Gender differences in digital and paper-based reading:
A case study of Dutch digital natives

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Abstract

This study examines the differences in reading behavior between teenage boys and girls in the Netherlands. It pays special attention to the difference between digital and paper-based reading and how this affects the gender gap in reading. Participants were 105 fourth-grade HAVO high school students, who either took a digital reading test or a paper-based reading test. The findings suggest that boys have a more positive attitude towards digital reading and will spend more time on the computer than girls. Additionally, girls seem to read more often than boys. Nevertheless, these three factors did not influence reading comprehension as no positive correlation was found between any of the factors and the test scores. No significant differences were found between the scores of boys and girls either in the paper-based test, or in the digital test. Unexpectedly, boys did not perform better on a digital test. than on paper-based test. The medium does not seem to affect the reading performances of either boys or girls. The finding that the test scores did not differ in any way suggests a promising future for incorporating digital testing in the Dutch education system because of its advantages over paper-based testing. Recommendations on how to incorporate digital testing in the classroom are given.

Keywords: Digital reading, reading comprehension, gender difference, PISA, Paper, computer, assessment, reading literacy.

1. Introduction

The world is rapidly changing, and technological advances can be seen all around us nowadays. Children are growing up in a highly digitalized world and therefore technology and media have become an integral part of the education system, especially in developed countries such as the Netherlands. Primary and secondary school teachers are frequent users of technology. According to Hixon and Buckenmeyer (2009), "[s]chools are recognizing and acknowledging this focus on technology by investing vast amounts of money in technological resources" (p.131). In reality, this means that instead of schoolbooks, digital learning materials are provided in 65% of all schools in the Netherlands, and instead of a blackboard, a Digi Board is used in 82% of the schools (Smeets & Horst, 2018, p. 53). It seems that there is a shift from paper-based to digital-based reading inside the classroom.

Digital reading can be seen outside the classroom as well. The introduction of smartphones and other electronic devices makes digital reading easy and convenient. Digital reading offers more advantages over paper-based reading. Firstly, the content is more sustainable than reading from paper. In 2018, over 125 million trees were used by the book and newspaper industries in the United States only (Yeong, 2012, p. 404). Secondly, digital texts are available throughout the internet for everyone, in contrast to paper-based books which are shipped long distances to get to warehouses or libraries. Finally, "[s]ince April of 2011, e-book sales have outsold printed books on Amazon.com" (Daniel & Woody, 2012, p. 18). Which indicates that the popularity of digital texts is increasing as well. Apart from being more sustainable, e-books or digital texts have other potential advantages over printed texts. Digital text may look more attractive to especially the younger generation because it can include videos, animations or hyperlinks. Another advantage is the fact that digital texts are generally less expensive than paper-based text. Furthermore, "ease of availability encourage[s] students to consult a computer for textbook information rather than a paper textbook" (Daniel & Woody, 2012, p. 18). Because of all these advantages, students of the 21st century may prefer digital texts.

Nevertheless, many students still use paper-based texts to read or study, and recent studies have claimed that reading comprehension is better when reading from paper in comparison to reading a digital text (Clinton, 2019; Mangen, 2013; Yeong, 2012). Moreover, digital reading may cause eye-fatigue (Yeong, 2012) or mind wandering (Clinton, 2019). In addition, a study by Lauterman and Ackerman (2014) provides evidence that the natural learning process tends to be shallower on screen than on paper (p. 461). These results all

indicate that digital reading is not the same as traditional or paper-based reading. Specifically, the results suggest reading from paper would result in better comprehension than digital reading.

On the other hand, the same study conducted by Lauterman and Ackerman (2014) also found that the consistent screen inferiority found in performance and overconfidence can be overcome by simple methods, such as practice and guidance on in-depth processing. This results in the fact that some learners become able to perform as well on screen as on paper (p. 462). Likewise, a study that focused on young children suggests that "children, if given enough time, may be able to comprehend equal amounts of information from paper and computer" (Kerr & Symons, 2006, p. 13). These studies may indicate that the difference in reading comprehension between digital and paper-based reading can be overcome with certain methods. It seems that paper-based reading does not necessarily lead to better reading comprehension.

Not only does the difference in reading comprehension change, there also seems to be a shift in the attitude towards digital reading. While studies show that there was a preference for printed books over e-books among students (Yeong, 2012; Kim & Kim, 2013), one more recent study shows that students prefer a digital text over printed text (Singer, 2017). This shift can be explained by the fact that the younger generation is growing up in a digital environment and may be getting used to reading digital texts. It seems that the next generations are ready for a more digital world in which reading digitally is standard. It must be noted, however, that this is only the case for teenagers living in a developed country where they are surrounded by technology which is widely used inside and outside the classroom.

Schools and universities in these countries are already exploring the use of technology within the classroom. Lauterman and Ackerman (2014) write that "[s]tudents face computerized reading comprehension tasks in their studies, and higher education candidates face them in online screening exams (e.g., the Graduate Management Admission Test, the GMAT)" (Lauterman & Ackerman, 2014, p. 456). It is to be expected that using computers or other electronic devices in the classroom will happen more and more often as many of today's teachers start focusing on 21st century skills (Clemens, 2014). According to Larson and Miller (2011), "in the 21st century classroom, students should collaborate and communicate in both online and offline environments" (p. 122). Being able to use a computer and read internet texts is, thus, essential for 21st century skills.

Many other 21st century skills are needed to work and learn in a digitalized world. According to Saavedra and Opfer (2013), "[m]ost [schools] focus on similar types of complex thinking, learning, and communication skills, and all are more demanding to teach and learn

than rote skills" (p. 8). Digital reading can be considered part of these 21st century skills because digital reading may require extra and higher level thinking skills than traditional paper-based reading (Leu et al., 2015, p. 3). Additionally, Voogt et al. (2011) stressed that "[p]olicymakers, leaders and researchers need to work closely together to incorporate 21st century skills in curricula and to develop assessments of those skills" (p. 2). It therefore seems that 21st century skills should be included in modern education and assessment.

An organization that studies 21st-centrury skills and includes them in students' assessments is the Organisation for Economic Co-operation and Development (OECD). Their Program for International Student Assessment (PISA) is an internationally standardized assessment scheme developed jointly by participating countries and administered to 15-year-olds in schools (Martyniuk, 2006, p. 11). PISA is known for its reading comprehension assessments that, nowadays, are administered both digitally and on paper. The different studies of the OECD have found a remarkable result. The reading performances of boys seem to decrease in comparison with the performances of girls (Hek, Buchmann, & Kraaykamp, 2019). This phenomenon does not only exist internationally but can also be found in a developed country such as the Netherlands.

In the Netherlands, the difference in reading performance between boys and girls is of broad interest as Dutch newspapers have reported about this problem throughout the last couple of years (Heijden, 2013; Kleinjan, 2017; Winters, 2017). The Trouw reports about the fact that women and girls have emancipated successfully. They are outperforming boys in secondary education, and there are more girls who have graduated from pre-university education than boys (Kleinjan, 2017). Heijden (2013) stresses that although girls outperform boys in all subjects in secondary education, the highest difference is in reading performances. Finally, Winters (2017) calls for different education for boys. She claims that the present education system focuses too much on languages and that experts are advocating for education that has more physical elements. There seems to be a need for a solution to this social problem in the Netherlands.

Surprisingly, a study by PISA on Scandinavian children found that the difference in reading performances between boys and girls decreases when reading digital texts (Reimer et al. 2018, p.127). This could be a possible solution for the gender gap in reading. Another finding of the study is that northern countries improved their results when taking a digital test. An explanation for this is that students in these countries have significant experience in using digital devices. In contrast, countries such as Turkey and South-Korea with low average use of the internet, performed worse when doing the digital test (Reimer et al. 2018, p.123). The average internet use of the northern countries is considered to be relatively high (Sweden 96.7%, Iceland

99.0%, Norway 99.2%, Finland 94.3%, and Denmark 96.9%) (Internet World Stats). Likewise, 95.9% of the Netherlands had access to the internet at home in December 2018 (Internet World Stats, 2019). These comparable internet statistics suggest that Dutch teenagers would, like teenagers in the northern countries, improve their results when taking a digital test. However, the study only focused on the results of Scandinavian children (Sweden, Iceland, Norway, Finland, and Denmark) and "due to the large statistical uncertainty associated with country-specific results, and of the non-representative nature of PISA field-trial samples, conclusions about the influence of the mode of assessment on individual countries' trends should not be drawn from this research" (Reimer et al. 2018, p. 28). A new study focusing on the reading results of Dutch teenagers seems to be necessary in order to examine whether the same phenomenon occurs in the Netherlands.

Since the discussion of including 21st century skills, specifically digital reading, in the curriculum takes places in the Netherlands as well, digital testing would not come as a surprise. Clemens (2014) already calls for a change in language teaching and to include digital reading in the classroom. It is already part of the curriculum and tests in the United States of America and Australia and should be introduced to the Netherlands too (Clemens, 2014, p.8). In addition to the many advantages digital reading has to offer such as sustainability, flexibility, and ease of availability, it could also be a promising solution to the gender gap in reading as well as a method to incorporate 21st century skills in the classroom.

Therefore, this study will focus on the differences between digital and paper-based reading but also on the differences between gender regarding digital and paper-based reading. To determine the behavior of teenagers and the use of computer in the 21st century, the following research question is formulated:

How is Dutch teenagers' reading comprehension affected by the medium (paper vs. digital)?

To answer this research question, several sub-questions are formulated. The narrowed gender gap in digital reading might be because boys simply spend more time on a computer, and this may differ from the time girls spend on a computer. To find out whether this is the case, the first sub-question is formulated.

1. Do Dutch teenage boys spend more time on a computer than Dutch teenage girls?

A second sub-question will focus on the teenagers' attitude towards digital reading itself. Having a more positive attitude towards digital reading and technology might influence the gender gap. Therefore, the second sub-question focuses on the difference in attitude towards digital reading between boys and girls.

2. Do boys have a more positive attitude towards digital reading than girls?

There may be several explanations of why there is a gender gap in both digital and paper-based reading. A simple explanation this study will focus on is the amount of time spent reading. Girls might simply read more than boys. The third sub-question will, therefore, concentrate on the difference in time spent reading for boys and girls.

3. Do Dutch teenage girls read more often than Dutch teenage boys?

To find out whether a gender gap in reading exists among this sample, the fourth sub-question focuses on the gender gap in paper-based reading.

4. Do girls score better on reading comprehension on paper-based texts?

Additionally, to see whether there a gender gap still exists in digital reading, the fifth sub-question focuses on the test scores of digital reading comprehension tests.

5. Do girls score better on reading comprehension on digital-based texts?

To find out whether the gender gap narrows when boys are being tested digitally, the sixth sub-question will explore the differences between the boys' group that is digitally tested and the boys' group that is being tested by a paper-based test.

6. Do boys score better on the digital-based reading comprehension text than on paper-based reading comprehension texts?

Since this study aims to explore the gender gap in reading in order to give recommendations to improve education in the Netherlands, the results of paper-based and digital tests are also examined. Digital testing might help to narrow the gender gap. However,

it should help to improve the boys' scores and not worsen girls' scores. To ensure that digital testing, in general, is not disadvantageous compared to paper-based testing, the seventh and final sub-question will explore the general difference between the two types of testing.

7. Are the scores of paper-based tests higher than the scores of digital tests?

In short, this study aims to provide an in-depth case study of the reading behavior of Dutch teenagers. The answers to these questions should give insight in the reading behavior of teenagers in the Netherlands specifically. Practically, the findings of this study will shed light on solutions regarding the gender gap in reading performances in the Netherlands and other developed countries. In addition, it may give information on how to incorporate digital testing and reading as a 21st century skill into the Dutch education system.

An overview of previous research is given, and seven different hypotheses are formulated in order to answer the sub-questions. While the primary focus of this study is on the gender gap in reading and the differences between digital and paper-based, it is also examined whether computer usage, attitude towards technology, and hours spent reading lead to a better reading performance in general. Therefore, the relationship of reading hours, PC usage, and attitude towards technology with reading performance. The findings are discussed to provide a broader insight in the reading behavior of Dutch teenagers, the gender gap, the differences between digital and paper-based reading and the several factors which influence these aspects. Finally, recommendations about incorporating digital testing in the classroom are given

2. Background

2.1 Digital Natives

Today's teenagers belong to generation Z, born between the mid-1990s and 2010. Generation Z is known to be highly connected and adapted to multi-tasking (Kim & Kim, 2013, p. 18). This generation, sometimes referred to as the "net generation", having been raised in a highly digitalized world, is accustomed to using the internet and to reading texts digitally. Teenagers born in this generation are therefore often referred to as digital natives. According to Prensky (2001), "[o]ur students today are all "native speakers" of the digital language of computers, video games and the Internet" (p. 1). In addition, he states that it is likely that the students' brains have physically changed in comparison to those of people from other generations, so-called 'digital immigrants', who have not been raised in the digital age and are still learning the new language. It can be said that thinking patterns of digital natives and digital immigrants are different (Prensky, 2001, p. 1). The "net generation" is characterized as "exceptionally curious, self-reliant, contrarian smart, focused able to adapt, high in self-esteem, and has a global orientation" (Støle, 2018, p. 1).

Compared to other generations, digital natives or students belonging to the 'net generation' will not experience any difficulties while using the internet, reading digitally, or taking digital tests. They are comfortable with and dependent on computers and may find obstacles, such as scrolling through a reading passage, to be a natural process (Kim & Kim, 2013, p. 18). In addition, research suggests that motivation and interest are stimulated in children when learning materials are presented on computers (Kerr & Symons, 2006, p 1; Meijer, Emmelot, Felix, and Karssen, 2014, p. 32).

2.2 Gender gap in technology

Although today's teenagers are digital natives, not all of them are equally able to use computers. Bennet and Maton (2010) have observed that there is significant variation in how the "net generation" use technology and that "rather than being a homogenous generation, there is a diversity of interests, motivations and needs" (p. 9). An issue that has received considerable attention from many researchers and society in general is that of the potential difference between males and females in technology use (Cai, Xitao Fan, & Jianxia Du. 2017. p. 1). According to Cai et al.'s meta-analysis, a gender difference exists in the use of technology (2017), with females having a less positive attitude toward technology use in general (Cai et al., 2017). Therefore, the researchers recommend helping females because their less positive

attitude towards technology "could explicitly or implicitly hinder females', especially younger girls', learning and using technology" (Cai et al., 2017, p. 10). Another study focusing on the differences in attitude between males and females is that of Volman, Van Eck, Heemskerk and Kuiper (2005), who studied the differences in attitude towards technology in the Netherlands. The same study compared gender differences in primary and secondary education and found that "unlike primary education, the gender differences found in secondary education were considerable. Girls use the computer less at home than boys and programming and games, in particular, are unpopular" (Volman et al., 2005, p. 51). Dutch male teenagers having a more positive attitude towards the use of technology, in general, may result in a gender gap when using a digital test in comparison to a paper-based test.

In addition to the gender difference in attitude towards technology use, another study by Imhof, Vollmeyer, and Beierlein (2007) found that German male students outperform female students at a computer task which involved recreating Power-Point slides that were given to the participants on paper. Though this was considered to be a relatively easy task using a familiar computer program, there was a significant difference in the performance of males and females (Imhof et al., 2007). A similar result was found in research relating to searching for information online. It was found that when searching for information on a computer "boys learned significantly more target-specific and target-related information than girls" (Roy, Roger, & Chi, 2003, p. 249). These findings suggest that boys have a head start in their performance regarding the use of a computer.

A reason for the difference in attitude and performance may be that males use their computer more heavily than females. This has been found in research involving high school students in Taiwan by Tsai and Tsai (2010), who found that "the boys had a significantly deeper involvement in using the Internet in terms of weekly time spent online, i.e. the Internet use intensity" (p. 1190). They attribute this finding to the fact that boys showed a high interest in playing video games. Likewise, Colley and Comber (2003) also found that in the UK, boys like the computer more than girls. They used it mainly for playing video games (p. 155). Similarly, Scheuermann and Björnsson (2009), who studied the gender gap in reading in Iceland, agreed that "because boys seem to have a preference for mechanical things they tend to use the computer more frequently" (p. 77). In addition, Colley and Comber also found that girls still use computers less, like them less and evaluate their own computing ability less favorably than do boys (Colley & Comber, 2003, p. 164).

The finding that boys use the computer more frequently than girls has not only been found in Taiwan, Iceland and the UK but is "rather reliable across different countries in Europe,

among them Spain, Belgium, the Netherlands, and France, and the US" (Imhof et al., 2007, p. 2825). Since these results have been found more than a decade ago, this study will focus on the difference in computer usage of Dutch teenagers as well. The expectations that boys spend more hours on the computer than girls and the expectation that boys have a more positive attitude result in the following two hypotheses:

H_{A1}: Boys will spend more hours using a computer than girls.

H_{A1}: $H_b > H_g$

H_{01}: There is no difference in the hours spent using a computer between boys and girls.

H_{01}: $H_b = H_g$ or (H_{01}: $H_b < H_g$)

H_{A2}: Boys will have a more positive attitude towards digital reading than girls.

H_{A2}: $A_b > A_g$

H_{02}: There is no difference in the attitude towards digital reading between boys and girls.

H_{02}: $A_b = A_g$ or (H_{02}: $A_b < A_g$)

2.3 Gender gap reading

Although females seem to spend less time on the computer and although females may have a less positive attitude towards the use of technology, males seem to have a less positive attitude towards academic and recreational reading, or as Hochweber and Vieluf (2016) put it, "boys are less interested in and engaged with reading than girls" (p. 268).

Not only do boys have a less positive attitude towards reading, but they are also outperformed by girls. Research among the OECD countries found that "the gender gap in reading literacy was especially noticeable in the underperformance group, where one in eight girls performed below the baseline proficiency level while one in four boys performed below that level" (Wu, 2014, p. 256). Despite some new ways of reading and learning while using computers, the reading performances of boys are lower in comparison with the performances of girls (Hek et al., 2019), which can clearly be seen in figure one.

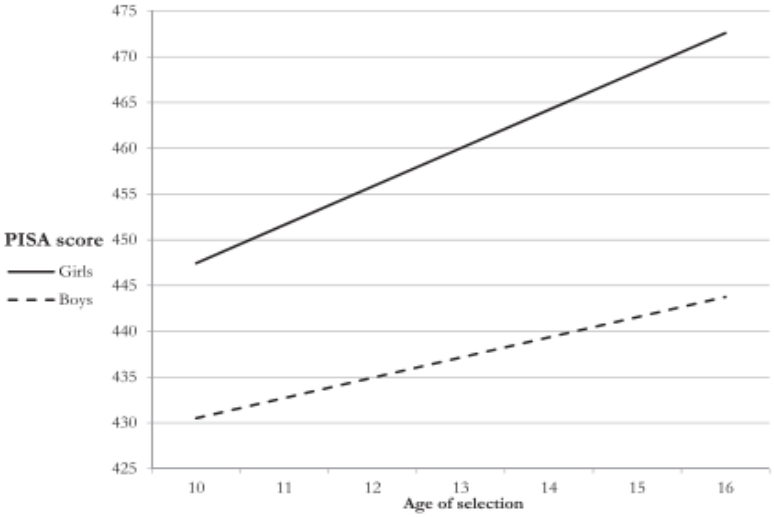


Figure 1: Performance scores with age of selection for girls and boys. (Hek et al., 2019, p. 177)

The fact that females outperform males in reading tasks has not come out of the blue. Lafontaine and Monseur (2009) observed that between roughly 1990 and 2000, the gender gap increased significantly. A decade later, the gender gap continues to grow. It is apparent in all 75 nations in all four PISA assessments (2000, 2003, 2006 and 2009) (Stoet & Geary, 2013, p. 1), including Australia, Brazil, the Netherlands, Qatar, Russia and the United States of America (Program for International Student Assessment (PISA)). This indicates that the gender gap in reading has been a worldwide problem for at least several decades. The increase in the gender gap can be seen in figure two. The first box represents the differences in 2000, the second in 2003, the third in 2006, and the fourth in 2009. The differences are expressed in PISA score points, which means that "the average student score of OECD countries is 500 points with a standard deviation of 100 points" (Stoet & Geary, 2013, p. 2). The most substantial difference can be seen at the 5th percentile in each box, while the smallest difference can be seen at the 95th percentile, indicating that the 5% poorest scoring boys differed more from the 5% poorest scoring girls than the 5% best scoring boys differed from the 5% best scoring girls in all four PISA assessments.

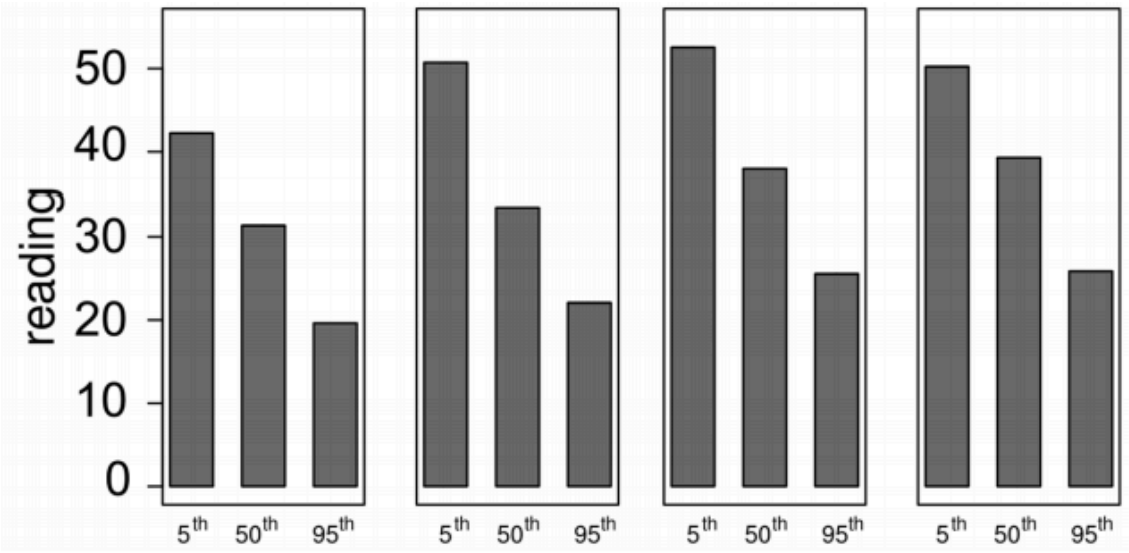


Figure 2: Sex differences per three years in reading performance. (Stoet & Geary, 2013, p. 3).

There are several explanations for the gender gap. Lafontaine and Monseur (2009) found that the type of text, as well as the sort of questions that are asked in a reading proficiency test, may potentially influence the growth of the gender gap (p. 77). Girls seem to be better at answering open-ended items than boys, and the gender gap is more extensive, in favor of females, for continuous texts (p. 74). According to the researchers, these two findings may contribute to the increasing gender gap since the number of open-ended items has increased in the PISA test (Lafontaine & Monseur, 2009, p. 77).

Another finding that may influence the difference in reading performance is the standardization of tests. Hek et al. (2019) found that differences between girls and boys in reading performance in secondary school are substantially related to standardization and differentiation of a country's educational system (p. 179). Standardization in curricula is more negatively related to boys' performance than to girls' performance. This would indicate that boys' performances are lower during central examination than girls' performances.

A third reason for the gender gap in reading might be the fact that, on average, girls simply read more narrative texts than boys. Fifteen years ago, Peter Thomas already observed that the reading behavior of boys and girls is different. According to Thomas (1994), "[g]irls favor fiction and are more likely to immerse themselves in a chosen book. Boys tend to favor illustrated information books about engines, war, football and fishing" (p. 152). This statement may sound clichéd, but it is a fact that girls read narrative texts more frequently than boys and that they might be more familiar with the texts used in reading assessments (Lafontaine & Monseur, 2009, p. 71). In addition, a study about the reading habits of citizens in the Netherlands revealed that, in general, women read more often than men (Wennekers,

Huysmans, & Haan, 2018, p. 60). This study included all sorts of texts such as books, magazines, and folders. It is also noteworthy that the same proportion of men and women read paper-based and digital texts, with 49% of readers reading both paper-based and digital texts (Wennekers et al., 2018, p.66). These findings suggest that both media platforms are more frequently used by women than by men.

To find out whether the hours spent reading may influence the gender differences in reading performance and based on the previously mentioned literature it can be expected that, on average, girls do read more than boys, leading to the following hypotheses.

H_{A3}: Girls will spend more hours reading than boys.

H_{A3}: $H_g > H_b$

H_{03}: There is no difference in the hours spent reading between girls and boys.

H_{03}: $H_g = H_b$ or (H_{03}: $H_g < H_b$)

2.4 Reading Literacy Definition

In the 1970s, reading literacy was broadly described as "being able to respond appropriately to written language" (Bormuth, 1973, p. 9). Additionally, a literate would be someone with the ability to respond competently in real-world reading tasks (p. 13). However, as the world is changing the definition of literacy is also changing. According to the Oxford Dictionary, the definition of the term literacy is "[t]he quality, condition, or state of being literate; the ability to read and write" ("Literacy," 2019). In this definition, writing is also part of being literate but the definition does not differentiate between digital and paper-based reading. This study will only focus on reading literacy, not on the ability to write.

The definition of reading literacy as 'the ability to read' remains vague as it does not elaborate on the skills that are needed in order to read competently. Furthermore, the nature of reading literacy has changed over the past years. As the medium through which we read and access texts is moving from paper to screen, the structure and the format of texts have changed. The definition of reading literacy is, therefore, changing as well. Reading literacy is the ability to comprehend and interpret pieces of continuous texts, but with the change in medium "success will also come through deploying complex information-processing strategies, including analyzing, synthesizing, integrating and interpreting relevant information from multiple text (or information) sources" (OECD, 2018a, p. 6). In the present, TIMSS (Trends in Mathematics and Science Study) and PISA (Programme for International Student Assessment) are the two largest and most widespread international large-scale assessments of learning outcomes (Reimer et al.,

2018, p. 11). PISA has been used to conduct assessments of student's reading, mathematics, and science literacy by the Organization for Economic Cooperation and Development (OECD) (Wu, 2014, p. 252). In 2000, 2009 and 2018, the main focus of PISA was the assessment of reading literacy. PISA first described reading literacy as "understanding, using and reflecting on written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society" (OECD, 2018a, p. 11). Their definition of reading had changed over the years and their latest definition includes digital and paper-based reading, which is why the word 'written' has been removed and in order to correctly engage with digital texts the word 'evaluating' has been added. According to the PISA 2018 framework this definition is the following: "Reading literacy is understanding, using, evaluating, reflecting on and engaging with texts in order to achieve one's goals, to develop one's knowledge and potential and to participate in society" (OECD, 2018a, p. 11). This definition is used in this study, as it includes both paper-based and digital-based reading.

2.5 Traditional Literacy

One of the views on traditional literacy is that of the simple view of reading. According to this simple view, reading consists merely of decoding (identifying different letters and words) and understanding (knowing what those words mean in context) (Gough & Tunmer, 1986, p. 7). The focus in this view is on decoding skills and once a particular text has been decoded, the reader processes the information in the same manner as spoken materials. The process of decoding is also a skill mentioned by PISA. They point out that to know what a text is all about, one should be able to decode it first (OECD, 2018b, p. 29). This is also the skill that dyslexics struggle with as Gough and Tunmer write that "studies have found dyslexic readers to have not merely weak, but almost nonexistent, decoding skills" (Gough & Tunmer, 1986, p. 8). It is for this reason that participants who struggle with dyslexia are left out of this study.

Nevertheless, PISA agrees that decoding skill is not enough to completely understand and engage with a particular written text. According to the complex view of reading, decoding skill is essential, but other skills that play an essential role according to the complex views of reading are vocabulary, grammatical knowledge, strategic competence, meta-cognitive knowledge, knowledge of text structure, and motivation (Gelderen, 2018, p. 6).

In this context, strategic competence (for example) can be described as "the ability to decide what to read and how to read it" (Rouet, Britt, & Durik, 2017, p.200). According to Coiro and Dobler (2007), "expert readers use a range of strategic cognitive processes to select,

organize, connect, and evaluate what they read" (p. 217). These strategic processes are thus important to read competently.

Likewise, meta-cognitive knowledge also plays a significant role. Metacognitive strategies are internal physiological processes that influence reading comprehension and are an important factor when controlling and regulating one's cognitive behaviors. In short, "[m]etacognition involves the state of being aware of one's thinking along with the control and regulation of one's cognitive behaviors" (Wu, 2014, p. 255). Artelt, Schiefele, and Schneider (2001) also found that metacognition has a substantial effect on reading comprehension (p.376). This indicates that a person with high meta-cognitive knowledge would have a better comprehension of written texts. Previous research reveals that females have a higher meta-cognitive knowledge than males as they use reading strategies more often. A study by Sheorey and Mokhtari (2001) showed that female students in general reported using 16 of the 28 strategies more frequently than did their male counterparts (p.445). In addition, it was found that girls scored higher in reading comprehension (Wu, 2014, p. 256). These findings imply that the higher meta-cognitive knowledge of girls contributes to the gender gap in reading performance.

A final skill that influences a person's reading literacy is motivation. This skill encompasses intrinsic motivation (reading because it is fun) and extrinsic motivation (reading to gain external rewards). Motivation, in general, has a positive influence on text comprehension (Guthrie, Klauda, & Ho, 2013; Gottfried, Fleming, & Gottfried, 2001) as well as on meta-cognition (Roeschl-Heils, Schneider, & Kraayenoord, 2003, p. 83). It can thus be said that motivation plays an important role in reading literacy as well as in reading performance. Generally, boys appear to have a lower motivation than girls (Logan and Medford, 2011, p. 86). Roeschl-Heils et al. (2003) pointed out that "boys require special attention in terms of developing their motivational and metacognitive skills required for reading" (p. 83). Lack of motivation may even have the biggest influence on a person's reading ability since Logan and Medford observed that "boys' low motivation, rather than lack of skill, explained the gender difference found in reading ability on the low-interest material" (Logan and Medford, 2011, p. 87). Both studies indicate that a higher level of motivation for girls can be a reason for the gender gap in reading literacy.

To conclude, several underlying skills are important determinants for a person's reading literacy, including decoding, vocabulary, grammatical knowledge, strategic competence, meta-cognitive knowledge, knowledge of text structure, and motivation. A lack of these skills has been found to influence reading comprehension. Furthermore, boys have been found to fall

behind in terms of both motivation and metacognition. Based on these findings, it can be expected that teenage girls will perform better on traditional paper-based reading tests than teenage boys.

H_{A4}: Girls perform better on paper-based reading tests.

H_{A4}: $P_g > P_b$

H_{04}: There is no difference in the performance of boys and girls on paper-based tests.

H_{04}: $P_g = P_b$ or (H_{04}: $P_g > P_b$)

2.6 Digital Literacy

The way in which we access and understand the information in pieces of text also changes when reading digitally (Rasmusson & Eklund, 2013, p. 401). It is clearly visible that a digital text differs from a paper-based text. It may contain hyperlinks and may have a different layout. Additionally, digital texts are presented on an electronic device such as a mobile phone, tablet, or computer screen. Various studies show that digital reading requires different skills than paper-based reading (Chan & Unsworth, 2011, p. 196; Leu, Kinzer, Coiro, Cammack, 2014; Coiro & Dobler, 2007). Digital reading is, thus, very different from traditional reading.

The different skills that are used in digital reading do not replace the skills used in traditional reading but are in addition to those skills. In fact, traditional reading is part of digital reading (Rasmusson & Eklund, 2013, p. 408; Coiro & Dobler, 2007, p.217). This indicates that students need the skills used in traditional reading in order to comprehend a digital text. According to Leu and his colleagues, digital reading expands on the so-called traditional models of comprehension (Leu et al., 2007, p. 5). Therefore, to understand the concept of digital reading comprehension, traditional models of comprehension should be considered. In addition, Leu et al. (2007) divide the new literacies of digital reading into five "major functions" (p.5):

1) identifying important questions
2) locating information
3) analyzing information
4) synthesizing information
5) communication information

These skills are important when reading and comprehending digital texts. (Leu et al., 2007, p. 5).

Another study that identifies the different skills needed for digital reading is that of Rasmusson en Eklund (2013). Besides traditional literacy (p. 407), they name navigation as an

important skill in digital texts. Likewise, PISA also underlines the importance of navigation skill when reading digital texts (Reimer et al., 2018, p. 125). This is described as "the way in which students move around in a digital text in order to orient themselves and to find the information they need" (p. 125). Navigating, or locating as Leu et al. call it, seems to be the most important skill in digital reading.

This may be because digital texts are non-linear as opposed to paper-based texts, which are linear. Linear texts are texts that are divided into paragraphs and have a clear layout. PISA describes linear reading as "reading that is normally performed when reading printed texts in books, newspapers, journals, etc." (Reimer et al., 2018, p. 124). Reading on the internet is non-linear as it does not have a clear layout. Pictures and videos may divide the text and hyperlinks can be included. Furthermore, it is not clear how long a non-linear text (on the internet) is and instead of flipping pages one has to scroll down when reading digital texts on the internet. Navigation skills are thus important in reading a non-linear digital text.

People with better navigation skill are thus better at reading digital texts. Several studies have examined how boys and girls differ in navigation skills. Wu (2014) suggest that "[r]esearch in the online search strategies usually have found that boys have better self-reported search (or navigation) skill" (p. 268). Likewise, Tsai (2009) found that "boys were observed and self-reflected with more accurate control strategies and more positive problem-solving strategies than girls in online information searching" (p. 482), which also indicates a difference in the navigation skill between boys and girls in favor of boys.

The fact that boys outperform girls on computer tasks, and that they have a more positive attitude towards technology in general, may contribute to the finding that the gender gap in digital reading is less extreme than for paper-based reading (OECD, 2011, p. 78). The PISA 2009 assessment included nineteen different countries, including Korea, China, Colombia, and Sweden. The Netherlands were not included in this study. However, this was the first PISA study to examine the differences between digital and paper-based reading. Specifically, it was found that "[w]hile girls are generally more proficient readers in both media, on average, girls score seven points lower in digital reading than in print reading, and boys score seven points higher" (OECD, 2011, p. 79). This implies that boys have an advantage in digital reading as opposed to paper-based reading and that girls have a disadvantage in digital reading as opposed to paper-based reading.

This is in line with the findings of a more recent study that also studied the gender effect in digital-based reading. Reimer et al. (2018) investigated the results of Scandinavian children (Sweden, Iceland, Norway, Finland, and Denmark) on a paper-based reading literacy test in

2012 and a digital reading literacy test in 2015. Reimer and his colleagues compared boys and girls from these different countries. They found that "the results for the Swedish boys confirmed the assumption that those who spend the most time on the Internet are those who benefitted the most from the change of test mode, while the results from the other countries and from girls, in general, do not support this assumption" (p. 146). Thus, only Swedish boys seem to have made an improvement, while the other four countries showed no significant difference.

Although boys may profit from digital reading as opposed to paper-based reading and their performances are better, girls remain generally more proficient readers on both media (OECD, 2011, p. 79). This can be seen in figure three. All these differences in performance are significant, except for Colombia.

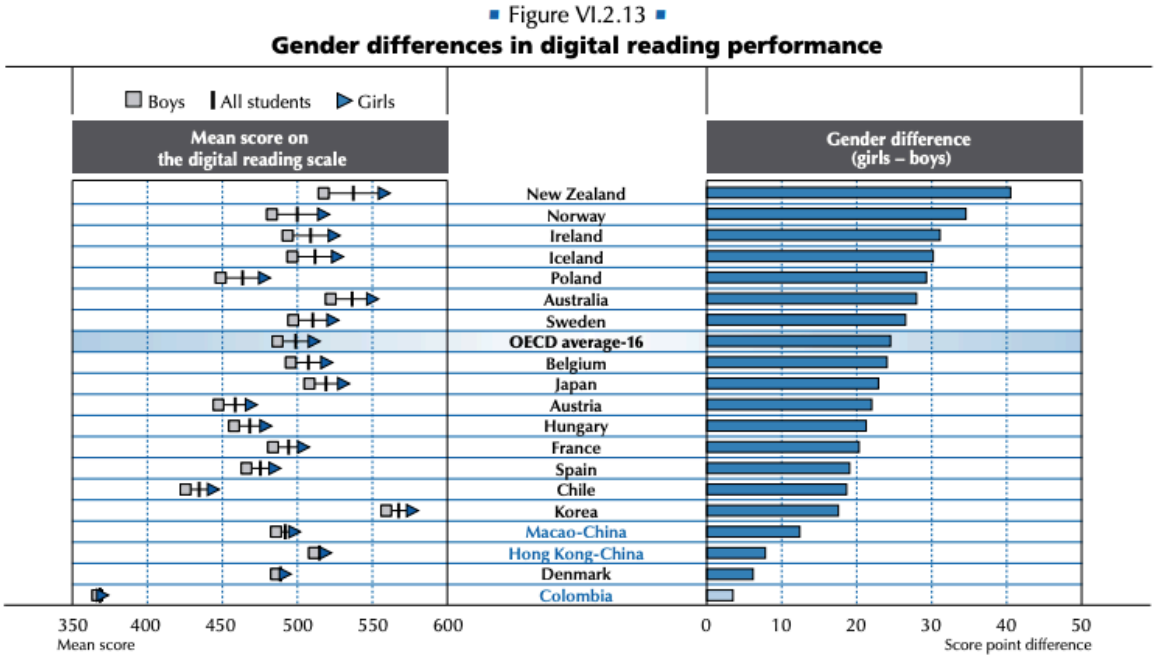


Figure 3: Gender differences in digital reading performance. (OECD, 2011)

Over the years, girls have continued to perform better than boys. "Digital reading was tested again in PISA 2012 (OECD, 2013; Skolverket, 2013), and the same general observations as in 2009 were confirmed" (Reimer et al. 2018, p.125). Overall, it can thus be expected that girls will outperform boys in digital reading tests as well as paper-based tests, which leads to the fourth hypothesis.

H_{A5}: Girls perform better on digital-based reading tests.

H_{A5}: $P_g > P_b$

H_{05}: There is no difference in the performance of boys and girls on digital-based tests.

H_{05}: $P_g = P_b$ or (H_{05}: $P_g > P_b$)

Nevertheless, the differences in performances on digital tests are not as large as the differences between boys and girls on paper-based reading. In 2015, PISA administered its first digital test. Reimer et al. observed that "in more or less all countries that have participated in PISA, the differences between boys and girls in reading decreased in 2015 compared with 2009. This was a break in a general trend towards bigger differences" (Reimer et al. 2018, p. 129). In addition, Rasmussen and Åberg-Bengtsson (2015) verified this narrowing gap between males and females, when it comes to digital reading (p. 704). Another study adds that "in general, changing the test modality to a computer-based presentation platform should not affect performance at the country level; however, the current results indicate that it will negatively impact the performance of girls in comparison to the boys" (Scheuermann & Björnsson, 2009, p. 193). Finally, OECD (2015) suggests that "boys tend to do better in both mathematics and reading when they sit a computer-based test, compared to their performance on paper-based tests – and that this advantage is largely a by-product of boys' familiarity with video games" (p. 44). These different studies, the fact that boys seem to prefer computer-based testing, and the fact that boys generally have skills suited for digital reading lead to the following hypothesis:

H_{A6}: Boys perform better on digital-based testing than paper-based testing.

H_{A6}: $P_d > P_p$

H_{06}: There is no difference in the performance of boys on paper-based testing and digital-based testing.

H_{06}: $P_d = P_p$ or (H_{07}: $P_d > P_p$)

2.7 General reading performance

Although it is expected that boys will perform better on digital tests than on paper-based tests, there has been a large number of studies that found that, in general, paper-based testing is preferred over digital testing. Virginia Clinton (2019) analyzed 33 different studies that studied reading from screens. She concluded that, in general, reading from paper results in better performances on reading tests than reading from a screen. She also suggests that a reason for this difference might be mind wandering, as "it is likely that readers may be more likely to think of topics unrelated to the task of reading when reading text from screens compared to paper. Mind wandering while reading has been found to be negatively associated with reading performance" (Clinton, 2019, p. 318). It is argued that this mind wandering starts because readers focus less on a text when it is presented on screen.

Another reason for mind wandering is given by Yeong (2012), who explains that eye fatigue may play a role in this. Eye fatigue can be described as the "physical injury from a reading environment that is not optimized for their benefit" (p. 393). Eyes can grow tired and the blinking rate decreases when reading from a screen. In short, Yeong (2012) found that "eye fatigue can reduce concentration, which may also affect comprehension" (p. 402). Another study by Lauterman and Ackerman (2014) found that the natural learning process tends to be shallower on screen than on paper and that students have better reading comprehension on paper.

However, there seems to be a shift in the difference between paper-based and digital reading. Daniel and Woodly (2013), found that "students in electronic conditions did not perform differently from those in the text conditions all levels of question difficulty" (p. 22). Likewise, Margolin et al. (2013) have demonstrated that "electronic forms of text presentation (both computer and e-reader) may be just as viable a format as paper presentation for both narrative and expository texts" (p. 517).

When PISA was first administered digitally, scores increased in the Nordic countries but decreased in South Korea and Turkey. Reimer et al. (2018) give the following explanation for this phenomenon "[o]ne difference between the Nordic countries and South Korea and Turkey is that Nordic students generally have more computer experience than students in these two countries" (p. 129). Similar to the Nordic students, the study of Porion et al. (2016) included French participants in this study, who all had experience of using computers. The fact that these participants were digital natives may have influenced the study, which has not found a difference between paper-based and digital testing. However, an additional explanation to his findings is also given, "[t]he development of computer screens and print quality should reduce the level of disparity between the two media, and this should be reflected in the improvement and consistent results" (p. 574). The technological possibilities continue to be improved, which may lead to better performances. This indicates that reading on screens may even be comparable once certain conditions relating to text structure and length, screen size, and several types of questions measuring comprehension and memory are met (Porion et al., 2016, p. 575). Margolin et al. (2013) stress that most of the research on the difference between paper-based and digital reading mainly focuses on online reading and hyperlinked text but that "[r]esearch on reading without hyperlinked text has focused on computers and has not demonstrated consistent results in its examination" (P. 513). This also indicates that text structure might play a role.

So far, however, as Clinton (2019) confirmed, most studies have found that reading comprehension is better when reading from paper. Therefore, reading digitally is likely to negatively influence the test results. This leads to the sixth and final hypothesis,

H_{A7}: The results of the digital test will be lower than the results of the paper-based test.

$H_{A7}: P_d < P_p$

H_{07}: There is no difference in the results of the digital test and the results of the paper-based test.

$H_{07}: P_d = P_p$ or $(H_{07}: P_d > P_p)$

2.8 The Dutch education system and CEFR levels of English

The Netherlands has a complex education system that is regarded as one of the OECD's most developed education systems (Nusche, Braun, Halasz, & Santiago, 2014, p. 17). It is roughly organized into two phases, which are both compulsory for children living in the Netherlands. The first is that of primary education, which lasts or eight years. After these eight years, students transfer different types of secondary education, based on their achievement and the advice of their primary school teacher (Nusche et al., 2014, p. 19). Students start their second phase of education when they are approximately twelve years old.

Secondary education lasts between four and six years and is divided into two different pathways, these can be seen on figure four. Most of the students enter pre-vocational education (VMBO), which lasts four years (Nusche et al., 2014, p. 19). This vocationally-oriented education focuses on preparing students for the labor market and provides a basis for further vocational training (MBO). The second pathway is pre-tertiary education, also consisting of two forms. The first is senior general secondary education (HAVO), which lasts five years and prepares students for professional higher education (HBO). Professional higher education is provided by universities of applied sciences throughout the Netherlands. The second pathway is pre-university education (VWO). This lasts for six years and intends to prepare students for academic higher education (WO), which is provided by universities. According to Nusche et al. (2014), "[i]n 2010, 41% of students having completed primary education entered HAVO or VWO" (p. 19). In general, the Dutch education system "achieves very good results by international standards. Attainment rates of the Dutch population are similar to the OECD average and show positive trends" (Nusche et al., 2014, p. 193).

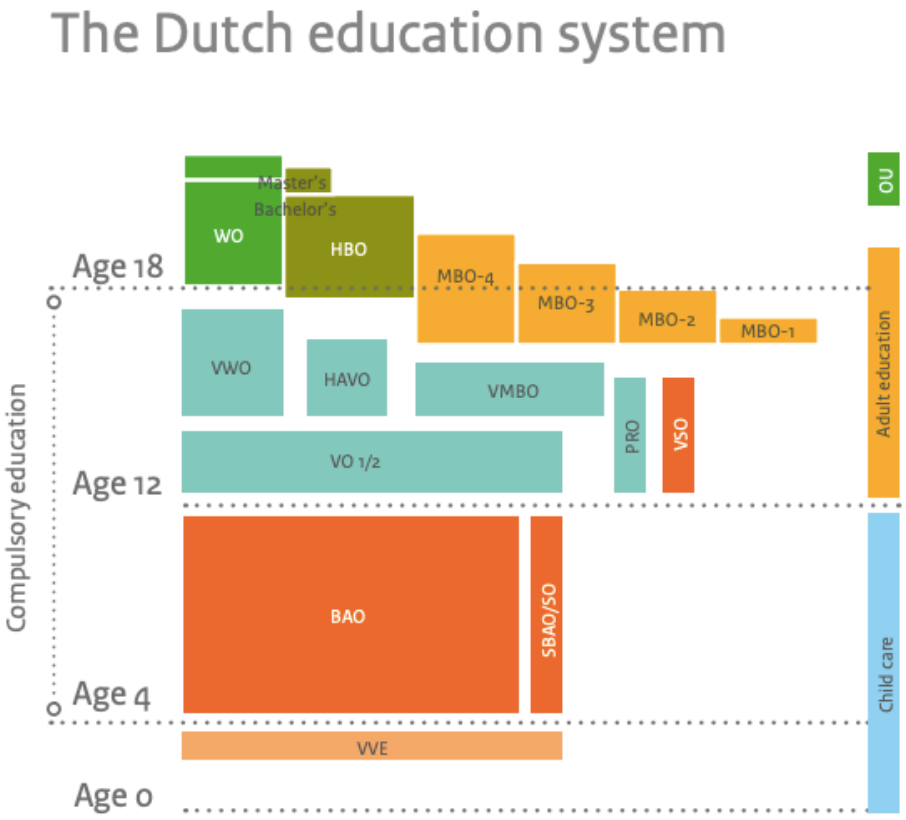


Figure 4: The Dutch education system (Dutch Ministry of Education, Culture and Science, 2014).

Testing is common in Dutch education, and standardized tests are frequently used. There are two high stakes tests. The first school leavers' primary test education is taken at the end of primary education and is used as a guideline to send students to a fitting pathway in secondary education. At the end of secondary education, students take a set of final examinations in a number of chosen subjects. The final examination is divided into two separate parts, a school examination and a central examination, which is developed by the Central Institute of Test Development (CITO). Final examination includes three compulsory subjects in all types of secondary education, which are Dutch language, some form of mathematics and English language (Scheerens, Ehren, Sleegers, & Leeuw, 2013). English language school examinations of the HAVO and VWO pathways generally consist of testing speaking, listening, and reading proficiency. The central examination, however, only focuses on reading proficiency.

It is noteworthy that for the VMBO centralized examinations, schools may use digital tests developed by CITO. Apart from testing reading proficiency, these tests also include listening and watching exercises (College voor Toetsen en Examens, 2018). The texts used to measure reading proficiency in these exams are generally shorter than those used in the HAVO and VWO centralized examination.

Students are expected to meet specific core objectives in the different subjects. Core learning objectives are specified for each of these different stages and tracks, which "provide the legal basis for what knowledge, insight and skills pupils should have achieved at the end of primary and secondary education" (Scheerens et al., 2013, p. 67). The core learning objectives for the subject English language are relatively high, because it one of the three core subjects. In addition, "[t]he sixth edition of the English Proficiency Index (EF EPI, 2017) places the Netherlands first in the English proficiency ranking of 72 countries worldwide" (Fasoglio & Tuin, 2018, p. 5). It seems clear that the subject of English receives considerable attention in Dutch education.

The core learning objectives of HAVO and VWO subjects of the centralized examination have to be specified within the Common European Framework of Reference for Languages (CEFR), a framework of describing, teaching and measuring certain language levels. The CEFR distinguishes six levels of language proficiency, reaching from breakthrough (A1) to mastery (C2) (Feskens, Keuning, Til, & Verheyen, 2014, p. 8). Feskens et al. (2014). revealed that the English language central examination of HAVO is on the CEFR B2 level (p. 39), which means that a student should have a vantage level of English in order to pass the centralized exam. In comparison, the CEFR level of the English language centralized exam of VWO is C1 (effective operational proficiency), and that of VMBO is B1 (threshold) (Feskens et al. 2014, p. 41). The test that is used in this study is a HAVO English language reading exam developed by CITO. The test requires students to have a B2 level in order to understand the text correctly.

Core learning objectives are determined in advance and are equal for HAVO and VWO students. These core objectives include the following:

- to point out which information is relevant
- to understand the main idea of a text
- to show the meaning of important textual elements
- to show relations between several textual elements
- to draw conclusions of the author's intentions (Meijer and Fasoglio, 2007, p. 13).

These objectives are specific and are comparable to the OECD's objectives and competencies. The OECD's PISA reading assessments is based upon five aspects, or objectives, that guide the development of these tasks:

- retrieving information
- forming a broad understanding
- developing an interpretation
- reflecting on and evaluating the content of a text

- reflecting on and evaluating the form of a text (OECD, 2017, p. 56).

In a way, the central examination in the Netherlands is comparable to tests used by PISA. However, it is noteworthy that the central examination differs from the types of tests PISA uses in their assessment because PISA uses reading tests in the participants' first language while in this study an English reading test is used. This difference may explain the parts of the core objectives (and the aspects) that do not correspond. In general, PISA seems to focus more on reflecting and evaluating textual fragments while the central examination seems to focus on actual understanding of textual fragments. This seems a logical difference as the PISA tests are designed to measure reading literacy, while the central examination is designed to test the knowledge of and literacy in a foreign language.

PISA does not use the CEFR levels since it does not measure language proficiency. Instead, it uses its own scale, including seven different levels of reading literacy. The scale includes the levels 1b, 1a, 2, 3, 4, 5 and 6, in which 1b is the lowest and six the highest. The level is determined by the number of points a participant scores on the test. For example, to reach level 1b, a participant should have a minimum of 262, and to reach level 6, a minimum of 698 is required (OECD, 2017, p. 59).

Dutch children scored a little above the international mean of 500 points and scored an average of 503 points (OECD, 2018c, p. 5). This places Dutch teenagers in the third level of the PISA scale, which demands a minimum of 480 points. In general, "[t]asks at this level require the reader to locate, and in some cases recognize the relationship between, several pieces of information that must meet multiple conditions" (OECD, 2017, p. 59). In addition, "[r]eflective tasks at this level may require connections, comparisons, and explanations, or they may require the reader to evaluate a feature of the text" (OECD, 2017, p. 59).

In brief, the Dutch education system is considered to be one of the most developed education systems which may lead to the fact Dutch teenagers generally perform well on PISA tests. After completing the HAVO pathway students have an English reading proficiency of B2 on the CEFR-scale. In addition, Dutch students score above average in reading literacy tests, which indicates that reading tasks should be no problem for Dutch students.

3. Methodology

3.1 Participants

The participants in this study are 105 high school students of different schools throughout the Netherlands. All students share the same level of English as they are in the same senior general secondary education class. They are all fourth-year HAVO students, which means that they are in their penultimate year of secondary education.

The participants are between 14 and 18 years old, with a mean age of 15. Among the participants are 63 females and 42 males. None (of these participants) have any learning disabilities, such as dyslexia or partially sightedness. In addition, none of the participants have English as their first language, nor do they speak English at home.

To represent the population correctly, participants were recruited from different high schools throughout the Netherlands. One class was recruited from 'T Hooghe Land in Amersfoort, two classes from De Vinse School in Amsterdam participated in the experiment, and two classes of the CSG Liudger in Drachten took part in the experiment. Before taking part in the experiment, the participants were asked to grant permission to use their data in this study. Participants who did not grant permission or did not meet the requirements were not included. Six teenagers with dyslexia and one teenager that has English as her first language were excluded. Participants from each class were randomly assigned to one of the two different tests (paper-based or digital).

3.2 Procedure

Each class was randomly divided into two different groups. The first group took the test on paper, and the second group took the test digitally. The tests are administered as any other test, i.e. participants were not allowed to talk with each other during the test. All students were separated to prevent them from cheating. Moreover, the teacher and researcher were present during the test administration. In Drachten and Amersfoort the two groups were separated, the first group made the test in an ordinary classroom, while the second group made the test in a classroom with computers. Either the researcher or the teacher was present in one of the two classrooms. The school in Amsterdam had enough room in the computer classroom to fit all students together. The teacher as well as the researcher was present during the assessment of both tests.

Participants had 35 minutes to finish the test. Before taking the test, participants filled in the questionnaire. After filling in the questionnaire, all participants started the test at the same

time, and after 35 minutes they were told to stop. The paper-based test was printed double-sided and was stapled. Students were allowed to remove the staples.

The digital test was displayed on Windows school computers via the website: enqueteviainternet.nl. It was uploaded in advance to give the students enough time. The test was displayed full screen and students only had to scroll down to the questions during the second text. Students who took the digital test also had to fill in the questions online. The questionnaire was also presented digitally for this group.

During the assessments, students were allowed to use an English to Dutch dictionary and to ask questions. Questions concerning some general problems such as 'How much time do we have left?' or 'can I use another piece of paper?' were answered, but questions concerning the content of the exam were not. One participant who did not speak Dutch was helped when the questions were formulated in Dutch. Furthermore, no technological problems occurred during the different assessments. All computers worked and there were no internet problems whatsoever.

3.3 Materials

The texts and questions that are used in the experiment are texts and questions of the final centralized HAVO exam English (high schools). The test can be found in appendix A. The same texts and questions were used for both tests. To be sure that no participant is familiar with these tests, a third back-up version of the exam was used. Unlike the first and second version, this exam cannot be found online. The test is beyond the level of the participants. However, the participants are used to practicing with these kinds of tests, so the tests are highly suitable for this experiment. In addition, the test is long, and it is expected that the participants cannot finish the test within the time they are given. In this way, a comparison between the digital test and the paper-based test with regard to the length of the test can be made.

The digital test is administered via internet. Therefore, a good-working Wi-Fi connection was necessary. The test includes four different texts: one short text (250 words) and three longer ones (690, 620 and 622 words). The questions include nine multiple-choice questions, ten 'gap-filling' questions, and six open-end questions. The participants have four options to each multiple-choice question, except for questions eleven and thirteen, which only have three options. The 'gap-filling' questions, where students have to fill in the right word in the gap in the text, can have three, four, and five options. The sequence of questions is random for the first texts (multiple-choice - open - multiple-choice - gap-filling - open - multiple-choice - open - open - multiple-choice - gap-filling - multiple-choice - open - multiple-choice -

multiple-choice - multiple-choice - multiple-choice -open). The fourth text included eight gap-filling questions. Participants could score one point per question with the exception of questions five and seventeen, where participants were able to score two points.

The questionnaire before the test included some general questions about the name, age, gender, and the languages spoken by the participant. The other questions focus on the participant's reading behavior, such as the average time spent reading and the participants' preferred medium. The latter is measured by using five different questions such as: ‘Do you print online articles?' or ‘Would you rather read a book or an e-book?' This questionnaire consists of multiple-choice questions and a few open-ended questions, which are used to provide an explanation for the chosen answers of the multiple- choice questions.

3.4 Analysis

Different variables are used in this study. The main independent variable that is used in this study is gender since the main purpose of this study is to examine the differences between the two genders.

The first dependent variable that is used is the number of hours spent on the computer. Participants filled in their average time spent on a computer per day. This was done by filling in a multiple-choice question which consisted of five different answer options, seldom, 0-2 hours per day, 2-4 hours per day, 4-6 hours per day and more than six hours per day. This resulted in five types of the variable for computer usage. The same question and answer options were used in the study by Reimer et al. (2018), who also used this variable as an indicator of computer experience (p. 132).

A second dependent variable is the attitude towards technology and digital reading in particular. This is measured by asking five different questions regarding online reading. The variable ranges from 0 to 1 in which 1 is a total preference for digital reading and 0 a total preference for paper-based reading. A participant who fills in two questions with a preference for technology and three with a preference for paper has an attitude towards digital reading of 0.4.

A third dependent variable that is used is that of the hours spent on reading. The average Dutch person spends three hours on reading per week (Wennekers et al., 2018, p.34). Participants were asked to indicate their reading behavior by filling in a multiple-choice question on the questionnaire. The three different answer options resulted in three types of the variable: 0 = less than three hours per week, 1 = approximately three hours per week, and 2= more than three hours per week.

The final dependent variable that is used is the participant's test score. Because only a few participants filled in the questions from the fourth and final text, these questions were not included in the score. This means that participants could score a total of 19 points instead of 27.

Both tests were graded and examined by the researcher, and the results were examined analyzed with an independent t-test that tested the different 0-hypotheses. The variables of time spent on reading per week and the average time spent on a computer per day might influence the participants' total score. Therefore, a Pearson product-moment correlation was run to determine the relationship between the hours spent on reading and the total score. Finally, the attitude towards technology and its relationship with the scores of people that took the digital test is also examined by running Pearson product-moment correlation, which ranges from +1, indicating a strong positive correlation, to -1, which indicates a strong negative correlation.

A quantitative analysis will be carried out as well since the participants are asked to explain their feelings towards digital testing in the questionnaire. This will give insight in the opinions towards digital testing of the participants and why they chose certain options in the questionnaire.

4. Results

4.01 Differences in computer usage

An independent-samples t-test was conducted to compare the usage of computers between boys and girls. There was a significant difference (0.041), as can be seen in table 1, in time spent on the computer per week between boys (M=1.57, SD=1.02) and girls (M=1.16, SD=0.99) conditions (t (103) = 2.08, p = 0.0401.

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
PC usage	Male	42	1,5714	1,01556	,15670
	Female	63	1,1587	,98712	,12436

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
PC usage	Equal variances assumed	,963	,329	2,075	103	,041	,41270	,19891	,01820	,80720
	Equal variances not assumed			2,063	86,278	,042	,41270	,20006	,01502	,81038

Table 1: Mean differences in the hours spent on the computer between boys and girls

These results suggest that boys do use a computer more often than girls. Girls spend approximately two to three hours per day on the computer per day while boys spend approximately three to four hours on the computer per day.

4.02 Differences in attitude towards computers

An independent-samples t-test was conducted to compare the attitude towards digital testing between boys and girls. There was a significant difference (0.001), which can be seen in table 2, in the attitude towards computers between boys (M=0.47, SD=0.28) and girls (M=0.31, SD=0.18) conditions (t (64,24) = 3,257, p = 0,002).

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Attitude	Male	42	,4724	,27866	,04300
	Female	63	,3137	,18217	,02295

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std, Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Attitude	Equal variances assumed	,9878	,002	3,532	103	,001	,15873	,04494	,06961	,24785
	Equal variances not assumed			3,257	64,242	,002	,15873	,04874	,06137	,25609

Table 2: Mean differences in the attitude towards digital testing between boys and girls

These results suggest that boys do have a more positive attitude towards technology and thus digital reading than girls. It is noteworthy that both groups seem to prefer printed texts and assignments over digital texts because both means are closer to zero than to one.

4.03 Differences in time spent reading

An independent-samples t-test was conducted to compare the time spent reading between boys and girls. There was a significant difference (P<0.00) in the hours spent reading between boys (M=0.38, SD=0.58) and girls (M=0.88, SD=0.67) conditions (t (96.243) = -4.106, p <0.00). These results suggest that girls do spend more time reading than boys, which can be seen in table 3.

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Reading hours	Male	42	,3810	,58236	,08986
	Female	63	,8889	,67468	,08500

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
Reading hours	Equal variances assumed	,000	1,000	-3,987	103	,000	-,50794	,12740	-,76060	-,25527
	Equal variances not assumed			-4,106	96,243	,000	-,50794	,12369	-,75346	-,26241

Table 3: Mean differences in the hours spent on reading between boys and girls

It is noteworthy that both genders read less than the average Dutch person does. This indicates that all teenagers read less than three hours per week (Wennekers et al., 2018, p. 34). The below-average time spent reading of Dutch teenagers may confirm Wennekers et al.'s concern that teenagers and young adults have a clear and continue to fall behind (Wennekers et al., 2018, p. 116).

4.04 Differences in paper-based test

An independent-samples t-test was conducted to compare the scores of the paper-based test between boys and girls. There was a difference of 0,35 in the scores between boys (M=8.91, SD=3.93) and girls (M=9.26, SD=3.25) conditions (t (48) = 0.34, p =0.74). However, as can be seen in table 4, this difference was not significant.

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Paper	Male	23	8,9130	3,93022	,81951
	Female	27	9,2593	3,25331	,62610

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
Paper	Equal variances assumed	,606	,440	-,341	48	,735	-,34622	1,01569	-2,38839	1,69596
	Equal variances not assumed			-,336	42,830	,739	-,34622	1,03131	-2,42628	1,73385

Table 4: Mean differences in the total score between boys and girls on paper-based tests

Girls performed better than boys, as expected. These results suggest that there is no significant difference between boys and girls in paper-based tests.

4.05 Differences in the digital test

An independent-samples t-test was conducted to compare the scores of the digital test between boys and girls. There was a difference of 0,38. in the scores between boys (M=8.89, SD=3.67) and girls (M=9.28, SD=3.31) conditions; (t (53) = 0.39, p = 0.7). As expected, girls did perform better on digital tests than boys. This difference, however, is not significant, which may indicate that Dutch teenage boys perform equally well on digital English reading tests as Dutch teenage girls.

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Screen	Male	19	8,8947	3,66507	,84083
	Female	36	9,2778	3,30896	,55149

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
Screen	Equal variances assumed	,711	,403	-,393	53	,696	-,38304	,97378	-2,33619	1,57011
	Equal variances not assumed			-,381	33,619	,706	-,38304	1,00555	-2,42742	1,66134

Table 5: Mean differences in the total score between boys and girls on digital tests

There does not seem to be a gender gap in reading in this sample since neither the difference between scores on the paper-based tests nor the difference between the scores of digital tests were significant, indicating that there is no disadvantage for girls. Both media can be used to measure reading performances, as no gender has a benefit in any of the media.

4.06 Differences in the scores between boys

An independent-samples t-test was conducted to compare the scores of boys between the digital and paper-based test. There was a difference of 0.11 in the scores between the digital test (M=8.89, SD=3.67) and the paper-based test (M=9, SD=3.87) conditions; t (41) = 0.09 p = 0.93. These results, that can be seen in table 6, suggest that there is no significant difference between tests made on paper and digitally.

Group Statistics

	medium	N	Mean	Std. Deviation	Std. Error Mean
Score	Screen	19	8,8947	3,66507	,84083
	Paper	24	9,0000	3,86737	,78942

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	Sdr. Error Difference	Lower	Upper
Score	Equal variances assumed	,533	,469	-,091	41	,928	-,10526	1,16073	-2,44940	2,23888
	Equal variances not assumed			-,091	39,624	,928	-,10526	1,15333	-2,43692	2,22640

Table 6: Mean differences in the total score between boys on the paper-based test and the digital test

It is remarkable that boys seem to perform, slightly, better on paper-based tests than on digital tests, given the fact that they spent significantly more hours on the computer than girls do. It was expected that this would cause boys to perform better on digital tests than on paper-based tests. In addition, previous research found that boys would benefit from a digital test as opposed to a paper-based test. This is not confirmed in this study. However, it is also not found that boys benefit from a paper-based test. In this case, the medium does not significantly influence the test scores of Dutch teenage boys.

4.07 Differences in the total scores

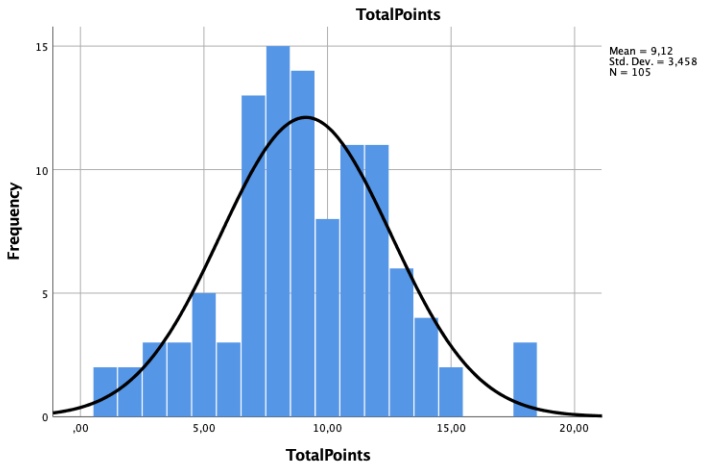
An independent-samples t-test was conducted to compare the scores of the digital and paper-based test. The distribution of the scores can be seen in graph 1. There was a difference of 0.37 in the scores between the digital test (M=9,14 SD=3,41) and the paper-based test (M=9,1, SD=3.55) conditions; t (103) = 0.07 p = 0.95. Surprisingly, in general, participants that took the digital test received higher scores than participants that took the paper-based test. This difference, that is visible in table 7, however, is not significant.

	Medium		Mean	Std. Deviation	Std. Error Mean
Total Points	Screen	55	9,1455	3,40706	,45941
	Paper	50	9,1000	3,54706	,50163

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
Total Points	Equal variances assumed	,000	,995	,067	103	,947	,04545	,67890	-1,30098	1,39189
	Equal variances not assumed			,067	101,119	,947	,04545	,68021	-1,30388	1,39479

Table 7: Mean differences in the total score between boys and girls



Graph 1: Distribution of the total score

These results may indicate that the medium does not have an effect on Dutch teenagers' reading performances. In order words, for Dutch teenagers that are growing up in the 21st century, it does not seem to make a difference, under these particular conditions, whether a text is read digitally or on paper.

4.08 Correlation between computer usage, time spent reading and scores

Although the finding that girls outperformed boys in both paper-based and digital tests was not significant, a bivariate analysis was run to determine whether factors such as hours spent reading and the hours spent on a computer correlated with the participants' scores.

Correlations

		Reading hours	Total Points	PC usage
Reading hours	Pearson Correlation	1	,041	-,088
	Sig. (2-tailed)		,678	,375
	N	105	105	105
Total Points	Pearson Correlation	,041	1	,131
	Sig. (2-tailed)	,678		,183
	N	105	105	105
PC usage	Pearson Correlation	-,088	,131	1
	Sig. (2-tailed)	,375	,183	
	N	105	105	105

Table 8: Correlation between hours spent on reading, hours spent on the computer and total score

A Pearson product-moment correlation was run to determine the relationship between the hours spent on reading and the total score. There was no correlation between the hours spent on reading and total score ($r = .04$, $n = 105$, $p = .68$). The relationship between computer usage and the total score was also determined although there was a very small positive correlation between the amount of time spent on a computer and the total score, which can be seen in table 8, this relationship was not significant ($r = .13$, $n = 105$, $p = .18$).

The lack of correlation between the total score, hours spent on reading and hours spent on a computer is surprising since it was expected that computer usage would affect the total score. Therefore, a second bivariate analysis was conducted. This time only including the data of participants that took the digital test.

Correlations

		Total Points	PC usage
Total Points	Pearson Correlation	1	,170
	Sig. (2-tailed)		,216
	N	55	55
PC usage	Pearson Correlation	,170	1
	Sig. (2-tailed)	,216	
	N	55	55

Table 9: Correlation between hours spent on the computer and total score of the digital test

Again, there was a very small positive correlation, that can be seen in table 9, between the total score and the time spent on a computer. This correlation was larger for the group of participants that took the digital test. Nevertheless, the correlation was still not significant (r =

.17, n = 55, p = .22). This indicates that spending more time on a computer per day does not increase the test score.

4.09 Correlation of attitude and the total scores

There is a minimum correlation, visible in table 10, between the attitude towards technology and the total scores of the digital test.

Correlations

		Attitude	Total Points
Attitude	Pearson Correlation	1	,069
	Sig. (2-tailed)		,618
	N	55	55
Total Points	Pearson Correlation	,069	1
	Sig. (2-tailed)	,618	
	N	55	55

Table 10: Correlation between attitude towards technology and total score of the digital test

This indicates that the more positive the attitude towards technology, the more likely it is to score more points in the digital reading test. However, the correlation is not significant, indicating that the attitude towards technology does not greatly affect the total score.

4.10 Analysis of participants' remarks

Participants were also asked to motivate their answers and explain their choices in the questionnaire. These answers can be seen in appendix B. It is surprising that both boys and girls seem to prefer paper-based tests over digital tests. Several reasons are given by the participants. Four participants mention that, although they are digital natives, they are "used to reading from paper". Eight participants find it "easier to take a paper-based test". One of the participants specifically mentions the navigation skill that is used in paper-based and digital reading and says that "especially navigating is easier when reading from paper". Two participants pointed out that computers would give them "computer eyes", which may be the same as the eye fatigue mentioned by Yeong (2012). Other advantages of paper-based tests that are mentioned are "the ability to make notes", "no technical problems", and "the ticking on keyboards is distracting".

However, some participants also point out the advantages of digital tests. One participant mentions the "ability to let the computer read the text for you", two participants mention that "it is more convenient to do a test digitally" and one participant added that "it is easier to read the answers since it is not necessary to decipher the different handwritings". Finally, one of the participants observed that "a test is a test" and seemed to have no opinion about the matter.

5. Discussion

The objective of this study was to explore the differences in reading performance between Dutch teenage boys and girls. More specifically, it aimed to compare performances of digital and paper-based reading in order to contribute to narrowing the gender gap in reading.

5.01 Computer Usage

It was predicted that one of the factors that might influence the gender gap and that might differ between boys and girls was the amount of time spent on a computer. As expected, boys, on average, did spend more time on a computer than girls on a daily basis. This is in line with previous research (Colley & Comber, 2003; Scheuermann and Björnsson, 2009; Imhof et al., 2007). These studies attributed this difference in computer usage to the fact that boys have a general preference for technology and like the computer more than girls (Colley & Comber, 2003; Scheuermann and Björnsson, 2009; Imhof et al., 2007). Boys seem to be online more and use the computer particularly for playing video games (Colley & Comber, 2003, p. 155). In other words, boys spend more time on the computer because they like it more. The findings of Colley and Comber (2003) highlight the importance of video games for boys and "give a picture of greater out-of-school use of computers both at home and with friends by boys" (p. 162). Likewise, Imhof et al. (2007) note that the difference in the use of computers between boys and girls might be because "female students used computers more strictly for task-oriented and study-related purposes whereas males enjoyed exploring the computers for a variety of other purposes besides studying" (p. 2825). In a technologically advanced country like the Netherlands, boys may be assumed to generally like and use computers for more purposes such as playing videogames and, therefore, spend more time on them. This study found that boys will generally use the computer three to four hours a day while girls would use a computer two to three hours a day. Although this study did not specify whether the computer usage took place during a week day or weekend day, it is comparable to an OECD (2015) study that found that "[o]n average across OECD countries, boys use the Internet for an average of three hours (180 minutes) on a typical weekend day" (p. 39).

However, the same study by Imhof et al. (2007) also found that the gender gap in study-related computer use has decreased and was no longer visible (p. 2835). This might indicate that in terms of studying and perhaps reading, there is no longer a gender gap in the use of computers for study-related purposes and that there only is a gender gap in the use of computers for other reasons such as playing video games. It is debatable, however, whether playing video games might contribute to digital reading in general.

5.02 Attitude towards technology

A second prediction was that another one of the factors influencing reading performance was the attitude towards technology and digital reading. The results of the second independent t-test confirmed the idea that technology is a male-dominated area. This finding has also been confirmed by other studies (Cai et al., 2017; Volman et al., 2005). The present study examined attitude towards computers and online reading by asking five different questions regarding the use of computers as opposed to print materials. This included questions such as: would you rather take a test on computer or on paper? Or, would you rather do your homework digitally or on paper? The findings would suggest that boys will use the computer more often than girls and that they will perform certain tasks on a computer rather than on paper. It seems that both groups would still prefer paper over computers since both groups' means are below 0,5, which indicates that most Dutch teenagers prefer paper over computers for reading purposes.

This is surprising since previous research has shown that computerized tasks stimulate motivation and interest in children (Kerr & Symons, 2006). Furthermore, the participants all belong to the generation of digital natives and are accustomed to using computers and other kinds of technologies (Prensky, 2001). Although both groups seem to prefer paper-based texts or assignments, boys still seem to be more willingly to use computers. This finding might give cause for some concern since the less positive attitude towards technology could hinder females and may result in a gender gap in the future. However, girls seem to outperform boys in other skills such as reading in general.

5.03 Reading hours

Several studies which examined interest in reading have suggested that, in general, boys are less interested in and less likely to enjoy reading (Hochweber and Vieluf, 2016; Thomas, 1994). Additionally, other studies have shown that girls spend more time reading than boys (Lafontaine & Monseur, 2009; Wennekers et al. 2018). The present study provides evidence that teenage Dutch girls, as expected, read significantly more than boys.

Whether girls enjoyed reading more than boys was not examined in this study. Previous research, however, implies that girls do enjoy reading more as they are "more likely to immerse themselves in a chosen book" (Thomas, 1994, p. 152). The significant difference in hours spent reading per week might also be different in different schools. Hochweber and Vieluf (2016) found that teaching and schools influence the gender gap. They acknowledged that although part of the gender gap may be explained by biological factors, early reading experiences in the

family, and societal norms about gender roles, there is some scope for schools to promote gender equity (p. 278).

Another factor that might have influenced the gender gap in hours spent reading per week is the fact that the question regarding reading in the questionnaire did not specify the concept of reading. This may have caused participants to have different ideas about the concept of reading. Perhaps for some, reading would include all types of reading (digitally or paper-based), for others, it may include only the reading of paper-based books. The question could have been more specific. Furthermore, the scales used in this question were very limited. Participants could only choose three different possibilities which were not specific (less than three, three, or more than three). Another scale might have given other results.

5.04 Differences in paper-based testing

It was predicted that girls would outperform boys in paper-based reading comprehension texts. However, although the mean difference between the two groups indicates that girls' performances on paper-based testing were indeed better than those of boys, this difference was not significant. This is an interesting finding since most previous research found better performances for girls on paper (Stoet & Geary, 2013; Roeschl-Heils et al. 2013). It is especially interesting since girls do spend more hours reading than boys in general. The aforementioned studies observed that the advantage of girls might be "related to an early advantage in many language-related competencies that facilitate learning to read" (Stoet & Geary, 2013, p.6). Furthermore, it might also be the case that "reading comprehension might also require more complex underlying social-cognitive processes for which girls also have an advantage" (Stoet & Geary, 2013, p.6). Another factor is given by Roeschl-Heils et al. (2013), who demonstrated that "students with better metacognitive knowledge about memory and reading performed better in tests assessing reading" (p. 82). However, not all research showed a significant difference between boys' and girls' performances.

Although girls did use more reading strategies than boys, a significant difference between the two genders was not found in the study by Sheore, & Mokhtari, (2001). They contributed the lack of gender effect to the uneven distribution between the two genders. This might also be the case in this study since the distribution of males (n=23), and females (n= 27) who did the paper-based test is also uneven. In fact, a total of 42 males and 63 females participated in this study. It would have been better if the genders were more equally divided.

5.05 Differences in digital testing

It was also expected that girls would outperform boys in digital tests. Comparable to the prediction about the paper-based test, there were several studies that found that girls outperformed boys on digital tests (Reimer et al. 2018; OECD, 2011, p. 79). The (2011) OECD study has observed that "[i]n all but one country the difference is statistically significant. The exception is Colombia, where girls outperform boys by an average of only three score points" (p. 52). Likewise, Wu (2014) found that girls outperformed girls in paper-based reading assessments, also found that "girls had a better knowledge of metacognitive strategies" (p. 268). This would indicate that girls would outperform boys in digital reading. However, Wu (2014) found that "the gender gap in ERA [electronic reading assessment] tended to be smaller and nearly negligible in most countries in the hypothesized model" (p. 268). Unexpectedly, the present study is in line with the latter findings of Wu (2014). Although there was a difference in the reading performance between boys and girls, this difference was not significant. This signifies that there is no difference in reading performance between boys and girls in digital reading.

No gender gap in digital reading has been established, which is, in combination with the fact that there is no difference in paper-based reading either, surprising. It indicates that girls and boys perform equally well in both media. However, the distribution of gender was again uneven. Only 19 male participants took the digital test, while 36 female participants took the test. This may have influenced the results of this study.

5.06 Digital and paper-based testing for boys

The main objective of this study was to examine whether there was a difference in the performances between boys who took different tests. It was expected that boys who took the digital test would have a better performance than boys who took the paper-based test because several studies suggested that a digital test would narrow the gender gap between boys and girls, indicating that boys would perform better digitally (Reimer et al. 2018; Rasmussen and Åberg-Bengtsson, 2015). In addition, Research by OECD suggests that "boys tend to do better in both mathematics and reading when they sit a computer-based test, compared to their performance on paper-based tests – and that this advantage is largely a by-product of boys' familiarity with video games" (OECD, 2015, p. 44). This study also highlighted the amount of time spent on a computer and also examined boys' familiarity with video games. Therefore, it is surprising that in the present study, boys performed better on the paper-based test. It seems that the medium does not significantly affect boys' reading scores.

5.07 Digital vs. paper-based testing

Although the mean difference between the two conditions of all participants, indicates that the group who made the test digitally outperforms the group who took the paper-based test, this difference was not significant. This is an interesting finding as most previous research suggests that taking a test digitally will negatively influence the test results (Clinton 2019; Yeong, 2012; Lauterman and Ackerman 2014).

A shift in the discussion of digital and paper-based reading seems to have taken place. Magolin et al. (2013), also found no significant differences in reading comprehension between different media and indicates that "if comprehension differences exist, the present research did not find them and therefore are likely to be very small differences or at least moderated by some other factor" (p. 517). This study confirms this indication. In addition, Reimer et al. (2018), have suggested that scores of countries whose inhabitants generally have more computer experience score better in digital tests. This might explain why the teenagers in the Netherlands did not show significant differences between the two tests. Porion (2016) also did not find a significant difference between the two media and, like Reimer et al. explain this by the fact that young people are more familiar with computers (p. 574). It seems that teenagers in the presents can truly be said to be digital natives.

Another reason given by Porion (2016) is that "digital media have progressed, and their quality has improved, seems to have had a positive effect on comprehension performances" (p. 574). This study may also suggest that teenagers in the Netherlands are ready for digital testing as they do not seem to suffer from eye fatigue. Nor do they comprehend texts less when they read digitally.

5.08 Factors influencing reading performance

The present study highlighted some of the factors that may have influenced the results of boys and girls. A Pearson-product correlation was calculated to see whether hours spent reading, hours spent on a computer or the attitude towards technology would correlate with reading performance. The first factor examined was the hours spent reading. It was found that the hours spent reading did not have a significant relationship with a participant's reading performance. Since the female participants in this study read more often than the male participants but did not have better reading performances this result was to be expected and did not come out of the blue. However, it was expected to have some influence on the results because reading more often would lead to an extensive vocabulary and a better knowledge of

text structure. These skills are fundamental for a better comprehension of texts (Gelderen, 2018).

The second factor that was examined in this study is the hours spent on a computer. No significant relationship was found between the hours spent on a computer and a participant's reading performance on the test. Nor was there a relationship between the hours spent on a computer and a participant's performance on the digital test. This finding is in line with previous research. Reimer et al. (2018) used a similar questionnaire in the Nordic countries and found no obvious pattern when students with more or less experience with using computers were compared. A positive correlation between time spent on the internet and test results seemed only valid in Sweden. Another noteworthy assumption is also given by Reimer et al., who state that the amount of time spent on the internet or computer is not really important. What is important is the students' experience of reading on a computer. They noted that "[t]heir activities could be more or less oriented towards reading, and there could be systematic differences in Internet use between the students in the different countries that we do not know about" (p. 146). It is, thus, important to consider the fact that spending time on the computer does not necessarily improve students' results in reading as students might not practice the skills that are necessary for digital reading. It seems plausible that this is accurate since many studies highlight the fact that the time boys spend on computers is mostly used for playing video games (Tsai and Tsai, 2010; Colley and Comber, 2003). In fact, the study by Imhof et al. (2007) highlighted the fact that girls use the computer mostly for task-oriented and study-related purposes. Using the computer for study-related purposes would give girls an advantage in digital tests. It is thus advisable for further research to use a more precise variable to measure how skilled people are with technology as computer use can be interpreted in different ways and one can do numerous activities on a computer.

The third factor that was highlighted in this study was the attitude towards technology and using computers. In line with previous research (Cai et al., 2017; Volman et al., 2005), it was found that girls, in general, have a less positive attitude towards technology. However, this study also found that a positive attitude does not necessarily lead to better scores when taking a digital test. Thus, although Cai et al. (2017) emphasized that a less positive attitude towards technology could hinder girls using technology, this statement was not supported in this study.

This is surprising since motivation plays an important role in the reading process and boys' low reading motivation is considered to be an explanation for the gender gap (Logan and Medford, 2011). It was expected that a positive attitude would lead to stronger motivation, which would then lead to a higher performance on the digital reading test because previous

research found that the use of technological applications has a positive influence on the motivation of Dutch teenagers and will most probably lead to better performances (Meijer et al., 2014). This finding is, however, not supported by this study.

5.09 Participants' remarks

Navigation skill was considered to be one of the most important skills needed for digital reading since digital texts are often non-linear. Rasmusson en Eklund (2013) mention navigation as an important skill in digital texts (p. 407), but PISA also underlines the importance of navigation skill when reading digital texts (Reimer et al., 2018, p. 1250). One participant specifically mentioned that navigating is more difficult when reading a digital text. However, the analysis suggests that the medium through which the test is presented does not significantly influence test results, which indicates that reading digitally is, generally, not more difficult.

The participants seem to be biased against reading texts on screens. Perhaps this bias has resulted from studies that have investigated this issue, which has been in the newspapers a lot (Rek, 2019; Nieuwenhuis, 2014). Or perhaps students drew this conclusion by themselves as many of them were not allowed to use electronic devices in the classroom. Further research could investigate where this bias towards technology in the generation of digital natives truly comes from and might give a more elaborate explanation of the feelings of the digital natives towards technology.

5.10 Limitations and further research

It is noteworthy that, in general, the participants did not seem to have a strong preference for computers when they were able to use paper as well. This is also indicated by the participants' remarks when asked about whether they would rather have a digital or paper-based test. The participants seem to be biased against and anxious about using computers. This might be the case since newspapers have reported that it is better to read from paper than from a screen (Rek, 2019; Nieuwenhuis, 2014). However, the test is a high-stake test, so it is also possible that students are afraid to try something new when doing such an important test like the centralized examination.

The reading comprehension test that was used in this study is comparable to those used in the centralized examination. It was developed and used by CITO and can be considered as a fairly good method to test reading comprehension. Participants did not seem to have any trouble taking the paper-based test, nor did they have any difficulty with doing the digital test. This may be because Dutch teenagers are used to tests developed by CITO. These tests may give difficulties or other outcomes when they are taken by teenagers from other countries since these students are not used to the tests.

Most researchers that have studied the difference between digital and paper-based testing used tests in the participants' native language (Porion et al., 2016; Lauterman and Ackerman, 2014; OECD, 2015; OECD, 2018c). The tests used in this study might, thus, be more difficult and test more than just the reading comprehension of students since it is meant to measure the reading comprehension and skill of a foreign language.

Furthermore, no gender gap in reading was found in the present study, neither in the scores of the paper-based test nor in the scores of the digital test. The scores of teenage boys and girls in the Netherlands were comparable, which might indicate that the gender gap does not exist anymore in the Netherlands. The disappearance of the gender gap seems unlikely, however, since PISA has provided much evidence of its existence over the past decade. A reason for the absence of the gender gap in this study might be because all participants in this study generally had the same level. All participants were part of the HAVO pathway, indicating that they all roughly have the same level of English. However, it would have been interesting to see whether the gender gap is significant in the three different schools used in this study.

Noteworthy, however, is the fact that in total there were significantly more girls in these classes than boys, confirming Kleinjan's (2017) statement that girls have emancipated successfully and that they are outperforming boys in secondary education and that there are

more girls who graduate from pre-university education than boys. PISA tests are administered at all levels of high schools in the Netherlands and would therefore find a significant difference in reading performances between boys and girls for the entire population of Dutch teenagers while this study used a sample of teenagers that are in senior general secondary education (HAVO), which prepares students for professional higher education (HBO).

Another reason for not finding a gender gap in this study is that it is less likely to occur in senior general secondary education since "the gender gap in reading literacy was especially noticeable in the underperformance group" (Wu, 2014, p. 256). A future study about the gender gap in digital and paper-based reading for Dutch teenagers could focus on reading performances in VMBO classes to see whether the gender gap exists in the underperformance group.

Moreover, the finding that there is no difference between the scores of different media may have been caused by the fact that the digital texts used in this study were plain pdf files. The texts did not contain hyperlinks and students did not need to scroll. In fact, the digital text was exactly the same as the paper-based test. This study may be considered to have examined the basic differences between paper-based and digital reading. Further research may expand on this study by examining factors that may influence results. Leu et al. (2015) observed that "[i]t is important to recognize that because reading assessments now appear online does not mean that they necessarily measure online reading ability" (p. 54). This might be the reason why there is no significant difference between the results of boys who took the digital test and boys who took the paper-based test. The technological knowledge that was needed to answer the question was minimal as the participants only had to click on an answer or type it down. Therefore, the technological advantage boys have as opposed to girls was of little use in this study.

A new study could use a more technological demanding digital test to see whether a such a digital test would narrow the gender gap, or what the effects of such a newly developed digital test would be on teenagers. In addition, performances of a more demanding digital test and a digital test such as the one used in this study could be compared in order to find out if performances stay the same. Such a study could incorporate more 21st century skills in the materials and might examine how this affects teenagers.

Furthermore, this study only focused on three different factors that may influence reading performance. However, it is important to bear in mind that there are numerous factors that might influence this performance. Follow-up studies could research whether other factors such as prior knowledge, motivation, images or text structure influence reading comprehension and whether these skills or factors differ between teenage boys and girls.

Finally, a new study could focus on the attitude of teenagers towards digital examination in the Netherlands and how to improve it and change the technology in education to something students want. The fact that the VMBO centralized examination is already offered digitally shows that it is possible to incorporate digital tests. A new study could investigate what the attitude of VMBO students are towards this matter and compare these attitudes to the attitudes of HAVO and VWO students.

It is, as Bennett and Maton (2010) suggested, "time to move beyond the 'digital natives' debate as it currently stands and towards a more sophisticated, rational debate that can enable us to provide the education that young people deserve" (p. 9). There is much to be gained from incorporating digital testing in educational programs and there is a need for further research on this subject.

6. Conclusion

The aim of this study was to give insight into the reading behavior of Dutch teenagers with regard to the gender gap in reading comprehension. Several studies have confirmed the existence of the gender gap and have found that it has been growing since the 1990s (Lafontaine and Monseur, 2009). Furthermore, it is apparent in all 75 nations, including the Netherlands, that joined the latest four PISA assessments (Stoet & Geary, 2013). Boys seem to lag behind on educational performance, which is of great interest to many educational researchers (Hek et al., 2019). It is also a social problem which has received much media attention in the Netherlands. It seems to be socially desirable that a solution to the growing gender gap in reading is found.

As several studies had found that the gender gap narrowed when reading tests were administered digitally (Reimer et al. 2018; Rasmussen and Åberg-Bengtsson, 2015), it was expected that digital reading might be a solution to the growing gender gap. It also offers other advantages. It is more sustainable, cheaper and may be perceived to be more attractive than paper-based tests. In addition, the generation of digital natives seems to be more motivated by learning via computers (Kerr & Symons, 2006), it is also of broad and current interest to many teachers in the Netherlands who want to incorporate 21st century skills in their educational programs (Clemens, 2014).

Unexpectedly, no gender gap in reading was found in this study. Teenage boys and girls seem to have an equal score in the reading comprehension test. Both the digital and the paper-based test did not show any differences regarding gender. In addition, there was no difference in boys' performances between the group that did the digital test and the group that did the paper-based test. Nevertheless, teenage boys and girls in the Netherlands did differ in their reading behavior because girls seem to read more often than boys.

Computer use, on the other hand, seems to be higher for boys than for girls and boys' attitude towards technology is more positive than that of girls. Although boys and girls differed in all of these three factors, they do not seem to have any significant positive relationship with teenagers' reading comprehension test scores. However, they do give insight into the differences between digital natives with regard to technology and reading.

The present study also provides evidence that the medium does not influence teenagers' reading performances. In other words, reading performances are alike when reading from a screen or reading from paper. This implies that digital natives might be ready for a shift towards

digital assessments of reading since reading from a screen does not negatively influence reading scores and offers more functions that can be used in testing.

Despite the fact that reading comprehension does not seem to differ when taking a digital or paper-based test, digital natives are still hesitant towards digital testing. They seem to be biased and think that digital testing will negatively influence their test results. Additionally, they feel that digital testing would cause headaches and many of the participants still prefer paper-based tests because they are used to these tests and have been taught to take paper-based tests.

As teachers make use of all kinds of different digital learning materials, digital testing would be a logical follow-up step. Studies such as that of Voogt et al. (2011) have stressed the importance of digital tests and underlined the need for new kinds of assessment that could also measure 21st century skills. It is important to keep in mind that "successful technology integration involves more than just having computers in classrooms" (Hixon and Buckenmeyer, 2009, p.143). Practically speaking, incorporating these kinds of digital tests in the Dutch education system for HAVO and VWO requires a change in the feelings of the digital natives towards digital testing so that they will feel comfortable taking these kinds of tests. Teachers could start incorporating low-stakes tests into their curricula in order to let teenagers practice because previous research has found that "pressures related to high-stakes testing gave teachers little time to attempt new instructional methods involving technology" (Hew and Brush, 2006, p. 230). Once the teenagers are used to the low-stakes digital tests, high stakes digital tests can be administered. This way, teenagers would feel prepared and ready when taking a digital reading test during the centralized examinations.

In short, the observed differences in reading behavior and technological experience do not influence reading performances. Nor does the medium or gender influence the reading performances of Dutch teenagers. This indicates that in terms of reading comprehension tests, Dutch teenagers in secondary schools seem ready for a shift towards digital testing. Digital testing is more sustainable, more economical and provides many opportunities regarding the assessment of 21st century skills. Digital testing can thus be considered as a better alternative to old-fashioned paper-based testing in the technologically advanced world that we live in.

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Appendices

Appendix A: Reading test

Beste leerling,

Je gaat straks beginnen aan een Engels leesvaardigheidstoets.

Voor deze toets heb je 35 minuten de tijd. Je mag een woordenboek gebruiken. Lees de vragen en de tekst goed door en probeer geen vragen over te slaan. Het is niet erg als je de toets niet helemaal af krijgt.

Deze toets bestaat uit 25 vragen.
Voor elk vraagnummer staat hoeveel punten met een goed antwoord behaald kunnen worden. Beantwoord de vragen op het antwoordblad.

Vul eerst de enquête in en vergeet niet je naam op het antwoordblad te zetten!

Veel succes!

Naam: ……

Leeftijd: ……

Geslacht:
- Man
- Vrouw
- Wil ik niet zeggen

1. Wat is je moedertaal (meerdere antwoorden mogelijk)?
   - Nederlands
   - Fries
   - Engels
   - Anders, namelijk ……

2. Welke talen spreek je thuis (meerdere antwoorden mogelijk)?
   - Nederlands
   - Fries
   - Engels
   - Anders, namelijk ……

3. Hoeveel lees je gemiddeld? (denk aan boeken, maar ook aan de krant, tijdschriften en (nieuws)artikelen op internet)
   - Minder dan 3 uur per week
   - Ongeveer 3 uur per week
   - Meer dan 3 uur per week

4. Wanneer je een boek leest, lees je dit dan het liefst op papier, of van een scherm (bv. een e-reader of tablet)?
   - Ik lees een boek het liefst van een scherm
   - Ik lees een boek het liefst op papier
   - Mij maakt het niks uit

5. Wanneer je een nieuwsbericht leest, lees je die dan het liefst in een papieren krant/tijdschrift of online?
   - Ik lees een nieuwsbericht het liefst online
   - Ik lees een nieuwsbericht het liefst in een krant of tijdschrift
   - Mij maakt het niks uit

6. Wanneer je een tekst moet lezen voor school lees je dit dan het liefst van papier, of van een scherm (bv. een iPad of pc)?
   - Papier
   - Scherm
   - Mij maakt het niets uit

7. Als je een digitale tekst wilt lezen, print je deze dan wel eens uit?
   - Ik print het altijd uit

- Ik lees het altijd digitaal
- Soms print ik het uit en soms lees ik het digitaal
- Ik lees nooit een digitale tekst

8. Als je in de vorige vraag hebt aangegeven dat je het een digitale tekst altijd of soms print, waarom kies je er voor om het te printen?

……...

9. Welke vaardigheden zouden volgens jouw getoetst moeten worden op het eindexamen Engels?

……

10. Op dit moment wordt het centrale eindexamen Engels op papier afgenomen. Zou jij het examen liever digitaal maken of liever op papier?

- Ik maak het examen het liefst digitaal
- Ik maak het examen het liefst op papier
- Mij maakt het niks uit

11. Licht je antwoord op de vorige vraag toe

……

12. Hoeveel maak je zelf gebruik van een computer? (Alleen om te lezen of algemeen?)

- Vrijwel nooit
- 0-2 uur per dag
- 2-4 uur per dag
- 4-6 uur per dag
- Meer dan 6 uur per dag

Ik geef hierbij toestemming voor het geanonimiseerde gebruik van mijn resultaat in het kader van onderzoek naar kwaliteit van toetsen

- Akkoord

Na deze pagina begint de toets. Veel succes!

Tekst 1
The deadly habit as soft target

…….
Comment
Maureen Dowd
……..

(1) If the First Lady were to worry about Julia Roberts as a role model, you'd think she would object to *Pretty Woman*, in which Ms Roberts presented prostitution as a yuppie avenue of upward mobility — to respect, rubies and Richard Gere.

(2) Or *Everyone Says I Love You*, in which the actress played a married woman who has an affair.

(3) Instead, the First Lady chooses an easy target, scolding Ms Roberts for smoking in *My Best Friend's Wedding*.

(4) "This portrayal of a modern woman so reliant on cigarettes is particularly troubling given that more young women are taking up the deadly habit," the First Columnist wrote.

(5) What about the character's willingness to lie and manipulate and break hearts? Or should children be taught it's okay to behave like Machiavelli if you don't light up?

(6) I've always loved old movies that glamorise smoking. But it never made me want to smoke. I've always loved old movies that glamorise bank robbers. But I never wanted to rob a bank. Movies are a powerful influence, but it is the family's role to shape values.

(7) The purpose of movies is not moral uplift. A holier-than-thou celluloid universe that portrays people as we want them to be, not as they are, is not art or entertainment. It's propaganda. It is their flaws that make characters interesting, and the purpose of art to explore all aspects of life.

Tekst 1 The deadly habit as soft target

1p **1** Which of the following best summarises Maureen Dowd's comment on the First Lady's criticism of Julia Roberts?
The First Lady's criticism
A did not do justice to Julia Roberts' varied career as an actress.
B exposed her own old-fashioned views on the role of women.
C focused on a fairly irrelevant point.
D was aimed at the wrong person.

"It's propaganda." (alinea 7)

1p **2** Wat is volgens Maureen Dowd het kenmerk van films die zij 'propaganda' noemt?

Tekst 2
How Tony Hawk Stays Aloft?

…….
Mark Hyman

……..
It's no mean trick to be a youth icon at 38. Can the skateboarder keep his franchise booming?

(1) On Nov. 7, Hawk's fans can point their boards to the video-game store and pick up the latest in his hot-selling series, *Tony Hawk's Project 8* following *Tony Hawk's Downhill Jam* which was released in October. Hawk also has a new direct-to-DVD movie in the stores (*Boom Boom Sabotage*), a clothing brand for boys, a weekly satellite radio show and even a deal that supplies cell-phone users with Hawk-inspired ringtones.

(2) Hawk's deals, which earn him from $5 million to $7 million a year, rank him among the richest pitchmen in any sport. What sets him apart even from that elite company, though, is his pipeline to young consumers. Strangely, for a father of three closing in on 40, Hawk hasn't lost his juice with kids, a trick few aging sports celebs have mastered. But hero worshippers are notoriously fickle, and Hawk faces challenges as he works to hold on to his cultish following.

(3) __4__, Hawk is flying high for now. "Anyone who doesn't know Tony Hawk lives in a cave!" says 14-year-old TV actor Cole Sprouse. So what's the source of Hawk's lasting appeal? Start with his pioneer status: Hawk was hardly the first kid on a skateboard, but when he started in 1975, public awareness of the sport was almost nil. He helped engender it. Then there's the fact that Hawk is still frequently found performing a death-defying 'Frontside Ollie Nose Blunt'. "Tony Hawk is a legendary name, yet he's still alive and on the scene. People pay homage to that," says Marshal Cohen, chief analyst at a market research company in New York.

(4) Hawk was the heavyweight champ of his sport through the 1980s and '90s. He hasn't skated competitively since 2003, though he performs often at exhibitions and on videos put out by his production company. "He lives and breathes the lifestyle that these kids are either doing or want to do," says Jeff Bliss, president of a sports marketing company.

(5) Hawk has also pulled off the near-miraculous feat of being as popular with parents as he is with their offspring. In a sport with an ethos of rebellion against school and adult authority, Hawk's clean-cut style stands out. "Parents are thrilled to look at this guy not tattooed up head to toe, a guy who wears a helmet when he skates. That's the one they want their kid to think is cool," says Pat Hawk.

(6) Hawk started skateboarding at 9, entered his first competition at 11, turned pro at 14, and won the world championship a year later. But it was a video game that turned him into a pop culture giant. In 1999, Activision Inc. put out *Tony Hawk's Pro Skater*. By 2000 it was a best-seller. The Activision games also stretch the Hawk brand far beyond kids with crash helmets in their closet. About 75% of the game's players don't even own a skateboard.

(7) Hawk's contribution to the video games, beyond his name, has been to insist on realism. Everything must mirror real skating, down to the paint jobs on the decks. "I'd played video games since *Missile Command* in the local arcade. When I got a chance to work on a game, I wanted it right," he says.

(8) Some of Hawk's deals appear to be less about skateboarding than cashing in, though, and they can make diehards wince. There's the Tony Hawk birthday party collection—paper cups and plates. A recent clothing deal with Kohl's also smells fishy to some. The skater's line of shirts, pants, and hoodies hit the shelves at the mass retailer in March.

(9) Hawk, of course, defends the deal. Still, he admits there have been issues. "After some early photo shoots," Hawk says, "we had to explain to Kohl's: 'If you do it your way, the core kids into Hawk clothing will be wondering: 'What's wrong with those guys?'" When you're a late-30s star building a brand aimed at teens, you can't have fans asking that question.

Tekst 2 How Tony Hawk stays aloft

1p **3** Which of the following is true of paragraphs 1 and 2?
In these lines the writer
A expresses concern about Hawk's expanding merchandise.
B focuses on the success of older sportsmen in skateboarding.
C points out that Hawk's success is not necessarily a permanent factor.
D stresses the fact that Hawk's being a father was of great benefit as a marketing tool.

1p **4** Which of the following fits the gap in paragraph 3?
A Furthermore,
B Still,
C Surprisingly,
D Therefore,

"Hawk's lasting appeal" (alinea 3)

2p **5** Welke **twee** verklaringen worden hiervoor gegeven in alinea 3?
NB een letterlijke vertaling levert geen scorepunten op!

1p **6** What is the main function of paragraph 5?
A To examine where the roots of the popularity of skateboarding really lie.
B To explain why Hawk is also a success with parents.
C To question whether Hawk is as adventurous as he pretends to be.
D To show that Hawk has a lot of influence on parents' decisions about what they permit their child to do.

1p **7** Geef van elk van deze redenen voor het succes van Hawk's videogames aan of deze in alinea 6 of 7 wordt genoemd.
1 They appeal to both skateboarders and non-skateboarders.
2 They depict the experiences of a very young skateboarding hero.
Noteer het nummer en daarachter "wel" of "niet" op het antwoordblad.

1p **8** Wat suggereert Mark Hyman in alinea 8 over Hawk's keuze om zijn kledinglijn bij Kohl's onder te brengen?

Tekst 3
Beauty and the beastly parade

(1) The Miss World contest has been called many things in its time — tacky, demeaning, boring — but never before has it been accused of undermining the moral values of an entire subcontinent. So outraged are Indian feminist groups at this week's staging of the event in Bangalore that they have threatened suicide squads in protest. Irritatingly for the feminists, perhaps, a man beat them to it. On Thursday, Suresh Kumar, 24, shouted anti-Miss World slogans as he burnt himself to death in the southern city of Madurai.

(2) The beauty contest at the Chinaswamy cricket stadium on Saturday (cricket is clearly a more acceptable form of cultural imperialism) has united not only feminists but also left-wing students and right-wing politicians. "We are not ready to lose our heritage for a bit of foreign currency, and we are willing to sacrifice our lives for our country," declared K N Shashikala, the founder of Women Awake. The organisers of Miss World — the evergreen British Eric and Julia Morley — have evidently strayed into deep waters.

(3) Politics of one sort or another has never been far from Miss World. __10__ in 1994 Miss Lebanon made the mistake of being pictured next to Miss Israel, and was interrogated for two hours by military intelligence when she returned home. And last year Miss Nigeria was withdrawn from the contest after protesters against the military regime in Lagos threatened sabotage. Gone, at least, are the days when a white Miss South Africa could explain the absence of black beauty queens by observing "most black girls are pregnant by the age of 15". Last year (as for the previous three years) the contest was held at Sun City in South Africa, with no less a modern icon than Nelson Mandela agreeing to receive a kiss from each Miss.

(4) If the pageant is good enough for Nelson, it is difficult to see why it is causing such a fuss in India. Miss World contests have, after all, raised £100m for charity (this year the Spastics Society for India is a beneficiary), and the swimsuit sequences have been pre-filmed in the Seychelles to avoid causing offence. The contract for the next Miss World contest, moreover, has been bought by India's most famous and popular film star, Amitabh Bachchan.

(5) India is sensitive about the contamination of its ancient culture, but beauty contests — increasingly popular there — tend to represent sexual and personal freedom rather than exploitation. What to western women may seem frivolous, or even demeaning, is often seen as a blow against a fuddy-duddy dress code. "The fact that it's glamorous

and that our city will be put on the international map is quite something," says Bageshree Paradkar, Bangalore editor of *Femina* magazine. Although British television is no longer interested, Miss World will be beamed to 2.5 billion people in 115 countries.

(6) Indian society is perhaps changing far faster than the potential suicides of Women Awake appreciate. According to a report only last week in the news magazine *Outlook*, Indian women are in the throes of a sexual revolution. Pornography and wife-swapping has become fashionable, and in cities such as Bombay and Calcutta, wives apparently pick up men in restaurants and clubs, paying them to dance naked before their lustful eyes.

(7) This makes the leggy lovelies of Miss World seem rather tame. In any case, cultural conflicts between Britain and India have usually been resolved amicably and to mutual advantage. In 1931, after Mahatma Gandhi had taken tea with King George V and Queen Mary at Buckingham Palace, reporters asked if he had felt properly dressed, in his loin cloth and sandals. "It was quite all right," Gandhi replied. "The king had enough on for both of us."

Tekst 3 Beauty and the beastly parade

1p **9** What is the aim of the second paragraph?
To point out that the Indian protests against the Miss World contest
A are typical of the emotional nature of Indian people.
B are widespread and may represent strong feelings.
C focus especially on the commercial exploitation of women.
D show a revival of old anti-British sentiments.

1p **10** Which of the following fits the gap in paragraph 3?
A By the way, in 1994...
B For example, in 1994...
C However, in 1994...
D Moreover, in 1994...

1p **11** What do lines ("Gone at least... from each Miss.") in paragraph 3 describe?
A A positive social development reflected by the Miss World contest.
B The effect that the Miss World contest has on career opportunities for women.
C The positive image that the Miss World contest has in some parts of the world.

"it is difficult to see" (alinea 4)
1p **12** Hoeveel redenen voert de schrijver hiervoor aan in deze alinea?

1p **13** What does the writer suggest about beauty contests in India in lines ("India is sensitive ... fuddy-duddy dress code.") in paragraph 5?
A They are a new form of British domination over India.
B They are regarded by many as reflecting Indian women's liberation.
C They are rightly criticised for affecting women's dignity.

1p **14** What does Bageshree Paradkar express in paragraph 5 ("The fact that ... is quite something")?
A Approval of the increased freedom for women in India.
B Disappointment at the conservative attitude of so many Indian women.
C Indignation with Women Awake's successes so far.
D Satisfaction about India receiving worldwide attention.

1p **15** What does the writer suggest about the views of Women Awake in paragraph 6?

A They are out of touch with developments in present-day India.
B They are sensible but appear to be ineffective.
C They do not appeal to Indian women living in rural areas.
D They rightly oppose the modern Indian way of life.

1p **16** What does the writer conclude in the last paragraph?

A A satisfactory solution to the clash about the next Miss World contest is likely to be found.
B Cultural differences between Indian and western people should not be underestimated.
C The general Indian lack of respect for British customs goes back a long way.
D The Indian protests against the next Miss World contest should not be taken seriously.

"Beauty and the beastly parade" (titel)

2p **17** Welke **twee** bij naam genoemde personen in het artikel zijn het eens met het woord 'beastly'?
Schrijf de twee namen op.

Tekst 4
Bang the rocks together, guys
Chimpanzee culture

(1) People are different, as individuals and as groups. Cultural variety has spiced life since culture began. But how different are people in this respect from other animals? Or, to put it another way, what is cultural variety and how did it begin? Some clues may come from chimpanzees, man's closest living relatives. Chimpanzee groups can be __18__ by the ways in which they use tools. And according to Dr William McGrew of Stirling University in Scotland, their capacity for making tools may be about as good as that possessed by mankind's ancestors, the early hominids.

(2) Dr McGrew has sifted through studies of 32 populations of chimpanzees and found a wide range of cultural traits. Some groups of chimps are very __19__. Gombe chimps use 11 sorts of tool - ranging from specially shaped twigs, with which they fish for termites, to 'sponge' made from chewed leaves that are used to soak up drinking water. Others, such as the chimps of Kibale in Uganda, use only one tool.

(3) Different tools can be used to tackle the same problem in different ways. Opening nuts, for instance, can be done by placing the nut on a hard surface and hitting it with something heavy until it cracks. But depending on where a chimp comes from, it will have different ideas about whether to use sticks or stones. Chimps are narrow-minded about this: they will open nuts only in the way their parents taught them to. Researchers can divide chimp societies into those of the 'stick industry' and of the 'stone industry' - rather as archaeologists classify cultures like the 'beaker' people by their most prominent __20__.

(4) From studying this diversity Dr McGrew concludes that all the known behaviour exhibited by man's immediate ancestors is within the capability of apes. Dr McGrew has compared the efforts of chimps with the work of early hominids by studying the Oldowan Industrial Complex. Oldowan tools - crudely fashioned stone implements -are found at several sites in East Africa, and date back 2,5 million years. Dr McGrew reckons there is nothing __21__ about them.

(5) The idea that these tools are the work of early __22__ is based, in part, on the fact that they are generally found in the savanna. Until recently, hominids were thought of as savanna dwellers and chimpanzees as forest dwellers. Now researchers have found chimp populations in areas with hardly any forest cover.

(6) Studies by zoologists such as Dr Jane Goodall, and by archaeologists looking at fossils, suggest that chimps eat meat and butcher their prey in the same way as the early hominids did. And, just as hominids took their tools from place to place, so chimpanzees will also carry tools quite a distance before using them.

(7) What chimps do not do is use tools to create other tools - sharpening the edge of a stone axe with another stone, for instance. But this distinction may reflect different __23__ rather than different mental abilities. Laboratory studies suggest chimps are capable of using tools to make further tools if they have to. __24__, in the wild such circumstances may not apply. Most of the toolmade tools used by early hominids were for cutting things up. Chimps have large, sharp-edged canine teeth to do this, and their greater-than-human strength allows them to dismember animals by hand. Knives and Axes are unnecessary.

(8) So chimpanzees may provide a model of the cultural environment of mankind's ancestors. The two cases will not be exactly the same but, as Dr McGrew says, 'Only when we are clear about the __25__ between chimpanzee and human will we be able to recognize the real differences.'

Kies bij iedere open plek in de tekst het juiste antwoord uit de gegeven mogelijkheden.

1p **18.**

A. changed
B. distinguished
C. saved
D. traced

1p **19.**

A. aggressive
B. complex
C. extensive
D. inventive

1p **20.**

A. artefact
B. eating habits
C. habitat
D. social rules

1p **21.**

A. exclusively human
B. original
C. typically apelike
D. unusual

1p **22.**

A. apes
B. civilisations
C. hominids

1p **23.**

A. instincts
B. needs
C. periods
D. skills
E. tools

1p **24.**

A. After all
B. As a result
C. For a start
D. However
E. Moreover

1p **25.**

A. conflicts
B. distinctions
C. similarities
D. stages of development

Vul dit gedeelte in na het maken van de toets.

1. Wat vind je van het lettertype van de toets?
    - Duidelijk
    - Onduidelijk

2. Licht je antwoord op de vorige vraag toe

……

3. Wat vind je van de lengte van de teksten die gebruikt werden in de toets?
    - Te kort
    - Te lang
    - Precies goed

4. Was het duidelijk hoe je de vragen moest beantwoorden?
    - Ja
    - Nee

5. Licht je antwoord op de vorige vraag toe

……

6. Wat vind je van de lay-out van het digitale examen (tekst en vragen op dezelfde pagina, onder elkaar)
    - Duidelijk
    - Onduidelijk
    - Geen mening

7. Achteraf gezien, zou je deze toets liever op papier of digitaal maken?
    - Papier
    - Digitaal
    - Geen mening

Appendix B: Answers to question eleven

Omdat ik dat gewend ben
Makkelijker om te lezen
Kun je makkelijker terugkijken
Makkelijker en sneller
Fijner en bij computers getik op toetsenborden
Bij online kun je typfouten maken
beter overzicht en gewend
overzichtelijker
fijner om in je hand te hebben
vasthouden
Op papier voelt voor mij fijner, ik kan het niet goed uitleggen, sorry
overzichtelijker
Ik ben niet goed met computers
Fijner leren
Fijner op papier
onderstrepen
Anders krijg je computer ogen
Fijner, vooral als je voor een langere tijd leest
beter om zelf te kunnen kiezen
is makkelijker te navigeren
Teksten kunnen dan worden voorgelezen
beter overzicht
digitaal is moeilijker te lezen
Dan denk je beter na
overzichtelijker
prettiger
ik denk dat ik anders afgeleid raak
gewend
voor de concentratie
makkelijker en digitaal kan uitvallen enzo
gewend
Digitaal gaat langzamer
fijne methode
Bij computers gaat altijd wel wat mis, wifi etc
papier is zo donker
kan beide
digitaal lezen is makkelijker
als het voorgelezen wordt digitaal
markeren, duidelijker in je hoofd
overzichtelijker, makkelijker terugkijken naar antwoorden

papier toch iets meer de voorkeur wegen mogelijkheid markeren
beter focussen, geluid muisklik
beter focussen, aantekeningen maken
online geneigd om door te klikken, papier kun je nog je antwoorden checken
makkelijker terugbladeren en markeren, geen risico dat het vastloopt, fijner lezen
voorwaarde dat school ook meer digitaal moet lesgeven
geen voorkeur want heeft nooit een toets digitaal gemaakt
papier mogelijkheid tot dingen aanstrepen
geen voorkeur, maar digitaal geen mogelijkheid om dingen aantestrepen
digitaal leidt meer af
getik leidt af
wat het efficiënts is
beter kunnen concentreren
makkelijker, geen goed handschrift
schrijven is handiger
fijner
maakt niet uit
maakt niet uit
alle toetsen tot nu toe gemaakt op papier
fijner om van papier te lezen, scherm geeft hoofdpijn
fijner
fijner
maakt niet uit
We oefenen ook op papier
Digitaal is handiger
Digitaal is makkelijker en zorgt voor minder onduidelijkheden qua handschrift
Overzichtelijker. Digitaal moet je verschillende tabbladen open hebben, dit is onhandig.
Makkelijker en overzichtelijker
3 uur lang naar een scherm staren is niet goed voor de ogen
Bij een leestekst op papier, dan kun je makkelijker terugkijken. Luistertoets kan ook digitaal.
Papier is fijner dan een beeldscherm
Gewend om op paper te werken. risico op technische problemen
Overzichtelijker
Overzichtelijker. Foute antwoorden (spelfouten) beter te zien, teruggaan is makkelijker.
Op de computer snel last van ogen en nek. Op papier meer overzicht.
Makkelijker om te lezen
Papier is fijner, risico op technische problemen. Schrijven geeft niet hetzelfde denkproces als typen.
Fijner om te schrijven dan typen of digitaal invullen
Beter concentreren
Van een scherm lezen is niet fijn

Kijken naar een scherm voor toetsen is erg onoverzichtelijk
Examen is examen
Een computer kan uitvallen en op papier kun je dingen markeren
Maakt me niet uit
Op papier is fijner
Tastbaar. Digitaal komt ook vaak gepaard met technische problemen en dit is een risico.
Risico op technische problemen en op papier is beter anders krijg ik misschien hoofdpijn
Als het meerkeuze is digitaal fijner
Krijg hoofdpijn van een scherm
Papier kun je makkkelijk bladeren en veranderen en digitaal moet je steeds scrollen
Papier is fijner