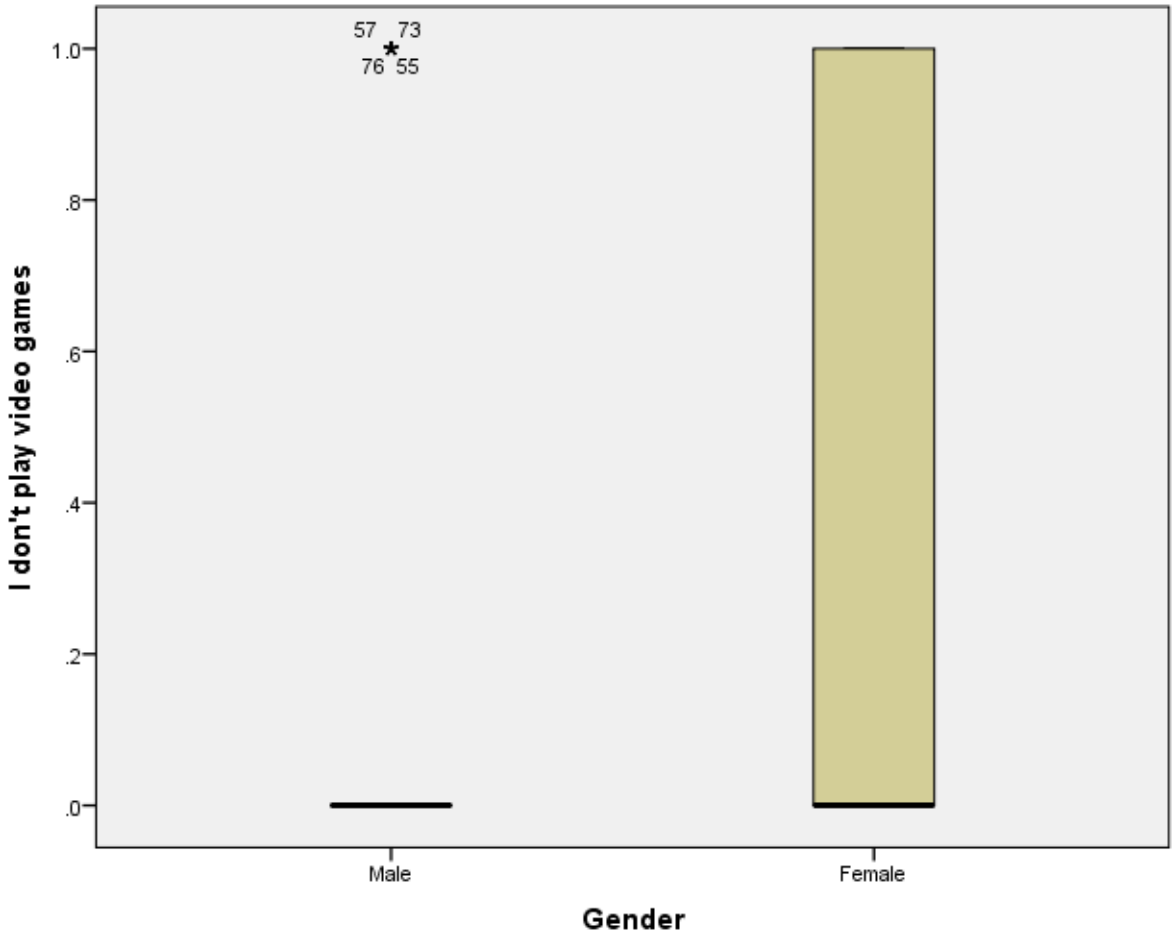
	Gender	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
I don't play video games	Male	45	100.0%	0	0.0%	45	100.0%
	Female	31	100.0%	0	0.0%	31	100.0%
I don't play Minecraft	Male	45	100.0%	0	0.0%	45	100.0%
	Female	31	100.0%	0	0.0%	31	100.0%

Descriptives

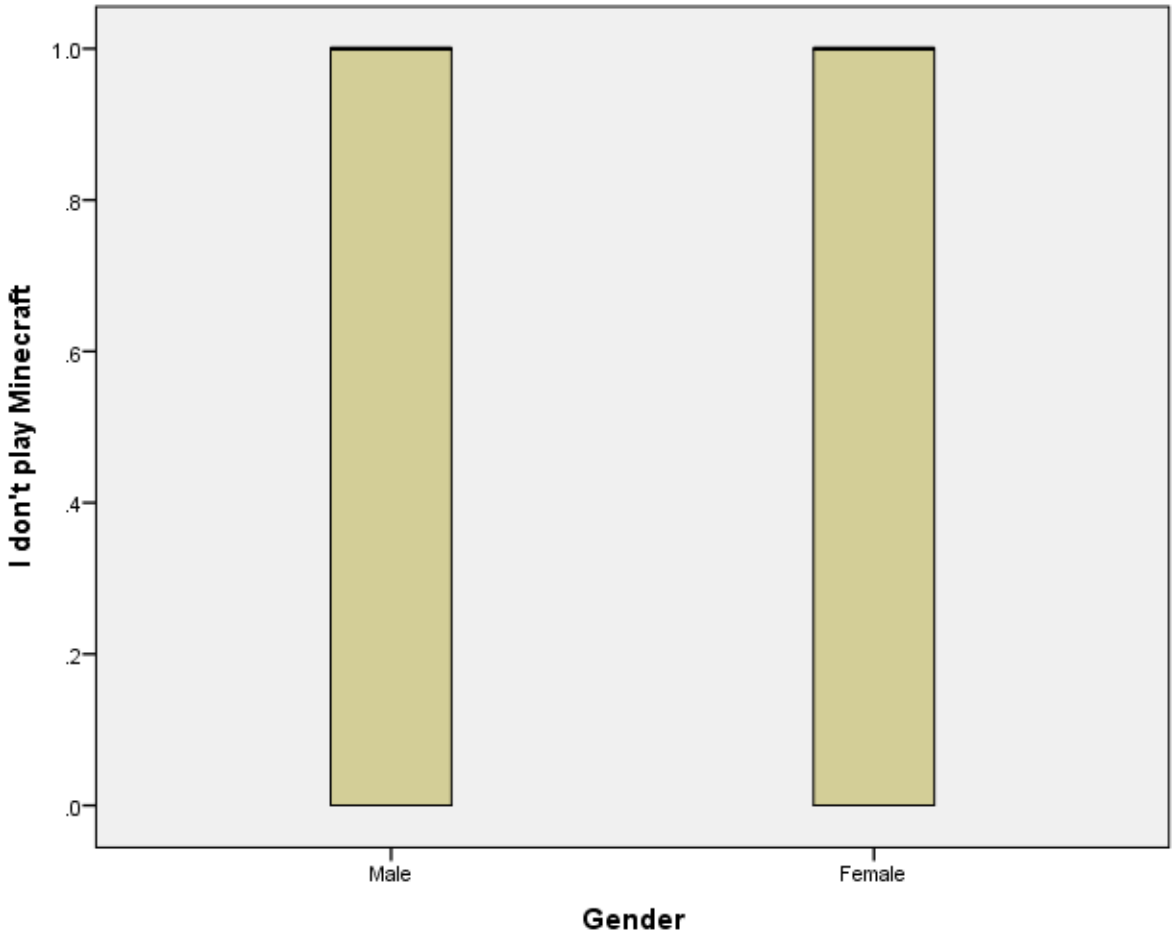
	Gender			Statistic	Std. Error
I don't play video games	Male	Mean		.16	.055
		95% Confidence Interval for Mean	Lower Bound	.05	
			Upper Bound	.27	
		5% Trimmed Mean		.12	
		Median		.00	
		Variance		.134	
		Std. Deviation		.367	
		Minimum		0	
		Maximum		1	
		Range		1	
		Interquartile Range		0	
		Skewness		1.967	.354
		Kurtosis		1.954	.695
	Female	Mean		.32	.085
		95% Confidence Interval for Mean	Lower Bound	.15	
			Upper Bound	.50	
		5% Trimmed Mean		.30	
		Median		.00	
		Variance		.226	
		Std. Deviation		.475	
		Minimum		0	
		Maximum		1	
		Range		1	
		Interquartile Range		1	
		Skewness		.798	.421

		Kurtosis		-1.462	.821
		Mean		.58	.074
		95% Confidence Interval for Mean	Lower Bound	.43	
			Upper Bound	.73	
		5% Trimmed Mean		.59	
		Median		1.00	
		Variance		.249	
	Male	Std. Deviation		.499	
		Minimum		0	
		Maximum		1	
		Range		1	
		Interquartile Range		1	
		Skewness		-.326	.354
		Kurtosis		-1.984	.695
I don't play Minecraft		Mean		.52	.091
		95% Confidence Interval for Mean	Lower Bound	.33	
			Upper Bound	.70	
		5% Trimmed Mean		.52	
		Median		1.00	
		Variance		.258	
	Female	Std. Deviation		.508	
		Minimum		0	
		Maximum		1	
		Range		1	
		Interquartile Range		1	
		Skewness		-.068	.421
		Kurtosis		-2.138	.821

I don't play video games



I don't play Minecraft



Case Processing Summary

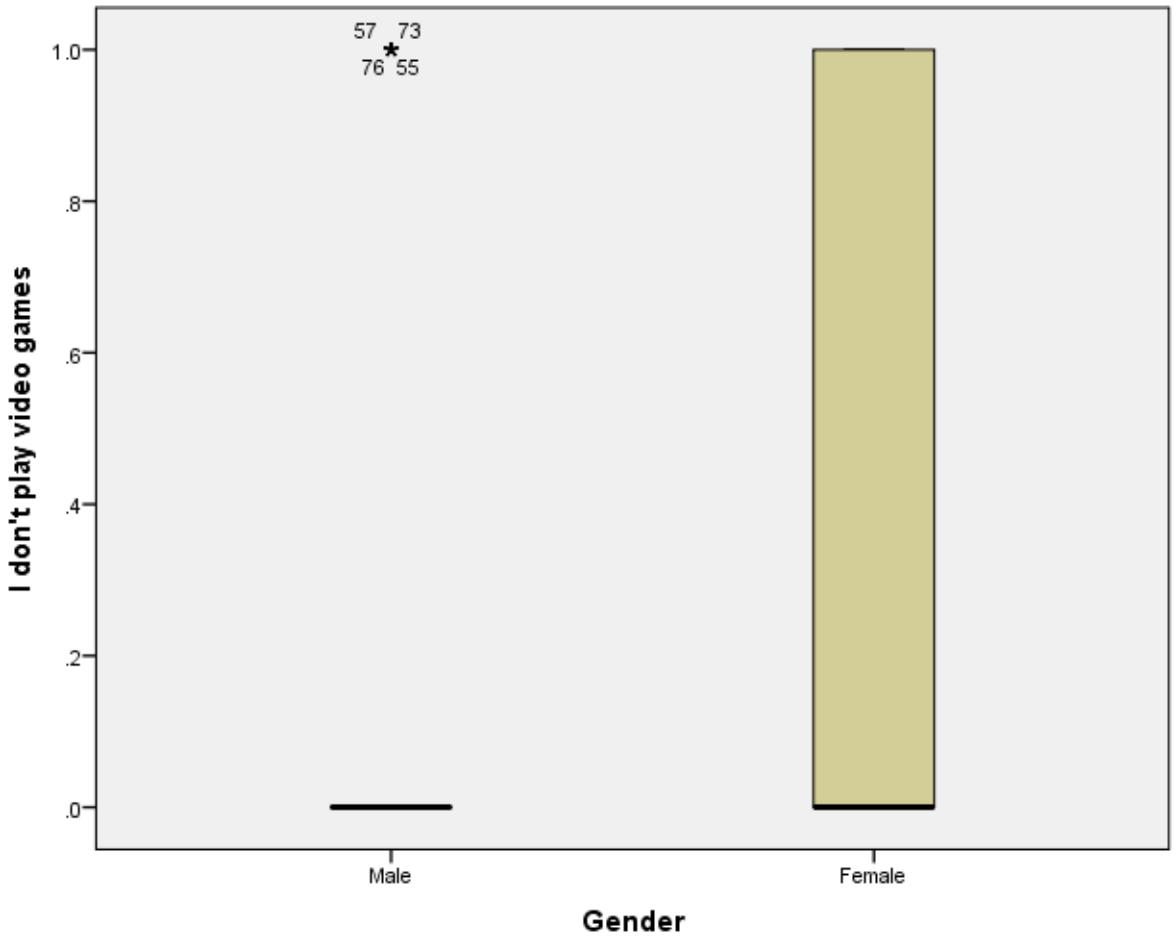
	Gender	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
I don't play video games	Male	45	100.0%	0	0.0%	45	100.0%
	Female	31	100.0%	0	0.0%	31	100.0%

Descriptives

	Gender			Statistic	Std. Error
I don't play video games	Male	Mean		.16	.055
		95% Confidence Interval for Mean	Lower Bound	.05	
			Upper Bound	.27	
		5% Trimmed Mean		.12	
		Median		.00	
		Variance		.134	
		Std. Deviation		.367	
		Minimum		0	

		Maximum		1	
		Range		1	
		Interquartile Range		0	
		Skewness		1.967	.354
		Kurtosis		1.954	.695
		Mean		.32	.085
		95% Confidence Interval for Mean	Lower Bound	.15	
			Upper Bound	.50	
		5% Trimmed Mean		.30	
		Median		.00	
		Variance		.226	
	Female	Std. Deviation		.475	
		Minimum		0	
		Maximum		1	
		Range		1	
		Interquartile Range		1	
		Skewness		.798	.421
		Kurtosis		-1.462	.821

I don't play video games



Frequencies

Statistics

		Gender	I don't play video games
N	Valid	76	76
	Missing	0	0

Frequency Table

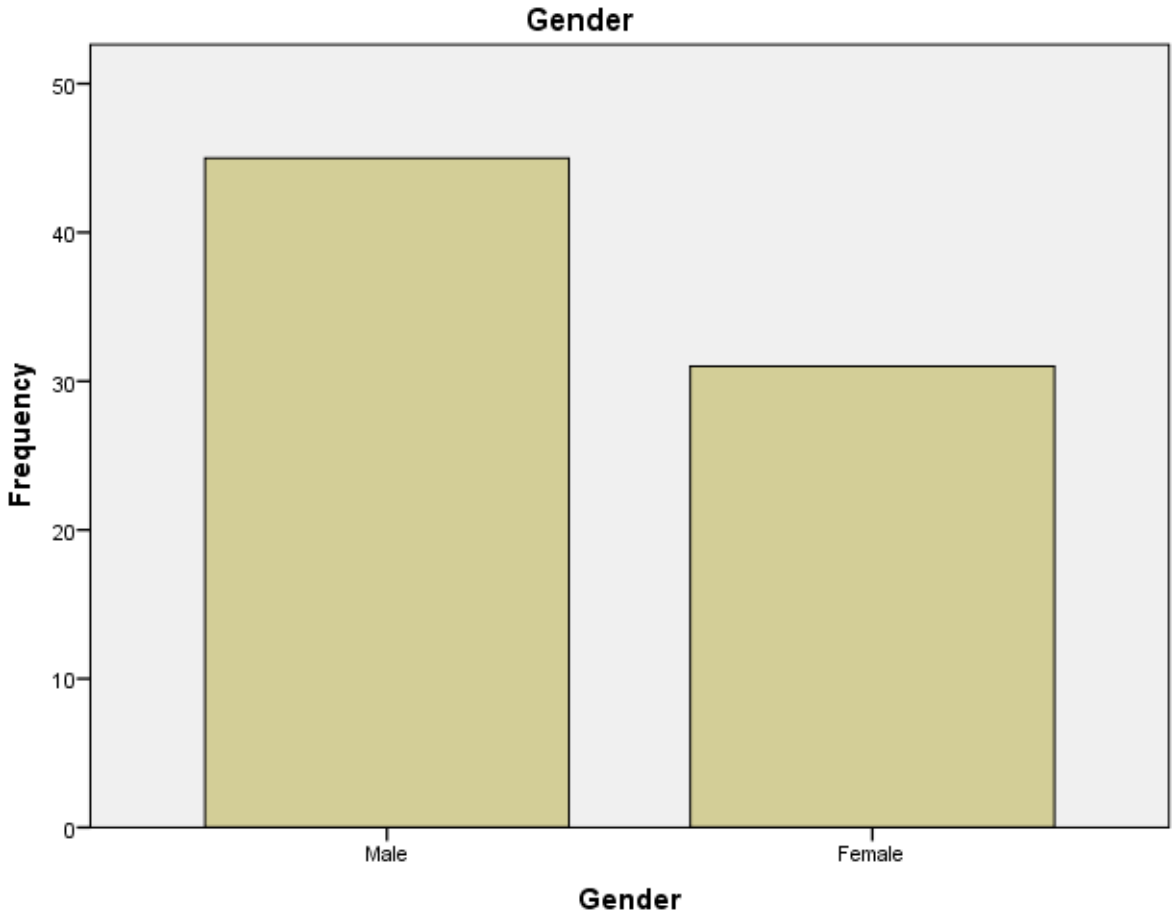
Gender

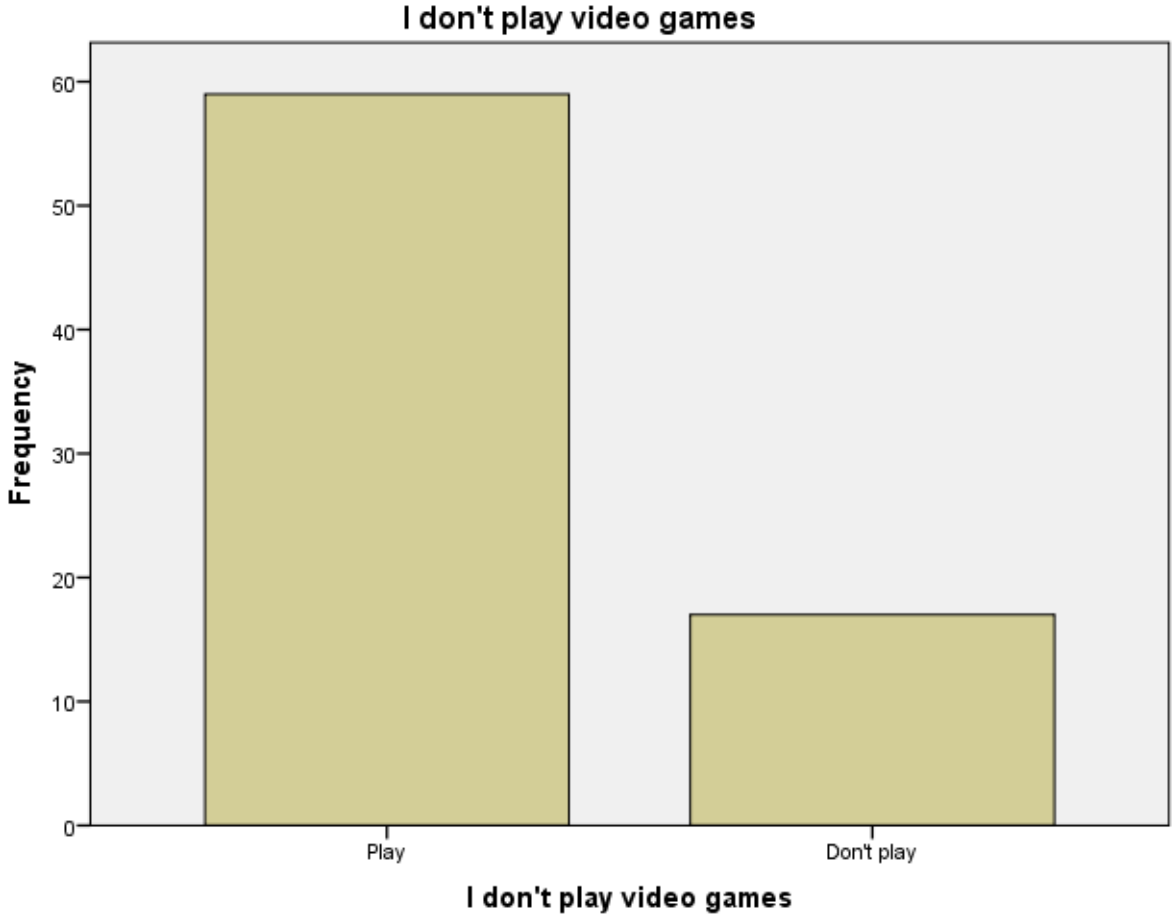
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	45	59.2	59.2	59.2
	Female	31	40.8	40.8	100.0
	Total	76	100.0	100.0	

I don't play video games

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Play	59	77.6	77.6	77.6
	Don't play	17	22.4	22.4	100.0
	Total	76	100.0	100.0	

Bar Chart


Gender
Frequency
50
40
30
20
10
0
Male
Female
Gender



Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * I don't play video games	76	100.0%	0	0.0%	76	100.0%

Gender * I don't play video games Crosstabulation

Count

		I don't play video games		Total
		Play	Don't play	
Gender	Male	38	7	45
	Female	21	10	31
Total		59	17	76

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Gender * I don't play Minecraft	76	100.0%	0	0.0%	76	100.0%

Gender * I don't play Minecraft Crosstabulation

Count

		I don't play Minecraft		Total
		Play	Don't play	
Gender	Male	19	26	45
	Female	15	16	31
Total		34	42	76

Case Processing Summary

	Gender	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
minecraft questions score	Male	45	100.0%	0	0.0%	45	100.0%
	Female	31	100.0%	0	0.0%	31	100.0%
normal questions score	Male	45	100.0%	0	0.0%	45	100.0%
	Female	31	100.0%	0	0.0%	31	100.0%
wpscore_percent	Male	45	100.0%	0	0.0%	45	100.0%
	Female	31	100.0%	0	0.0%	31	100.0%
NVR_percent	Male	45	100.0%	0	0.0%	45	100.0%
	Female	31	100.0%	0	0.0%	31	100.0%

Descriptives

	Gender			Statistic	Std. Error
minecraft questions score	Male	Mean		68.4848	3.03856
		95% Confidence Interval for Mean	Lower Bound	62.3610	
			Upper Bound	74.6087	
		5% Trimmed Mean		70.2020	
		Median		72.7273	
		Variance		415.477	
		Std. Deviation		20.38326	
		Minimum		.00	

		Maximum		100.00	
		Range		100.00	
		Interquartile Range		18.18	
		Skewness		-1.458	.354
		Kurtosis		3.062	.695
		Mean		58.3578	3.69393
		95% Confidence Interval for	Lower Bound	50.8138	
		Mean	Upper Bound	65.9018	
		5% Trimmed Mean		58.2763	
		Median		63.6364	
		Variance		422.998	
	Female	Std. Deviation		20.56692	
		Minimum		27.27	
		Maximum		90.91	
		Range		63.64	
		Interquartile Range		27.27	
		Skewness		-.063	.421
		Kurtosis		-1.357	.821
		Mean		64.1667	3.58870
		95% Confidence Interval for	Lower Bound	56.9341	
		Mean	Upper Bound	71.3992	
normal questions score	Male	5% Trimmed Mean		64.9691	
		Median		62.5000	
		Variance		579.545	
		Std. Deviation		24.07375	

		Minimum		12.50	
		Maximum		100.00	
		Range		87.50	
		Interquartile Range		37.50	
		Skewness		-.417	.354
		Kurtosis		-.653	.695
		Mean		52.8226	3.78832
		95% Confidence Interval for	Lower Bound	45.0858	
		Mean	Upper Bound	60.5594	
		5% Trimmed Mean		53.8306	
		Median		50.0000	
		Variance		444.892	
	Female	Std. Deviation		21.09247	
		Minimum		.00	
		Maximum		87.50	
		Range		87.50	
		Interquartile Range		25.00	
		Skewness		-.691	.421
		Kurtosis		1.080	.821
		Mean		66.6667	2.77393
		95% Confidence Interval for	Lower Bound	61.0762	
		Mean	Upper Bound	72.2572	
		5% Trimmed Mean		67.5114	
wpscore_percent	Male	Median		68.4211	
		Variance		346.260	
		Std. Deviation		18.60807	
		Minimum		5.26	
		Maximum		100.00	

		Range		94.74	
		Interquartile Range		26.32	
		Skewness		-.835	.354
		Kurtosis		1.432	.695
		Mean		56.0272	3.03426
		95% Confidence Interval for	Lower Bound	49.8304	
		Mean	Upper Bound	62.2239	
		5% Trimmed Mean		56.3007	
		Median		57.8947	
		Variance		285.408	
	Female	Std. Deviation		16.89402	
		Minimum		15.79	
		Maximum		89.47	
		Range		73.68	
		Interquartile Range		31.58	
		Skewness		-.225	.421
		Kurtosis		-.416	.821
		Mean		67.4074	2.41032
		95% Confidence Interval for	Lower Bound	62.5497	
		Mean	Upper Bound	72.2651	
		5% Trimmed Mean		67.9527	
NVR_percent	Male	Median		66.6667	
		Variance		261.434	
		Std. Deviation		16.16891	
		Minimum		25.00	
		Maximum		100.00	

		Range		75.00	
		Interquartile Range		16.67	
		Skewness		-.600	.354
		Kurtosis		.371	.695
		Mean		67.2043	2.73084
		95% Confidence Interval for Mean	Lower Bound	61.6272	
			Upper Bound	72.7814	
		5% Trimmed Mean		66.8011	
		Median		66.6667	
		Variance		231.183	
	Female	Std. Deviation		15.20470	
		Minimum		41.67	
		Maximum		100.00	
		Range		58.33	
		Interquartile Range		25.00	
		Skewness		.321	.421
		Kurtosis		-.108	.821

Tests of Normality

	Gender	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
minecraft questions score	Male	.205	45	.000	.874	45	.000
	Female	.186	31	.008	.914	31	.017
normal questions score	Male	.163	45	.004	.941	45	.024

	Female	.162	31	.038	.915	31	.017
wpscore_percent	Male	.160	45	.006	.946	45	.037
	Female	.115	31	.200*	.967	31	.443
NVR_percent	Male	.193	45	.000	.941	45	.023
	Female	.192	31	.005	.939	31	.077

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Mann-Whitney Test

Ranks

	Gender	N	Mean Rank	Sum of Ranks
minecraft questions score	Male	45	43.01	1935.50
	Female	31	31.95	990.50
	Total	76		
normal questions score	Male	45	42.87	1929.00
	Female	31	32.16	997.00
	Total	76		
wpscore_percent	Male	45	44.10	1984.50
	Female	31	30.37	941.50
	Total	76		
NVR_percent	Male	45	39.56	1780.00
	Female	31	36.97	1146.00
	Total	76		

Test Statistics[a]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Mann-Whitney U	494.500	501.000	445.500	650.000
Wilcoxon W	990.500	997.000	941.500	1146.000
Z	-2.176	-2.105	-2.678	-.510
Asymp. Sig. (2-tailed)	.030	.035	.007	.610

a. Grouping Variable: Gender

NPar Tests

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
minecraft questions score	59	65.7935	21.50898	.00	100.00	54.5455	72.7273	81.8182
normal questions score	59	59.5339	24.49259	.00	100.00	50.0000	62.5000	75.0000
wpscore_percent	59	63.1579	19.12700	5.26	100.00	52.6316	68.4211	73.6842
NVR_percent	59	66.6667	16.73835	25.00	100.00	58.3333	66.6667	75.0000
Gender	59	1.36	.483	1	2	1.00	1.00	2.00

Mann-Whitney Test

Ranks

	Gender	N	Mean Rank	Sum of Ranks
minecraft questions score	Male	38	31.29	1189.00
	Female	21	27.67	581.00
	Total	59		
normal questions score	Male	38	33.25	1263.50
	Female	21	24.12	506.50
	Total	59		
wpscore_percent	Male	38	32.83	1247.50
	Female	21	24.88	522.50
	Total	59		
NVR_percent	Male	38	31.21	1186.00
	Female	21	27.81	584.00
	Total	59		

Test Statistics[a]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Mann-Whitney U	350.000	275.500	291.500	353.000
Wilcoxon W	581.000	506.500	522.500	584.000
Z	-.788	-1.979	-1.713	-.737
Asymp. Sig. (2-tailed)	.431	.048	.087	.461

a. Grouping Variable: Gender

NPar Tests

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th

minecraft questions score	34	67.6471	21.01735	.00	100.00	61.3636	72.7273	81.8182
normal questions score	34	54.4118	23.41214	.00	100.00	37.5000	50.0000	75.0000
wpscore_percent	34	62.0743	18.81129	5.26	100.00	52.6316	63.1579	73.6842
NVR_percent	34	63.9706	18.77124	25.00	100.00	50.0000	66.6667	75.0000
Gender	34	1.44	.504	1	2	1.00	1.00	2.00

Mann-Whitney Test

Ranks

	Gender	N	Mean Rank	Sum of Ranks
minecraft questions score	Male	19	18.00	342.00
	Female	15	16.87	253.00
	Total	34		
normal questions score	Male	19	17.82	338.50
	Female	15	17.10	256.50
	Total	34		
wpscore_percent	Male	19	18.55	352.50
	Female	15	16.17	242.50
	Total	34		
NVR_percent	Male	19	16.95	322.00
	Female	15	18.20	273.00
	Total	34		

Test Statistics[a]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Mann-Whitney U	133.000	136.500	122.500	132.000
Wilcoxon W	253.000	256.500	242.500	322.000
Z	-.336	-.211	-.701	-.368
Asymp. Sig. (2-tailed)	.737	.833	.484	.713
Exact Sig. [2*(1-tailed Sig.)]	.758[b]	.837[b]	.493[b]	.732[b]

a. Grouping Variable: Gender

b. Not corrected for ties.

Crosstabulations

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
I don't play video games * Do you like maths	58	98.3%	1	1.7%	59	100.0%
I don't play video games * Do you like problem solving?	59	100.0%	0	0.0%	59	100.0%

I don't play video games * Do you like problem solving?

Crosstab

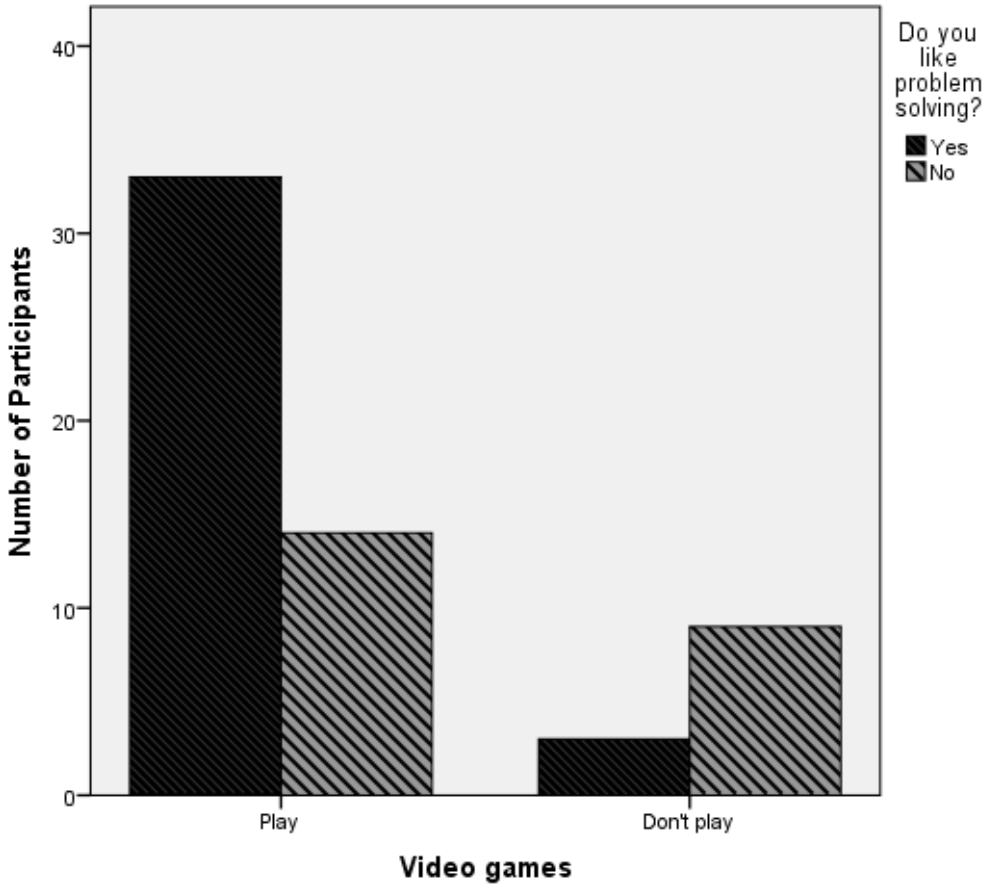
			Do you like problem solving?		Total
			Yes	No	
I don't play video games	Play	Count	33	14	47
		Expected Count	28.7	18.3	47.0
	Don't play	Count	3	9	12
		Expected Count	7.3	4.7	12.0
Total		Count	36	23	59
		Expected Count	36.0	23.0	59.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.215[a]	1	.004		
Continuity Correction[b]	6.424	1	.011		
Likelihood Ratio	8.157	1	.004		
Fisher's Exact Test				.007	.006
Linear-by-Linear Association	8.076	1	.004		
N of Valid Cases	59				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.68.

b. Computed only for a 2x2 table



Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
I don't play Minecraft * Do you like problem solving?	59	100.0%	0	0.0%	59	100.0%

I don't play Minecraft * Do you like problem solving? Crosstabulation

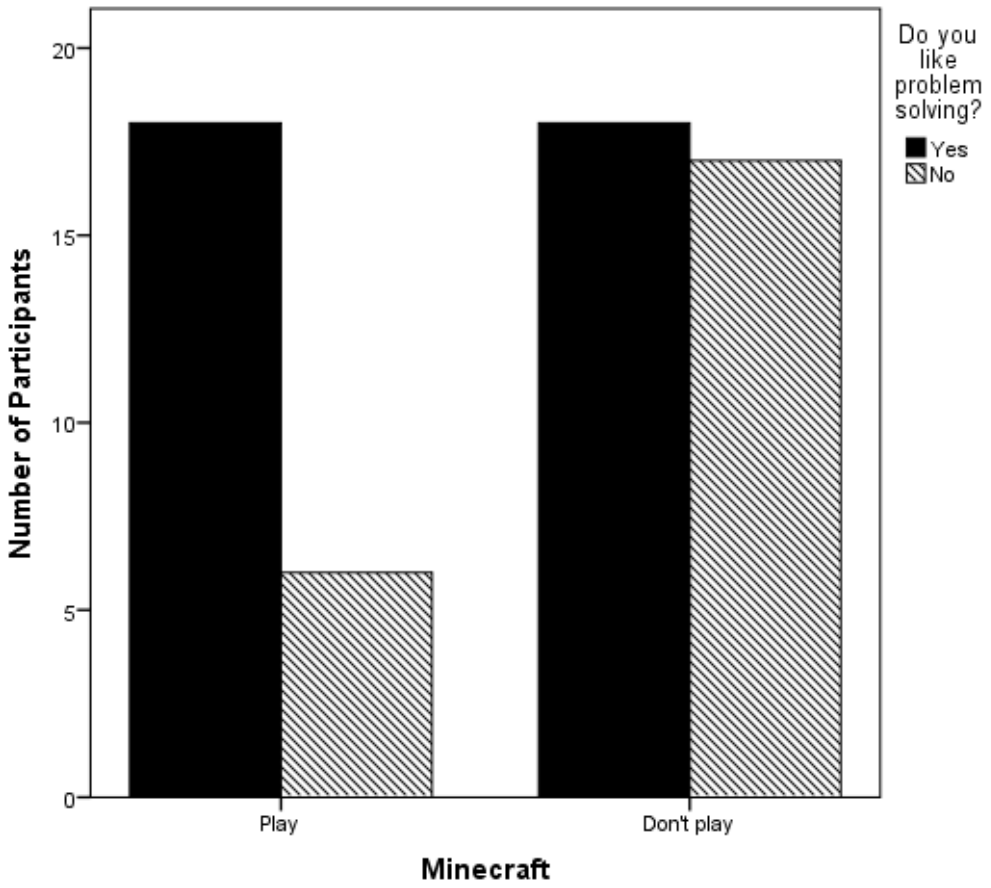
			Do you like problem solving?		Total
			Yes	No	
I don't play Minecraft	Play	Count	18	6	24
		Expected Count	14.6	9.4	24.0
	Don't play	Count	18	17	35
		Expected Count	21.4	13.6	35.0
Total		Count	36	23	59
		Expected Count	36.0	23.0	59.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.326[a]	1	.068		
Continuity Correction[b]	2.408	1	.121		
Likelihood Ratio	3.420	1	.064		
Fisher's Exact Test				.103	.059
Linear-by-Linear Association	3.269	1	.071		
N of Valid Cases	59				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.36.

b. Computed only for a 2x2 table



Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
I don't play video games * Do you like maths	62	100.0%	0	0.0%	62	100.0%

I don't play video games * Do you like maths Crosstabulation

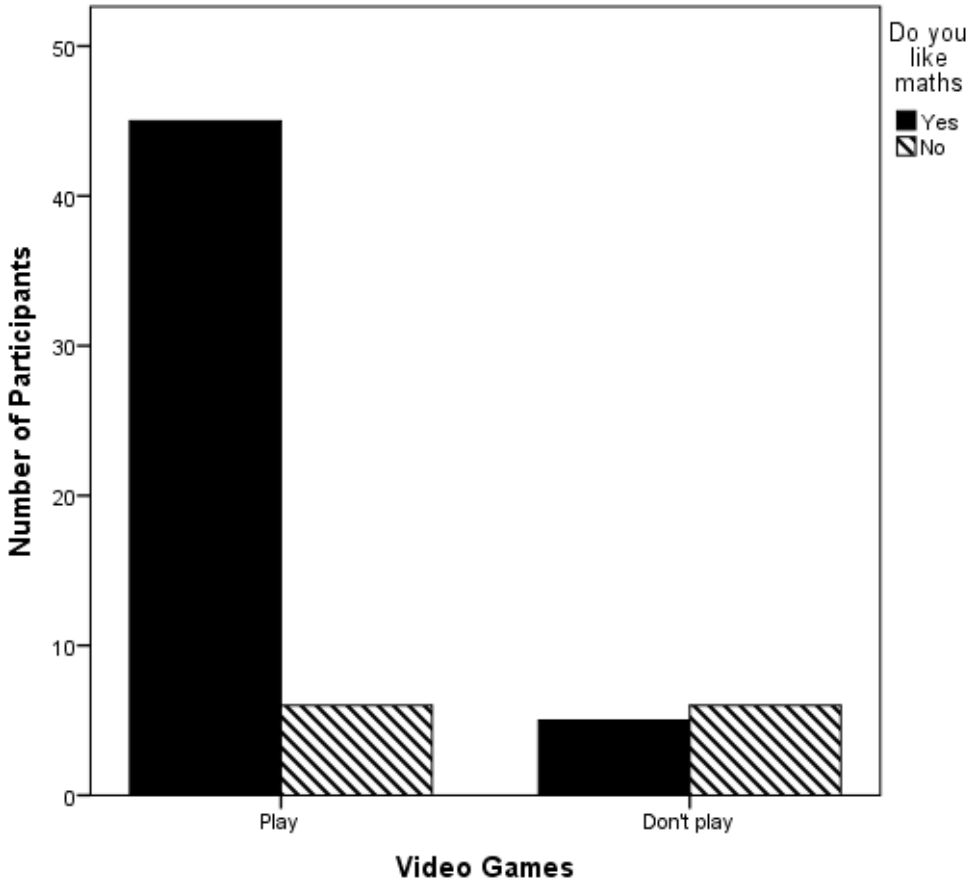
			Do you like maths		Total
			Yes	No	
I don't play video games	Play	Count	45	6	51
		Expected Count	41.1	9.9	51.0
	Don't play	Count	5	6	11
		Expected Count	8.9	2.1	11.0
Total		Count	50	12	62
		Expected Count	50.0	12.0	62.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	10.610[a]	1	.001		
Continuity Correction[b]	8.046	1	.005		
Likelihood Ratio	8.821	1	.003		
Fisher's Exact Test				.004	.004
Linear-by-Linear Association	10.439	1	.001		
N of Valid Cases	62				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.13.

b. Computed only for a 2x2 table



Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
I don't play Minecraft * Do you like maths	62	100.0%	0	0.0%	62	100.0%

I don't play Minecraft * Do you like maths Crosstabulation

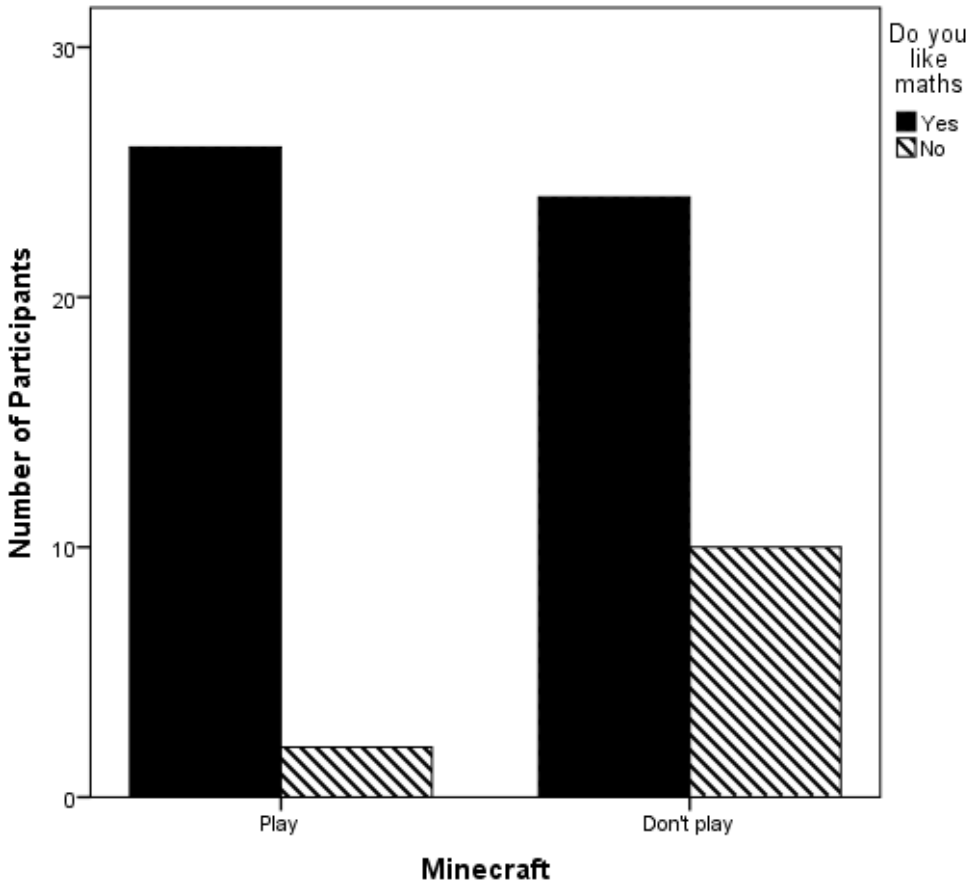
			Do you like maths		Total
			Yes	No	
I don't play Minecraft	Play	Count	26	2	28
		Expected Count	22.6	5.4	28.0
	Don't play	Count	24	10	34
		Expected Count	27.4	6.6	34.0
Total		Count	50	12	62
		Expected Count	50.0	12.0	62.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.878[a]	1	.027		
Continuity Correction[b]	3.556	1	.059		
Likelihood Ratio	5.321	1	.021		
Fisher's Exact Test				.050	.027
Linear-by-Linear Association	4.800	1	.028		
N of Valid Cases	62				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.42.

b. Computed only for a 2x2 table



Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent

Do you think you are good at maths? * I don't play video games	48	100.0%	0	0.0%	48	100.0%
Do you think you are good at maths? * I don't play Minecraft	48	100.0%	0	0.0%	48	100.0%

Do you think you are good at maths? * I don't play video games

Crosstab

			I don't play video games		Total
			Play	Don't play	
Do you think you are good at maths?	Yes	Count	42	5	47
		Expected Count	42.1	4.9	47.0
	No	Count	1	0	1
		Expected Count	.9	.1	1.0
Total		Count	43	5	48
		Expected Count	43.0	5.0	48.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.119[a]	1	.730		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.222	1	.637		
Fisher's Exact Test				1.000	.896
Linear-by-Linear Association	.116	1	.733		
N of Valid Cases	48				

a. 3 cells (75.0%) have expected count less than 5. The minimum expected count is .10.

b. Computed only for a 2x2 table

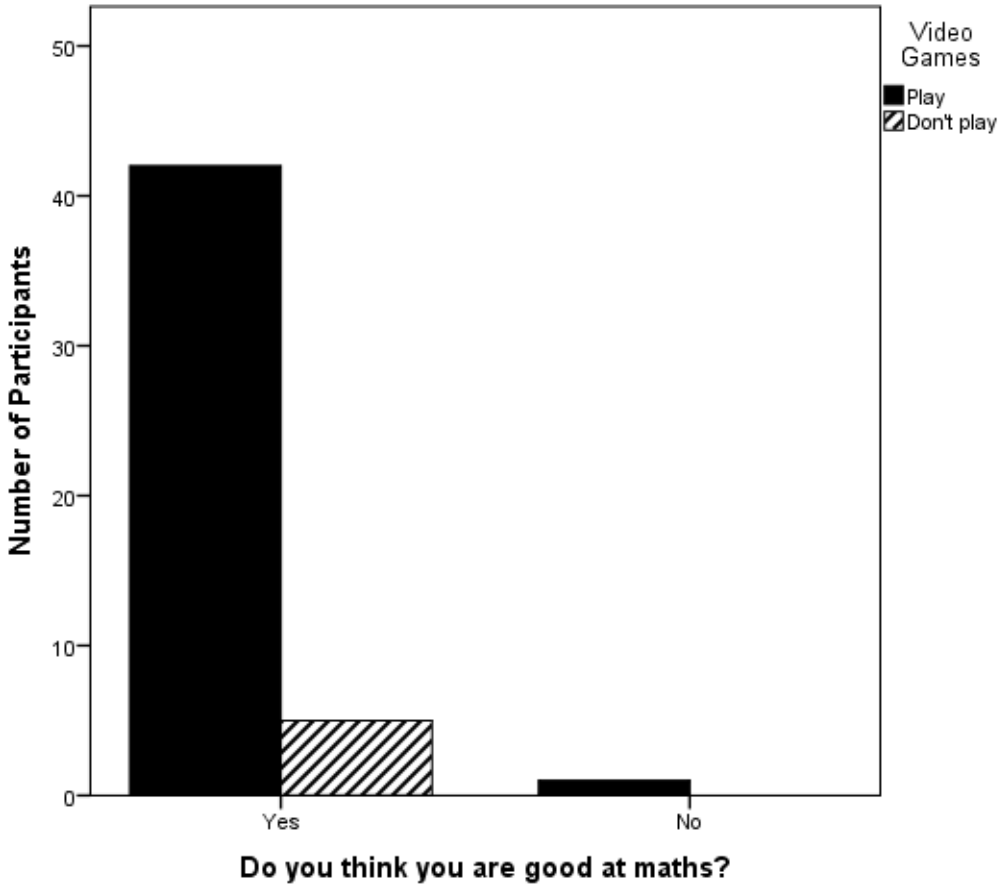
Symmetric Measures

	Value	Approx. Sig.

Nominal by Nominal	Phi	-.050	.730
	Cramer's V	.050	.730
N of Valid Cases		48	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.



Do you think you are good at maths? * I don't play Minecraft

Crosstab

			I don't play Minecraft		Total
			Play	Don't play	
Do you think you are good at	Yes	Count	23	24	47

maths?	No	Expected Count	23.5	23.5	47.0
		Count	1	0	1
		Expected Count	.5	.5	1.0
Total		Count	24	24	48
		Expected Count	24.0	24.0	48.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.021[a]	1	.312		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	1.408	1	.235		
Fisher's Exact Test				1.000	.500
Linear-by-Linear Association	1.000	1	.317		
N of Valid Cases	48				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .50.

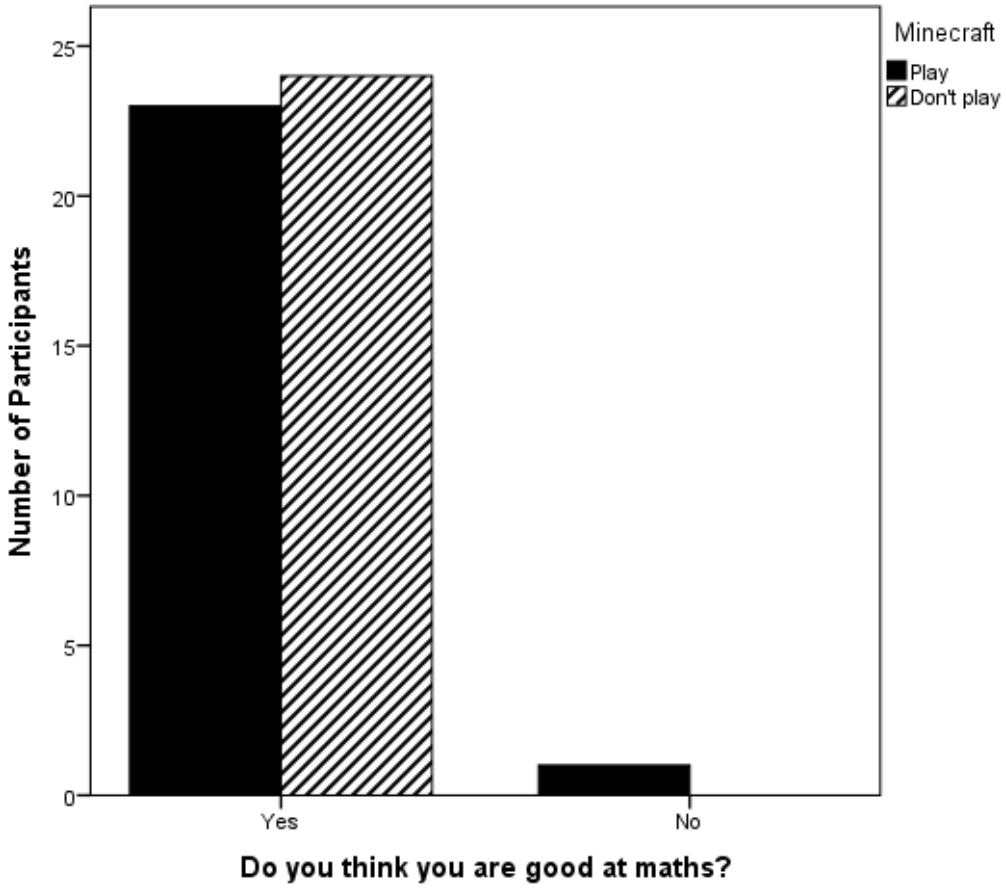
b. Computed only for a 2x2 table

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.146	.312
	Cramer's V	.146	.312
N of Valid Cases		48	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.


Minecraft
Play
Don't play
Number of Participants
25
20
15
10
5
0
Yes
No
Do you think you are good at maths?

Minecraft Playing Style

Kruskal-Wallis Test

Ranks

	Do you play Minecraft alone	N	Mean Rank
minecraft questions score	Always	3	11.33
	Often	16	16.63
	Sometimes	14	18.64
	Total	33	
normal questions score	Always	3	10.17
	Often	16	17.94
	Sometimes	14	17.39
	Total	33	
wpscore_percent	Always	3	11.17
	Often	16	16.78
	Sometimes	14	18.50
	Total	33	
NVR_percent	Always	3	21.67
	Often	16	14.59
	Sometimes	14	18.75
	Total	33	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	1.510	1.719	1.462	2.199
df	2	2	2	2
Asymp. Sig.	.470	.423	.482	.333

a. Kruskal Wallis Test

b. Grouping Variable: Do you play Minecraft alone

```
NPAR TESTS
  /K-W=minecraftqs normalqs wpscore_percent NVR_percent BY cq9b(1 4)
  /MISSING ANALYSIS.
```

NPar Tests

Kruskal-Wallis Test

Ranks

	Do you play Minecraft online with others	N	Mean Rank
minecraft questions score	Always	1	7.50
	Often	8	16.75
	Sometimes	13	22.35
	Never	12	13.58
	Total	34	
normal questions score	Always	1	14.50
	Often	8	17.44
	Sometimes	13	20.08
	Never	12	15.00
	Total	34	
wpscore_percent	Always	1	10.00
	Often	8	16.94
	Sometimes	13	21.42
	Never	12	14.25
	Total	34	
NVR_percent	Always	1	20.00
	Often	8	19.75
	Sometimes	13	19.35
	Never	12	13.79
	Total	34	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	6.226	1.766	3.967	2.641
df	3	3	3	3
Asymp. Sig.	.101	.622	.265	.450

a. Kruskal Wallis Test

b. Grouping Variable: Do you play Minecraft online with others

```
NPAR TESTS
  /K-W=minecraftqs normalqs wpscore_percent NVR_percent BY cq9c(1 4)
  /MISSING ANALYSIS.
```

NPar Tests

Kruskal-Wallis Test

Ranks

	Do you play Minecraft offline with others	N	Mean Rank
minecraft questions score	Always	2	6.00
	Often	7	21.86
	Sometimes	14	15.57
	Never	10	17.80
	Total	33	
normal questions score	Always	2	8.50
	Often	7	24.00
	Sometimes	14	14.36
	Never	10	17.50
	Total	33	
wpscore_percent	Always	2	7.75
	Often	7	24.43
	Sometimes	14	14.82
	Never	10	16.70
	Total	33	
NVR_percent	Always	2	11.25
	Often	7	18.29
	Sometimes	14	20.43
	Never	10	12.45
	Total	33	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	4.895	6.465	6.797	4.920
df	3	3	3	3
Asymp. Sig.	.180	.091	.079	.178

a. Kruskal Wallis Test

b. Grouping Variable: Do you play Minecraft offline with others

```
NPAR TESTS
  /K-W=minecraftqs normalqs wpscore_percent NVR_percent BY cq10a(1 4)
  /MISSING ANALYSIS.
```

NPar Tests
Kruskal-Wallis Test

Ranks

	Play Minecraft with people younger	N	Mean Rank
minecraft questions score	Always	2	6.00
	Often	6	23.67
	Sometimes	13	12.96
	Never	10	17.35
	Total	31	
normal questions score	Always	2	8.50
	Often	6	22.92
	Sometimes	13	13.04
	Never	10	17.20
	Total	31	
wpscore_percent	Always	2	7.75
	Often	6	24.17
	Sometimes	13	11.81
	Never	10	18.20
	Total	31	
NVR_percent	Always	2	10.50
	Often	6	22.75
	Sometimes	13	16.31
	Never	10	12.65
	Total	31	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	8.713	6.589	10.041	5.563
df	3	3	3	3
Asymp. Sig.	.033	.086	.018	.135

a. Kruskal Wallis Test

b. Grouping Variable: Play Minecraft with people younger

NPar Tests

Kruskal-Wallis Test

Ranks

	Play Minecraft with people same age	N	Mean Rank
minecraft questions score	Always	6	18.58
	Often	9	17.00
	Sometimes	12	17.25
	Never	5	11.30
	Total	32	
normal questions score	Always	6	12.42
	Often	9	21.89
	Sometimes	12	16.83
	Never	5	10.90
	Total	32	
wpscore_percent	Always	6	15.25
	Often	9	19.72
	Sometimes	12	17.33
	Never	5	10.20
	Total	32	
NVR_percent	Always	6	16.67
	Often	9	16.44
	Sometimes	12	18.00
	Never	5	12.80
	Total	32	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	2.026	6.084	3.603	1.115
df	3	3	3	3
Asymp. Sig.	.567	.108	.308	.773

a. Kruskal Wallis Test

b. Grouping Variable: Play Minecraft with people same age

NPar Tests

Kruskal-Wallis Test

Ranks

	Play Minecraft with people older	N	Mean Rank
minecraft questions score	Always	1	11.00
	Often	2	28.75
	Sometimes	15	17.40
	Never	14	14.18
	Total	32	
normal questions score	Always	1	14.50
	Often	2	22.25
	Sometimes	15	17.03
	Never	14	15.25
	Total	32	
wpscore_percent	Always	1	14.50
	Often	2	25.75
	Sometimes	15	17.20
	Never	14	14.57
	Total	32	
NVR_percent	Always	1	19.00
	Often	2	21.50
	Sometimes	15	18.23
	Never	14	13.75
	Total	32	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	4.933	1.126	2.716	2.416
df	3	3	3	3
Asymp. Sig.	.177	.771	.438	.491

a. Kruskal Wallis Test

b. Grouping Variable: Play Minecraft with people older

NPar Tests

Kruskal-Wallis Test

Ranks

	Don't know ages	N	Mean Rank
minecraft questions score	Always	1	18.00
	Often	3	22.83
	Sometimes	3	17.33
	Never	25	15.58
	Total	32	
normal questions score	Always	1	8.00
	Often	3	19.67
	Sometimes	3	18.17
	Never	25	16.26
	Total	32	
wpscore_percent	Always	1	14.50
	Often	3	22.00
	Sometimes	3	17.33
	Never	25	15.82
	Total	32	
NVR_percent	Always	1	24.00
	Often	3	20.67
	Sometimes	3	23.50
	Never	25	14.86
	Total	32	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	1.721	1.311	1.255	3.761
df	3	3	3	3
Asymp. Sig.	.632	.726	.740	.288

a. Kruskal Wallis Test

b. Grouping Variable: Don't know ages

NPar Tests

Kruskal-Wallis Test

Ranks

	Do you play Minecraft alone	N	Mean Rank
minecraft questions score	Always	3	11.33
	Often	16	16.63
	Sometimes	14	18.64
	Total	33	
normal questions score	Always	3	10.17
	Often	16	17.94
	Sometimes	14	17.39
	Total	33	
wpscore_percent	Always	3	11.17
	Often	16	16.78
	Sometimes	14	18.50
	Total	33	
NVR_percent	Always	3	21.67
	Often	16	14.59
	Sometimes	14	18.75
	Total	33	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	1.510	1.719	1.462	2.199

df	2	2	2	2
Asymp. Sig.	.470	.423	.482	.333

a. Kruskal Wallis Test

b. Grouping Variable: Do you play Minecraft alone

```
NPAR TESTS
  /K-W=minecraftqs normalqs wpscore_percent NVR_percent BY cq9b(1 4)
  /MISSING ANALYSIS.
```

NPar Tests

Kruskal-Wallis Test

Ranks

	Do you play Minecraft online with others	N	Mean Rank
minecraft questions score	Always	1	7.50
	Often	8	16.75
	Sometimes	13	22.35
	Never	12	13.58
	Total	34	
normal questions score	Always	1	14.50
	Often	8	17.44
	Sometimes	13	20.08
	Never	12	15.00
	Total	34	
wpscore_percent	Always	1	10.00
	Often	8	16.94
	Sometimes	13	21.42
	Never	12	14.25
	Total	34	
NVR_percent	Always	1	20.00
	Often	8	19.75
	Sometimes	13	19.35
	Never	12	13.79
	Total	34	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	6.226	1.766	3.967	2.641
df	3	3	3	3
Asymp. Sig.	.101	.622	.265	.450

a. Kruskal Wallis Test

b. Grouping Variable: Do you play Minecraft online with others

```
NPAR TESTS
  /K-W=minecraftqs normalqs wpscore_percent NVR_percent BY cq9c(1 4)
  /MISSING ANALYSIS.
```

NPar Tests

Kruskal-Wallis Test

Ranks

	Do you play Minecraft offline with others	N	Mean Rank
minecraft questions score	Always	2	6.00
	Often	7	21.86
	Sometimes	14	15.57
	Never	10	17.80
	Total	33	
normal questions score	Always	2	8.50
	Often	7	24.00
	Sometimes	14	14.36
	Never	10	17.50
	Total	33	
wpscore_percent	Always	2	7.75
	Often	7	24.43
	Sometimes	14	14.82
	Never	10	16.70
	Total	33	

	Always	2	11.25
	Often	7	18.29
NVR_percent	Sometimes	14	20.43
	Never	10	12.45
	Total	33	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	4.895	6.465	6.797	4.920
df	3	3	3	3
Asymp. Sig.	.180	.091	.079	.178

a. Kruskal Wallis Test

b. Grouping Variable: Do you play Minecraft offline with others

```
NPAR TESTS
  /K-W=minecraftqs normalqs wpscore_percent NVR_percent BY cq10a(1 4)
  /MISSING ANALYSIS.
```

NPar Tests

Kruskal-Wallis Test

Ranks

	Play Minecraft with people younger	N	Mean Rank
	Always	2	6.00
	Often	6	23.67
minecraft questions score	Sometimes	13	12.96
	Never	10	17.35
	Total	31	
	Always	2	8.50
normal questions score	Often	6	22.92
	Sometimes	13	13.04

	Never	10	17.20
	Total	31	
	Always	2	7.75
	Often	6	24.17
wpscore_percent	Sometimes	13	11.81
	Never	10	18.20
	Total	31	
	Always	2	10.50
	Often	6	22.75
NVR_percent	Sometimes	13	16.31
	Never	10	12.65
	Total	31	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	8.713	6.589	10.041	5.563
df	3	3	3	3
Asymp. Sig.	.033	.086	.018	.135

a. Kruskal Wallis Test

b. Grouping Variable: Play Minecraft with people younger

```
NPAR TESTS
  /K-W=minecraftqs normalqs wpscore_percent NVR_percent BY cq10b(1 4)
  /MISSING ANALYSIS.
```

NPar Tests

Kruskal-Wallis Test

Ranks

	Play Minecraft with people same age	N	Mean Rank
minecraft questions score	Always	6	18.58
	Often	9	17.00

	Sometimes	12	17.25
	Never	5	11.30
	Total	32	
	Always	6	12.42
	Often	9	21.89
normal questions score	Sometimes	12	16.83
	Never	5	10.90
	Total	32	
	Always	6	15.25
	Often	9	19.72
wpscore_percent	Sometimes	12	17.33
	Never	5	10.20
	Total	32	
	Always	6	16.67
	Often	9	16.44
NVR_percent	Sometimes	12	18.00
	Never	5	12.80
	Total	32	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	2.026	6.084	3.603	1.115
df	3	3	3	3
Asymp. Sig.	.567	.108	.308	.773

a. Kruskal Wallis Test

b. Grouping Variable: Play Minecraft with people same age

```
NPAR TESTS
  /K-W=minecraftqs normalqs wpscore_percent NVR_percent BY cq10c(1 4)
  /MISSING ANALYSIS.
```

NPar Tests

Kruskal-Wallis Test

Ranks

	Play Minecraft with people older	N	Mean Rank
minecraft questions score	Always	1	11.00
	Often	2	28.75
	Sometimes	15	17.40
	Never	14	14.18
	Total	32	
normal questions score	Always	1	14.50
	Often	2	22.25
	Sometimes	15	17.03
	Never	14	15.25
	Total	32	
wpscore_percent	Always	1	14.50
	Often	2	25.75
	Sometimes	15	17.20
	Never	14	14.57
	Total	32	
NVR_percent	Always	1	19.00
	Often	2	21.50
	Sometimes	15	18.23
	Never	14	13.75
	Total	32	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	4.933	1.126	2.716	2.416
df	3	3	3	3
Asymp. Sig.	.177	.771	.438	.491

a. Kruskal Wallis Test

b. Grouping Variable: Play Minecraft with people older

NPar Tests

Kruskal-Wallis Test

Ranks

	Don't know ages	N	Mean Rank
minecraft questions score	Always	1	18.00
	Often	3	22.83
	Sometimes	3	17.33
	Never	25	15.58
	Total	32	
normal questions score	Always	1	8.00
	Often	3	19.67
	Sometimes	3	18.17
	Never	25	16.26
	Total	32	
wpscore_percent	Always	1	14.50
	Often	3	22.00
	Sometimes	3	17.33
	Never	25	15.82
	Total	32	
NVR_percent	Always	1	24.00
	Often	3	20.67
	Sometimes	3	23.50
	Never	25	14.86
	Total	32	

Test Statistics[a,b]

	minecraft questions score	normal questions score	wpscore_percent	NVR_percent
Chi-Square	1.721	1.311	1.255	3.761
df	3	3	3	3
Asymp. Sig.	.632	.726	.740	.288

a. Kruskal Wallis Test

b. Grouping Variable: Don't know ages