Evaluating scripted collaborative gameplay while playing a serious game

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Abstract

Background: Studies investigating computer supported collaborative gameplay over solely gameplay report ambiguous learning effects. It has been suggested that external supports, like scripts, may be necessary to support children in communicating on higher levels and, as a result, in learning more while playing serious games.

Aim: The aim of this thesis was to investigate three hypotheses arising from this proposal: Scripted collaborative gameplay improves communication on a higher level, increases the learning results and decreases the motivation. It was thought that using conflict-scripts encourages the children to reflect more and to use more explanations and that this can facilitate the learning experiences. When scripting is proven to be effective, scripted collaborative gameplay could be used in education to facilitate learning.

Method: 32 children of the eighth grade were randomly assigned into pairs. An experiment with a scripted condition (n=8) and a control group (n=8) was used. They played a serious game for 25 minutes. The dialogues during gameplay were recorded. The scripted condition got conflict- scripts. They had conflicting variables in the game, which they had to make as high as possible. After gameplay they had to complete a knowledge test individually. A motivation questionnaire was used before and after gameplay to investigate possible motivation changes.

Results: The scripted condition used significantly fewer statements of the second-level (t-test; p=.001) and significantly more statements of the third- (t-test; p<0.05) and fourth-level (t-test; p<0.001) than the control group. The scripted condition scored much higher on the knowledge test than the control group (t-test one tailed; p<0.05). Fourth-level statements were significantly related to the knowledge score (r=.474, p<0.01). No significant learning effect was found based on the game score and there was no motivation effect.

Conclusion: This study showed that scripting can support children in communication on a higher level and, as a result, in learning more while playing a serious game. This study showed no significant effect of scripting on motivation.

Discussion: Before uttering concrete statements about using scripts in education, one should check whether these results can be generalized to other games and other age groups. When the results can be generalized, it is necessary to know the optimal support for children to facilitate learning, in which situations scripting has the best learning effect and how it can be combined with other school activities before it can be added to the curriculum of the schools.

Samenvatting

Achtergrond: Onderzoeken naar het samen spelen van een game op de computer rapporteren geen eenduidige leereffecten. Gesuggereerd wordt, dat externe ondersteuningen, zoals "*scripts*", nodig zijn om kinderen aan te moedigen om op een hoger niveau te communiceren en als effect betere leerresultaten te bereiken tijdens het spelen van een educatieve game.
Doel: Het doel van deze these is om drie hypotheses te toetsen: Scripting zorgt ervoor dat er op een hoger niveau wordt gecommuniceerd, dat de leerresultaten verbeteren en dat de motivatie afneemt. Er werd gedacht dat het gebruik van conflicterende scripts de kinderen zou aanmoedigen om meer te reflecteren, meer argumenten te gebruiken en dat dit de leerervaringen zal vergemakkelijken. Mochten de scripts effectief blijken te zijn, dan zou het in het onderwijs gebruikt kunnen worden om leren te vergemakkelijken.
Methode: 32 kinderen uit groep 8 werden random ingedeeld in tweetallen. Er is gebruik gemaakt van een experiment met een groep met scripts (n=8) en een controle groep (n=8). De kinderen speelden een educatieve game gedurende 25 minuten. De gesprekken zijn tijdens het spelen opgenomen. De groep met scripts kregen conflicterende scripts; ze kregen conflicterende variabelen in de game die ze zo hoog mogelijk moesten maken. Na het spelen van de game werd er individueel een kennistest ingevuld. Een motivatietest werd voor en na het spelen van de game afgenomen om te kijken of er een motivatie-effect optrad.
Resultaten: De groep met scripts gebruikten significant minder uitspraken van het 2de niveau (t-test; p=.001) en significant meer uitspraken van het 3^{e} niveau (t-test; p<0.05) en het 4de niveau (t-test; p<0.001) dan de controle groep. De groep met scripts scoorden hoger op de kennistest dan de controle groep (t-test eenzijdig; p<0.05). Uitspraken van het 4de niveau hadden een significant verband met de kennisscore (r=.474, p<0.01). Er was geen significant leereffect gevonden op basis van de gamescore en ook geen significant motivatie-effect.
Conclusie: Dit onderzoek laat zien dat scripts kinderen ondersteunen om op een hoger niveau te communiceren en als effect, zorgt voor een groter leereffect tijdens het spelen van een educatieve game. Dit onderzoek laat geen significant effect zien van scripts op de motivatie.
Discussie: Voordat er concrete uitspraken worden gedaan over het invoeren van scripts in het onderwijs, zal eerst gekeken moeten worden of de resultaten op andere games en leeftijdsgroepen van toepassing zijn. Als de resultaten generaliseerbaar zijn, is het noodzakelijk te weten wat de optimale ondersteuning is voor kinderen om het leren te vergemakkelijken en in welke situaties scripts het beste leereffect hebben en hoe het gecombineerd kan worden met andere schoolactiviteiten.

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Introduction

Nowadays, interactive computer games are extremely popular (Fromme, 2003). Especially young people are actively playing games. Since the early nineties, playing video- and computer games is a big part of their daily activities (Fromme, 2003). Children spend much more time on playing computer games than on doing educational activities; respectively 15 hours and 1 hour and 48 minutes a week (Hofferth & Sand, 2001). Due to the extremely popular interactive computers games and the huge amount of time children spent playing these games, researchers investigate whether computer games could facilitate learning in education.

Using games in education is often referred to as game-based learning [GBL] (Wouters & Oostendorp, 2013). GBL has the following features; it is interactive and challenging, the player has to reach goals, and the game gives feedback to the player in the form of a score or something else (Vogel et al., 2006; Wouters & Oostendorp, 2013). Feedback is meant to give the players the opportunity to alter their plan. In the game, there are rules and limits (Leemkuil & de Jong, 2012; Garris, Ahlers & Driskell, 2002). The player has to make some decisions about what to do in order to reach a goal and he has to take into account the limits (e.g. the maximum amount of natural resources and money). By changing input variables and observing the consequences of their taken actions, players learn the underlying model of the game (Leemkuil & de Jong, 2012), which they can apply to new situations. For that purpose, the children need an active problem solving attitude. The goal of GBL is not to entertain them, but to use the entertaining features of the game for education (Lee, Peng & Park, 2009; Zyda, 2005). The games used in education are also referred to as "serious games". These games are meant to facilitate learning (Wouters & Oostendorp, 2013).

Possible reasons why people think that games can facilitate learning may be the entertaining features of the game (Lee, Peng & Park, 2009) and that gameplay corresponds with the interests of children (Kiili, 2005). Gameplay gives children pleasure and is challenging. This motivates children and could improve learning. Kiili (2005) agreed that motivation facilitates learning, but in his point of view, the experiences in the game are responsible for the motivation, not the fun. The educational theories also emphasized that motivation will improve the effectiveness of the learning process (Lee, Peng & Park, 2009) and that receiving continuous feedback improves the learning process. Feedback gives players the possibility to alter their way to reach the goal. It also gives players the opportunity to apply earlier obtained knowledge to new and different contexts in the game. According to

Lee, Peng and Park (2009), games could be an effective educational tool. Grienfield (as cited in Fromme, 2003) also indicates that games could have a positive effect. These positive effects could be the result of the complex cognitive skills of the children that are addressed when playing the game.

Whether games actually facilitate learning is ambiguous (Leemkuil & de Jong, 2012). There are studies which reported significant effects of games over traditional instruction (e.g. Laffey, Espinosa, Moore & Lodree, as cited in Vogel et al., 2006; Vogel et al., 2006) and studies which do not report a significant effect (e.g. Costabile, de Angeli, Roselli, Lanzilotti & Plantamura, 2003; Kim, Kim, Min, Yang & Nam, 2002). The study of Ke (2008) also shows that using an educational game had no significant effect on cognitive test performance. The results show that the cognitive test performance of the children of 4^{th} and 5^{th} grade were not significantly higher after using an educational game for five weeks. However, at the end, the children were significantly more positive about math. This is also what Lee, Peng & Park (2009) had expected. Due to this ambiguity, it cannot be said with certainty what the relation is between gameplay and learning (Vogel et al., 2006). It is not clear whether players spontaneously engage in learning processes during gameplay (Wouters & Oostendorp, 2013). So it could be concluded that games alone are not sufficient for facilitating learning experiences.

During GBL, teachers do not say or explain anything. The players have to look for relevant information by themselves. Not all the information is given at once; instead, the players must discover and obtain knowledge through experiences (de Jong, 2006). The learning processes in which they have to engage during gameplay are exploration, orientation, generalization of various solutions, assessing these solutions, evaluation of the consequences and reflection. While learning with a game, players need to use an active experiential learning style. Learning style is positively correlated with learning results. Kolb & Kolb (2005) showed that people with different learning styles have different talents. Simon (2000) also found that learning styles have a significant influence on learning outcomes. Learners whose learning style matches the task are more successful. Because of the coherence between learning style and learning results, learning styles are also included in this study.

A possible reason why games are not as sufficient for learning as expected, may be that the players are overwhelmed (Killi 2005; Wouters & Oostendorp, 2013). There is a lot of information available and players do not know what is relevant and what is not. Through the huge amount of information, players could be overloaded. Players also had difficulties using the relevant variables, making predictions and drawing the right conclusions from taken

actions (de Jong, 2006). In addition, players tried to reach a certain goal instead of making and testing predictions. They think about what to do next, but do not plan further and do not analyze their actions and which consequences these actions had (de Jong, 2006). Players often use a trial-and-error strategy during the gameplay (Dempsey, Haynes, Lucassen & Casey, 2002). This strategy is the most commonly used strategy in all different game categories. A trial-and-error strategy means that players react to different things in the game, like circumstances and consequences and other feedback instead of rules and instructions (Dempsey et al., 2002). They just try and do not reflect on why they had chosen an action and they only change their actions when something goes wrong. Due to the fact that people do not know the basic rules of a game (Siang & Rao, 2003) and the underlying model of the game (Leemkuil & de Jong, 2004), they find it difficult to use the earlier obtained knowledge in other situations.

Reflection, as well as exploration, orientation, knowledge about different solutions to problems, valuation of these solutions and evaluation of the consequences of the actions, are all important for learning (de Jong, 2006). In the study of Koops and Hoevenaar (2012) a "Serious Gaming Lemniscate Model" [SGLM] was used. This model contained two different cycles, namely a game cycle and a learning cycle. In the two cycles, a different kind of learning occurred (Koops & Hoevenaar, 2012). In the game cycle there is only intuitive learning. This means that players cannot make their obtained knowledge explicit. They are only able to apply it in the game. In the learning cycle, there is scientific learning. This can only be obtained through reflection in the learning cycle (Koops & Hoevenaar, 2012). The obtained spontaneous conceptual knowledge in the game cycle has to be translated into formal conceptual knowledge. This could be done through an intervention. The intention of this intervention is to support players to reflect in the learning cycle and to encourage them to use the obtained knowledge in new situations in the game cycle (Koops & Hoevenaar, 2012), which otherwise hardly occur or not at all. The meta- study of Wouters & Oostendorp (2013) also revealed the importance of reflection. Reflection has a significant effect on learning results. So, it may be necessary to give players an instructional support to encourage reflection.

There are studies about different forms of instructional support, like advice (Leemkuil & de Jong, 2012) and collaboration (Van der Meij, Albers & Leemkuil, 2011). Collaboration means that equal- status interactions occur within small groups. The children are working together without any intervention of the teacher (Cohen, 1994). They are allowed to discuss the material they are supposed to play with. Collaboration was investigated, because it was

thought that collaboration could facilitate learning through the discussions between children about their choices. The idea was that children would reflect more by discussing different options and giving more argumentation on their choices. It was thought that this would help children to make their implicit knowledge explicit (Leemkuil & de Jong, 2004). An experiment that also investigated collaboration showed that groups perform on average and that not everybody in the group is equally active (Forsyth, as cited in Harteveld and Bekebrede, 2011). So, one might wonder whether collaboration positively affects the learning process. On the other hand, Harteveld and Bekebrede (2011) discuss whether learning is socially grounded. Human beings process information individually, but are at the same time influenced by others. If this is the case, this social learning process has to be implemented in gameplay, so we can learn from each other. Also, Wenger (as cited in Harteveld and Bekebrede, 2011) states that a group knows more than a single individual. If this is the case, the question raises if this social learning process has to be implemented into the games. Harteveld and Bekebrede (2011) indicate that achieving this is obviously much more suitable for a multiplayer game than for a single-player game.

The study of van der Meij, Albers and Leemkuil (2011), as previously mentioned, investigated whether people benefit more from playing a computer game in pairs rather than from playing alone. This study showed that playing together had no effect on the individual knowledge. They also investigated the dialogues between the pairs. They used an observation scheme based on the literature of collaborative dialogues in education, which suggested that there are four levels of communication. It was speculated, that collaboration may stimulate people to make their implicit knowledge explicit. The result of this study is that most of the things people say are second-level verbalizations, like explicating and proposing. This means that most statements were for telling each other which actions they wanted to do next. It contains only superficial aspects of the game (van der Meij, Albers & Leemkuil, 2011). The results also indicated that there is no fourth-level verbalization. This means that there was no conversation about the concepts, principles and structures of the game. Like Forsyth (as cited in Harteveld & Bedebreke, 2011), who concluded that not everybody is equally involved in the game, this study also revealed that a partners reaction is often just a (dis)agreement. The partner often does not give further argumentation for the dis(agreement). This study revealed that there was only first- and second-level communication and that the children did not arrive spontaneously at the higher levels of communications. Also, Barron (2003) states that learners will rarely engage in productive interactions and gain better knowledge when they just collaborate. They seldom ask questions, clarify their choices, give argumentations and reflect

on their prior knowledge. Van der Meij, Albers and Leemkuil (2011) advised to investigate whether higher levels of communication can be arrived through scripting and, as a result, better individual knowledge. This will be investigated in this study.

In scripted collaborative gameplay, the players are assigned different roles. The insertion of collaboration scripts during gameplay attempts to promote productive interactions by structuring the interaction process (Kobbe et al., 2007). Collaboration scripts are aimed to trigger the knowledge generative interactions, like argumentation (Kobbe, et al.,2007; Dillenbourg & Jermann, 2006). There are various kinds of scripts schemes, such as "*the jigsaw scheme*" in which each member only has access to a small part of the knowledge which they must bundle before they can solve the problem; "*the conflict scheme*" in which each member is asked to play conflicting roles that trigger argumentation; and "*the reciprocal scheme*" in which one of the members regulates the other member and they switch the roles afterwards (Dillenbourg & Jermann, 2006). This study is about "the conflict scheme", called conflict-scripts.

Wood, Bruner and Ross (1976) state that these conflict- scripts are intended to advance reflection. The conflict-scripts could encourage more explanations, questions and comments between the players, because they have conflicting variables, which they have to make as high as possible. These conflicting variables could stimulate players to think more about their choices and to explain their thoughts to each other. In this way it stimulates to make the implicit explicit. According to Wood, Bruner and Ross (1976) only learners with the ability to give high-level explanations will benefit. Learners who have a low-level ability may fail to give good argumentations on their choice. Conflict-scripts influence the way in which learners interact (Kobbe et al., 2007). According to the researchers, the roles learners get assigned in scripted collaboration are designed to engage them in the activities, such as explaining and questioning, that otherwise rarely occur or not at all. If learners really engage in these activities, this leads to higher cognitive processing and, as a result, to higher learning results (Kobbe et al., 2007). Explaining, for example, improves learning, because it checks for inconsistencies and gaps in their knowledge. This way, they clarify it for themselves (Webb, 1989). If there are any gaps, the learner has to resolve this and the result is better learning than before. King (1994) states that questioning can improve comprehension, because they force themselves to think about the material and compare it with other information. Questioning also allows people to check for errors in their understanding.

Also, Gegenfurtner, Veermans and Vauras (2013) indicate that scripting is needed to facilitate learning, because without adequate guidance the collaboration could result in non-

reciprocal interpretations of what they are supposed to learn. This statement is based on the article of Järvelä (1995). In reciprocal learning children engage in activities like, asking each other questions, summarizing, discussing and clarify things they do not understand and making predictions (Webb, 1989). They effectively interact with peers to get more mutually shared knowledge, which is knowledge they have in common (Järvelä, 1995). Järvelä (1995) states that if the aim is to have an optimal collaboration during the learning process, a reciprocal understanding between the people is needed. Except the positive effects of scripted collaborative gameplay, there are also some negative aspects of scripted collaborative gameplay, like "over- scripting" and negative motivational effects. These negative motivational effects could be a result of a high degree of coercion (Dillenbourg, 2002), a lack of "self- determination" (Rummel & Spada, 2007) or a script that is too rigid (Morris, Hadwin, Gress, Miller, Fior, Church & Winne, 2010). Too much structure and overly detailed scripts are also likely to cause motivational loss (Kollar, Fischer & Hesse, 2006).

There has already been a study among students in regards to scripting (Schellens, van Keer, Wever & Valcke, 2007). This study showed that using scripts in collaborative discussion groups resulted in more intensive and active individual participation in the groups. More intensive and active students achieved higher learning results (Schellens et al., 2007). Also, the study of Hummel et al. (2011) showed that the learning effects of students significantly enhanced through the use of scripts in collaboration. In this study, there will be examined whether this is also the case for children.

There is reason to think that scripting will improve learning results, because of the possible ability to facilitate learners to communicate on higher levels. This means that learners will use questioning, explaining and other activities of the higher levels, which will result in more reflection. This study will investigate whether scripting really improves higher level communications and, as a result, individual knowledge. This study will give more insight in the effectiveness of scripted collaborative gameplay on learning. When scripting is proven to be effective, scripted collaborative gameplay could be used in education to facilitate learning. The research question in this study is: Will children benefit more from scripted collaboration when they play a computer game rather than from just playing in pairs? There are three hypotheses in this study: H1) Scripted collaborative gameplay improves communication on a higher level. H2) Scripted collaborative gameplay increases the learning results. H3) Scripted collaborative gameplay decreases the motivation. In the following section is explained how this study is conducted.

Method

To answer the research question of this study, it is investigated whether scripted collaborative gameplay could provide support to communicate on a higher level and whether this results in better learning effects compared to collaborative gameplay without any script. This study is an example of evaluation research. Evaluation research implies that there will be checked whether the effect of the independent variable on the dependent variable differs in the different conditions. In this study will be examined whether there is a different learning effect between the two conditions when the variable script is manipulated. In one of the conditions, the subjects received a script, while the subjects in the other condition played spontaneously. This study is an example of an experiment.

Participants

Participants were selected from a primary school in a city in the east of the Netherlands. All selected children were from the eighth grade. In this study, a total of 32 participants were involved. These participants were divided over the two conditions, so that both conditions comprised sixteen participants. All participants of both conditions played the game in pairs. In order to clarify, sixteen participants played the game in collaborative mode and the other sixteen participants played the game in scripted collaborative mode. All participants were volunteers. Nobody received a reward for their participation. The participants were randomly divided into pairs. These pairs were randomly assigned to one of the two conditions. This makes it a random sampling. The age of the children varied from 11 to 13 years (M=11.56 years, SD=.620). 16 participants were male and 16 participants were female.

Materials

Game

The game “Entercities” was used to check whether the learning results of children improved through scripted collaborative learning compared to just playing a computer game in pairs. This game is a serious game and can be played online for free (see: http://www.enercities.eu/) in twelve languages. The main goal of this game is to build a sustainable city. Players learn to deal with, for instance, pollution, shortages of energy and sustainable energy. In the beginning of the game there is only a town hall and the player has the possibility to build on a small piece of land. The player has to ensure that there is enough housing and industry in order to make money and also enough energy for the people in the

city. This energy can be provided through renewable and non- renewable energy sources. Renewable energy is much more expensive than non-renewable energy. The intention is to develop the city without the exhaustion of natural resources. The player has to find a balance between the development of the city and durability and, according to the site, between people, planet and profit. Players have to make a lot of decisions about what to do when. For example: the player has to make a decision whether to take a coal plant to provide energy or to provide it through wind-energy. The first option is much cheaper than de second one, but the players have to keep in mind that, as a result, the natural resources decrease much faster. When the players reach a certain sub goal (a predetermined amount of inhabitants), they go to the next level. The game has four levels. In the next levels, there are more options available and the player has more land to build on. The players could execute a lot of strategies, but the long term results show them whether the taken decisions were good enough. Sometimes, a female in the game called "Alex" gives advice. She says things like "The power plant can only be built at the river" and "Be careful where you build a power plant, because people do not want to live next to it".

Measuring instruments

Four questionnaires had to be filled in by the subjects. One of the questionnaires, which is about motivation, had to be filled in twice. The questionnaires will be explained one after the other.

- *Game experience questionnaire*

The game experience questionnaire is the first questionnaire the participants had to complete (see Appendix 2). This questionnaire had three closed questions about the game experience they had, the same questions as the questions asked in the study of van der Meij, Albers and Leemkuil (2011). The questions were about the month, prior to the experiment, such as the average time the children spend on gaming per week, the average time they spend on playing strategy games per week (because this is the category of "Enercities") and if they had ever played the game "Enercities" before. This way, it could be checked whether this had any influence on the knowledge test. The response options were already predetermined, so the participants only had to check the box that best applied to them. If they had played the game "Enercities" already, they had to fill in how much time they had spent on playing this game. The predetermined options were the same for each question, namely the categories: "0 hour", "1-5 hours", "6-10 hours" and ">10 hours". The question if they had ever played the game

before, could be answered with “yes” or “no”. The objective of these questions was to check whether there are significant differences between the two conditions in the beginning of the game. There is also a possibility to check whether these data have a significant influence on the score of the knowledge test and the game score. The questionnaire was filled in with pen and paper.

- *Learning style questionnaire*

The second questionnaire the subjects had to fill in before playing the game is the learning style questionnaire (see Appendix 3). The learning style is measured with the VARK questionnaire designed by Flemming (as cited in Dobson, 2009). This questionnaire was about four different learning styles, namely: visual, auditory, reading/writing and kinesthetic. A visual learning style means that children learn best with support from pictures, graphs and diagrams. Auditory learners learn best through listening and through discussing learning material. Children with a read/write learning style prefer textual materials and kinesthetic learners are likely to learn better when they are physically involved or use a simulation (Dobson, 2009). This questionnaire is suitable for children of elementary schools. It contained 16 multiple choice questions. The participants had to answer the questions by choosing one or more of the four predetermined options. This questionnaire was available in Dutch. The reliability of de VARK subscales is determined by using correlations. These are r=0.85, r=0.82, r=0.84 and r=0.77 for respectively visual, aural, read/write and kinesthetic learning style (Leite, Svinicki & Shi, 2010). This questionnaire was taken to check whether there are significant differences between the participants in the two conditions at the beginning of the game. With these data there is also a possibility to check whether this data has a significant influence on the score of the knowledge test. This questionnaire was filled in with pen and paper.

- *Motivation questionnaire*

The motivation questionnaire is the third questionnaire the participants had to fill in (see Appendix 4). This questionnaire contained twenty questions about the motivation of the participants at that moment. This is originally a German questionnaire, namely: “FAM: Ein Frageboge zur Erfassung aktueller Motivation in Lern- und Leistungssituationen” (Rheinberg, Vollmeyer & Burns, 2001). This questionnaire was translated into Dutch myself, because the participants were all Dutch. The FAM consists of four components, like anxiety, probability of success, interest and challenge. “Anxiety” was about the degree of anxiety the participants experienced from the possible bad results of the game. “Probability of success” was about the

expectation of the participants about the game score. “Interest” was about the degree of interest the participants had and “challenge” was about the degree of challenge the participants experienced. All the eighteen questions were answered through a 7-point Likert-scale. The items were divided over the four components. Anxiety contains items 5, 9, 12, 16, 18, probability of success contains items 2, 3, 13, 14, 19 interest contains items 1, 4, 7, 11, 17 and challenge contains items 6, 8, 10, 15, 20. The reliability of this questionnaire is examined through Rheinberg, Vollmeyer and Burns (2001) and is between Cronbach’s α=0.66 and α=0.90. With the data of this questionnaire, the conditions can be checked on significant differences at the beginning of the game. This questionnaire was completed both before and after playing the game to check whether the motivation was decreased through the scripted collaborative gameplay. This questionnaire was filled in with pen and paper.

It was calculated whether the reliability of this questionnaire was also sufficient for this sample, because conclusions were drawn based on this questionnaire. For this study the reliability was between Cronbach’s α=0.369 and α=0.828. The lowest reliability was for ‘anxiety’, so this construct was removed from this study. The reliability of the other constructs were all above α=0.70, so these constructs had a sufficient reliability and were used in this study.

- *Knowledge test*

After playing the game the participants had to fill in a knowledge test (see Appendix 5). This questionnaire measures the knowledge people obtained through playing the game. The knowledge test is no existing questionnaire. It is designed by others who also did research to the game “Enercities”. This test was a draft version with which is done a pilot with two children to see whether they understood the questions and whether something was unclear for the subjects, because this test was originally made for MBO students. The pilot was done with two children from eighth grade. It was also checked how many points the children had achieved on the test. In this way it becomes clear whether the test needs to be changed or not. This was not the case, so the same test was used in this study. First, there were questions about their names, age, score in the game and which level they had reached. Thereafter, there were 12 questions about the game. There were two closed questions, where the participants had to choose between predetermined options. In both questions, the participants had to explain their answer. All the other questions were open. At these questions, the participants had to think carefully and had to produce an answer by themselves. The questions were about different aspects, like advantages and disadvantages of certain sources, questions about what

was on the picture and how it works, how you could make your score higher on one of the variables and questions about how to react in new situations. All the participants had to complete the test individually. It was not allowed to discuss the answer options with others. All the participants made the same test. The maximum score on the knowledge test is 25 points. This test was filled in with pen and paper. See Appendix 1 for the answers of this test.

It was calculated whether the knowledge test was sufficient reliable for this sample, because conclusions were drawn based on this test. For the knowledge test the p-value was calculated. The p-value was between 0.3-0.8, this means that the proportion of good answers was between 30% and 80% each question. Due to the sufficient reliability of this test, Cronbach's α=.68, no items were removed. The reliability of this test is sufficient, because this test measured different constructs, which means that not all items measure the same.

Coding scheme

The dialogues of the children were recorded, written out and analyzed by using a coding scheme. The coding scheme, which is used in this study, is the same as the one used in the study of van der Meij, Albers and Leemkuil (2011). In this scheme, there are four communication levels. Level one is de lowest form of communication and level four the highest. In the study of van der Meij, Albers and Leemkuil (2011) the third-level consisted only of predictions. In this study the third-level is extended with making considerations about which action to take. With considerations is meant the dialogue acts about weighing advantages and disadvantages about certain actions and choosing which action is the best in a particular situation. In Table 1 the explanation of the four levels of communication are given. In these table there are given some examples as well, in order to make the meaning of the levels more clearly. In short, first-level communication is only about visible aspects of the game, whereas fourth-level communications is mostly about explanations/argumentations for reasoning out their ideas. The idea is that higher level communications contribute more to the understanding of the game.

Table 1

Coding Scheme of the Dialogue Activities

Dialogue activities	**Explanation about the activity**	**Example in this study**
Fourth- level communication	Relating something of the game to prior knowledge Explanations/argumentations: reasoning out ideas	'I have a similar game on my phone, you have to buy something and put it down' 'Because that is cleaner energy'
Third-level communication	Predictions of effects of taken actions or prediction about a future situation and making considerations about which action is the best	'If we do this, our environment is likely to increase' 'If we choose this, we will get 6 points and if we choose this one we only get two'
Second-level communication	Proposing actions and responding to or evaluating these actions	'Click here' 'One more house?' 'Yes, you can do it' 'No, do not'
First-level communication	Explaining what is going on in the game and questions about the game	'We have no money' 'Look, this has increased' 'What is this, forest?'

Procedure

Before the start of the test, two things had to be done. First, the researcher received a name list of the class which would be tested. This way, it was possible to randomly divide the children into pairs. After that, the pairs were randomly assigned to one of the two conditions. Second, the researcher made sure that everything was ready for testing the children. The researcher made sure that the laptops and computers were on and that there was a description of the assignment at every laptop and computer.

After this was done, the investigation began. At the beginning, there was a short introduction in which the researcher explained to the children who she was and where she

studied. The goal of the study was not fully explained to the children, because knowledge about the knowledge test could influence the results. The researcher only explained that they would first get a questionnaire about their game experiences and their learning style and that afterwards, they were going to play a computer game in pairs. She also explained that the children were not allowed to talk about the game with each other until everyone was tested.

After this introduction, there was a classical moment in which all the children got the first two questionnaires, namely the game experience questionnaire and the learning style questionnaire. They also received a paper with their pair numbers. It was explained by the researcher that they had to write down this number on every questionnaire. It was explained that the children had to fill in the questionnaires individually. After that, the children completed the two questionnaires. The introduction and filling in the questionnaires were planned to take 30 minutes. When the children were done, the questionnaires were collected.

After the classical moment the children were tested with six pairs at a time. This was done in another quiet room. The distance between the pairs was sufficient, so the risk of influencing each other was minimized. These pairs were told that they had to read the assignment and fill in the motivation questionnaire individually. In the assignment for the scripted collaborative condition, the role was added. One child of the pair had to make the environmental score in the game as high as possible and the other one the economic score. After everyone was done with the motivation questionnaire, the questionnaires were collected and the pairs began playing the game. At this moment, the recording devices were also turned on by the researcher. The roles for the scripted collaborative pairs were emphasized again at the start of playing the game. For the motivation questionnaire ten minutes were planned and for playing the game 25 minutes were planned.

After this, these pairs wrote down their game score and game level and went to another room. In this room, they made a motivation questionnaire and a knowledge test. Another person was watching, to make sure that the children did not cheat. For the motivation questionnaire ten minutes were planned and for the knowledge test 20 minutes. All the children started the knowledge test at the same time. The questionnaires had to be done individually. When the children were done, the questionnaires were collected. This was done for all the pairs.

After all the pairs were tested, there was a short debriefing in the classroom. The researcher asked the children whether they liked the game and questionnaires or not. Also, the goal of this study was explained to the children and they were told that half of the pairs had a role while playing the game. After that, the researcher thanked the children and the teacher

with a treat for participating. The researcher answered each question the children or the teacher had.

Scoring

- *Learning Style*

For this questionnaire, it is possible that the children gave more answers per question or that some questions remain unanswered, because this was allowed according to the description of the test. The scoring of these questionnaire was per subscale. Each of the sixteen multiple choice questions had four answer options. Each answer option stands for one of the four learning styles. The intention is to sum the amounts of V's, A's, R's and K's that the participant had circled. This was done for all the participants. At the end of scoring there were four quantities for each participant.

- *Motivation questionnaire*

This questionnaire contained twenty items. The items were answered through a 7-point Likert- scale. The scoring of these questionnaire was done per subscale. Each subscale contained five items. The score of each subscale was determined by adding the five scores of the items of that subscale. Before adding these scores, some items were rescaled, because for these items a high score meant low motivation. The rescaled items were 3 and 14. After that, the scores were summed and divided by the amount of items for that subscale. This is done for all the subscales. At the end of scoring, there were four quantities for each participant.

- *Knowledge test*

At the beginning of checking the answers, a codebook was made (see Appendix 1). For each question, two points could be given. The participants got zero points if the answer was wrong, one point if the answer was not entirely correct and two points for a completely correct answer. Question seven was about three possibilities to increase electricity. This question was worth three points. Each correct possibility was worth one point. After each question was checked, the total scores of the participants were calculated by adding the scores of all questions. The maximum score of the test was 25 points. At the end of scoring, there was one quantity for each participant.

-Coding scheme

The dialogues of the children were recorded. After this, these dialogues were written out one by one and scored using the coding scheme. This scheme had four categories of communication. With this scheme the dialogic acts were classified according to the different levels of communication. Almost all dialogic acts fitted a category, but there were a few exceptions. These dialogic acts belonged to more than one category. For example, a proposal for a specific action might include argumentations to support their choice. In such situations, these dialogic acts were classified in both categories. After classifying all dialogic acts, the expressions associated with a particular category were all summed and divided by the total amount of statements. This is done for all the pairs. At the end of scoring, there were four percentages for each pair.

Analyses

Before analyzing the data, it was checked whether the participants in the two conditions, although randomly assigned, were not significantly different from each other on beforehand. A Mann Whitney test was used to check whether the distributions of the two conditions were equal. The results showed that for ‘game experiences’, ‘learning style’ and ‘motivation’, the distributions of the two conditions were not significantly different from each other. Therefore, it may be assumed that the groups did not differ from each other. Because of this, no one was conducted as a covariate. To get reliable results, it was also checked whether the two conditions reached different game levels, because one of the questions in the knowledge test was about an object which became available in level 4. There was not found a significant difference.

Analyses of the data.

To verify the three hypotheses, the collected data was analyzed using SPSS.

H1: A t-test was conducted to check whether scripting had an effect on the use of the various communication levels. An analysis of variance (ANOVA) was used for each condition to determine differences in use of the various communication levels.

H2: A one tailed t-test was conducted to check whether the scripting condition had better learning outcomes than the non- scripted condition. A one-way ANOVA was conducted to check whether scripting had an effect on the game score.

H3: A one- way ANOVA was conducted to check whether scripting had an effect on the motivation after gameplay. Thereafter, a paired sample t-test was conducted for each

condition to determine whether the motivation had significantly changed between, before and after gameplay. Because it is not clear whether the difference scores were significantly different between the two conditions, a one way ANOVA was conducted to check this. For significant effects, the effect size *d* was calculated.

After the hypotheses were tested, Pearson-correlations were made to calculate whether game experiences, learning style, motivation and dialogue activities were significantly related to learning results and game scores. In this study an $\alpha < .05$ was used as the significance criterion, making $p \leq .05$ significant and $.05 \leq p \geq .08$ marginally significant.

Results

Dialogic acts

The absolute quantities of dialogic acts are shown in Table 2. The absolute quantities of dialogic acts are shown for all communication levels for both conditions, as well as the total amount. For each communication level, percentages were also calculated, making it possible to compare the two conditions. The percentages are based on the amount of activities of each level divided by the total amount of activities. These percentages for all pairs, as well as the averages and standard deviations, are shown in Table 3 for the non- scripted condition and in Table 4 for the scripted condition. First was calculated whether scripting had an effect on the use of the different communication levels. Thereafter, it was calculated for each condition whether the use of the different communication levels was significantly different. The percentages shown in Table 3 and Table 4 were used for these calculations.

Table 2

The Absolute Quantities of Dialogue Acts of the Scripted Condition (n=8) and the Non-Scripted Condition (n=8)

	Communication levels				
Conditions	1	2	3	4	Total
Non- Scripted condition (control group)	403	669	87	46	1205
Scripted Condition	396	481	131	139	1147

A t-test was conducted to check whether scripting had an effect on the use of the various communication levels. There was no significant effect of scripting on the amount of statements used of the first level ($t(14)=0.016$, $p=.988$). There was a significant effect of

scripting on the amount of statements used of the second level ($t(14)=4.399$, $p=.001$). The scripted condition used significantly fewer statements of the second level than the non-scripted condition, as shown in Table 3 and Table 4. Scripting also had a significant effect on communications of the third level ($t(14)=-2.875$, $p=.012$). Table 3 and Table 4 also show that the scripted condition used significantly more statements of the third-level than the non-scripted condition. There was also a significant effect of scripting on the amount of statements used of the fourth level ($t(14)=-5.369$, $p=.00$). The scripted condition used significantly more statements of the fourth level than the non-scripted condition did. Because of these significant effects, the effect sizes d were calculated. The effect size of scripting on the amount of second-level communications is $d=1.48$, for third-level communications $d=1.18$ and for fourth level communications $d=1.60$, which are all large effects.

Use of the different communication levels

An analysis of variance (ANOVA) was conducted to determine whether the use of the different communication levels was significantly different. For the non-scripted condition, the use of the different communication levels during gameplay were significantly different from each other ($F(3,28)=223.59$, $MSE=4853.86$, $p=.00$). Because of this significant difference, post hoc tests (Bonferonni) were conducted to clarify the difference. The Post hoc tests showed that in the non-scripted condition, first level statements were used significantly more than third-level statements ($MD=28.48$, $MDE=2.33$, $p=.00$) and also more than fourth-level statements ($MD=31.97$, $MDE=2.33$, $p=.00$). Second-level statements were used significantly more than first-level statements ($MD=28.48$, $MDE=2.33$, $p=.00$), more than third-level statements ($MD=48.42$, $MDE=2.33$, $p=.00$) and also more than fourth-level statements ($MD=51.91$, $MDE=2.33$, $p=.00$). Third-level statements were used significantly more than fourth-level statements (MD=3.49, MDE=2.33, p=.00).

For the scripted condition the analysis of variance (ANOVA) also showed a significant difference between the use of the communication levels ($F(3,28)=52.74$, $MSE=1825.78$, $p=.00$). Post hoc tests (Bonferonni) showed that the scripted condition used significantly more first-level statements than third-level statements ($MD=22.33$, $MDE=2.94$, $p=.00$), and also more than fourth-level statements ($MD=22.44$, $MDE=2.94$, $p=.00$). Second-level statements were used significantly more than third-level statements ($MD=29.03$, $MDE=2.94$, $p=.00$), and also more than fourth-level statements ($MD=29.14$, $MDE=2.94$, $p=.00$). The other dialogue activities were not significantly different from each other.

Table 3

The Dialogue Activities in Percentages of the Total Amount of Statements of the Non- Scripted Condition

	Pairs									
Communication levels*	1	2	3	4	5	6	7	8	Mean	SD
Fourth-level	5.37	0	7.32	0.83	2.24	3.37	3.88	2.27	3.16	2.38
Third-level	8.05	3.37	9.05	10.74	8.21	10.67	3.10	0	6.65	3.98
Second-level	55.71	62.92	52.16	50.41	47.76	58.43	60.85	52.28	55.06	5.32
First-level	30.87	33.71	31.47	38.02	41.79	27.53	32.17	45.45	35.13	6.09
Total	100	100	100	100	100	100	100	100	100	17.77

*As a percentage (%) of the total statements

Table 4

The Dialogue Activities in Percentages of the Total Amount of Statements of the Scripted Condition

	Pairs									
Communication levels*	1	2	3	4	5	6	7	8	Mean	SD
Fourth-level	15.81	15.69	7.94	14.38	15	11.25	12.28	4.52	12.11	4.07
Third-level	6.84	15.69	14.29	9.58	7.14	14.38	14.04	15.48	12.18	3.72
Second-level	47.86	31.37	34.92	33.53	53.57	44.37	39.47	40	40.63	7.60
First-level	29.49	37.25	42.86	42.51	24.29	30	34.21	40	35.08	6.75
Total	100	100	100	100	100	100	100	100	100	22.14

*As a percentage (%) of the total statements

Learning outcomes

The learning effects were calculated in two ways, namely based on the score of the knowledge test and based on the game score. The averages and standard deviations of the scores on the knowledge tests and the game scores of the two conditions are shown in Table 5. The maximum score of the knowledge test was 25 points. First was calculated whether scripting had an effect on the knowledge score. Thereafter was calculated whether scripting had an effect on the game score.

Table 5

Knowledge Outcomes and Game Score of the Non- Scripted Condition (n=16) and the Scripted Condition (n=16)

Variable	Mean	SD
Knowledge outcomes*		
Non-scripted condition (16)	12.375	3.775
Scripted condition (16)	15.313	5.003
Game score		
Non-scripted condition (8)	132.750	39.865
Scripted condition (8)	169.125	69.608

* Maximum score of the test was 25 points.

Knowledge score

As shown in Table 5, in favor of the scripted condition, the averages are 12.375 (SD=3.775) and 15.313 (SD=5.003). A one tailed t-test was conducted to check whether the learning outcomes of the scripted condition were significantly higher than the learning outcomes of the non-scripted group. This was done one tailed, because it was expected that scripting improves the learning outcomes. The learning outcomes of the scripted condition were indeed significantly higher than of the non- scripted condition ($t(30)=-1.875$, $p=.036$ one tailed). Because of the significant effect, the effect size was calculated. The effect size of scripting is $d=0.64$, which means a middle sized effect. In Figure 1, to clarify the significant effect, the distribution of the knowledge outcomes are shown. It can be seen that the knowledge score of the scripted condition was between 7 and 22, whereas the knowledge score of the non-scripted condition was between 5 and 18. It also shows that 50% of the participants in the scripted condition scored above 15, whereas in the non-scripted condition this is 25%.

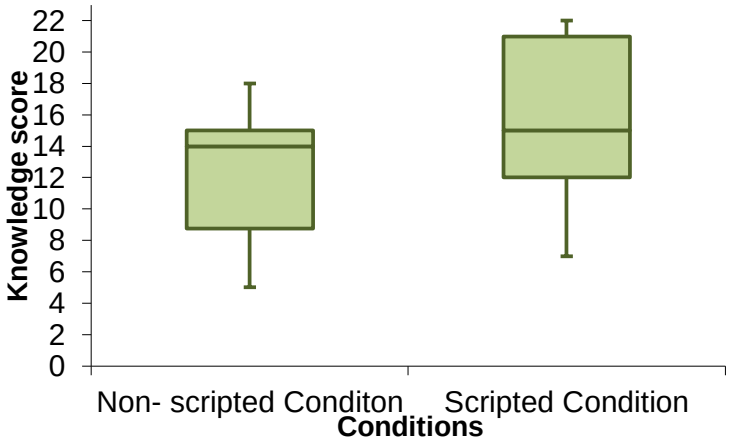

Figure 1. Boxplots of the distribution of the knowledge scores of the two conditions.

Game score

As shown in Table 5, in favor of the scripted condition, the averages are 169.125 (SD=67.248) and 132.750 (SD=38.505). A one-way ANOVA was conducted to compare the effect of scripting on the game score between the two conditions. This is done because another form of learning that takes place while playing a computer game, is intuitive learning. This means that children get a higher score in the game while learning, but they are not able to make this knowledge explicit. There was no significant effect of scripting on game scores for the two conditions ($F(1,14)=1.645$, $p=.220$). Interesting to mention, is that the standard deviation of the scripted condition is much higher than that of the non- scripted condition. This can be seen in Table 4. Because of this striking outcome, there was made a boxplot to show the distribution of the game scores. Figure 2 shows that the game score for the non-scripted condition ranged from 74 to 182, whereas for the scripted condition the game score ranged from 85 to 272. Due to the non-significant effect there were made no further calculations.

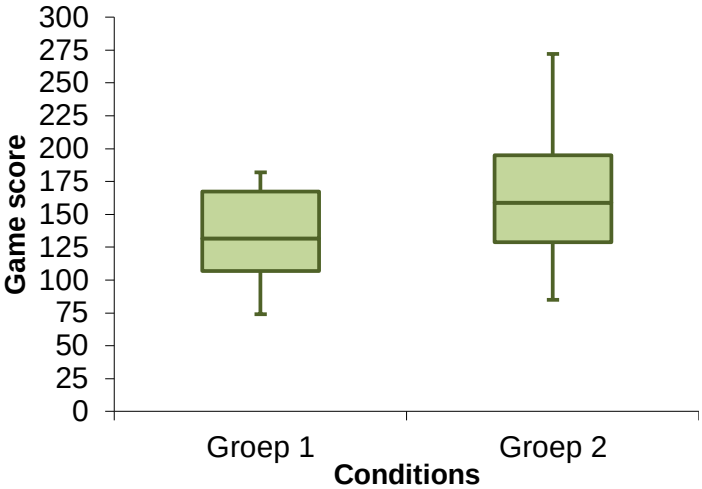

Figure 2. Boxplots of the distribution of the game scores of the two conditions.

Motivation

The subscales of the motivation questionnaire were analyzed separately. The second motivation questionnaire had two missing data on the "probability of success"-scale. The average was calculated by cumulating the remaining items and dividing this by the amount of remaining items. All the averages and standard deviations are shown in Table 6. The difference scores were calculated by subtracting the motivation score before and after gameplay. The averages and standard deviations are based on a 7-point Likert-scale. First was calculated whether scripting had an effect on the motivation after gameplay. Thereafter, for each condition was calculated whether the motivation changed significantly between before and after the gameplay. Because it was not clear whether the motivation changes of the two conditions were significantly different from each other, after the first two calculations, a third calculation was made.

Table 6

Self- Efficacy Scores for all Subscales for the Non-Scripted Condition (n=16) and the Scripted Condition (n=16)

	Before	**Afterwards**	**Difference** *
Subscale	Mean (SD)	Mean (SD)	Mean (SD)
Probability of success**			
Non-scripted Condition (16)	4.613 (.847)	4.069 (1.193)	-.544 (1.162)
Scripted Condition (16)	4.794 (.627)	4.594 (.947)	-.200 (1.007)
Interest			
Non-scripted Condition (16)	4.800 (1.393)	4.850 (1.813)	.050 (.761)
Scripted Condition (16)	5.056 (1.091)	5.000 (1.159)	-.056 (.876)
Challenge			
Non-scripted Condition (16)	4.625 (1.326)	4.225 (2.073)	-.400 (1.339)
Scripted Condition (16)	4.769 (.981)	4.938 (.714)	.169 (.856)

* Score before – score afterwards

** In this subscale were two missing values.

A one-way ANOVA was conducted to check whether scripting had an effect on the motivation after gameplay. No significant effects of scripting on the motivation after gameplay were found. A paired-sample t-test was conducted to calculate whether the

motivation decreased significant during gameplay. This was done for both conditions. The difference scores are shown in Table 6. No significant motivation changes for both conditions were found.

A one-way ANOVA was conducted to check whether the difference scores of the two conditions were significantly different. No significant differences were found for "probability of success" ($F(1,31)=.800$, $p=.378$) for "interest" ($F(1,31)$, $p=.717$) and for "challenge" ($F(1,31)=2.050$, $p=.163$).

Relation between knowledge score and game score

First, the correlation between knowledge score and game score was calculated. The correlation between knowledge score and game score is non-significant ($r=.157$, $p=.391$). A Pearson- correlation test was also conducted to check whether the communication levels were significantly related with the knowledge score and game score. Only the significant correlations are mentioned. Only the relative quantities of the fourth-level communications were significantly related to the knowledge score ($r=.474$, $p=.006$) and the game score ($r=.509$, $p=.044$). These positive correlations mean that the higher the fourth-level communications were, the higher the knowledge scores and game scores were.

A Pearson-correlation test was also conducted to check whether game experiences, learning style or motivation were significantly related to the knowledge score or the game score. Only the significant correlations are mentioned. There is a significant correlation between knowledge test and "probability of success" before ($r=4.28$, $p=0.015$) and afterwards ($r=.393$, $p=.026$). This means that if participants expected a higher score in the game beforehand, they had a higher knowledge score. If they had a higher knowledge score, they expected to have a higher game score when playing it another time. There is a significant effect between knowledge score and "interest" before ($r=.367$, $p=.039$) and afterwards ($r=.504$. $p=.003$). If participants were more interested beforehand, they had a higher knowledge score and if they had a higher knowledge score, they were more interested afterwards. Another significant effect was found between knowledge score and "challenge" afterwards ($r=.409$, $p=.020$). This means that if participants had a higher knowledge score, they experienced a higher challenge afterwards. A marginally significant effect was found between knowledge score and the experience with strategy games ($r=.343$, $p=.059$). When participants had more experience with strategy games, they had a higher knowledge score.

For game score, there is a significant effect between game score and "probability of success" afterwards ($r=.551$, $p=.001$). When participants had a higher game score, they also

expected to have a higher game score when playing it another time. There is a significant effect between game score and "challenge" afterwards (r=.386, p=.029). The meaning of this is, that when participants had a higher game score, they experienced higher challenge afterwards. There is a significant effect between game score and "interest" afterwards (r=.459, p=.008). This means that when participants had a higher game score, they were more interested afterwards.

More interesting significant correlations are between strategy games and "probability of success" before (r=.356, p=.049). If participants had more experience with strategy games, they expected to have a higher score in the game. There is a significant correlation between kinesthetic learning style and strategy games (r=.423, p=.018). This means that when the participants had a higher experience with strategy games, the amount of chosen kinesthetic learning style answers is higher. Fourth-level communication was significantly related to "challenge" afterwards (r=.341, p=.042). The participants who used more fourth- level communications experiences more challenge afterwards.

Discussion

This study was about scripted collaborative gameplay. The aim of this study was to investigate whether scripting could provide support to communicate on a higher level and whether this results in better learning. The research question was: will children benefit more from scripting when they play a computer game rather than from just playing in pairs? To answer this question, the dialogues were analyzed, as well as the learning outcomes and the motivation of the participants. In the beginning of this study, it was expected that children benefit more from scripting rather than from just playing in pairs. There were made three hypotheses: H1) Scripted collaborative gameplay improves communication on a higher level. H2) Scripted collaborative gameplay increases the learning results. H3) Scripted collaborative gameplay decreases the motivation.

The results of the dialogues showed that the communication of the scripted condition had more third- and fourth-level communications than the non-scripted condition, whereas the second-level communications were decreased. This was already expected. In different studies, the researchers expected scripting to be able to support communication during gameplay. Wood, Bruner and Ross (1976) expected that scripting could improve explanations, questions and comments between the players. Kobbe et al. (2007) also believed that scripting caused more explanations to occur. The fact that there were used more fourth- level communications in the scripted condition can be logically explained. The pairs in this study got conflicting

variables, which they had to make as high as possible. The idea behind this kind of scripting is that it triggers argumentation (Dillenbourg & Jermann, 2006) and that players require more explanations before they reached an agreement (Dillenbourg & Hong, 2008). It is also understandable that the percentage of second-level communications decreased, because there were made more fourth-level statements.

Kobb et al. (2007), as already mentioned in the introduction, believed that learning outcomes increase through the use of more fourth- level communications during gameplay. This corresponds with the results of this study. In this study the learning outcome was increased, but only based on the knowledge test. There are a few possible reasons for the increase of the knowledge score. First, as already mentioned, through the increased amount of explanations. Through the conflict-scripts, people are encouraged to reflect more and make their implicit knowledge explicit. The meta- study of Wouters and Oostendorp (2013) also revealed that the learning results were increased through doing more reflection. Without the support of any script, the collaboration resulted in a non-reciprocal interpretation of what they are supposed to learn (Gegenfurtner, Veerman & Vauras, 2013). Because of the positively significant relation between fourth-level communication and knowledge score found in this study, this could be an obvious reason. Besides this, paying attention to relevant variables is another possible reason why the learning results increased. Scripts support the players in paying attention to relevant variables. Wouters and Oostendorp (2013) believe that focusing on specific features of the game is a manner in which people select relevant information. They found that reflection and selection both improve learning, but that selection is more effective than the stimulation of integrating new information, such as reflection. A common problem of learning with games is, as already mentioned in the introduction, that players have difficulties choosing relevant variables (de Jong, 2006) and that they do not know which aspects of the game to focus on (Nelson and Erlandson, 2008). Scripts which select relevant variables could solve this problem and enhance learning. The first reason is best applied to this study, because the players had conflict-scripts. This kind of scripting provokes discussion, triggers argumentations (Dillenbourg & Jermann, 2006) and requires more explanations before reaching an agreement (Dillenbourg & Hong, 2008). Due to the fact that fourth-level communications and knowledge score were significantly related, it makes it understandable that this was the reason for the learning effect in this study.

There was no significant effect of scripting based on the game score. How is it possible that scripting had a significant effect on the knowledge score, whereas this was not the case for the game score? As mentioned in the results, knowledge score and game score

were not significantly related to each other. The study of Leemkuil and de Jong (2012) also found no relationship between game score and knowledge score. The meta-study of Wouters and Oostendorp (2013) revealed that the effects of various supports are larger for knowledge scores than for game scores. That scripting had no effect on game scores could be due to the fact that the game was only played once. There were no measurements to indicate whether there was a gain in implicit knowledge. This could only be measured when the game was played more than once, by observing whether the game behavior has changed and whether the game score is higher (Leemkuil & de Jong, 2012). But why was the expectation actually that game score would also rise? The scripted condition had to make the environment score and the economic score as high as possible, but in the game these variables are less conflicting than in real life. The game consisted of more factors that influence the environment score than the economic score, so it could be that this variable received more attention. To make the economic score higher, business districts or industries must be built, which negatively influence the environment score, but the participants had to do it in order to play the game. So, the players of the scripted condition had to take into account both conflicting variables and had to make compromises about which action to take. These compromises are not always the best choices in the game and this could be an explanation why the game score is not higher in the scripted condition than in the non-scripted condition. The results of the knowledge score nevertheless showed that this has not influenced the knowledge score. While analyzing the dialogues, it has been noticed that the pairs were mostly goal-orientated during gameplay instead of applying newly obtained knowledge in other situations. A lot of the expressions in this study were about reaching the next level, like “we have to build houses, because then we reach the next level” and “click on level up, level up!”. This could also be a reason that the game score did not rise.

Noteworthy, the standard deviation of the scripted condition was much higher than the standard deviation of the non-scripted condition. This is an interesting result to discuss, but finding an explanation for this is much more complicated. An example of a possible explanation is that not everyone was equally aware of their role. In some conversations of the scripted- condition there were no statements from which could be concluded that they had a script. This could be the reason why the standard deviation of the scripted condition is much higher. The recommendation of van der Meij, Albers and Leemkuil (2011) that scripting may improve the communication and, as a result, the learning outcomes was indeed true if we look at the significant effect of scripting on fourth-level communication and the significant effect

of the knowledge score. By interpreting the results, it should be kept in mind that there was used a small sample and only children from the eighth grade of one primary school.

The results of this study are in contradiction with the third hypothesis. In the beginning of this study, it was expected that scripting leads to a motivation decrease due to a lack of "self- determination" (Rummel & Spada, 2007), a script that is too rigid (Morris et al., 2010), a high degree of coercion (Dillenbourg, 2002), overly detailed scripts (Kollar, Fischer & Hesse, 2006) and other possible reasons. This hypothesis has not been verified by the results of this study. When looking at the possible explanations of the motivation decrease, it can be concluded that the scripts which are used in this study, did not have a high degree of coercion, was not overly detailed or too rigid. With the used scripts, there was enough space for the self- determination of the players, because they were allowed to choose their actions by themselves. This is also what Kollar, Fischer and Hesse (2006) mentioned. A solution to overcome the motivation loss is to give the players space to rely on their own strategies and to experience things by themselves.

This study found a significant relation between the knowledge score and "probability of success" before and after gameplay and also between prior experiences with strategy games and knowledge outcomes. The study of Orvis, Orvis, Belanich and Mullin (2005) was about a videogame-based training with military participants. The results also showed that self-efficacy and prior videogame experiences were predictive for learning outcomes. Learning outcomes were measured in various ways, namely the ease in using the game, team cohesion, training satisfaction and training motivation. Participants with greater self-efficacy and greater prior video game experiences scored higher on each of these ways of measuring. The definition of self-efficacy in their study is the same as "probability of success" in this study, namely one's judgment of one's capability to perform a particular task.

Some of the children struggled with the first motivation test. They did not understand how to fill in how motivated they were to play the game, because they did not know the game beforehand. This can also be heard in the conversations. Some said "How should we know this, we do not know the game yet" and the other said "It was about your first impression". When children asked this question, it was explained this to all the children to make sure that everyone knew how to fill in this test and that everyone did this in the same way to ensure the reliability of this study. The results showed that there are much more significant correlations with the motivation questionnaire which was completed after gameplay than before. This could be due to the fact that the children had a better understanding of the game.

One aspect that has to be kept in mind when interpreting the results, is the already mentioned sample size of this study, because it was very small. To get reliable results, this study has to be verified with a much larger sample. For further research the results should be tried to be reproduced with a larger sample. In this sample there were only children from the eighth grade of one primary school. For further research, this study could be done with children from more primary schools. It could also be checked whether the effects are the same for different age groups. Important to check in further research is whether the effects found in this study are also valid with other games, because without knowing this, there could not be done any generalizing statements at all. The recommendation of Leemkuil and de Jong (2012) to do further research to implicit knowledge is also recommended after this study, because the gaining of implicit knowledge could be investigated by observing whether the players had a different game style or a higher game score when they play the game a second time. In this study the game was played only once, so this could not be investigated.

To summarize, the aim of this study was to investigate whether scripting could provide encouragement to communicate on a higher level and whether this results in better learning. In the introduction was mentioned that this study would provide more insight in the effectiveness of scripted collaborative gameplay on learning and, when this was proven to be effective, this could be used in education to facilitate learning. This study contributes to the theory in the sense that it has been proven that scripting can improve the communications, enhance learning and that the argumentation of the fourth-level is related to the knowledge score. Before uttering concrete statements about using scripting in education, one should check whether these results can be generalized to other games and other age groups. When the results can be generalized, it is necessary to know the optimal support for children to facilitate learning, in which situations scripting has the best learning effect and how it can be combined with other school activities before it can be added to the curriculum of the schools.

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Appendices

Appendix 1: Codebook

Vraag 1

Bij deze vraag kunnen maximaal 2 punten gehaald worden.
1 punt voor een goed aangekruiste mogelijkheid: ‘verbeterde isolatie’ of ‘eco- daken’.
1 punt voor een juiste uitleg. Indien optie ‘verbeterde isolatie’ is aangevinkt dient in de uitleg te staan dat bij deze optie de natuurlijke hulpbronnen het grootste plusgetal heeft. Indien optie ‘eco- daken’ is aangevinkt dient in de uitleg te staan dat bij deze optie het meeste erbij komt.

Bij deze vraag zijn de andere opties fout gerekend, omdat die opties in verhouding meer geld kosten en het minder/evenveel oplevert.

Vraag 2

Bij deze vraag kunnen maximaal 2 punten gehaald worden.
1 punt voor een goed voordeel: Er dient iets te staan van dat het goedkoop is of dat het veel energie levert.
1 punt voor een goed nadeel: Er dient iets te staan van dat het slecht voor het milieu is, het vervuilend is of een vieze geur heeft.

Vraag 3

Bij deze vraag kunnen maximaal 2 punten gehaald worden.
1 punt voor de mogelijkheid: ‘stadscentrum’, omdat het stadscentrum voor upgraden per persoon het minste aan groen en natuurlijke hulpbronnen verbruikt.
1 punt voor een goed begrip van ‘duurzaamheid’, ook al is het verkeerde antwoord gekozen. Er dient begrepen te worden dat er veel mensen wonen voor weinig verbruik (van ruimte en dus groen en natuurlijke hulpbronnen). Indien er alleen geantwoord wordt dat er veel mensen worden, 0 punten toekennen.

Vraag 4

Bij deze vraag kunnen maximaal 2 punten gehaald worden.
1 punt voor het aangeven dat het een windmolen is.
1 punt voor het begrip dat dit energie opwekt (door middel van de wind).

Vraag 5

Bij deze vraag kunnen maximaal 2 punten gehaald worden.
2 punten indien gezegd wordt dat er meer energie geleverd wordt door een grotere windmolen

te plaatsen of door de bestaande windmolen te upgraden (grotere bladeren).
óf 1 punt, indien gezegd wordt dat er meer energie geleverd wordt door ze aan de zee te zetten. Hier wordt één punt aan toegekend, omdat een windmolen aan zeer meer energie levert dan in een woonwijk.

Vraag 6

Bij deze vraag kunnen maximaal 2 punten gehaald worden.
2 punten als ze inzien dat de milieuscore omhoog gaat als er dingen van het kopje "boom" gekocht worden, zoals bossen bouwen, parken bouwen.
óf 1 punt, indien gezegd wordt dat er iets gebouwd moet worden, maar er niet gespecificeerd wordt wat dat er dingen van het kopje "boom" gebouwd moeten worden.

Vraag 7

Bij deze vraag kunnen maximaal 3 punten gehaald worden.
Aan elk goed opgegeven manier om energiescore omhoog te krijgen, wordt 1 punt toegekend, zoals het noemen van duurzame energiebronnen, niet- duurzame energiebronnen en het upgraden ervan.

Vraag 8

Bij deze vraag kunnen maximaal 2 punten gehaald worden.
2 punten als ze inzien dat de economiescore omhoog gaat als er dingen van het kopje "€" gebouwd worden, zoals industrie en zakendistrict.
óf 1 punt, indien gezegd wordt dat er iets gebouwd moet worden, maar niet gespecificeerd wordt dat er dingen van het kopje "€" gebouwd moeten worden.

Vraag 9

Bij deze vraag kunnen maximaal 2 punten gehaald worden.
2 punten indien gezegd wordt dat dak-windmolens in deze situatie niet direct nodig zijn, aangezien het groene rondje van energie op dat moment helemaal vol zit.
óf 1 punt indien gezegd wordt dat het wel nodig is, omdat energie altijd handig is.
Hiervoor wordt 1 punt toegekend, omdat er specifiek na deze situatie gevraagd wordt en niet in het algemeen.

Vraag 10

Bij deze vraag kunnen maximaal 2 punten gehaald worden.
1 punt als ze inzien dat milieu en welzijn slecht zijn.

1 punt als ze een oplossing noemen voor het probleem, zoals het bouwen van bossen/parken of dingen onder het kopje van welzijn.
Indien er alleen een oplossing genoemd wordt, worden er ook 2 punten toegekend, aangezien ze dan wel doorhebben wat er fout gaat.

Vraag 11

Bij deze vraag kunnen maximaal 2 punten gehaald worden.
2 punten als er gezegd wordt dat de lage welzijn score door de windmolens komt die naast de woonwijken staan en deze weggehaald moeten worden.
óf 1 punt, indien er gezegd wordt dat de welzijn score laag is, omdat er geen markt is of andere dingen van het kopje “welzijn” en deze toegevoegd moeten worden.

Vraag 12

Bij deze vraag kunnen maximaal 2 punten gehaald worden.
2 punten indien er meer dan één van de volgende dingen gezegd worden: huizen, markten, werkgelegenheid, elektriciteit.
óf 1 punt, indien er maar één van deze dingen genoemd wordt.

Appendix 2: Game experience questionnaire

Hoeveel tijd heb je afgelopen maand gemiddeld per week aan het spelen van games besteed?

- 0 uur
- 0-5 uur
- 6-10 uur
- >10 uur

Hoeveel tijd heb je afgelopen maand gemiddeld per week aan strategie games besteed? Bijvoorbeeld de Sims, SimCity etc.

- 0 uur
- 0-5 uur
- 6-10 uur
- >10 uur

Heb je ooit het spel “Enercities” Gespeeld?

- Ja
- Nee

Zo ja, hoelang heb je dat spel dan gespeeld in totaal?

- 0 uur
- 0-5 uur
- 6-10 uur
- >10 uur

Appendix 3: Learning style questionnaire

Deze vragenlijst gaat over jouw voorkeuren voor leren. Je mag meerdere antwoorden kiezen. Kies meer dan één antwoord als een enkel antwoord niet voldoende is voor jou. Omcirkel de letter voor het antwoord.

1. Ik houd van websites die:
a. dingen hebben waar ik op kan klikken en waar ik iets mee kan doen.
b. mogelijkheden voor muziek, chat en discussie hebben.
c. interessante geschreven informatie en artikelen hebben.
d. een interessant ontwerp en visuele effecten hebben.

2. Je weet niet zeker hoe je een woord schrijft. Bijvoorbeeld “bacteriën” of “bacterieën”. Ik zou:
a. de woorden in mijn hoofd zien en kiezen op basis van hoe ze eruit zien.
b. de woorden in mijn hoofd of hardop horen.
c. het woord opzoeken in het woordenboek.
d. beide woorden opschrijven op papier en er één kiezen.

3. Je wilt een verrassingsfeestje voor een vriend voorbereiden. Ik zou:
a. vrienden uitnodigen en het dan gewoon laten gebeuren.
b. me voorstellen dat het feest aan de gang is.
c. lijstjes maken van wat er moet gebeuren en wat te kopen voor het feest.
d. erover bellen of sms’en met anderen.

4. Je gaat iets bijzonders koken voor je familie. Ik zou:
a. iets maken wat ik al eens eerder gemaakt heb.
b. het bespreken met mijn vrienden.
c. ideeën en plannen zoeken in boeken en tijdschriften.
d. geschreven instructies zoeken om het te maken.

5. Je bent gekozen als mentor of leider van een activiteitenprogramma in de vakantie. Je denkt dat dit programma misschien wel interessant is voor je vrienden. Ik zou:
a. de activiteiten beschrijven die ik in het programma zou gaan doen.
b. ze de kaart laten zien van waar het gehouden wordt en foto’s ervan.
c. de activiteiten gaan voordoen die ik in het programma zou gaan doen.

d. ze de lijst van activiteiten in het programma laten zien.

6. Je staat op het punt een nieuwe digitale camera of mobiele telefoon te kopen. Wat zou, afgezien van de prijs, jouw beslissing het meeste beïnvloeden?
a. hem uitproberen.
b. de details over de eigenschappen lezen.
c. het is het nieuwste model en ziet er goed uit.
d. de verkoper die me erover vertelt.

7. Probeer je te herinneren hoe je geleerd hebt om een nieuw computerspel of bordspel te spelen. Ik leerde het beste door:
a. anderen het eerst te zien doen.
b. te luisteren naar iemand die het uitlegde en vragen te stellen.
c. aanwijzingen van de plaatjes in de instructies.
d. de instructies te lezen.

8. Nadat je een toneelstuk hebt gelezen moet je een project doen. Ik zou liever:
a. schrijven over het toneelstuk.
b. een scene uit het toneelstuk naspelen.
c. een scene uit het toneelstuk hardop lezen.
d. iets tekenen of schetsen wat in het toneelstuk is gebeurd.

9. Je staat op het punt de nieuwe computer van je ouders aan te sluiten. Ik zou:
a. de instructies die erbij zitten lezen.
b. een vriend bellen, sms'en of e-mailen en vragen hoe het moet.
c. de doos uitpakken en beginnen de onderdelen in elkaar zetten.
d. de plaatjes volgen die laten zien hoe het moet.

10. Je moet de weg wijzen naar een huis in de buurt. Ik zou:
a. met ze meelopen.
b. een kaart tekenen op een papiertje of online een kaart erbij pakken.
c. de instructies opschrijven als een lijst.
d. ze de weg vertellen.

11. Je hebt een probleem met je knie. Ik heb liever dat de dokter:
a. me een plaatje laat zien van wat er mis is.
b. me een artikel of folder geeft waarin knieblessures worden uitgelegd.
c. me beschrijft wat er mis mee is.
d. laat zien wat er mis is met een model van een knie.

12. Er is een nieuwe film in de stad. Wat zou je beslissing om wel of niet te gaan het meeste beïnvloeden?
a. Je hoort vrienden erover praten.
b. Je leest wat anderen erover zeggen online of in een tijdschrift.
c. Je ziet er een trailer van.
d. Hij lijkt op andere films die je leuk vond.

13. Ik heb liever een leraar die:
a. excursies, casestudies, video's en practica gebruikt.
b. discussies in de klas, online discussies, online chats en gastsprekers gebruikt.
c. een leerboek en genoeg hand-outs gebruikt.
d. diagrammen, grafieken en kaarten gebruikt.

14. Je bent aan het leren hoe je foto's moet nemen met je nieuwe digitale camera of mobiele telefoon. Ik zou graag:
a. voorbeelden van goede en slechte foto's en manieren om ze te verbeteren willen hebben.
b. duidelijk geschreven instructies met lijsten en opsommingtekens willen hebben.
c. een kans hebben om vragen te stellen en te praten over de eigenschappen van de camera.
d. plaatjes willen hebben die de camera laten zien en hoe je hem moet gebruiken.

15. Je wilt wat feedback over een gebeurtenis, wedstrijd of toets. Ik zou feedback willen hebben:
a. waarbij voorbeelden worden gebruikt van wat ik heb gedaan.
b. waarbij iemand het met me bespreekt.
c. waarbij een geschreven beschrijving of een tabel van mijn resultaten wordt gebruikt.
d. waarbij grafieken worden gebruikt die laten zien wat ik heb bereikt.

16. Je moet je ideeën presenteren in de klas. Ik zou:

a. een paar kernwoorden opschrijven en telkens opnieuw oefenen wat ik wil zeggen.

b. voorbeelden en verhalen verzamelen om het echt en praktisch te maken.

c. plaatjes maken of grafieken om te helpen mijn ideeën uit te leggen.

d. mijn spreekbeurt uitschrijven en leren door hem telkens opnieuw te lezen.

Appendix 4: Motivation questionnaire

Before

Deze vragenlijst gaat over je motivatie op dit moment. De bedoeling is dat jij het antwoord omcirkeld die het beste op jou van toepassing is.

1. Ik houd van spelletjes spelen.

Niet waar						Waar
1	2	3	4	5	6	7

2. Ik geloof de moeilijkheid van deze taak aan te kunnen.

Niet waar						Waar
1	2	3	4	5	6	7

3. Waarschijnlijk lukt deze taak mij niet.

Niet waar						Waar
1	2	3	4	5	6	7

4. Bij deze taak hou ik van de rol als wetenschapper, die verbanden ontdekt tussen dingen.

Niet waar						Waar
1	2	3	4	5	6	7

5. Ik voel bij deze taak de druk om goed te moeten presteren.

Niet waar						Waar
1	2	3	4	5	6	7

6. Deze taak is een echte uitdaging voor mij.

Niet waar						Waar
1	2	3	4	5	6	7

7. Nadat ik de instructie van deze taak gelezen heb, lijkt mij deze taak zeer interessant.

Niet waar						Waar
1	2	3	4	5	6	7

8. Ik ben erg benieuwd hoe goed ik deze taak zal volbrengen.

Niet waar						Waar
1	2	3	4	5	6	7

9. Ik ben er een beetje bang voor, dat ik mezelf hiermee voor schut zet.

Niet waar						Waar
1	2	3	4	5	6	7

10. Ik ben vast besloten mij volledig in te zetten bij deze taak.

Niet waar						Waar
1	2	3	4	5	6	7

11. Bij taken zoals deze heb ik geen beloning nodig. Ik doe ze ook zonder beloning met veel plezier.

Niet waar						Waar
1	2	3	4	5	6	7

12. Het is voor mij vervelend als deze taak mij niet lukt.

Niet waar						Waar
1	2	3	4	5	6	7

13. Ik ben van mening dat het iedereen kan lukken.

Niet waar						Waar
1	2	3	4	5	6	7

14. Ik ben van mening dat ik deze taak niet kan uitvoeren.

Niet waar						Waar
1	2	3	4	5	6	7

15. Als het me lukt deze taak uit te voeren, dan ben ik trots op wat ik kan.

Niet waar						Waar
1	2	3	4	5	6	7

16. Als ik aan de taak denk, ben ik een beetje bang.

Niet waar						Waar
1	2	3	4	5	6	7

17. Zo’n taak als deze zou ik ook in mijn vrijetijd uitvoeren.

Niet waar						Waar
1	2	3	4	5	6	7

18. De specifieke prestatie- eisen bij deze taak schrikken mij af.

Niet waar						Waar
1	2	3	4	5	6	7

19. Ik verwacht dat deze taak mij gemakkelijk af zal gaan.

Niet waar						Waar
1	2	3	4	5	6	7

20. Als deze taak moeilijk wordt, geef ik niet op.

Niet waar						Waar
1	2	3	4	5	6	7

Afterwards

Deze vragenlijst gaat over je motivatie op dit moment. De bedoeling is dat jij het antwoord omcirkeld die het beste op jou van toepassing is.

1. Ik houd van spelletjes spelen.

Niet waar						Waar
1	2	3	4	5	6	7

2. Ik geloof dat ik de moeilijkheid van taken zoals deze aankan.

Niet waar						Waar
1	2	3	4	5	6	7

3. Waarschijnlijk lukken taken zoals deze mij niet.

Niet waar						Waar
1	2	3	4	5	6	7

4. Bij taken zoals deze hou ik van de rol als wetenschapper, die verbanden ontdekt tussen dingen.

Niet waar						Waar
1	2	3	4	5	6	7

5. Ik voel bij taken zoals deze de druk om goed te moeten presteren.

Niet waar						Waar
1	2	3	4	5	6	7

6. Taken zoals deze zijn een echte uitdaging voor mij.

Niet waar						Waar
1	2	3	4	5	6	7

7. Nadat ik de instructie van een taak zoals deze gelezen heb, lijkt mij zo'n taak zeer interessant.

Niet waar						Waar
1	2	3	4	5	6	7

8. Ik ben erg benieuwd hoe goed ik taken zoals deze zal volbrengen.

Niet waar						Waar
1	2	3	4	5	6	7

9. Ik ben er een beetje bang voor, dat ik mezelf met taken zoals deze voor schut zet.

Niet waar						Waar
1	2	3	4	5	6	7

10. Ik ben vast besloten mij volledig in te zetten bij deze taken zoals deze.

Niet waar						Waar
1	2	3	4	5	6	7

11. Bij taken zoals deze heb ik geen beloning nodig. Ik doe ze ook zonder beloning met veel plezier.

Niet waar						Waar
1	2	3	4	5	6	7

12. Het is voor mij vervelend als taak zoals deze mij niet lukt.

Niet waar						Waar
1	2	3	4	5	6	7

13. Ik ben van mening dat zo'n taak als deze iedereen kan lukken.

Niet waar						Waar
1	2	3	4	5	6	7

14. Ik ben van mening dat ik taken zoals deze niet kan uitvoeren.

Niet waar						Waar
1	2	3	4	5	6	7

15. Als het me lukt een taak zoals deze uit te voeren, dan ben ik trots op wat ik kan.

Niet waar						Waar
1	2	3	4	5	6	7

16. Als ik aan een taak zoals deze denk, ben ik een beetje bang.

Niet waar						Waar
1	2	3	4	5	6	7

17. Zo'n taak als deze zou ik ook in mijn vrijetijd uitvoeren.

Niet waar						Waar
1	2	3	4	5	6	7

18. De specifieke prestatie- eisen bij een taak zoals deze schrikken mij af.

Niet waar						Waar
1	2	3	4	5	6	7

19. Ik verwacht dat taken zoals deze mij gemakkelijk af zullen gaan.

Niet waar						Waar
1	2	3	4	5	6	7

20. Als een taak zoals deze moeilijk wordt, geef ik niet op.

Niet waar						Waar
1	2	3	4	5	6	7

Appendix 5: Knowledge test

Deze kennistoets maak je alleen! Dus niet overleggen met anderen, het geeft niet als je het antwoord op een vraag niet weet.

Vraag 1

Wanneer je op een bedrijventerrein met lichte industrie klikt, verschijnt het menu dat je hiernaast kunt zien.
Deze speler heeft er al voor gekozen om recycle installaties te plaatsen waarmee hij voor 2 punten, voor 1 punt krijgt en voor gaat er een punt af. Hij wil dit bedrijventerrein nog meer verbeteren en moet kiezen uit de vier mogelijkheden die hieronder staan. Zet een kruisje bij de mogelijkheid die jij zou kiezen.

Warmte opslag

CO2 reductie plan

Verbeterde isolatie

Ecodaken

Waarom heb je voor deze optie gekozen?

Vraag 2

	Hiernaast zie je een kolencentrale. Wat zijn de voordelen en nadelen van een kolencentrale? Noem een voordeel. Noem een nadeel.
Voordeel: Nadeel:	

Vraag 3

Welke woonwijk is het meest duurzaam? Geef ook aan waarom je voor deze optie hebt gekozen. Lage woonwijk Stadscentrum Woontoren

Vraag 4

	Wat is dit? Hoe werkt het (ongeveer)? En wat kun je er mee?

Vraag 5

	Hiernaast zie je windmolens. In Nederland kun je ook windmolens vinden, bijvoorbeeld bij de Oosterscheldekering. Daar werden 26 oude windmolens vervangen door 15 nieuwe. Je zou verwachten dat er dan minder elektriciteit geleverd zou worden. Dit is niet het geval, de nieuwe windmolens leveren 10 keer zoveel elektriciteit. Denk terug aan het spel. Hoe kan een windmolen meer energie leveren?

Vraag 6

	Je wilt overwinningspunten halen voor “natuurtalent”. Hoe kun je er voor zorgen dat je milieu score omhoog gaat? Noem één mogelijkheid.

Vraag 7

 Noem drie mogelijkheden om de score bij dit icoon omhoog te krijgen.

Vraag 8

Deze speler heeft overwinningspunten gehaald voor “sterke economie”.
Hoe kun je er voor zorgen dat je economie score omhoog gaat? Noem één mogelijkheid.

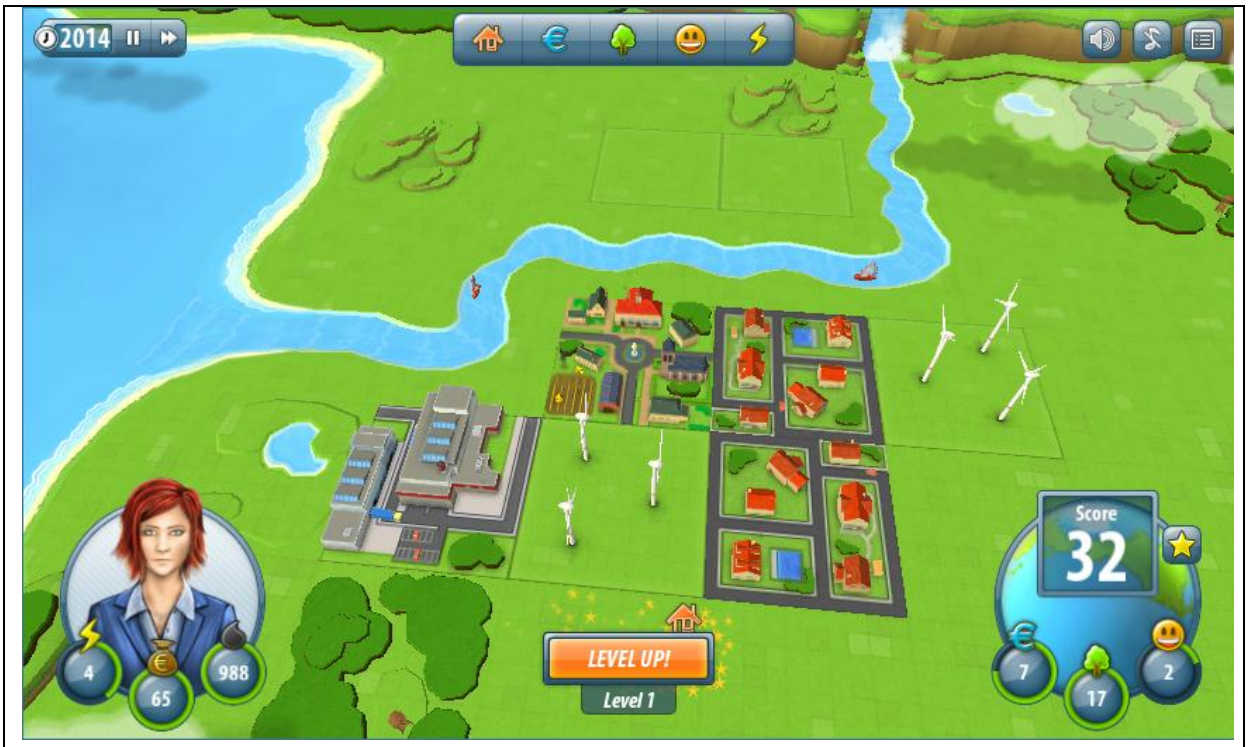
Vraag 9

 Vind je het in deze situatie nodig om dakwindmolens te plaatsen? Waarom wel of niet?

Vraag 10

Wat gaat er fout in dit level? Welke stappen zou jij nemen om dit probleem op te lossen?

Vraag 11



De welzijn score is erg laag. Hoe komt dat? Wat zou je anders hebben gedaan? Welke stappen

zou je nemen om dit probleem op te lossen?

Vraag 12

Wat is de eerste stap die je neemt als je met het spel begint? En waarom doe je dat?