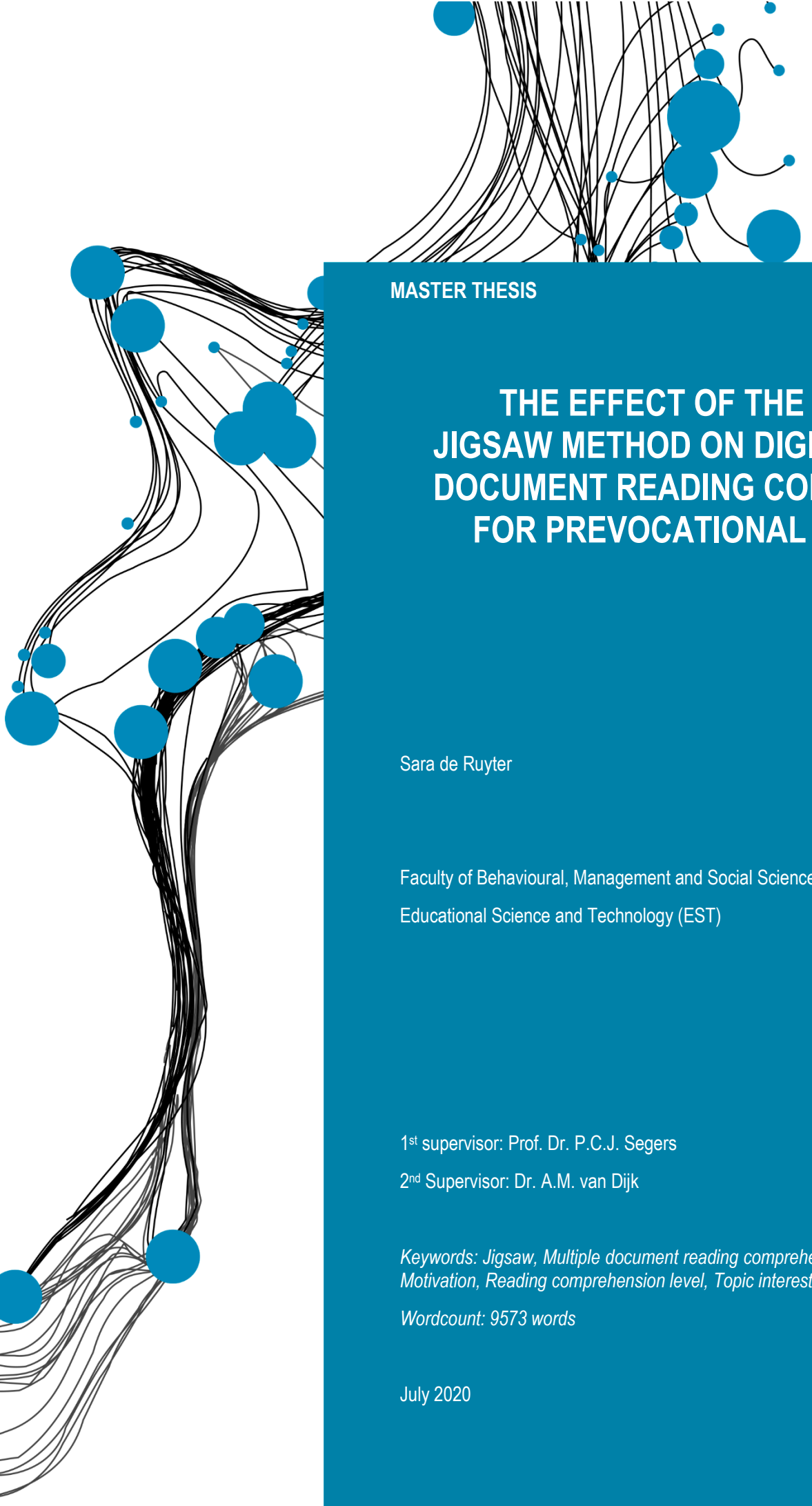

MASTER THESIS

THE EFFECT OF THE COOPERATIVE JIGSAW METHOD ON DIGITAL MULTIPLE DOCUMENT READING COMPREHENSION FOR PREVOCATIONAL EDUCATION

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Summary

Digital multiple document reading comprehension, creating an understanding of multiple digital texts, is an important and often used skill in the 21st century. However, many prevocational education students struggle with properly comprehending multiple documents. This results in lower grades and can eventually impact post-school opportunities. In addition, prevocational education students often lack motivation for reading tasks, which in turn can lead to lower reading outcomes. Cooperative learning methods could increase motivation and, therefore, reading comprehension outcomes. One of these cooperative methods is the Jigsaw method, in which students work in small groups. In this method each group member is responsible for a unique part of the learning materials, which he or she later shares with the other group members. In this study, it was examined whether the Jigsaw method positively impacts task motivation and multiple document reading comprehension outcomes. Furthermore, it was investigated how reading comprehension level, reading motivation, reading self-efficacy, reading avoidance and topic interest moderate the effect of Jigsaw on multiple document reading comprehension outcomes. The study was conducted among 83 Dutch first and second year prevocational education students. The students participated in a pre-test-post-test experiment, in which they were asked to perform a digital multiple document reading comprehension task and a writing task either in the individual group or the Jigsaw group. No significant differences in multiple document reading comprehension outcomes were found between the Jigsaw group and the individual group. Additionally, task motivation did not mediate the effect of Jigsaw on multiple document reading comprehension outcomes and the effects were not moderated by reading comprehension level, reading motivation, reading self-efficacy, reading avoidance and topic interest. Hence, it can be concluded that prevocational students can benefit as much from a multiple document reading assignment that involves the Jigsaw method as from traditional individual multiple document reading assignments, regardless of their individual differences. Therefore, the Jigsaw method can be a good variation on the assignments given in class.

The effect of the cooperative Jigsaw method on digital multiple document reading comprehension for prevocational education

Understanding digital texts is a fundamental skill in the 21st century as digital reading has become a common practice for knowledge acquisition (e.g., Goldman, 2018; Rouet & Britt, 2014). Digital reading often requires readers to extract information from multiple sources, such as information from different websites (Goldman & Scardamalia, 2013). The act of creating "a coherent mental representation that integrates contents from multiple texts that deal with the same situation or issue" is called multiple document reading comprehension (Bråten, Anmarkrud, Brandmo, & Strømsø, 2014, p. 10). Multiple document reading is nowadays regularly used in education (Beker, van den Broek, & Jolles, 2019). Student have to make assignments and homework that include searching for information on the internet, combining information from multiple sources, or learning from different texts on the same topic (Bråten, Ferguson, Anmarkrud, & Strømsø, 2013). However, many prevocational education students struggle with multiple document reading comprehension. Results of the Programme for International Student Assessment (PISA) that includes such multiple document reading, show that prevocational students in general have lower reading comprehension ability scores than their peers (Feskens, Kuhlemeier, & Limpens, 2016; Gubbels, van Langen, Maassen, & Meelissen, 2019; OECD, 2016). One factor that could contribute to the low scores is that students from prevocational tracks often lack motivation for learning and learning activities (Prince, 2014). In addition, these students also tend to have less motivation for reading than students from higher levels (Gubbels et al., 2019). The lack of motivation for reading and learning tasks negatively affects the effort they invest in reading (Bråten et al., 2014). Therefore, a lack of motivation can result in lower multiple document reading comprehension outcomes. Not properly comprehending multiple documents has major consequences for academic success and in addition post-school opportunities, as learning often depends on reading comprehension ability (Bråten, Britt, Strømsø, & Rouet, 2011; McGeown, Duncan, Griffiths, & Stothard, 2015). Therefore, it is necessary to find ways to increase their motivation and, as a result, their multiple document reading comprehension outcomes.

One potential approach is implementing cooperative learning methods and more specifically the Jigsaw method. In Jigsaw, students work in small groups, where each member is responsible for learning a unique segment of information that he or she later shares with the rest of his or her group (Aronson, Blaney, Stephan, Sikes, & Snapp, 1978). According to Esnawy (2016), Jigsaw could enhance motivation which in turn leads to higher engagement in learning and better learning outcomes. Esnawy also suggested that cooperative methods, such as Jigsaw, encourage information sharing which leads to a better understanding of the learning materials. Thus, Jigsaw could potentially

increase task motivation and, as a result, increase multiple document reading comprehension outcomes for students in prevocational education. In the present study, the effect of the Jigsaw method on digital multiple document reading comprehension for prevocational education was investigated. Since individual differences in reading comprehension ability and reading motivation, which are known to be low for this specific group, could affect students' motivation and multiple document reading comprehension outcomes (e.g., Barzilai & Strømsø, 2018; List & Alexander, 2019; Unsworth & McMillan, 2013), these were taken into account as well. Furthermore, the topic or subject of a text is also found to strongly influence reading comprehension (Bråten et al., 2014). Variations in topic interest could explain differences in multiple document reading outcomes and motivation. The effect of the Jigsaw method could be influenced by these variables. Therefore, this study also investigated to what extent the effect of the Jigsaw method is affected by students' individual differences in single document reading comprehension level, reading motivation and topic interest.

Digital reading

In the last few decades, modern technologies, such as digital devices and the internet, have caused a shift in reading from paper-based texts to digital texts (Bråten, Britt, Strømsø, & Rouet, 2011; Delgado, Vargas, Ackerman, & Salmerón, 2018). Consequently, digital reading has become an integral part of life and is used for personal, professional and academic purposes (Goldman, 2018; Goldman, Braasch, Wiley, Graesser, & Brodowinska, 2012; Salmerón, García, & Vidal-Abarca, 2018). Digital reading, as opposed to traditional linear reading has certain benefits. Digital reading provides swift access to information and learning materials (Stadtler, Scharrer, Brummernhenrich, & Bromme, 2013). These materials are easy to find and to use (Singer & Alexander, 2017b) and are, in addition, cost efficient (Delgado et al., 2018) and paperless (Singer & Alexander, 2017b).

However, digital reading also imposes certain challenges compared to traditional print reading (Goldman & Scardamalia, 2013). For instance, when readers engage in digital reading, they can encounter complex non-linear text structures (Salmerón, García, et al., 2018). As a result, information is often presented in a way that is more mentally demanding than reading from single linear printed texts (Singer & Alexander, 2017a). One of these structures that readers encounter more often in digital reading than in print reading is the use of multiple sources to learn about a certain topic (Barzillai, Thomson, Schroeder, & van den Broek, 2018; Bråten et al., 2013). On the internet, readers can find a high number of sites and texts on the same topic. To filter down this information and create an understanding of the topic multiple document reading comprehension is required (Beker, van den Broek, & Jolles, 2019). Multiple document reading comprehension, however, can be very complicated for weak readers (Kanniainen, Kiili, Tolvanen, Aro, & Leppänen, 2019) and, as a result, for students in prevocational education.

Multiple document reading comprehension

Reading comprehension of both single texts and multiple texts is a complex task that involves the construction of a mental representation of the information of the text (e.g., McCarthy et al., 2018; Rouet & Potocki, 2018). To comprehend a text, readers need to select relevant pieces of information from the text and process these pieces of information in their working memory in order to build meaningful and coherent connections between the different pieces of information and their own prior knowledge (Rouet & Potocki, 2018; Saux et al., 2017; Wylie et al., 2018). The most common model for the information processing for comprehensive reading is Kintsch' (1988b, 1998) construction-integration model (e.g., Bråten, Anmarkrud, Brandmo, & Strømsø, 2014; Cho, 2014; Wylie et al., 2018). Kintsch (1988) stated that when new information enters the working memory two models are constructed, the text-base model and the situation model. The text-base model includes all the detailed information retrieved from the texts, hence, it presents all the causal and chronological relationships in a text (Salmerón, Cañas, Kintsch, & Fajardo, 2005). In the situation model, context is given to the pieces of information by connecting them to the prior knowledge of the reader (Salmerón, Strømsø et al., 2018). In conclusion, the text-base model is the representation of the content of the text and the situation model is the representation of the meaning of the text. In more recent studies the Reading Systems Framework (Perfetti & Stafura, 2014) is used. In this framework the construction-integration model is combined with other models to create a broader concept of the processes of reading. According to this framework, word comprehension also has a prominent role in reading comprehension.

Multiple document reading comprehension means that readers acquire an understanding of a topic or idea by reading multiple texts, instead of a single text (Beker et al., 2019). In other words, it means that readers need to integrate information of multiple texts into the same coherent mental representation (e.g., Bråten et al., 2011; Rouet, 2013). Multiple document reading comprehension could lead to a deeper understanding of a topic or issue as multiple documents present a topic from multiple viewpoints, thus, it could lead to more insight (Bråten et al., 2013; Voss & Wiley, 1997). However, it also imposes certain challenges compared to single text reading (Rouet & Britt, 2014).

A first challenge that readers encounter, is that they need to read multiple texts as a set, instead of reading them as separate texts (List & Alexander, 2019). Whereas traditional reading comprehension requires students to create an understanding from only one text, multiple document reading comprehension requires readers to understand the content of each separate text and, on top of that, the connections between the texts. Thus, they need to understand the information from all texts as a whole. This means that readers need to create a text-base model and a situational model of every single text, and, in addition, an integrated mental model, in which the connections between strings of information from the different documents are represented (Barzilai & Strømsø, 2018; Salmerón, Gil, & Bråten, 2018). A second challenge is the lack of consistency and coherence between multiple

documents (Maier & Richter, 2014; Rouet & Britt, 2014). Whereas a single text is logically structured and the presentation of information is consistent throughout the text, multiple texts might contain gaps, overlapping information, discrepancies, different perspectives and writing styles. As a result, integrating the information from multiple texts requires additional processing (Stadtler et al., 2013).

Cooperative learning

A potential way to reduce the cognitive demand of a complex task is by dividing the workload over multiple students (Kirschner, Paas, & Kirschner, 2009). Hence, students could benefit from cooperative learning when they engage in multiple document reading comprehension (Guthrie et al., 2006). According to Slavin (2015), cooperative learning refers to "teaching methods in which students work together in small groups to help each other learn academic content." (p.5). Students need each other to create the best possible learning outcomes for all students, instead of creating only a good outcome for themselves (e.g., Johnson & Johnson, 2017; Slavin & Cooper, 1999). Effective cooperative learning consists of five basic elements: positive interdependence, promotive interaction, individual accountability, social skills and group processing (Johnson & Johnson, 2017). 'Positive interdependence' means that students need each other to succeed. Hence, they are not able to complete the task or assignment successfully on their own. 'Promotive interaction' refers to the interaction that takes place between students. According to Johnson and Johnson, "students promote each other's learning" by explaining and teaching the learning content and connections between the learning content and prior knowledge to each other (2017, p. 10). 'Individual accountability' means that the students are also individually assessed to avoid some students doing more than others. 'Social skills' is the fourth element that is needed for cooperative learning to succeed. Students need to be able to use group work skills such as communication, leadership roles and time management. The last element is 'Group processing', which is a reflective element that helps students realise what they have accomplished as an individual and as a group.

According to Johnson and Johnson (2008), one of the benefits from cooperative learning is active engagement. The authors stated that cooperative learning leads to actively engaged students due to the positive interdependence and individual accountability. Furthermore, in a later research of Johnson and Johnson (2017) they noted that cooperative learning leads to, amongst other benefits, higher achievement, greater productivity, higher-level reasoning and more transfer of the learning materials. In addition, Chinn and Clark (2015) suggested that the collaborative creation of an argumentation enhance students learning as students can learn from each other's perspective and create a more thought out argumentation. Similarly, Wissinger and De La Paz (2016) stated that discussing the learning materials creates a deeper reasoning. Thus, when students learn from contradictive texts, they can create a deeper understanding and better reasoning on the subject by discussing the materials with others.

Guthrie et al. (2006) suggested that stimulating tasks such as cooperative learning can increase intrinsic motivation and learning. Motivation can be defined as the interest that someone has in engaging in an activity (Mitchell, 1982; Pakdel, 2013; Ryan & Deci, 2000). Intrinsic motivation means that someone does an activity out of personal interest and the satisfaction and enjoyment that solely comes from the activity itself (e.g., Ryan & Deci, 2000; Wigfield et al., 2008). It is suggested that readers with high intrinsic motivation are deeper engaged in reading a text which leads to more meaningful learning and a deeper understanding of the text (e.g., Guthrie, Wigfield, & You, 2012; Logan, Medford, & Hughes, 2011; Stadtler et al., 2013). In other words, motivation will activate better processing of the reading material (Guthrie et al., 2004). According to Barzilai and Strømsø (2018), motivation is needed to activate the skills and processes needed for multiple document reading comprehension. The intrinsic motivation that is caused by a stimulating task is in literature also referred to as task motivation. Slavin (2015) stated that "from a motivationalist perspective task motivation is the single most impactful part of the learning process" (p. 6). Due to their needed contribution in the learning process and the lack of competition cooperative learning tend to lead to higher task motivation (Esnawy, 2016; Slavin, 2015).

A method that implements most of the elements of cooperative learning and that has been found to increase motivation and learning outcomes, is the Jigsaw method (e.g., Esnawy, 2016; Ghaith & Bouzeineddine, 2003; Ghaith & El-Malak, 2004). This method, created by Aronson et al. (1978), is a cooperative method in which students become responsible of their own learning. In the Jigsaw method students are divided over small groups. Each member is assigned to a unique part of the learning materials. After studying the learning materials each of the group members then present their own part of information to their group. By sharing and listening they create an understanding of the full material (Aronson et al., 1978; Slavin, 1980; Slavin & Cooper, 1999).

Over the years, research on Jigsaw has revealed several benefits, including positive effects on learning outcomes. Aronson et al. (1978) investigated the effect of Jigsaw in an elementary classroom setting over a time period of six weeks. In this experiment they compared traditional teaching to Jigsaw. Their study showed that students in the Jigsaw condition performed the same or better than their peers in traditional education. Furthermore, they also found positive effects on students' self-esteem and social skills. Students in the Jigsaw condition enjoyed school more and felt less need to compete with their peers. In a more resent study of Roseth, Lee and Saltarelli (2019), in which the Jigsaw method was tested over a long period of time to see whether the ideas of Aronson were still accurate, it was found that Jigsaw did increase academic achievement. However, it was found that instead of replacing competition with cooperation, it led to a mix of competition and cooperation. The study showed that individualistic efforts were important as well.

Jigsaw can also be applied to a multiple document reading comprehension task. The multiple documents can be divided over group members. Instead of reading multiple texts as an individual, each group member is responsible for only one text and by discussing all texts the readers could make

a mental model together. They obtain understanding of the other texts by discussing the texts and creating a collaborative mental model which integrates all texts. Researchers have studied this effect of Jigsaw on reading comprehension achievement. Shaaban (2006) studied the effect of Jigsaw on reading comprehension and motivation to read on grade five English second language learners. Although he did not find any effect on reading comprehension, his study did reveal positive effects of jigsaw on students' motivation to read. In contrast, Sabbah (2016) found in a study on the effect of Jigsaw on reading comprehension for English second language learners, that Jigsaw positively affected the reading achievement of students. The author contributed these positive results to the individual accountability, as students are in charge of their own learning, and the interactions between students during cooperative learning, as students can peer tutor. He suggested that Jigsaw makes learning fun. Ghaith and El-Malak (2004) investigated the effect of Jigsaw on the literal reading comprehension and higher-order comprehension. In this case, literal comprehension was defined as "the ability to understand explicitly stated information in the text (p.9)" and higher order comprehension was defined as the ability to make inferences about the meaning, purpose and accuracy of the text. Although the authors found no significant differences in the results of literal reading comprehension for the Jigsaw and the control group, their study revealed that Jigsaw improved higher-order comprehension.

Individual differences

Pisa results of 2018 did not only show that students from prevocational education scored lower on average on every reading comprehension skill category than their peers on higher educational tracks, they also showed that students in prevocational education had less reading motivation and reading self-efficacy (Gubbels et al., 2019). The students felt less competent in reading than the peers from pre-university education and disliked reading more than students from pre-university and higher general secondary education. Furthermore, reading avoidance (reading reluctant behaviour) is found especially amongst prevocational students (Nielen, Mol, Sikkema-de Jong, & Bus, 2016). Individual differences such as reading comprehension level, reading motivation, reading self-efficacy, and reading avoidance could also influence multiple document reading comprehension outcomes. In addition, the topic of a text impacts students multiple document reading comprehension outcomes as well (List & Alexander, 2017).

Reading comprehension level

Multiple document reading comprehension requires many of the skills needed for single text reading comprehension and additional skills to connect the information from different texts (Goldman, 2018). Research has indicated that strong single text readers are more likely to connect information from multiple texts (Goldman et al., 2012; Hahnel, Goldhammer, Naumann, & Kröhne, 2016).

According to Coiro (2011) and Kanniainen, Kiili, Tolvanen, Aro and Leppänen (2019), offline reading comprehension skill is one of the strongest predictors of digital reading, including multiple document reading. Furthermore, poor reading is linked to poor motivation, as low skilled readers often dislike reading (Morgan, Fuchs, Cordray, & Fuchs, 2016). According to Ghaith (2001), poor readers are likely to enjoy cooperative learning because they do not have to compete with highly skilled readers, instead, these students can learn from their more capable classmates. Henry, Castek, 'O'bryne and Zawilinski (2012) found that working together, increases the motivation for (online) reading for low ability readers. In a later study of Ghaith and Bouzeineddine (2003) it was found that low achievers had higher motivation than high achievers when a form of the Jigsaw method was implemented in an English second language class. The Jigsaw method can not only affect their motivation but also their reading outcomes as in heterogeneous groups (mixed ability groups) students have the opportunity to learn from their higher ability peers (Gillies, 2003).

Reading motivation

Reading motivation can be defined as the attitude that an individual has towards reading in general (Baker & Wigfield, 1999). Readers with high reading motivation like reading (Guthrie & Wigfield, 2000; Kaakinen et al., 2018). They often engage in reading activities and find pleasure in reading books and texts. Most studies on reading motivation distinguish two different core dimensions of the concept, expectance and value, based on Wigfields and Eccles' (2000) expectancy-value theory (McGeown Duncan, Griffiths, & Stothard, 2015; Retelsdorf, Köller, & Möller, 2014). Reading value (also known as reading motivation) is the personal value that someone gives to reading, thus, whether he or she will enjoy reading. Reading expectance (also known as reading self-efficacy) on the other hand, is a reader's belief about their own reading competency. However, since this research concerns prevocational education students a third dimension should be considered. In some cases, an individual's reading motivation is exceptionally low, hence, it turns in to a fear of reading which leads to reading reluctant behaviour, thus, they avoid reading of any kind (Nielen et al., 2016). Reading avoidance is a trait often seen in prevocational education students and can also impact reading comprehension outcomes (Nielen & Bus, 2016).

Reading motivation, reading self-efficacy and reading avoidance seem to be strongly correlated with reading comprehension level (e.g., Ehrlich, Kurtz-Costes, & Loridant, 1993; Morgan et al., 2016). Low reading motivation, low reading and high reading avoidance are associated with low reading comprehension ability and low reading comprehension outcomes. A similarity between students with low reading motivation, low reading self-efficacy and high reading avoidance is that these students often have developed a dislike towards reading or a low self-concept about their reading skills due to repeated reading failure caused by low reading comprehension skills (e.g., Morgan et al., 2016; Nielen et al., 2016; Retelsdorf et al., 2014) According to these studies, students with these negative attitudes towards reading also tend to avoid reading activities and when they engage they put

less effort in the reading task due to the lack of task motivation and fear of failure. This, in turn, results in lower reading comprehension outcomes. The Jigsaw method can affect students with low reading motivation and high reading avoidance as students in cooperative often promote learning and in this case reading to each other (Johnson & Johnson, 2017). Moreover, the Jigsaw method is known to enhance students' self-efficacy due to the students feeling of empowerment and the lack of competitiveness (Darnon, Buchs, & Desbar, 2012). Hence, students with low self-efficacy may benefit from the Jigsaw method.

Topic interest

According to List and Alexander (2017), motivational aspects that is expected to influence multiple document reading comprehension outcomes is topic interest. Topic interest is a positive feeling elicited by the subject of a text (Fulmer & Frijters, 2011). Topic interest is intrinsically determined (Schiefele, 1999). The concept of topic interest can be measured by combining two components, the feeling that someone expects to have when reading a text with a specific topic (e.g. excited, engaged, bored) and the expected value he or she attaches to that text (meaningful, useful, worthless) (Schiefele, 1992). Positive feelings and a high value are associated with higher topic interest.

High topic interest seems to be correlated to high reading comprehension outcomes (e.g., Schiefele & Krapp, 1996; Unsworth & McMillan, 2013). According to Schiefele (1999), interest in the topic motivates readers to engage in the reading task. Thus, topic interest can enhance task motivation. As a result of the enhanced motivation, it is believed that topic interest indirectly leads to higher reading comprehension outcomes. However, several studies remark that the effect of topic interest is strongly affected by the complexity of the task (e.g., Fulmer & Frijters, 2011; Schiefele, 1992). When readers are faced with a highly demanding task, such as the integration of information from multiple texts, topic interest has more influence on reading comprehension outcomes (Strømsø, Bråten, & Britt, 2010). Readers with low topic interest can benefit from the motivational aspects of the Jigsaw method as this will increase the engagement and, therefore, their reading comprehension outcomes. This effect will be less apparent with students who already have high task motivation because of their topic interest.

The present study

According to the theoretical framework presented above, multiple document reading comprehension a complex skill that many prevocational educational students struggle with (Gubbels et al., 2019). However, the Jigsaw method, a cooperative learning method, in which the learning content is divided over members of small groups and learning happens through sharing the individual learning content (Aronson et al., 1978), could lead to higher task motivation and, as a result, higher learning outcomes (Ghaith & El-Malak, 2004; Sabbah, 2016; Shaaban, 2006). In addition, individual

differences such as reading comprehension level, reading motivation, reading self-efficacy, reading avoidance and topic interest could influence the extent to which the Jigsaw method affects intrinsic motivation and multiple document reading outcomes (Goldman, 2018; Morgan et al., 2016; Schiefele, 1992). The present study is a follow-up study of Morren's (2019) pilot study. She investigated the effect of Jigsaw on Dutch vocational education students' multiple document reading comprehension ability. In her experiment, she made Jigsaw groups of four students in which each of the students read a different text and then shared the information with his or her group. In the pilot no effects were found of the Jigsaw method probably due to the small sample size of the study (Wilson Van Voorhis & Morgan, 2007). Furthermore, the pilot was conducted with a different target group, with different traits. This research aimed to investigating the mediator effect of task motivation and the moderator effects of reading comprehension level, reading motivation, reading self-efficacy, reading avoidance and topic interest. Therefore, in the present study the following research questions were investigated:

- To what extent does the Jigsaw method increase students' multiple document reading comprehension outcomes in Dutch prevocational education and to what extent is this effect mediated by task motivation?
- To what extent do reading comprehension level, reading motivation, reading self-efficacy reading avoidance and topic interest influence the effect of the Jigsaw method on task motivation and multiple document reading comprehension outcomes in Dutch prevocational education?

In Figure 1 Research model, the research model is presented. It was expected that the Jigsaw method increases multiple document reading comprehension outcomes. Furthermore, it was expected that task motivation acts as a mediator for the effect of Jigsaw on multiple document reading comprehension. Thus, that the Jigsaw effect increases task motivation and that higher task motivation leads to higher multiple document reading comprehension outcomes.

In addition, it was expected that reading comprehension level, reading motivation, reading self-efficacy, reading avoidance and topic interest acted as moderators for the effect of Jigsaw on task motivation and multiple document reading comprehension. It was expected that especially students with low topic interest, low reading motivation, low reading self-efficacy, high reading avoidance and a low reading comprehension level benefit from the Jigsaw method due to the expected increase in task motivation and, therefore, multiple document reading comprehension outcomes.

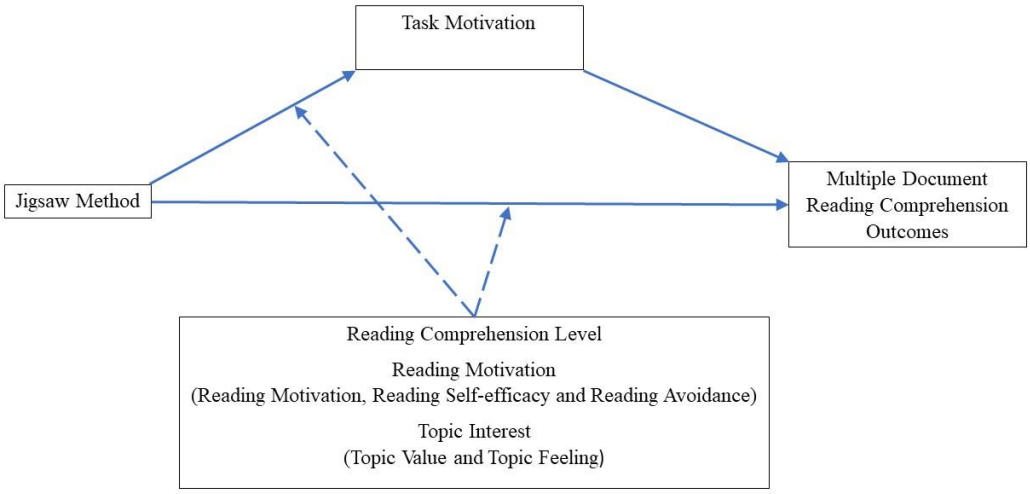

Figure 1 Research model

Method

Design of the study

The research questions were investigated by a pre-test-post-test design with an experiment. In the experiment which involved a Jigsaw group and an individual group, students had to do a reading and writing task. The learning materials for the reading task were four short digital texts about broiler chicken (Morren, 2019). Each text was about half a page long. The first text (text A) had Wakker Dier, an organisation against animal cruelty, as source and had as main message that broiler chickens lived in worse conditions than other chickens. The second text (text B) had de Stentor, a newspaper, as a source and had as main message that broiler chicken was better for the environment than biological chicken. The third text (text C) had a researcher from the University of Groningen as a source and had as main message that broiler chicken was less healthy for humans to eat than other chicken. The fourth text (text D) had a manager of Albert Heijn, a supermarket, as a source and had as main message that broiler chicken was more affordable than biological chicken. Hence, of the four texts, two texts supported broiler chicken and two were against it. These texts have been tested on vocational education. Prior and after the experiment students made questionnaires and a test to determine their reading comprehension level, reading motivation, reading self-efficacy, reading avoidance and topic interest.

Participants

The participants of this study were selected through convenience sampling. For this study, out of the eleven schools that were approached for participation, one school was willing to participate. The

school selected eight classes with a total of approximately 250 students that fitted the description of the target group of this research. The parents of the students from these selected classes then received an information folder about the research and a consent form that asked for active parental consent and the consent of the students. Parents of 98 students and the students themselves gave permission for participation. From the 98 students, 13 were absent when the experiment took place, one student withdrew from the experiment before it started, and one student stopped while doing it because it.

The remaining participants were 83 students (43 boys, 35 girls, 5 unknown) from the first and second year of the highest levels of the prevocational educational path (mavo, kader). The participants all came from eight classes of the same prevocational education school in the Netherlands. The participants had an average age of 13,55 years (SD = 0,736). From this group of participants 20,5 % of the students attended the first year and 72,3 % attended the second year of secondary education. Furthermore, 56% of the students did Mavo (the highest level of prevocational education), 28,9 % did Kader (the second highest level of prevocational education), 3,6% did a combination of Mavo and Kader; and 3,6% did a combination of Basis (lowest level) and Kader. From the participants 8,4 % was diagnosed with dyslexia, 6 % did not know whether they were diagnosed and 78,3 % did not have dyslexia. Furthermore, 83,1% of the students spoke usually Dutch at home, 2,4% spoke another language as often as Dutch at home and 8,4 % of the students more often spoke another language at home. These other languages were English, Turkish, French and Thai.

In the experiment students were either placed in the Jigsaw condition or control group. Each class was randomly assigned to the control group or Jigsaw condition and within the Jigsaw condition then groups of four students were formed by randomly assigning them to the groups. It can be assumed that groups were heterogeneous. If it were not possible to create a group of four, the left-over students would do the individual test. The Jigsaw condition and the control condition had a close to equal sample size (48,2 % Individual, 51,8 % Jigsaw).

Materials

Multiple document reading comprehension outcomes

Multiple document outcomes were measured with a writing assignment in the form of an essay in which students had to tell their opinion and support it with supportive and counter arguments from the texts. This assignment was a duplication of the essay assignment of Morren (2019). Collecting essays is a common way to measure how much participants can recall from reading (Hastings, Hughes, Magliano, Goldman, & Lawless, 2012). The essays were coded by using a codebook that contained content elements and main messages for each of the texts. Content elements were specific strings of information that students could have retrieved from reading certain parts of a text such as “broiler chicken is the most commonly held animal in the Netherlands”. Text A contained 31 content elements, text B 22 content elements, text C 14 content elements and text D 15 content elements. Each

of the four texts also contained one main message. Main messages were the general message that could be retrieved from a text such as "Broiler chicken is better for the environment then biological chicken". Each of the content element and main message codes could be only used once per essay. Except for when students used an argument both as a pro- and counter argument. 10% of the essays were coded by an independent second rater to create inter-rater reliability, which was achieved with an intraclass correlation coefficient of .96 for single measures and .98 for average measures. The final scores were calculated by counting the number of content elements and main messages in an essay and the total number of texts used. Lastly, a point was added when a student used pro- and counter arguments. For example, if a student gave a total of seven arguments from which four were coded as content elements of text A, one was coded as a content element of text B, one was coded as the main message of text A and one was coded as the main message of text B, this would mean that the student got a score of nine because he or she used seven arguments from two of the four texts. When this student used both supporting and counter arguments for broiler chicken, he or she would receive an additional point and the total score would be ten points. Thus, the maximum score that could be given to an essay was 91 points (86 points for using all the content and main messages, four points for using all four texts and one point for using pro- and counter arguments) given that each argument was only given as a pro- or counter argument.

Task motivation

Students' task motivation was assessed by the intrinsic Motivation Inventory (Reynolds, 2006; Ryan, 1982). This questionnaire is often used in research to measure task motivation and contains six statements such as "I enjoyed doing this activity very much" that can be answered on a seven-point scale which ranks from "not true at all" to "very true". The questionnaire was translated into Dutch and the questions were tested with two individuals with a similar age group and educational level as well as a prevocational teacher. The mean score of the scale was used as score. A reliability test with the conducted data revealed a reliability coefficient (α) of .84.

Reading comprehension level

Reading comprehension level was assessed with the SALSA-test (Daas, Havermans, & Van Noortwijk, 2009; Steensel et al., 2013; Steensel, Oostdam, & Gelderen, 2012). The SALSA-test is a reading comprehension test for prevocational education. Students read a total of five texts. After reading a text, students need to answer multiple choice and open questions about the content of the text. The test contains 30 closed and seven open questions. The closed questions had a reliability score (α) of .79 and contained multiple choice questions such as "Which of the following statements is true?" with four options given for statements and only one correct answer. Open questions were questions such as "What does the asterisk that is displayed by some of the ingredients mean?". The test was graded by using the scorebook of the test which contained clear guidelines for scoring the open questions and the right answers of the closed questions. A score was retrieved from the

percentage of the sum of scores of right answers divided by the maximum number of points to score which was 40. The students could get a percentage score of 0 to 100.

Reading motivation

Reading motivation was assessed by the leesmotivatievragenlijst (reading motivation questionnaire) (Nederlands Expertisecentrum, 2019; Scheltinga et al., internal document). The leesmotivatievragenlijst is a questionnaire that exists of 20 statements that are answered on a four-point ranking scale, rating from "not true at all" to "very true". The questionnaire measures the three dimensions of reading motivation, reading self-efficacy, and reading avoidance. According to Scheltinga et al. (internal document), reading motivation had a reliability score of α=.85, reading self-efficacy had a reliability score of α=.77 and reading avoidance had a reliability score of α=.76. Reading motivation is measured by seven statements such as "I like to read in my spare time", reading self-efficacy is measured by seven statements such as "I need extra help while reading", and reading avoidance is measured by six statements such as "When I need to read books/texts for school I try to avoid it". The mean score of each scale was used as score. A reliability test with the conducted data revealed a reliability coefficient (α) of .86 for reading motivation, a reliability coefficient (α) of .80 for reading self-efficacy and a reliability coefficient (α) of .74 for reading avoidance.

Topic interest

Students topic interest was measured by the Interest scale (Schiefele, 1996). This questionnaire contains seven statements that are ranked on an eight-point scale rating from "not at all" to "very". The questions were adjusted to the topic used in this experiment which is broiler chicken. Four statements are about the students' expected feelings, e.g. "When I read a text about broiler chickens, I expect to feel bored" and three statements are about the value a student gives to the topic, e.g. "I find reading texts broiler chickens useful". The scale has a reliability coefficient (α) of .78 (Schiefele, 1996) The questionnaire was translated into Dutch and the questions were tested with two individuals with a similar age group and educational level as well as a prevocational teacher. The mean score of the scale was used as score. A reliability test with the conducted data revealed a reliability coefficient (α) of .88.

Procedure

The data was collected in two sessions. The SALSA-test was conducted by the Dutch class teachers during regular Dutch class hours. Teachers were given instructions of the test beforehand. The experiment was conducted in 90-minute sessions in which two classes participated at a time. During the experiments, the students were seated in two computer rooms and the teacher of the class was present. Students started with filling in the online Qualtrics topic interest and reading motivation questionnaires. During the experiment, the respondents in the control condition were required to read four texts about broiler chickens in an online GRAASP environment, whereas, in the Jigsaw condition

these texts were divided over the members of the small Jigsaw groups. Thus, each member reads one texts and shares the information with his or her group. Their knowledge was tested in the essay assignment which is written on Microsoft word and saved on an external hard drive. Lastly, the respondents filled in an online Qualtrics task motivation questionnaire. Most students were finished with the full assignment after 60 minutes, with a few exceptions. From the total of the 98 students 13 students were absent during the experiment and 2 students decided that they did not want to proceed during the experiment which resulted in 83 participants that finished the experiment. Some students did not participate in the Salsa test or the pre-test questionnaires which led to some missing data. The data was collected in combination with another experiment in which the Jigsaw method was investigated in combination with prior believes, sourcing information and the collaboration of the students.

Analytical approach

The research questions were answered by analysing the results of SPSS analyses. For this research, the software of Statistical Package for the Social Sciences (SPSS) version 25 was used. In SPSS an additional regression analysis tool (PROCESS) created by Hayes (2013) was used. This tool shows the significance and effect sizes in models with mediators and moderators. Two types of analysis models were run through the program. The direct and indirect effect of Jigsaw on multiple document reading comprehension outcomes was investigated with Hayes model 4. In this model the dependent variable (Y) was multiple document reading comprehension outcomes, the independent variable (X) was the Jigsaw-individual condition and task motivation was added to the model as a mediator (M). The second research question was investigated by using Hayes process model 8. In order to keep enough power for these analyses the relationships and effects between the moderators were not investigated. Thus, for each of the five analyses multiple document reading comprehension outcomes was used as the dependent variable (Y), the Jigsaw-individual condition as the independent variable (X), task motivation as a mediator (M), and for each analysis one of the five different moderators, reading comprehension level, reading motivation, reading self-efficacy, reading avoidance and topic interest, (W) was used.

Results

Descriptive statistics and Pearson correlations

First, the descriptive statistics and Pearson correlations were analysed. Table 1 gives an overview of the descriptive statistics and Pearson correlations of the variables included in this study. Most of the variables were normally distributed except for multiple document reading comprehension outcomes. This distribution was skewed to the right with a mean of 3.80 (SD = 3.02), however,

according Hayes (2013), the analysis could still be performed because the skewedness of the variable should have minimum effect on the outcomes of the analysis by using the Hayes analyses. There was a significant negative correlation between the Jigsaw condition and task motivation, a significant positive correlation between multiple document reading comprehension outcomes and reading comprehension level, multiple document reading comprehension outcomes and reading motivation and multiple document reading comprehension outcomes and reading avoidance. Furthermore, there was a negative correlation between task motivation and topic interest. No significant correlation was found between Jigsaw and multiple document reading comprehension outcomes or between intrinsic motivation and multiple document reading comprehension outcomes.

Table 1

Descriptive Statistics and Pearson Correlations of Study Variables.

	1.	2.	3.	4.	5.	6.	7.	8.
1. Jigsaw – individual								
2. M.D.R.C. outcomes	.17							
3. Task motivation	-.24*	-.04						
4. R.C. level	.11	.28*	.17					
5. R. motivation	.14	.30*	.02	.35*				
6. R. self-efficacy	-.02	.07	.01	.29*	.06			
7. R. avoidance	-.22	.37*	.07	-.54*	-.63*	-.42*		
8. Topic interest	.14	.17	-.37*	.13	.20	.00	.19	
Mean		3.80	4.33	45.83	2.01	2.94	2.39	3.56
SD		3.02	1.37	15.57	.68	.57	.64	1.46

Note. p<.05 are flagged *
M.D.R.C. outcomes stands for multiple document reading outcomes
R.C. level stands for reading comprehension level
R. motivation stands for reading motivation
R. self-efficacy stands for reading self-efficacy
R. avoidance stands for reading avoidance

The effect of Jigsaw on multiple document reading comprehension outcomes

To answer the first research question, Hayes analysis model 4 was used to determine the direct and indirect effect of Jigsaw on multiple document reading comprehension. Table 2 shows the results. No significant direct effect was found between the Jigsaw method and multiple document reading comprehension outcomes, indicating that the Jigsaw method does not have an impact on multiple document reading comprehension outcomes. Furthermore, the indirect effect of Jigsaw on multiple document reading comprehension outcomes via task motivation was also not significant.

Table 2

Relations of Jigsaw-Individual Condition, Multiple Document Reading Comprehension Outcomes and Task motivation.

Variable	Task Motivation	M.D.R.C. Outcomes
Jigsaw – Individual	-.6392*	1.0016
Task Motivation		-.0039
R^2	.0553*	.0280

Note. p<.05 are flagged*

M.D.R.C. outcomes stands for multiple document reading outcomes

The effects of the moderators

To answer the second research question, it was investigated whether the effect of the Jigsaw method on multiple document reading comprehension outcomes and task motivation was moderated by reading comprehension level, reading motivation, reading self-efficacy, reading avoidance or topic interest. Even though the effect itself was not significant; a moderation is still possible. This was investigated by running a Hayes process analysis model 8 with each of these variables separately. The results of these tests are shown in

Table 3

. The analyses did not show a significant moderator effect of any of the moderator variables on the effect of Jigsaw on multiple document reading comprehension outcomes or on the effect of Jigsaw on task motivation. Data analysis scenario 1 with reading comprehension level as a moderator was significant as a student's reading comprehension level affected the multiple document reading comprehension outcomes, however, the reading comprehension level did not predict the direct or indirect effect of Jigsaw on multiple document reading comprehension outcomes. In addition, scenario 4 with reading avoidance is also significant, however, none of the predictors is a significant predictor of multiple document reading comprehension outcomes.

Table 3

Effects of the Moderators in Data analysis scenarios 1, 2, 3, 4 and 5

Variable	Task Motivation	M.D.R.C. Outcomes
Scenario 1 with Reading Comprehension Level		
Jigsaw - Individual	-.1884	3.9705
Task Motivation		-.0630
R.C. Level	.0316	.1513*

Jigsaw x R.C. Level	-.0094	-.0642
R^2	.0869	.1383*
Scenario 2 with Reading Motivation		
Jigsaw - Individual	-1.9521	-.7212
Task Motivation		-.0179
R. Motivation	-.9758	.1569
Jigsaw x R. Motivation	.6428	.7189
R^2	.0850	.0061
Scenario 3 with Reading Self-efficacy		
Jigsaw - Individual	-2.5049	4.1010
Task Motivation		.0480
R. Self-efficacy	-.8500	1.8744
Jigsaw x R. Self-efficacy	.6248	-1.0547
R^2	.0761	.0396
Scenario 4 with Reading Avoidance		
Jigsaw - Individual	.5362	-.1406
Task Motivation		.0405
R. Avoidance	.8076	-2.0758
Jigsaw x R. Avoidance	-.4945	.2740
R^2	.7028	.1406*
Scenario 5 with Topic Interest		
Jigsaw - Individual	.9137	3.0051
Task Motivation		.0795
Topic Interest	.2842	1.2332
Jigsaw x Topic Interest	-.4085	-.5991
R^2	.2241	.0706

Note. p<.05 are flagged*
M.D.R.C. outcomes stands for multiple document reading outcomes
R.C. level stands for reading comprehension level
R. motivation stands for reading motivation
R. self-efficacy stands for reading self-efficacy
R. avoidance stands for reading avoidance

Discussion

The goal of the present study was to investigate to what extent the Jigsaw method could increase multiple document reading comprehension outcomes in Dutch prevocational education and how this effect was mediated by task motivation. Additionally, it was investigated how reading

comprehension level, reading motivation, reading self-efficacy, reading avoidance and topic interest moderated these effects. The results indicated no direct effect of Jigsaw on multiple document reading comprehension outcomes. Furthermore, no mediator effects of task motivation or moderator effects of reading comprehension level, reading motivation, reading self-efficacy, reading avoidance and topic interest were found.

Jigsaw and multiple document reading comprehension outcomes

Regarding the first hypothesis, both the Jigsaw group and the individual group had similar means for multiple document reading comprehension outcomes, which indicates that there is no effect of the Jigsaw method on multiple document reading comprehension. Although, these results contradict the results of Sabbah (2016), they are in line with the results of Morren (2019), who also did not find a difference in multiple document reading comprehension outcomes in vocational education.

According to Shaaban (2006), the effectiveness of the Jigsaw method is very sensitive to contextual factors including the length of the experiment. The duration of the experiment in this study was relatively short compared to other experiments that involve the Jigsaw method (Ghaith & Bouzeineddine, 2003; Ghaith & El-Malak, 2004; Sabbah, 2016). Thus, a possible explanation of the found results could be that the duration of the experiment. According to Aronson et al. (1978), students need time and practice to develop cooperation skills such as listening and helping to implement the jigsaw technique effectively. Johnson and Johnson (2009) stated group members need to develop skills for social interactions to properly cooperate. In later work of Aronson (2002), he noted that students become better in working in the Jigsaw groups when they practice it over a longer period. Hence, the Jigsaw method becomes more effective over time as students develop the skills needed for effective cooperation.

A second explanation for the results could be that in this study, students were assessed with a writing task instead of a reading achievement test, which is often used in other research (e.g., Ghaith & El-Malak, 2004; Sabbah, 2016). The method of assessing students' multiple document reading outcomes might have affected the results of this research as students scored low on the writing assignment. Although the maximum score that a student could acquire was 91 points, the highest score that was given to a student in this research was twelve points. Furthermore, from the results of this study it was found that the normal distribution of the scores of multiple documents reading comprehension was skewed to the right, since many of the students got no points. From analysing the essays, it could be concluded that students had difficulty with writing a good argumentation for the essay assignment, as students amongst other things often repeated the same argument. Therefore, the results might have also reflected the writing skills of students.

According to Marchland and Skinner (2007), high school students often neglect asking for help when facing difficulties. Therefore, a third possible reason could be that students in the Jigsaw condition did not ask for an elaboration when they did not understand the information from their

groupmates. Moreover, according to Lew, Alwis, and Schmidt (2010), students with low academic skills often have a more positive image of their own capacities. Hence, they might not detect that they lack knowledge or need help and, therefore, they do not ask their students for help. As a result, students might have faced difficulties when they had to do the essay task due to the lack of knowledge, which in turn led to lower multiple document reading comprehension outcomes.

Regarding the second hypothesis, it was found that task motivation did not mediate the effect of Jigsaw on multiple document reading comprehension outcomes, since the jigsaw method did not increase students task motivation. This is contradictive to the results of Shaaban (2006), who found that Jigsaw increased motivation for reading tasks. According to Gottfried (2009), motivation is dependent on many contextual variables, including a students' peer relationships. Therefore, the results for motivation can be easily influenced by the group composition. Ladd, Herald-Brown and Kochel (2009) stated that a student's peers and the relationship with these peers have a large influence in their engagement and motivation and thus, also in the performance of a student. Hence, if students had to work in a team with peers they did not have a positive relationship with this might have caused less motivation for the reading task.

Another explanation for the found results could be that in the experiment the social interdependence did not result in positive interdependence. Positive interdependence is an important factor that determines outcomes for motivation and achievements in cooperative methods (Roseth et al., 2019). Positive interdependence is acquired if a students' success depends on getting information from others and sharing information with others (Johnson & Johnson, 2017). However, in this experiment students were dependent on getting information from others but they did not have to share it, since they would have to make an individual essay. Hence, in the experiment positive means interdependence was used, instead of positive outcome interdependence (Roseth et al., 2019). According to the authors, positive mean interdependence leads to lower outcomes for motivation and achievement than positive outcome interdependence. Thus, the form of positive interdependence could have impacted students' motivation.

Moderator effects

With the second research question it was investigated to what extent the effect of Jigsaw on multiple document reading comprehension and task motivation was moderated by reading comprehension level, reading motivation, reading self-efficacy, reading avoidance and topic interest. Regarding reading comprehension, a significant effect was found of reading comprehension level on multiple document reading comprehension outcomes. This confirms theories on how reading comprehension predicts multiple document reading comprehension outcomes (Coiro, 2011; Kanniainen et al., 2019). However, no significant impact on the direct and indirect effect of Jigsaw on multiple document reading comprehension outcomes was found for any of the moderators.

A possible explanation for the lacking moderator effect for each of the five moderator variables could be the lack of power in this experiment. The research was conducted with a very small participants sample (83 participants). This created a lack of power for the results of the experiment. The research models should, therefore, be interpreted with caution (Wilson Van Voorhis & Morgan, 2007). The power of the effects was too small to conclude whether the effects of the moderator variables were significant or not, as a wrong conclusion could be made due to a type I or type II error. However, the correlations table showed a significant correlation between reading motivation and multiple documents reading comprehension outcomes, and reading avoidance and multiple document reading outcomes. Similarly, a significant correlation was found between topic interest and task motivation. Hence, these variables might still be moderators when the experiment is performed with a larger sample size.

A second explanation for the results could be that students had difficulty with giving an accurate representation of their reading motivation, reading self-efficacy, and reading avoidance, since all these variables were measured by self-reports. Students often make an inaccurate judgement of themselves when they have to fill in a self-report (Lew et al., 2010). According to Scheltinga et al. (internal document), especially younger students from prevocational education had difficulty with reflecting on their reading motivation, self-efficacy and reading avoidance, when they were interviewed as a follow-up for the reading motivation questionnaire. The outcomes that were used to measure these variables might not be an accurate representation. Therefore, the moderator effects might not have become visible.

A final explanation could be that students in this study did not perceive higher task motivation in the Jigsaw group which resulted in little moderation of the individual differences variables. It was expected that students with low reading level, reading motivation, reading self-efficacy and topic interest, and high reading avoidance would benefit more from the Jigsaw method because their task motivation would boost. However, students in the Jigsaw method did not experience higher task motivation, hence, the students were not more engaged in the task.

Limitations

This research has some other limitations besides the design of the experiment, the methods that were used for testing and the lack of power due to the small sample size.

First, the current research did not monitor the discussions that took place in the Jigsaw groups. Therefore, it is unknown what content the students discussed in this part of the experiment and to what detail they shared their learning materials. Also, it is not known whether the students had the right cooperative learning skills and prior experience to properly take part in group discussions and whether the students had a positive collaboration with their group mates. A lack of cooperation elements such as social skills could have a large impact on the task motivation and multiple document reading comprehension outcomes (Roseth et al., 2019). Therefore, it is suggested to take the content and the

dynamics of the group discussions into account in future research on Jigsaw in prevocational education.

Second, the topic of the text, broiler chicken, was not a familiar topic for some students. Although the topic is often in the news or found on other information channels, some students did not know what a broiler chicken was. This resulted in a lot of questions of students and students were even more dependent on the information of the other students to understand what the texts were about. According to Coiro (2011), topic-specific prior knowledge has a significant effect on multiple document reading comprehension for students who have difficulty with digital reading. If the experiment was conducted with a topic that was more familiar to the students, the results of the writing assignment might have been higher. Hence, the outcomes of multiple reading comprehension would probably be less skewed.

Lastly, in the current experiment the Jigsaw method was implemented in a light version. During the experiment students read their own learning material and shared it immediately with their group mates. However, in most Jigsaw experiments the students get the chance to discuss their learning material first with students who read the same material before sharing it with their heterogeneous Jigsaw group (e.g., Sabbah, 2016; Shaaban, 2006). These homogeneous discussion groups are called expert groups (Slavin, 1980). The expert group discussions give students the chance to see if they have the right understanding of their part of the learning material. It is possible that this difference in the design affects the outcomes of the current study. Therefore, it is suggested to also incorporate expert group conversations in a follow-up study.

Implications and conclusions

The results of this research are surprising in a way that in previous research it has been found that the Jigsaw method is more effective than individual learning. Instead, this research contradicts these studies, as it was found that both methods seem to be equally effective. Hence, this research shows that the Jigsaw method is not effective under the circumstances of this study. The results indicate that the method has some boundary conditions in order to be more effective than traditional learning methods. However, it seems that Jigsaw can be implemented by practitioners without affecting multiple document reading comprehension outcomes. Furthermore, the method does not seem to be affected by students' individual differences or task motivation. This allows for the Jigsaw method to be used as a variation on individual teaching methods and all students can participate in the Jigsaw method in the same way regardless of their reading level, reading motivation, reading self-efficacy, reading avoidance level or topic interest. In conclusion, the Jigsaw method seems as effective as individual multiple document reading comprehension while not mediated by task motivation or moderated by reading comprehension level, reading motivation, reading self-efficacy, reading avoidance or topic interest.

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