



MASTER THESIS

The effect of the Jigsaw method and prior attitudes on multiple documents reading comprehension

Michaela Jezikova
S2169614
Psychology, Learning Sciences

Behavioural, Management and Social Sciences
University of Twente

Prof. Dr. P.C.J. Segers
Dr. A.M. van Dijk

06.07.2020

UNIVERSITY OF TWENTE.

Abstract

This study investigated the effect of cooperative Jigsaw method and prior attitudes towards the topic on comprehending and integrating conflicting information in multiple texts. For this purpose, 78 Dutch pre-vocational students were distributed in an experimental and a control group. For assessing multiple documents reading comprehension, all participants were asked to read individually or in the groups four texts containing contrasting arguments about broiler chicken. Consequently, they individually expressed their opinion towards the topic in the form of a short essay. Besides, participants were tested on prior and post-experiment attitudes towards this topic. In addition, the experimental group performed the reading task by working according to the Jigsaw method and was tested on the quality of cooperation. The essays were scored on content elements, main messages, and the number of articles they were retrieved from, resulting in an overall score of multiple documents reading comprehension. Hierarchical regression showed no significant change in reading comprehension of students performing the task cooperatively or individually. Prior attitudes, on the other hand, had a slight effect on reading comprehension, meaning that they could negatively influence students' reading comprehension. Further regression analysis showed that prior attitudes had a significant effect on post-experiment attitudes, indicating that reading multiple texts resulted in a change of attitudes towards the topic in the individual working condition. Based on this analysis and the frequency table, it can be concluded that the majority of the students' weak and neutral attitudes were easily manipulated by the contrasting information from multiple texts, resulting in one-sided opinions towards the broiler chicken.

Keywords: multiple documents reading comprehension; Jigsaw method; prior attitudes; post-experiment attitudes;

1. Introduction

Nowadays, the Internet enables access to a vast amount of information (Singer & Alexander, 2017). For this reason, students are frequently asked to use the Internet as a source of information for writing essays on various topics (Macedo-Rouet, Braasch, Britt, & Rouet, 2013). To get a deeper understanding of an issue, it is crucial to integrate the information from multiple texts and connect them with prior knowledge (Rouet, 2013). However, some students find it challenging to integrate the information into an overall gist (Meneghetti, Carretti, & De Beni, 2006). This may be related to lower prior knowledge, which is crucial in making associative links with the new information in working memory. Consequently, students result in having problems with making inferences about the text (Cain & Oakhill, 2006).

Furthermore, working on school assignments might bring students to topics that are known for multiple competing theories (Kobayashi, 2009). When dealing with contrasting information, prior attitudes towards a topic discussed in the texts may have an impact (Stadtler & Bromme, 2013). They may serve as a knowledge base in compensation for lack of prior knowledge (Maier & Richter, 2013). Thereupon, students pay attention to arguments consistent with their prior attitudes and neglect the inconsistent ones, even though both contribute to an insightful point of view on an issue (Maier & Richter, 2013).

To avoid these problems, cooperative learning might pose a suitable alternative (Ghaith & El-Malak, 2004). Jigsaw method, in particular, might be beneficial for several reasons. The learning material is distributed between the students within a small group, which makes each student responsible only for one part of a topic, and it reduces the reading overload (Aronson & Patnoe, 2011). Discussing the topic within a group might bring different points of view and encourage students to the elaboration of contrasting information. The effect of using Jigsaw on comprehension of multiple documents and the effect of prior attitudes hereupon are not yet clear. Therefore, the current study aimed to investigate the effect of the Jigsaw method as well as prior attitudes on multiple documents reading comprehension. The results could shed light on the possibility of reducing the effect of prior attitudes by the Jigsaw method, which could improve the reading comprehension of the students.

1.1 Multiple documents reading comprehension

Comprehension is needed for integrating diverse sources of information into a meaningful representation of an issue (Anmarkrud, Bråten, & Strømsø, 2014). Text

comprehension is a process in which the reader strives to transform text information into a mental model (Rouet, 2013). Forming a mental model starts with the processing of a single text. During this process, two representations are involved: the *text model*, which is a representation of the propositions in a text, and the *situation model*, as a representation of what the text is about (Verhoeven & Perfetti, 2009). To arrive at these models, the reader must process the visual input of orthographic and phonological units, which leads to the identification of individual words (Verhoeven & Perfetti, 2009). In this process, general knowledge of word meanings represented in long-term memory plays an important role. It enables automatic conversion of words into a linguistic presentation (Kintsch, 2019). Since words are integrated into the sentences, the reader must analyze the structure of sentences using morphology and syntax (Perfetti & Stafura, 2014). By working with a sentence structure and word meanings, the reader can extract the meaning of a sentence. Sentences together present a situation, which the reader connects with his prior knowledge, resulting in a construction of new knowledge related to his or her individual experiences. These processes are called word-to-text integration and result in text comprehension (Verhoeven & Perfetti, 2009).

Multiple documents reading comprehension is a far more complex process than the comprehension of a single text, since multiple documents include more than one coherent, continuous text (van Oostendorp & Goldman, 1998). When processing multiple texts, the *document model* provides a complete mental representation by the combination of two sub-models: the *intertext model* and the *situation model* (Britt, Rouet, & Durik, 2017; Perfetti, Rouet, & Britt, 1999). The intertext model refers to information regarding the document source, the content of the text as well as the author's intended goal and audience. It facilitates the reader to link this information to corresponding texts (Jucks & Paus, 2013). The situation model is a representation of a situation described in a single text, which is continuously updated by other texts referring to either the same situation or describing different situations within the same topic. Both models need to be connected for reading comprehension to be developed (Britt et al., 2017; Perfetti et al., 1999).

Documents describing the same situation usually consist of contrasting arguments from different authors (Strømsø, 2017). Therefore, when a reader is about to create a consistent mental representation of those documents, (s)he must think of integrating, comparing the information as well as allocating the source information to statements presented in the documents (Rouet, Britt, & Durik, 2017; Strømsø, 2017). Readers often have difficulties with these processes, and the integration of information from multiple texts leads to one-sided representation. Failures to form a balanced representation of contrasting information could be

explained by the tendency to focus only on one side of the arguments (Richter & Maier, 2017). That is partly caused by prior attitudes, which can have an impact on understanding contrasting issues.

1.2 The effect of prior attitudes on multiple document reading comprehension

Attitudes are evaluations expressing the relation towards an object or situation (Crano & Prislin, 2006). The strength of the attitudes varies. On the one side, firmly held attitudes that are important to a person tend to be strong. They are highly resistant to change and have effects on perception and behavior. On the other side, weak attitudes tend to be neutral and can be easily manipulated (Olson & Zanna, 1993).

When students process information from multiple documents, their prior attitudes may influence this process in two ways. First, students tend to seek information that is consistent with their attitudes and quickly deny the ones which oppose them (Fischer, Jonas, Frey, & Schulz-Hardt, 2005). Second, while readers undoubtedly accept the information in compliance with their attitudes, they devote more attention to scrutinizing the information inconsistent with them (Taber, Brook, & Franklin, 2006). Many studies proved that prior attitudes impact the integration of contrasting information as well as comprehension accordingly to the first situation mentioned above. For instance, in the study conducted by Kardash and Scholes (1996), students with strong prior attitudes focused more on the arguments in compliance with their prior attitudes, leading to a biased perspective in comparison with students who considered both sides of the issue. Another study supported this finding and stated that when participants expressed their opinion towards a topic, they significantly concurred with arguments consistent with their attitude and even found them more convincing (Kobayashi, 2010).

These effects can be explained by the belief-consistency effect, which is caused by the validation process that takes part in the comprehension of conflicting information (Maier & Richter, 2013). The validation process, as a routine part of the comprehension activities, is monitoring the text information for its validity or plausibility, which is consistent with the reader's knowledge and beliefs (Maier, Richter, & Britt, 2018). The monitoring of plausibility of information can impact comprehension in two ways, depending on the involvement of just one or two steps of the *Two-step model of validation* (Richter & Maier, 2017). The first step of the model includes the detection of text-belief consistencies. This means that readers tend to concentrate their prior knowledge as well as beliefs to the information they find plausible and

devote less or no attention to information inconsistent with their beliefs. Seeking for information, which confirms rather than contradicts the reader's beliefs, is involuntary and poses a passive mechanism for dealing with conflicting information. Consequently, it leads to the belief-consistency effect mentioned above (Richter, 2015). The second step depends on the reader's involvement and interest to achieve a justified point of view on a controversial issue. Once the inconsistencies between prior beliefs and text information are found, the reader can resolve them by elaborative processing. That cannot be done without the reader's prior knowledge and working memory that enable searching for additional information in the texts or retrieving pro- and con- arguments from long-term memory. This way, the reader could adopt a more balanced mental model of the issue (Richter, 2015; Richter & Maier, 2017).

Consulting the topic within a group of students could lead to a deeper evaluation of contrasting information since every member has the opportunity to express their arguments towards the topic. Taking different points of view into consideration and building upon each other's knowledge may result in more balanced inferences as well as knowledge acquisition (Jurkowski & Hänze, 2015). Whether the negative effect of prior attitudes could be reduced by a discussion of the topic in the cooperative group is so far unknown.

1.3 Cooperative learning – Jigsaw method

Cooperative learning has experienced success and became one of the most dominant instructional procedures throughout most of the world (Johnson & Johnson, 2009). The application of social interdependence theory partly contributed to this success (Johnson & Johnson, 2009). "Social interdependence exists when the outcomes of individuals are affected by their own and other's actions" (Johnson & Johnson, 2009, p. 366). Besides positive social interdependence, likewise, individual accountability and the use of social skills belong to factors that lead to productive cooperation (Johnson & Johnson, 2009). One of the methods that meet these requirements of successful cooperation is the Jigsaw method.

The *Jigsaw classroom* was first introduced in 1978 by Aronson. Since then, positive outcomes have been documented, including improvements not only in academic performance but also in group relationships, self-esteem, and attitudes towards school (Resor, 2008). Students in the Jigsaw classroom are divided into groups of four to six, and each group gets a piece of learning material from the subject matter. Every member of the group needs to study a unique segment of the information individually. As a result, they become experts for that specific topic and need to present the material to other members. After each member of the

group becomes an expert for the part that s(he) was meant to work on, s(he) is responsible for transferring the relevant information to other members. This individual accountability means that every member believes that his/her contribution to the group goals is equally valuable (Aronson & Patnoe, 2011). When members realize that the group goals are achieved only based on each member's work, they encourage each other's efforts to complete the task, and that is how positive interdependence is formed (Aronson & Patnoe, 2011; Walker & Crogan, 1998). Cooperation would not be effective without teamwork. It requires students to accept and support each other, communicate assertively and approach conflicts constructively (Johnson & Johnson, 2009).

The Jigsaw method has been frequently implemented in the area of social subject matters in which text-based material is mostly used. In such tasks, reading and comprehension skills are inevitably involved (Aronson & Patnoe, 2011). Moreover, tasks in which comprehension of multiple documents is required are inherently complex, and for an individual student, it may be cognitively demanding to carry them out (Mayer, 2005). Therefore, it is crucial to control the reading load for meaningful learning. Thus, the Jigsaw method seems ideal because it distributes the task in equal parts between the group members and reduces the students' experienced overload. This effect is called a *distribution advantage* (Kirschner, Paas, & Kirschner, 2009; Mayer, 2005), but whether the Jigsaw indeed has this positive effect on multiple documents reading comprehension has scarcely been studied.

All group members are expected to contribute to group work by sharing opinions and solving problems (Johnson & Johnson, 2009). If inconsistencies in the texts are found, they are also expected to be resolved more efficiently when more students are involved in the group compared to the individuals (Maier & Richter, 2013; Mayer, 2005). Also, shared prior knowledge could contribute to the text processing, resulting in an elaborated representation of an issue not influenced by previously held attitudes, which often substitute lacking prior knowledge.

1.4 The present study

The problems with reading comprehension that students are experiencing are caused not only by low cognitive and metacognitive skills but also partly by the effect of prior attitudes (Meneghetti et al., 2006; Richter & Maier, 2017). Students of Dutch pre-vocational education score low on general knowledge according to the latest records from PISA tests, which negatively affects their reading comprehension on a topic that requires such knowledge

(Gubbels, van Langen, Maassen, & Meelissen, 2019). Furthermore, students often try to substitute this knowledge with prior attitudes towards a topic when processing information from multiple sources. Additionally, half of the Dutch students at the age of fifteen reported that they rarely read for pleasure (OECD, 2009). Consequently, when encountering contrasting information, they may not be interested in elaborating such information more deeply, resulting in a shallow interpretation. For this reason, the Jigsaw method could be a helpful alternative. By using the Jigsaw method, the reading task is distributed in smaller parts over the group members (Aronson & Patnoe, 2011). Therefore, students do not have to put much cognitive effort in reading multiple documents but focus only on one part of the learning material (Mayer, 2005). Additionally, discussing the topic allows students to see the subject from different perspectives (Aronson & Patnoe, 2011). Consequently, it could lead to a balanced overview of the topic and to losing a resistant one-sided attitude. If the requirements are met for cooperative work to be successful such as positive interdependence, there is an expectation that students will acquire a better understanding of an issue and come to a more balanced argument for writing an essay. The present study investigates whether multiple documents reading comprehension of adolescent students could improve by using a collaborative, Jigsaw method. Moreover, it investigates the effect of prior attitudes on reading comprehension and whether this effect could be reduced by using a Jigsaw method. Based on the literature overview, these research questions will be answered:

1. What effect does the Jigsaw method have on multiple documents reading comprehension, and to what extent do prior attitudes impact this effect?
2. What effect do prior attitudes have on integrating information from multiple texts into an essay, and do attitudes change after reading the multiple texts when working individually versus working cooperatively?

The first expectation is that multiple documents reading comprehension would increase by using a cooperative Jigsaw method in comparison with individual reading. The effect of prior attitudes would be less strong for students performing the task in the Jigsaw condition. Secondly, it is expected that strong prior attitudes towards a topic would impact the opinions expressed in the essay more for students working individually compared with students working cooperatively. Furthermore, the cooperation of students could interfere, and the possibility of changing the prior attitudes is expected in the Jigsaw groups compared to the individuals.

An experimental study was conducted to examine these hypotheses. Students were asked to complete a multiple documents reading comprehension task and, followingly, an argumentation task by working individually or in a Jigsaw group. First, students were asked to read four texts presenting contrasting arguments towards breeding a broiler chicken. Such a debatable topic can invoke different points of view and also pose a challenge to integrate this information and come to a balanced interpretation for writing an essay. Attitudes toward this topic were measured before the experiment and once more after, to see a possibility of change. A cooperation questionnaire measuring the quality of cooperation within a Jigsaw group was completed after the argumentation task.

2. Methods

2.1 Participants

Students of the first and second grades of a Dutch pre-vocational school participated in the study. Consent forms were received from the parents, and 90 students in total confirmed the participation. From this amount, eight students did not participate due to sickness, and four students were excluded from the study because of incomplete data. Consequently, the total number of participants was 78, from which 42 (53.8%) were female and 36 (46.2%) male. The students ranged between 12-15 years, whereas the average age was 13.1. The majority of the students were native Dutch; however, five of them spoke also Turkish, one student spoke English and Thai, and one student spoke French. Students were randomly assigned to either Jigsaw or individual groups. Eventually, 38 students have created a group of students working on the task individually, and 40 students were assigned to Jigsaw groups, resulting in 10 Jigsaw groups.

2.2 Materials

2.2.1. Multiple documents reading comprehension task

Four articles presenting arguments against and for the breeding of broiler chicken were prepared in the digital form and demonstrated to students. The average length of the texts was 179 words, and they were retrieved from original articles of the organization *Wakker Dier*, a Dutch online library, a Dutch online health blog, and a Dutch weblog *The Daily Standard*. The texts have the same form as they were first used in research done by a former student of the University of Twente (Morren, 2019). All four articles present real but contrasting information. While two articles use arguments against the breeding of a broiler chicken, the other two

articles present advantages of this breeding method. For this study, three of the sources were altered. The first article is written by *Wakker Dier*, a Dutch organization fighting for the animal's rights, whose advertisement is well known for discrediting a supermarket chain Albert Heijn for selling the unhealthy broiler chicken. The second article's source was adjusted as presented in the local newspaper *de Stentor*, also known in the region where the participants study. The third article pretends to be written by a professor of a reputable Dutch university. The fourth article presents a debatable argument for a broiler chicken from a manager of a supermarket *Albert Heijn*. Participants were asked to read either all or only one of the texts. Students in the Jigsaw group were additionally asked to meet the group members for a discussion of the topic. After reading the texts or discussions, students proceeded with writing an essay.

2.2.2. Argumentation task

Participants' multiple documents reading comprehension was measured by the argumentation task. Research has shown that argumentation tasks, in comparison with summary tasks, facilitate comprehension and learning (Bransford, Brown, & Cocking, 2000). Argumentation leads to elaborating, integrating, as well as self-explaining information, which fosters deeper processing of the information and results in better learning (Joshua & Hemmerich, 2002). Argumentation tasks are especially beneficial when using multiple documents since students seemed to get the best understanding of a topic (Vidal-abarca, Gil, Bråten, & Strømsø, 2010).

Students were, therefore, asked to write a short essay. In ten sentences or a range of a minimum of 400 characters, students were asked to individually express their opinion about broiler chicken. They should have reflected on a topic and interpreted it by using the arguments obtained from the articles they have read or discussed in the group.

Firstly, the number of content elements and the presence of main messages were coded according to Codebook created by a former student of the University of Twente and adjusted by the co-researcher of this study (Morren, 2019). The content elements were identified as arguments discussed in the individual texts, while the main messages were identified as general conclusions covering the content elements. Both could correspond to opinions for or against breeding a broiler chicken or stay neutral. Secondly, the total score of multiple documents reading comprehension was computed based on the number of previously coded content elements, main messages, and the number of texts from which they were retrieved. Since all three elements strongly correlated within each other, $r(76) = .251^*$; $r(76) = .638^{**}$; $r(76) =$

.730**, unified score for multiple documents reading comprehension was determined. While the number of content elements varied with every text, the number of main messages was limited to one message per text. For this reason, the overall score could differ from each other, and the actual score ranged from 0-11. Lastly, the final opinions made by students were divided into four categories: no opinion, for, against, and neutral.

To have reliable results of the test, 10% of the data needed to be coded by a second independent coder. The intraclass correlation was calculated based on the total score from both coders and the score coded on individual texts. The coefficient of the total score was $\alpha = .981$, which shows excellent reliability, whereas values for individual texts were all above .80 or .90, indicating good reliability.

2.2.3. *Prior attitudes questionnaire*

For measuring student's prior attitudes towards a topic, a self-designed questionnaire was used and translated to Dutch. The questionnaire consisted of eight positive or negative attitude statements towards broiler chicken (see Table 1). An inspiration for constructing the statements was taken from a six-item questionnaire measuring the attitudes towards violent videogames and their effects on behavior by van Strien, Brand-Gruwel, and Boshuizen (2013). The answers were measured with a five-point Likert scale from (-2) 'Strongly Disagree' to (+2) 'Strongly Agree' while four questions were reverse coded. For the sake of clarity, the score ranging from 5-25 was divided into three subcategories. The lowest scores (5-11) present a view of strong disagreement with breeding a broiler chicken, scores ranging (12-18) present a neutral attitude and higher scores (19-25) present agreement with breeding a broiler chicken. The value of the internal consistency of the questions in the pre-experiment session was $\alpha = .488$; however, in the post-experiment, the Cronbach's alpha was $\alpha = .661$. The value of Cronbach's alpha was, at first, very low, and considered insufficient. Based on the correlations between the items, three questions with the lowest values of correlation were deleted in both the pre-test and post-test, namely questions 4., 6., and 8. (see Table 1). As a result, Cronbach's alpha improved to the values of $\alpha = .602$ for prior attitudes questionnaire and $\alpha = .613$ for post-experiment attitudes. Reliability values of .60 to .70 are considered acceptable (Kline, 1999).

Table 1*Prior attitudes questionnaire*

1. People should know what the treatment conditions of broiler chicken are.
2. *Too much fuss is made about broiler chicken.
3. Bio chicken should be as affordable as broiler chicken.
4. Broiler chicken is a real problem.
5. *There is no reliable evidence that chickens are suffering.
6. *Broiler chicken should be sold regardless of circumstances.
7. *Claims about infected meat making people sick are exaggerated.
8. Broiler chicken should be banned.

Note. * = reverse coded questions

2.2.4. *Group cooperation questionnaire*

A questionnaire by Gommans, Segers, Burk, and Scholte (2015) was used to measure the quality of cooperation in a Jigsaw group. As a predictor of good cooperation within a group, these three elements are predicted to be the most important: cooperation satisfaction (how is working in a group satisfying for an individual), dominance (whether every member of the group gets an equal chance to express his opinion) and mutual listening (whether all the members of the group listen to each other's opinions). Since the questionnaire is originally designed to measure cooperation in dyads, the questions were adjusted for a small group for this purpose. Cooperation satisfaction was assessed in three questions and dominance and mutual listening both in two questions, whereas all the questions were measured with a ten-point Likert scale from 'not much/well' (1) to 'very much/well' (10). The Cronbach's alpha of cooperation satisfaction was $\alpha = .771$, dominance was $\alpha = -.174$ and mutual listening was $\alpha = .340$. Due to the insufficient values of internal consistency, only cooperation satisfaction was taken into consideration. In the assessment of the cooperation satisfaction, students were asked the question: (e. g., "How would you like to work on another assignment with your group members?"). The questionnaire was not supposed to test the hypotheses, but only to provide an evaluation of the quality of cooperation within Jigsaw groups, which on average, scored by 59.3 % on cooperation satisfaction. The results will not be further analyzed since one component out of three might not provide a reliable evaluation.

2.3 Procedure

Firstly, permission for performing the study from the ethical committee of the University of Twente was obtained. Secondly, parents were asked for their consent to experiment with their child. The consent form contained information about the goal of the study and the anonymization of the data. On experiment day, every student got a laptop since all the questionnaires, and the reading task was prepared in a digital form. Pre-testing lasted seven minutes and consisted of filling out a questionnaire about prior attitudes towards a broiler chicken. Subsequently, participants were divided into two groups, each of them working in separate classrooms, one cooperatively and one individually. In the timeframe of 20 minutes, students working individually were asked to read four texts, which presented contrasting arguments towards breeding of a broiler chicken. Afterward, students were asked to write an essay in 10 minutes, in which they could express their opinion towards the topic discussed in the texts. Jigsaw groups worked in an arrangement of four students in each group. Every participant read one of the four texts individually and then presented it to the rest of the group. Students then talked about the topic and their opinions together. They had 20 minutes in total for reading and discussing the topic. After the discussion, each of the members was asked to express their opinion in the essay within 10 minutes. Finally, all participants filled in the same questionnaire about attitudes towards the topic one more time. Additionally, students working in the Jigsaw groups answered a few questions regarding cooperation satisfaction, which lasted five minutes.

3. Results

To answer the research questions, firstly, descriptive statistics were computed on prior attitudes, post-experiment attitudes, multiple documents reading comprehension, and cooperation satisfaction (see Table 2). All the results are separated by the condition under which students performed the task, individually or cooperatively. Secondly, Pearson's correlations were computed to assess the relationships between the previously mentioned variables. The results indicated the strength of the relationships as expected in the hypotheses. As can be seen in Table 3, the results are presented separately according to the same condition. On the one hand, prior attitudes negatively correlate with reading comprehension in Jigsaw groups ($p = .046$). The higher the prior attitudes, the lower the reading comprehension or vice versa. On the other hand, prior attitudes strongly correlate with post-experiment attitudes

within individuals ($p < .001$). In other words, there is a positive relationship between students' prior attitudes towards broiler chicken with attitudes after reading the texts.

Table 2

Descriptive Statistics of Study Variables (n = 78).

Variable	Condition	M	SD	Min	Max	Skewness	Kurtosis
Prior attitudes	Individuals	15.03	3.141	7	22	-.363	.821
	Jigsaw	14.75	3.128	8	23	.032	.157
Reading comprehension	Individuals	3.47	2.679	0	9	.334	-.596
	Jigsaw	4.00	3.130	0	11	.328	-.852
Post-experiment attitudes	Individuals	14.26	3.923	5	20	-.758	.695
	Jigsaw	14.58	1.810	9	19	-.578	2.626
Cooperation satisfaction	Jigsaw	17.80	6.402	5	30	.132	-.390

Note. The results for individuals (n = 38) and for the Jigsaw groups (n = 40).

Table 3

Intercorrelations for Study Variables Disaggregated by Conditions.

Variable	Individuals\ Jigsaw groups.		
	1	2	3
1. Prior attitudes	-	-.317*	.239
2. Reading comprehension	-.108	-	-.158
3. Post-experiment attitudes	.600**	-.282	-

Note. The results for the Jigsaw groups (n = 40) are shown above the diagonal. The results for the individuals (n = 38) are shown below the diagonal.

* $p < .05$. ** $p < .01$.

Based on the first research question, it was expected that the Jigsaw method would positively influence reading comprehension in comparison with individual reading, and prior attitudes would have a stronger impact in the individual condition compared to the Jigsaw. To test these assumptions, a hierarchical regression analysis was conducted (see Table 4), with multiple documents reading comprehension as the dependent variable. Assumptions were checked prior to the analyses. In Step 1, the condition for performing the task was included (i.e., individuals or Jigsaw groups). In Step 2, prior attitudes were added. In Step 3, prior attitudes were added as a moderator under the condition. None of the steps were significant.

No significant effect for the condition was found in Step 1 ($p = .429$), indicating that there is no difference in reading comprehension between individual and cooperative reading. The effect of prior attitudes on multiple documents reading comprehension in Step 2 was slightly below the threshold of significance ($p = .052$), the trend suggested that stronger prior attitudes towards the topic could have a negative effect on reading comprehension. The effect of prior attitudes as a moderator for one of the conditions in Step 3 was not significant ($p = .285$), meaning that the effect of prior attitudes was similar across conditions.

Table 4

Hierarchical Regression Results for Multiple Documents Reading Comprehension.

Predictor	ΔR^2	B	SE (B)	β
<i>Step 1</i>				
Condition		.526	.661	.091
	.008			
<i>Step 2</i>				
Condition		.469	.650	.081
Prior attitudes		-.207	.105	-.221
	.049			
<i>Step 3</i>				
Condition		3.826	3.187	.661
Prior attitudes		-.092	.150	-.098
Prior attitudes*condition		-.225	.210	-.600
	.015			
Total R^2 adj.	.034			

Note. Condition = Individuals or Jigsaw groups

Concerning the second research question, it was expected that prior attitudes would have a stronger impact on the opinions expressed in the essays for students in the individual condition than the Jigsaw. To test this expectation, descriptive statistics were computed. As shown in Table 5, frequencies of prior attitudes distributed by three categories are shown vertically, and opinions distributed by four categories horizontally. Based on the Chi-square significance value, there is no relationship between the variables neither for individuals ($p = .356$) nor for Jigsaw groups ($p = .697$). Nevertheless, from Table 6, it can be seen that the majority of the students had a neutral attitude towards broiler chicken but ended up with an opinion against it. Explicitly, 15 out of 38 students (39.5%) working individually and 22 out of 40 students (55%) working in Jigsaw groups expressed one-sided opinions. Comparingly,

only ten students in total expressed balanced neutral opinions, seven within individuals, and three students from Jigsaw groups.

Table 5

Frequencies of Opinions with Prior Attitudes Towards Broiler Chicken (n = 78).

	Condition	No opinion	Opinion for BC	Opinion against BC	Neutral opinion
Attitude against BC	Individuals	1	0	4	0
	Jigsaw	1	0	6	1
Neutral attitude	Individuals	6	2	13	7
	Jigsaw	3	8	14	3
Attitude for BC	Individuals	1	1	2	1
	Jigsaw	0	2	2	0

Note. The frequencies of prior attitudes are shown vertically. The frequencies of opinions are shown horizontally. BC = Broiler chicken.

In the second research question, it is further asked whether prior attitudes of students in the Jigsaw groups would change after discussing the multiple texts with members of the groups. As mentioned above, Table 3 shows a strong correlation of prior attitudes with post-experiment attitudes for students working individually and no significant correlation for the Jigsaw groups. Therefore, to see the effect of the prior attitudes and the condition on post-experiment attitudes, hierarchical regression analysis was conducted with post-experiment attitudes as the dependent variable (see Table 6). In Step 1, prior attitudes were included. In Step 2, the condition (individuals/Jigsaw groups) was added. Finally, in Step 3, prior attitudes as a moderator for one of the conditions were included. In Step 1, an effect of prior attitudes on post-experiment attitudes was found ($p < .001$), suggesting an overall relationship between prior and post-experiment attitudes. No significant effect for the condition was found in Step 2 ($p = .485$), meaning that there is no difference in post-experiment attitudes between individuals and students in the Jigsaw groups after controlling for prior attitudes. Lastly, in Step 3, the effect of condition as a moderator for the relationship between prior attitudes and post-experimental attitudes was found ($p = .002$), indicating that the effect of prior attitudes differs across conditions; the effect is significant in the individual condition, but not in the Jigsaw condition.

Table 6*Hierarchical Regression Results for Post-experiment Attitudes.*

Predictor	ΔR^2	B	SE (B)	β
<i>Step 1</i>				
Prior attitudes		.434	.099	.449
	.202***			
<i>Step 2</i>				
Prior attitudes		.437	.100	.452
Condition		.433	.616	.072
	.005			
<i>Step 3</i>				
Prior attitudes		.750	.134	.776**
Condition		9.542	2.850	1.593**
Prior attitudes*Condition		-.612	.187	-1.573**
	.100**			
Total R ² adj.	.279			

p < .01. *p < .001.

4. Discussion

The present study investigated the effect of the Jigsaw method and prior attitudes on multiple documents reading comprehension of adolescent students. Furthermore, it examined whether the effect of prior attitudes, mostly leading to the one-sided interpretation of the information, could be reduced by the Jigsaw method. Results showed no differences between the Jigsaw method and individual reading of multiple documents on reading comprehension outcomes. Stronger prior attitudes showed a negative relationship with reading comprehension, predicting a negative effect on reading comprehension in the Jigsaw groups, and a positive relationship with post-experiment attitudes, indicating a change of attitudes in the individual condition. According to the frequencies of prior attitudes within both conditions, most of the students had neutral attitudes and were inclined to have one-sided opinions expressed in the essays after reading multiple texts.

Regarding the first research question, it was expected that the Jigsaw method would improve reading comprehension. However, no difference was found in the reading comprehension of the students working individually versus cooperatively. This contradicts previous studies that show the positive effects of the Jigsaw method on reading comprehension (Abd El Sami Ali, 2001; Kazemi, 2012). A possible explanation as to why this was not the case for multiple documents reading comprehension could lie in the lack of specific skills needed for the cooperative method to be effective. Since the students did not have experience with the

Jigsaw method before, they could have had problems getting familiar with the method as well as using social skills to collaborate with the group members (Shaaban, 2006). Students need interpersonal and small-group skills for cooperation to be successful (Aronson & Patnoe, 2011; Johnson & Johnson, 2009). Another possible reason could be low general and prior knowledge that play a fundamental role in processing a text. Lack of this knowledge could obstruct students from retrieving the meaning of the text and selecting the relevant information (Meneghetti et al., 2006). In such a case, they are not able to share relevant information with group members. Consequently, students may not benefit from the Jigsaw method without receiving the necessary information for completing the task.

Concerning the prior attitudes, it was expected that the negative effect of prior attitudes on reading comprehension would be stronger for students reading individually than in the Jigsaw groups. In contrast, the correlation coefficient indicated a negative relationship between stronger prior attitudes and lower or higher reading comprehension in the Jigsaw condition. The regression analysis tentatively suggested that stronger prior attitudes could negatively affect the reading comprehension of students in the Jigsaw groups. However, after controlling for the condition, the effect was similar across conditions. The negative effect of prior attitudes on information processing, in general, is in line with several studies (see Kobayashi, 2010; see Van Strien, Brand-Gruwel, & Boshuizen, 2014). In these studies, it was shown that participants with stronger prior attitudes were more likely to write essays leaning to one side of the debate.

Relating to the second research question, it was expected that the belief-consistency effect would appear, meaning that students would form an opinion towards the topic in line with their previously held attitudes. It was also expected that this effect would be stronger in the individual condition compared to the Jigsaw. The frequencies of prior attitudes and opinions that appeared within both conditions showed that the majority of the students expressed a neutral attitude towards the topic, and only after reading the texts, they inclined to one side of the arguments. Therefore, it cannot be concluded that the belief-consistency effect did appear. In general, the students could have had a neutral attitude because they were not familiar with the topic. Since the attitudes are a result of previous experience with subject or situation, if students did not hear about broiler chicken before, their attitude could not have been formed yet.

Subsequently, it was expected that a group discussion of the topic would lead students to a more balanced representation of an issue. A strong correlation between prior and post-experiment attitudes in the individual condition was found, indicating a relationship between the attitudes before and after reading the multiple texts. Taking further analysis into account, it

was shown that there was a stronger effect of prior attitudes in the individual condition, meaning that the change from prior to post attitudes was more significant compared to the Jigsaw groups. Even though the change of attitudes did not lead to balanced representation in the Jigsaw condition, there is a slight chance that the group discussion could have interfered and reduced the effect of prior attitudes. However, there was no difference neither in post-experiment attitudes nor in opinions expressed in the essays across the conditions, meaning that all students inclined to one-sided arguments after all. The reason could be that the topic discussed in the texts was, indeed, new for students. Processing new information is always a challenging task, and if prior knowledge is missing, prior attitudes usually serve as a knowledge base that guides the selection and interpretation of the information and fosters the integration of contrasting points of view (Pratkanis, 1989). Therefore, the support of prior knowledge could prevent students from a tendency to stick with one side of the arguments when dealing with contrasting information (Richter & Maier, 2017).

The present study has several limitations that should be taken into consideration. First of all, prior attitudes questionnaire initially consisted of eight questions; however, the questions' internal consistency was very low. Even after erasing three questions, the Cronbach's alpha was still low. This may be caused by questions being not suitable for measuring prior attitudes. In addition, it could be caused by the topic not being familiar to most of the students. Thus, a suggestion would be to opt for more age-appropriate questions suitable for assessing prior attitudes. Secondly, the cooperation questionnaire also had problems with internal consistency, and two components out of three were not reliable. That could happen because the original was not designed for groups but dyads. Although the questions were accustomed to fit groups, their reliability turned out to be very low; therefore, they were not considered in the study. In future research, a questionnaire tailored for measuring cooperation satisfaction within a group should be used. The third limitation is the design of the research. The longitudinal design of the research would create a space for students to get familiar with the method. The process would get more coordinated as students would know how to achieve mutual goals. Moreover, the group discussion would get more cohesive, with students already knowing each other (Johnson & Johnson, 2009). For future research, it would be recommended to investigate the effect of the Jigsaw method on multiple documents reading comprehension for the long-term. Aronson and Patnoe (2011) suggest introducing the Jigsaw method with team-building exercises to improve listening and helping skills.

This study builds on existing knowledge about the Jigsaw method as a powerful cooperative method recently and frequently implemented in traditional classrooms. While

previous studies have demonstrated the beneficial effects of the Jigsaw method on reading comprehension, these results focused on the reading comprehension of multiple documents (Abd El Sami Ali, 2001; Kazemi, 2012). Although these results did not contribute to an increase in reading comprehension outcomes, they have underlined how important it is to take a longer time and effort when implementing this method. The research provides a deeper insight into the effect of prior attitudes on integrating the contrasting information from multiple documents. It is advised that teachers ensure that students have enough background knowledge to comprehend a text to avoid using prior attitudes as a knowledge base when dealing with contrasting information in texts. They could use group brainstorming to invoke what students already know about a particular topic (Alvermann, Smith, & Readence, 1985). This way, it could encourage the students to share the knowledge retrieved from multiple texts in further Jigsaw discussion and foster their multiple documents reading comprehension.

In conclusion, the present study did not find significant results for the improvement of multiple documents reading comprehension using the Jigsaw method, however interesting results regarding the prior attitudes have been found. The effect of prior attitudes on reading comprehension as well as the change from prior to post attitudes was found. Since this change of attitudes was less significant in the Jigsaw groups, the cooperative Jigsaw method could be investigated more deeply as a way of reducing the effect of prior attitudes on processing multiple texts.

References

- Abd El Sami Ali, M. F. (2001). The effect of using jigsaw reading technique on the EFL pre-service teachers' reading anxiety and comprehension. *Journal of Education College, 3*, 1–21.
- Alvermann, D. E., Smith, L. C., & Readence, J. E. (1985). Prior Knowledge Activation and the Comprehension of Compatible and Incompatible Text. *Reading Research Quarterly, 20*(4), 420–436.
- Anmarkrud, Ø., Bråten, I., & Strømsø, H. I. (2014). Multiple-documents literacy: Strategic processing, source awareness, and argumentation when reading multiple conflicting documents. *Learning and Individual Differences, 30*, 64–76.
<https://doi.org/10.1016/j.lindif.2013.01.007>
- Aronson, E., & Patnoe, S. (2011). *The jigsaw classroom: Building cooperation in the classroom*.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How People Learn- Expanded Edition*. Washington, DC: National Academy Press.
- Britt, M. A., Rouet, J. F., & Durik, A. M. (2017). *Literacy beyond text comprehension: A theory of purposeful reading*. Taylor & Francis.
- Cain, K., & Oakhill, J. (2006). Profiles of children with specific reading comprehension difficulties. *British Journal of Educational Psychology, 76*(4), 683–696.
<https://doi.org/10.1348/000709905X67610>
- Crano, W. D., & Prislin, R. (2006). Attitudes and Persuasion. *Annual Review of Psychology, 57*(1), 345–374. <https://doi.org/10.1146/annurev.psych.57.102904.190034>
- Fischer, P., Jonas, E., Frey, D., & Schulz-Hardt, S. (2005). Selective exposure to information: The impact of information limits Selektive Konfrontation mit Informationen Der Einfluss von Informationsgrenzen. *European Journal of Social Psychology, 35*(4), 469–492. Retrieved from <http://www3.interscience.wiley.com/cgi-bin/jhome/1823>
- Ghaith, G., & El-Malak, M. A. (2004). Effect of jigsaw ii on literal and higher order efl reading comprehension. *International Journal of Phytoremediation, 21*(1), 105–115.

<https://doi.org/10.1076/edre.10.2.105.27906>

- Gommans, R., Segers, E., Burk, W. J., & Scholte, R. H. (2015). The role of perceived popularity on collaborative learning: A dyadic perspective. *Journal of Educational Psychology, 107*(2), 599.
- Gubbels, J., van Langen, A. M. L., Maassen, N. A. M., & Meelissen, M. R. M. (2019). *Resultaten PISA-2018 in vogelvlucht*. <https://doi.org/10.3990/1.9789036549226>
- Johnson, D. W., & Johnson, R. T. (2009). *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning*. (July), 365–379.
<https://doi.org/10.3102/0013189X09339057>
- Joshua, A., & Hemmerich, J. A. (2002). *Proceedings of the Annual Meeting of the Cognitive Science*.
- Jucks, R., & Paus, E. (2013). Different Words for the Same Concept: Learning Collaboratively From Multiple Documents. *Cognition and Instruction, 31*(2), 227–254.
<https://doi.org/10.1080/07370008.2013.769993>
- Jurkowski, S., & Hänze, M. (2015). How to increase the benefits of cooperation: Effects of training in transactive communication on cooperative learning. *British Journal of Educational Psychology, 85*(3), 357–371. <https://doi.org/10.1111/bjep.12077>
- Kardash, C. M., & Scholes, R. J. (1996). Effects of preexisting beliefs, epistemological beliefs, and need for cognition on interpretation of controversial issues. *Journal of Educational psychology, 88*(2), 260.
- Kazemi, M. (2012). The Effect of Jigsaw Technique on the Learners' Reading Achievement: The Case of English as L2. *Mjal, 4*(3), 170–184.
- Kintsch, W. (2019). The Role of Knowledge in Discourse Comprehension. *Cognitive Modeling, 95*(2), 163–182. <https://doi.org/10.7551/mitpress/1888.003.0005>
- Kirschner, F., Paas, F., & Kirschner, P. A. (2009). Individual and group-based learning from complex cognitive tasks: Effects on retention and transfer efficiency. *Computers in Human Behavior, 25*(2), 306–314. <https://doi.org/10.1016/j.chb.2008.12.008>

- Kline, R. B. (1999). Book review: Psychometric theory. *Journal of Psychoeducational Assessment, 17*(3), 275–280.
- Kobayashi, K. (2009). The influence of topic knowledge, external strategy use, and college experience on students' comprehension of controversial texts. *Learning and Individual Differences, 19*(1), 130–134. <https://doi.org/10.1016/j.lindif.2008.06.001>
- Kobayashi, K. (2010). Strategic use of multiple texts for the evaluation of arguments. *Reading Psychology, 31*(1), 121–149. <https://doi.org/10.1080/02702710902754192>
- Macedo-Rouet, M., Braasch, J. L. G., Britt, M. A., & Rouet, J. F. (2013). Teaching Fourth and Fifth Graders to Evaluate Information Sources During Text Comprehension. *Cognition and Instruction, 31*(2), 204–226. <https://doi.org/10.1080/07370008.2013.769995>
- Maier, J., & Richter, T. (2013). Text Belief Consistency Effects in the Comprehension of Multiple Texts With Conflicting Information. *Cognition and Instruction, 31*(2), 151–175. <https://doi.org/10.1080/07370008.2013.769997>
- Maier, J., Richter, T., & Britt, M. A. (2018). Cognitive processes underlying the text-belief consistency effect: An eye-movement study. *Applied Cognitive Psychology, 32*(2), 171–185. <https://doi.org/10.1002/acp.3391>
- Mayer, R. (n.d.). *The Cambridge Handbook of Multimedia Learning*. Cambridge University Press, 2005.
- Meneghetti, C., Carretti, B., & De Beni, R. (2006). Components of reading comprehension and scholastic achievement. *Learning and Individual Differences, 16*(4), 291–301. <https://doi.org/10.1016/j.lindif.2006.11.001>
- Morren, M. (2019). *Jigsaw method, metatextual knowledge, and prior subject knowledge in multiple documents reading comprehension*. University Of Twente.
- OECD. (2009). *PISA 2009 Results : Learning to Learn*.
- Olson, J. M., & Zanna, M. P. (1993). Attitudes and Attitude Change. *Annual Review of Psychology, 44*(1), 117–154. <https://doi.org/10.4324/9781315784786>

- Perfetti, C. A., Rouet, J. F., & Britt, M. A. (1999). Toward a theory of documents representation. In *The construction of mental representation*.
- Perfetti, C., & Stafura, J. (2014). Word Knowledge in a Theory of Reading Comprehension. *Scientific Studies of Reading, 18*(1), 22–37.
<https://doi.org/10.1080/10888438.2013.827687>
- Resor, C. (2008). Encouraging students to read the texts: the jigsaw method. *Teaching History: A Journal of Methods, 33*(1), 20–28.
- Richter, T. (2015). Validation and comprehension of text information: Two sides of the same coin. *Discourse Processes, 52*(5), 337–355.
<https://doi.org/10.1080/0163853X.2015.1025665>
- Richter, T., & Maier, J. (2017). Comprehension of Multiple Documents With Conflicting Information: A Two-Step Model of Validation. *Educational Psychologist, 52*(3), 148–166. <https://doi.org/10.1080/00461520.2017.1322968>
- Rouet, J. F. (2013). The skills of document use: From text comprehension to Web-based learning. In *Routledge* (Vol. 112). <https://doi.org/10.1192/bjp.112.483.211-a>
- Rouet, Jean François, Britt, M. A., & Durik, A. M. (2017). RESOLV: Readers' Representation of Reading Contexts and Tasks. *Educational Psychologist, 52*(3), 200–215. <https://doi.org/10.1080/00461520.2017.1329015>
- Singer, L. M., & Alexander, P. A. (2017). Reading on Paper and Digitally: What the Past Decades of Empirical Research Reveal. *Review of Educational Research, 87*(6), 1007–1041. <https://doi.org/10.3102/0034654317722961>
- Stadtler, M., & Bromme, R. (2013). Multiple Document Comprehension: An Approach to Public Understanding of Science. *Cognition and Instruction, 31*(2), 122–129.
<https://doi.org/10.1080/07370008.2013.771106>
- Strømsø, H. I. (2017). Multiple Models of Multiple-Text Comprehension: A Commentary. *Educational Psychologist, 52*(3), 216–224.
<https://doi.org/10.1080/00461520.2017.1320557>
- Taber, C. S., Brook, S., & Franklin, B. (2006). Naval School Explosive Ordnance Disposal

Printable Fact Sheet. *American Journal of Political Science*, 50(3), 755–769.

<https://doi.org/10.1111/j.1540-5907.2006.00214.x>

Van Oostendorp, H., & Goldman, S. R. (1998). The construction of mental representation during reading. In *Psychology Press* (Vol. 111).

<https://doi.org/10.1192/bjp.111.479.1009-a>

Van Strien, J. L. H., Brand-Gruwel, S., & Boshuizen, H. P. A. (2014). Dealing with conflicting information from multiple nonlinear texts: Effects of prior attitudes. *Computers in Human Behavior*, 32, 101–111. <https://doi.org/10.1016/j.chb.2013.11.021>

Verhoeven, L., & Perfetti, C. (2009). Using Route and Survey Information to Generate Cognitive Maps. *Applied Cognitive Psychology*, 23(2), 223–235.

<https://doi.org/10.1002/acp>

Vidal-abarca, E., Gil, L., Bråten, I., & Strømsø, H. I. (2010). *SCIENCE TEXTS : SUMMARY TASKS ARE SOMETIMES BETTER THAN ARGUMENT TASKS*.

<https://doi.org/10.1080/02702710902733600>

Walker, I., & Crogan, M. (1998). Academic performance, prejudice, and the jigsaw classroom: new pieces to the puzzle. *Journal of Community & Applied Social Psychology*, 8(6), 381–393. [https://doi.org/10.1002/\(sici\)1099-1298\(199811/12\)8:6<381::aid-casp457>3.3.co;2-y](https://doi.org/10.1002/(sici)1099-1298(199811/12)8:6<381::aid-casp457>3.3.co;2-y)