The Influence of a Serious Game on Language Learning

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Abstract

The purpose of this paper was to figure out if a serious game could increase the effectiveness of learning Japanese words compared to the old fashioned way with plain text. For our study we had a total of 30 participants. The participants were split into two groups – one group used the game called: My Japanese Coach and the second group used a plain list of words. Each group were given 10 minutes in order to learn 20 Japanese words. The results showed that there was a statistically significant difference between the two groups. The group which took the serious game showed a significantly lower score than the group that used plain text to learn the words. The conclusion is that in our study the effectiveness of learning Japanese words through a serious game *can* be stated as false. However we genuinely think that serious gaming should be considered as a method for these types of learning environments.

Keywords: Serious game, language learning

1. Introduction

With the advent of affordable desktop computers and their increased presence in our society came new paradigms for both entertainment and working life. The novelty of the technology together with its increased prevalence in our personal space has brought gaming to the forefront of debates on their tendencies to distract or even the possibility of manipulating its user into violent acts (Ivarsson, 2009). The focus on the detrimental effects of this technology however foregoes the possibilities granted by its inherent interactive and visually arresting properties. While the value of the digital world for businesses and communication is indisputable, the educational aspect has been highlighted only in more recent years (Wouters et al., 2013). Digital games offer a variety of interesting mechanics that have been studied concerning the ability to provide alternative and perhaps even improved methods of learning, such as their ability to intrinsically motivate students and appeal to the more visual aspects of learning. The category of these so-called serious games is a broad one however, leading to a need to specify the scope of the subject. Although a singular, general definition is often difficult to give, serious games can be identified by their non-entertainment related primary purpose. Serious games often still incorporate many elements of 'regular' games and thus are often classified under the name of edutainment. In this paper serious gaming will be referred to exclusively as games with a goal clearly related to knowledge discovery and learning.

Language acquisition is one of the learning goals serious gaming can be applied to. In this paper we look at the effectiveness of a serious game in its ability to assist with teaching a language. In addition, we aim to find out whether a game increases the user's motivation to learn. This can be stated in a research question as follows: Is it more effective to learn Japanese words through a serious game or by learning the words from a

plain text, and how does motivation play a role in this?

2. Theoretical background and related work

2.1 Serious games as a motivation for learning.

Increased motivation through serious gaming is widely recognized (Abt, 1987). The play aspect of serious games is crucial for it to cause increased motivation. This play aspect can be defined as voluntary, intrinsically motivating and it involves a level of active, sometimes physical engagement (Rieber, 1996).

The second point needs further elaboration. Most motivation models emphasize intrinsic motivation, which focuses on the motives to perform a task that are derived from the participation itself (Garris, 2002). Extrinsic motives can also play an important part when looking at motivation, but it has been proven that intrinsic motives are more effective (Garris, 2002).

This intrinsic motivation has been subdivided into 3 parts by Malone, which are fantasy, curiosity and challenge (Malone, 1981). Fantasies make instructional environments more interesting and more educational (Malone, 1981). The remaining two, curiosity and challenge, lie in close relationship with each other. Curiosity should be triggered, which means that the game should not be too complicated or too easy in respect to the user's existing knowledge (Malone, 1981). There should be clear, specific, and difficult goals, which creates a challenge and increases performance (Garris, 2002). Although intrinsic motivation plays a big role in games, extrinsic values are also of importance. Deci and Ryan see the importance of extrinsic motivation in self determined learner behavior (1985). It helps to make the learner engage in activity, because he or she desires the outcome and values it as important.

2.2 The effectiveness of serious games

In an experiment by Wong, it was shown that new media is more effective than more traditional ways of educational material (Wong, 2007). Four ways were used to teach students information on biological processes, which were paper, hypertext, replay and a game. Only the text version proved to be ineffective as less knowledge was obtained. Other research shows different results. Proske's experiment compares game based writing training with traditional forms of writing training (2014). In the end, game based practice encourages students to spend more time on practicing, but it does not guarantee better achievement (Proske, 2014). Van Eck claims that serious games are more effective because the knowledge can be applied in the environment in which you learn and demonstrate it (2006). An experiment by the Lightspan Partnership shows that games can increase scores of students. Kids were to play serious games over the weekend in addition to their school work for 6 hours and their vocabulary increased by 25 percent respectively over the control groups. Math scores also increased significantly (Prensky, 2005).

2.3 Serious games to learn a language

Many serious games have been produced that aim to improve someone's language skills (Sandberg, 2014; Johnson 2007; Silva, 2011). Wouters looked at whether serious games help to learn a language (2013). It was found that serious games are beneficial for language acquisition. This can for instance be explained by the fact that graphics and visualizations may encode better encoding of meanings of words (Clark, 1991). They also help users to practice the language in a playful and authentic way. (Suh et al, 2010)

2.4 Implications for our study

Based on previous research it has become clear that serious games can increase the user's motivation and can make learning more effective. Wouters et al found that a serious game can increase the effectiveness of learning a language. We would like to find out whether this is also true for one particular game called My Japanese Coach. It is expected, based on just discussed research, that a serious game to learn the Japanese language will improve the motivation and effectiveness in respect to paper based education.

3. Method

3.1 Participants

In total we had 30 participants for the study. 15 participants were selected for condition A (the serious game) and 15 participants for condition B (the wordlist). The participants were randomly chosen from two locations of the

University of Amsterdam, however it is important to note that those that chose to join our experiment might not be completely representative of the population due to their inherent inclination to participate. The age of the participating students was between the 18 and 26. By choosing students, the chance that they were familiar with English was high. This was needed because the serious game itself was in English. The participants were selected only if they did not speak Japanese at all, but did understand English. This was tested before they were randomly assigned to one of the two conditions of the study.

3.2 Design

3.2.1 Independent variables

The study was based on an experiment with two conditions: condition 'serious game' and condition 'wordlist'. These were the levels of the independent variable 'learning environment'. The condition 'wordlist' formed our control condition against which to compare the condition 'serious game'. This condition also contained a list of twenty Japanese words which the participants were asked to learn. The list of words was presented to them on a computer through the computer program 'Word' (see appendix below). The condition 'serious game' consisted of a computer game with a list of the same Japanese words. The serious game used was called 'My Japanese Coach'.

3.2.2 Dependent variables

There were two dependent variables in the study, namely effectiveness and motivation. Effectiveness referred to which learning environment resulted in learning more Japanese words. It was measured on the basis of the scores of the participant on the word-test. The condition with the highest average score of the participants on the word-test was seen as most effective for learning Japanese words. During grading of the test, the size of the mistake was taken in account. When a participant left a gap or wrote down a completely different word they got zero points, when they made a spelling mistake they got one point and when they had written the word perfectly they got two points. For the test we asked 15 words, thus the lowest score they could get was zero points and the highest score was 30 points.

The motivation test we used for our study was based off an online motivation test (prestatiemotivatietest). The online version was an general motivation test by default, therefore we made some small adjustments to be able to fit our study. The motivation was measured by nine theses with a 5-points Likert-scale, where 1 stood for strongly disagree and 5 stood for totally agree (see appendix), like 'Ik span me in voor deze opdracht', 'Ik vind het leuk om op deze manier woorden te leren' and 'Ik ben opgegaan in het leren van de woordjes dat ik alles om me heen vergat'. Afterwards, the points were counted together the average was taken. The condition with the highest average was seen as most motivated for the participant to learn Japanese words.

3.2 Materials

3.2.2 Serious game

The serious game 'My Japanese Coach' was used in order to teach our experiment group Japanese. The game was published by Ubisoft in 2008 for the Nintendo DS and is no longer in production. An open-source emulator, DeSmuME (DeSmuME), was used to play the ROM-version of the game. The game was artificially completed using cheat codes and two 'lessons' of 10 words each were chosen to be studied, for a total of 20 words, and which were subsequently tested.

Two snapshots of the game were chosen for the participants to be played and their respective states were saved, which then could be loaded in exactly the same place for each participant.

Image 1 shows the starting interface when loaded. It shows the English words with the kanji, the traditional Japanese characters, to the right. When clicked, the kanji changes into romanji, the western 'romanized' version of the Japanese characters written in the Latin alphabet, and the correct pronunciation was spoken to the participant. After being introduced to the 10 words in the lesson in this manner, the participant enters 'game mode' wherein two games are played in order to practice the learned words. Short instructions were given in-game and following that, the game would start.

Image 1

Image2

The gaming part was fulfilled by two mini-games: Hit-a-Word and Multiple Choice. In the former the participants test both their knowledge of Japanese and their responses by clicking the correctly translated word transposed on a tiny hamster that pops up from the ground (Image 2). Hitting the correctly 'worded' hamster nets the player a percentage shown on the right board, as well as a visual cue (Image 3). Clicking on the incorrect answer gives the player a negative visual cue (Image 4). When the timer ran out, the player clicks too many wrongly worded hamsters or reaches a score of 100%, the next word would be randomly chosen. The left board shows how many words the player has completed adequately, e.g. those words wherein the player has a score higher than 50%.

Image 3

The latter is a simple multiple choice test (Image 5) which gives a similarly clear indication of the correct and incorrect answers. The player has a minute to answer as many of the 10 possible questions correctly as he or she can. The left side shows the number of correct answers, and the right side the number of incorrectly answered ones. Whenever the player clicks a right answer, a large green image appears indicating success; upon clicking a wrong answer he or she is shown a red sign similar to a stop sign.

Image 4

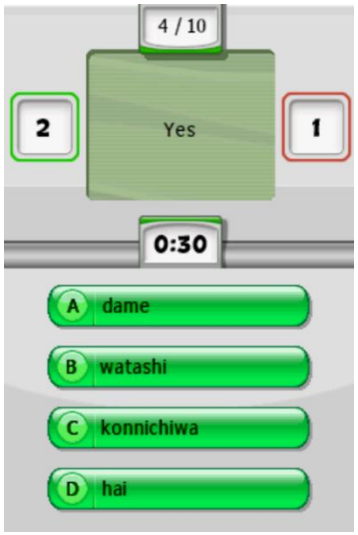

Image 5

Image 6

At the end of the game, the player receives feedback on his or her performance in the form of a score screen (Image 6) that indicates the player's mastery of a certain word depending on the number of correctly answered questions. Then the player can choose to replay the mini-game or move on to the next mini-game. For our purposes, players were forced to play both mini-games three times to not have to differentiate between the possible differences in learning value between both mini-games.

3.2.3 Written wordlist

The wordlist consisted of 20 Japanese words, written in romanji, underneath each other with next to the word the translation in English. The words were placed in a random order. The 20 words of the wordlist are the same words used in the serious game (for the complete wordlist: see appendix). It was crucial to use the same words in condition 'serious game' as in condition 'wordlist' to avoid biases. It could be that one word is easier to learn then another, which can result in higher scores in one condition compared to the other. The results could then no longer be assigned to the learning environment alone, but also to the difference in word difficulty.

4. Results

Two Independent-Samples T-Tests were performed in order to determine whether there were any (significant) differences between the test scores and motivation scores of both the Game and the Paper group. First the data was checked for whether it complied with the assumption required for a T-Test. A boxplot of both scores showed that there was a single deviant outlier, which was removed and replaced by another test result. This new list of scores did not have any significant outliers that could skew the data incorrectly. Each group's scores was shown as being normally distributed by the Shapiro-Wilks test ($p = .860$ and $p = .639$ respectively with. $p > .05$). Levene's Test for Equality of Variances indicated that both scores ($p = .397$ and $p = .239$ respectively) showed homogeneity of variances. Both scores thus met the requirement for the Independent-Sample T-Test.

The study discovered that there was a statistically significant difference between the two groups with regards to test score. The Game group ($M = 14.53$, $SD = 5.53$) had a significantly lower score than the Paper group ($M = 22.40$, $SD = 4,05$) after learning the words for 10 minutes, $t(28) = -4.446$, $p = 0.000$.
There was no significant difference between the Game group ($M = 3.622$, $SD = .350$) and the Paper group ($M = 3.570$, $SD = .632$) with regards to motivation, $t(28) = .278$, $p = .783$.

5. Discussion

The question we are trying to answer in this paper: Is it more effective to learn Japanese words through a serious game or by learning the words from a plain text and how does motivation play a role in this? As stated in the theoretical framework, we expected game-based learning to be more effective and motivational than traditional vocabulary learning. We also stated that this might not be

the case if the user isn't motivated. Our findings do not comply with the first statement, the participants using the game to study the words had significantly worse results in effectiveness compared to the participant using the classic way of studying the words. The motivation test did not show any significant improvements. Regarding the second statement, even though our motivation test did not show a significant improvement for game based learning it doesn't prove that the statement is true. To find that out more research is needed.
Our statements were based on earlier research about serious games, our results are most in line with Proske's (2006) experiment. He compares game based writing training with traditional forms of writing training. His findings show that game based learning motivates the learner to spend more time practicing but it doesn't increase effectiveness. Van Eck (2006) provides an explanation for the decrease in effectiveness, he states that serious games are more effective because the knowledge can be applied in the environment in which you learn and demonstrate it. Our serious game consisted of two mini-games called hit a word and multiple choice, neither of the two submerges you into a particularly Japanese world in which the language is explained and taught. A second explanation is provided by Malone (1981), his research is focused on what makes a game enjoyable, his results show that there are huge differences in preference when it comes to games, by chance it is possible that our game did not comply with the preferences of our participants. Malone also finds that games without a clear goal are significantly less interesting than other versions. The goal in our game is to get your score up as high as possible by doing the mini-games multiple times, by using only parts of the game in our research the participants might have felt like the game didn't provide a clear goal, resulting in less motivation and effectiveness. A third explanation might be that learning twenty words in ten minutes is too long for traditional vocabulary learning. Especially since the game includes a short introduction and a couple extra options like speech practicing, Which might distract from the actual task of learning the words and results, resulting in decreased effectiveness for the game. Also, the time between switching from mini-game to mini-game takes a short while, this means that, since each mini-game teaches you ten words, the participant has to remember the first half of the words longer than the second half of the words. While the other group can keep learning the words without any interruption.

Since our research was focused on short-term learning it doesn't provide any evidence for long-term learning. Baltra (1990) has done such a study, he let students play an adventure game to learn languages with, he found increased motivation and effectiveness. To find out if My Japanese Coach also has better long-term effects further research is needed.

Our research also doesn't study the effects for different educational levels. To find out if a higher educational level influences the effectiveness and motivation with our study more research is needed.

Lastly our research makes use of two different mini-games, further research could be done to find out if the separate mini-games provide different results. For example, we noticed that participants did much worse with the hit a word game compared to the multiple choice game, this is because the hit a word game involves reaction speed while the multiple choice game doesn't.

6. Conclusion

The purpose of this paper was to figure out if learning words through serious gaming had any positive effect compared to the old fashion plain text. We also tested the motivation of our contestant if that could actually play a role in the outcome of our study. As stated in the theoretical framework and discussion, we expected game-based learning to be more effective and motivational than paper based learning – our results proved us otherwise.
There appears to be a statistically significant difference between the groups. The results favour paper based learning in every way. The Gaming group had a mean score of 14.53, which is significantly lower compared to the score of the Paper group (22.40). Even the motivation which we expected to favour the gaming group more, showed no difference between the two groups (3.622 to 3.570).

However as stated in in the discussion our research used two different mini games – Hit the Word and multiple choice. We noticed that the multiple choice showed a much better effectiveness compared to the Hit the Word mini-game. Even though that is bold statement, further research could be done to provide feedback to each other to help identify and resolve inconsistencies between the two games.

Despite our statement proving us wrong we genuinely think that serious gaming can be used for effective learning. Since our research was merely focused on short-term learning it doesn't necessarily provide any evidence for a long-term learning. We experienced that serious gaming has a lot of advantages and potential to seriously consider using it as a method for these types of learning environments. However we also experienced that the way it is presented towards the contested is crucial for the effectiveness of its goal. Nevertheless with the rise of the internet, social media and technology we think that serious gaming can establish an important role in the learning environment and should be considered as a modern future method.

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7. Appendices
Appendix 1: The Study

Deel 1: Vragenlijst
Deel 1: Algemeen

1. Wat is je geslacht	Man/Vrouw
2. Wat is je leeftijd?	… jaar
3. Kan je Japans begrijpen?	Ja, dan bedanken we je voor de moeite en is hierbij de vragenlijst afgelopen/Nee, ga dan verder
4. Begrijp je Engels?	Ja, ga dan verder/ Nee, dan bedanken we je voor de moeite en is hierbij het onderzoek voor je afgelopen

Deel 2: Woorden leren
U krijgt nu van de onderzoeker verdere uitleg over het leren van de woorden. Nadat u klaar bent met wat de onderzoeker u heeft uitgelegd mag u verdergaan met deze vragenlijst. Alvast bedankt.

Deel 3: Woordentoets
Nu krijg je 10 minuten de tijd om de volgende 15 woorden te vertalen naar het Japans die u net geleerd heeft.

Yellow	
	Gray
Bad	
	Thank you
Red	
	Goodbye
Hello	
	This
Black	
	Green
I (formal)	
	White
Blue	
	No
Yes	

Deel 4: Motivatie-test

		Helemaal oneens				Helemaal eens
1.	Ik span me in voor deze opdracht	0	0	0	0	0
2.	Ik vind het leuk om op deze manier woorden te leren	0	0	0	0	0
3.	Ik heb mijn best gedaan tijdens de opdracht	0	0	0	0	0
4.	Ik ben opgegaan in het leren van de woordjes dat ik alles om me heen vergat	0	0	0	0	0
5.	Toen ik met de opdracht bezig was, voelde ik me lekker	0	0	0	0	0
6.	Ik span me in voor deze opdracht om dat het van mij gevraagd word	0	0	0	0	0
7.	Ik beleef plezier aan deze opdracht	0	0	0	0	0
8.	De opdracht is uitdagend	0	0	0	0	0
9.	Ik heb het gevoel dat ik iets heb geleerd	0	0	0	0	0

Deel 5: Woordenlijst voor de participanten

White	shiroi
Black	kuroi
Blue	aoi
Red	akai
Green	midori
Brown	chairo
Yellow	kiiro
Orange	orenji iro
Gray	haiiro
Pink	pinku
Good	ii
Bad	dame
Yes	hai
No	iie
Hello	konnichiwa
Goodbye	sayounara
This	kore
That	sore
Thank you	arigatou
I (formal)	watashi

Appendix 2: Results

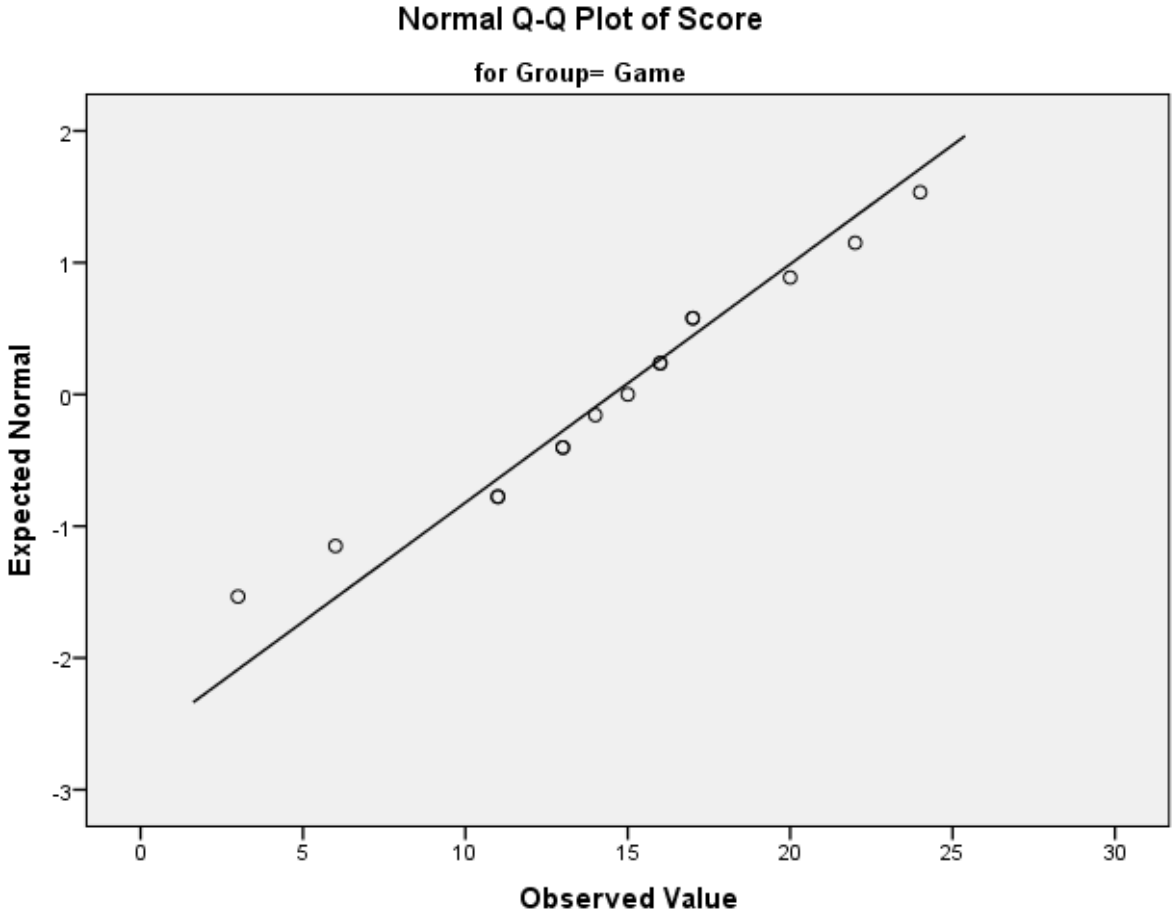
Normality

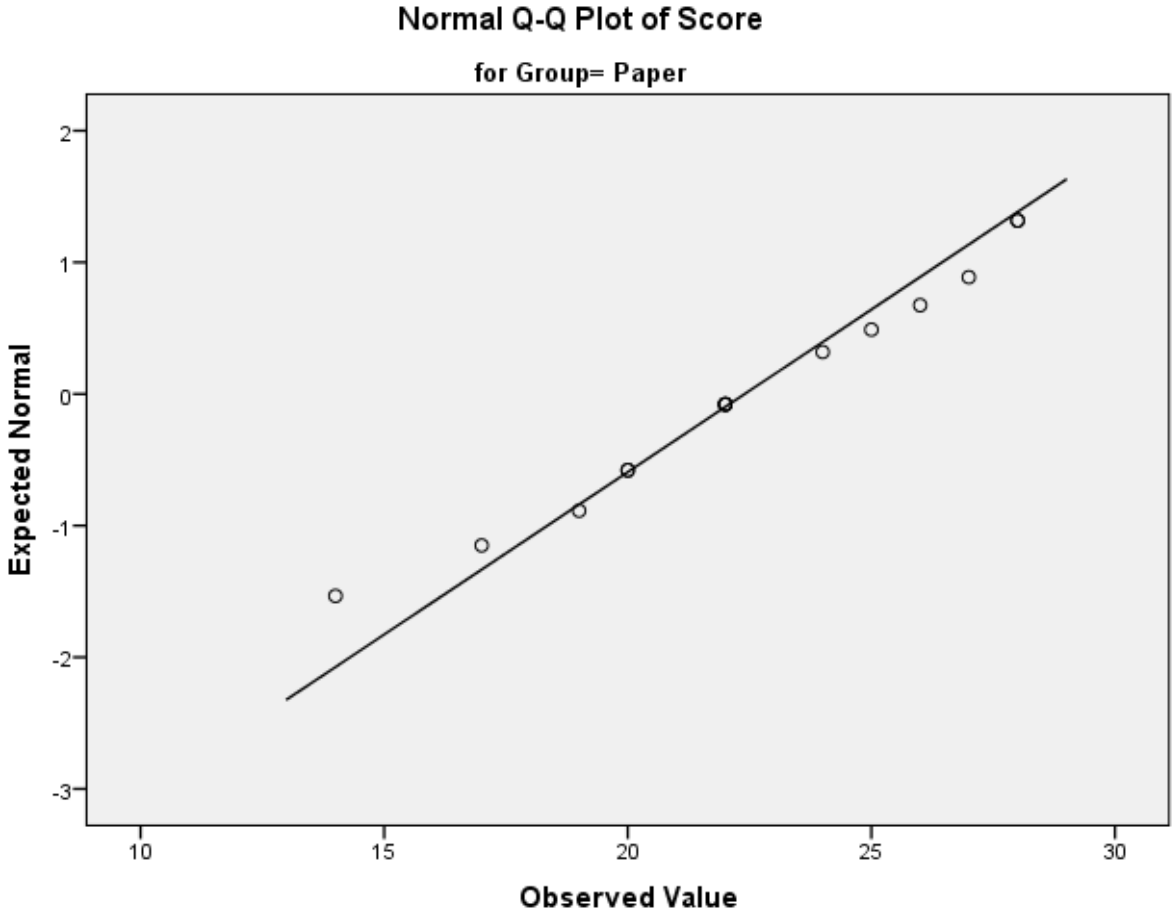
Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
Score	Game	.128	15	.200*	.970	15	.860
	Paper	.139	15	.200*	.957	15	.639

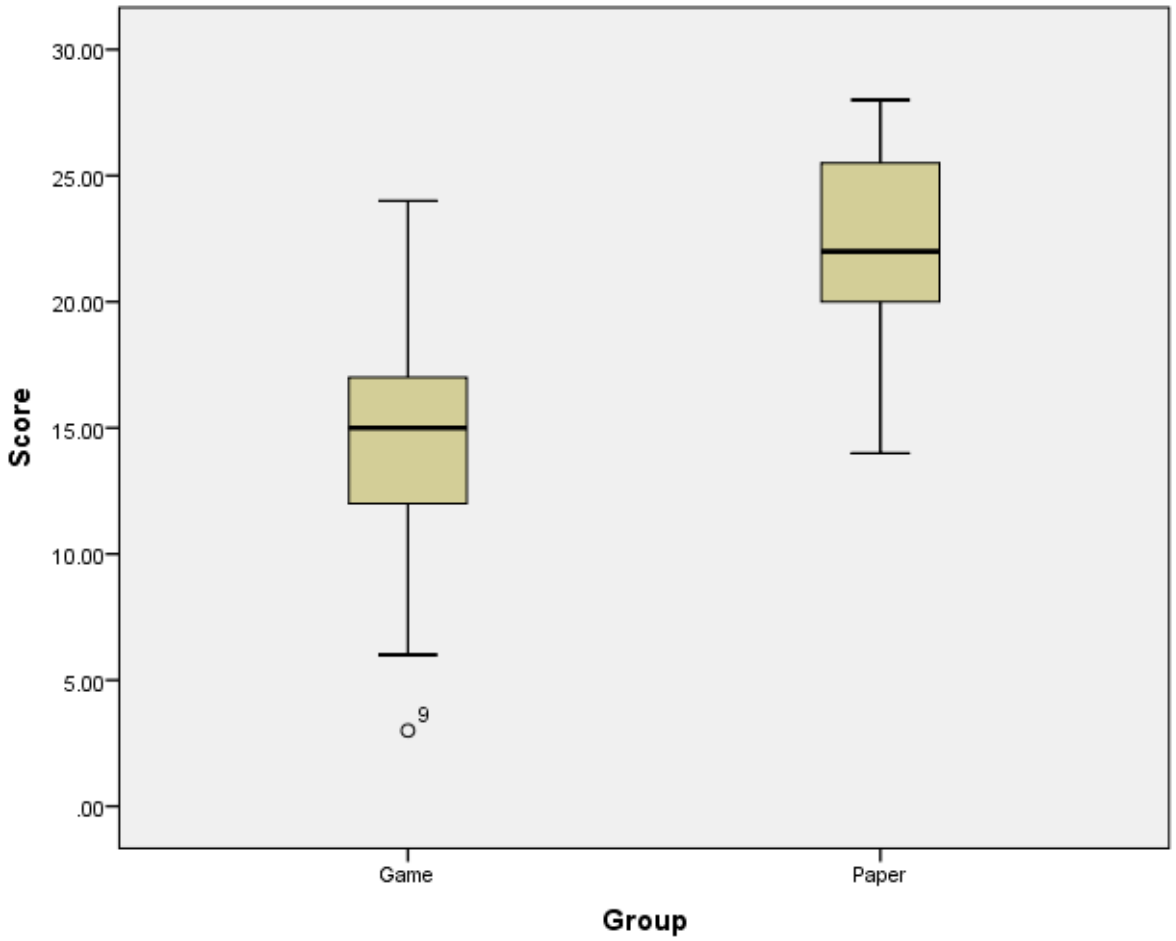
*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction




Normal Q-Q Plot of Score
for Group= Paper
Expected Normal
Observed Value
2
1
0
-1
-2
-3
10
15
20
25
30

Outlier detection



Game

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	12	19	25	22.00	2.132
Score	15	3	24	14.53	5.527
Motivation	15	3.22	4.22	3.6222	.35086
Valid N (listwise)	12				

Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	?	3	20.0	20.0	20.0
	Female	7	46.7	46.7	66.7
	Male	5	33.3	33.3	100.0
	Total	15	100.0	100.0	

Papier

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	12	18.00	26.00	22.2500	2.34036
Score	15	14.00	28.00	22.4000	4.04969
Motivation	15	2.33	4.89	3.5704	.63255
Valid N (listwise)	12				

Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	?	3	20.0	20.0	20.0
	Female	2	13.3	13.3	33.3
	Male	10	66.7	66.7	100.0
	Total	15	100.0	100.0	

Independent Sample T-Test “Score” and **homogeneity of variances**

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Score	Game	15	14.5333	5.52742	1.42717
	Paper	15	22.4000	4.04969	1.04563

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Score	Equal variances assumed	.739	.397	-4.446	28	.000	-7.86667	1.76923	-11.49076	-4.24257
	Equal variances not assumed			-4.446	25.668	.000	-7.86667	1.76923	-11.50565	-4.22768

Independent Sample T-Test “Motivation” and **homogeneity of variances**

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Motivation	Game	15	3.6222	.35086	.09059
	Paper	15	3.5704	.63255	.16332

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Motivation	Equal variances assumed	1.446	.239	.278	28	.783	.05185	.18677	-.33072	.43442
	Equal variances not assumed			.278	21.870	.784	.05185	.18677	-.33561	.43931

Individual contribution to the project

Everyone: data collection

Milan Lefferts: Introduction (1), description of serious game (3.2), Results (4), data analysis in SPSS, make wordlist

Amin Belbraouate: Conclusion (6), Abstract

Jan Jaap Meijerink: Discussion (4), find emulator/game, make handout

Lisa List: Method (3)

Laura Mul: Theoretical Framework (2), literature review