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CONTROL

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Effects of sequentially increasing learner control on students'

achievement and intrinsic motivation

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Abstract

Most teachers believe that learner control over task selection positively affects learners' motivation and achievement. However, research on learner control shows mixed results on motivation and learning. Possible explanations for these findings are the cognitive overload novice learners might experience and their insufficiently developed self-regulated learning skills. To support novice learners in developing their self-regulated learning skills and prevent cognitive overload, sequentially increasing learner control might be a solution. This research, with 77 secondary education students, has examined whether sequentially increasing learner control leads to better learning and higher intrinsic motivation. In the controlled condition learners received no control over task selection and in the experimental condition learners received gradually more control. Results from an analysis of covariance do not confirm the hypothesis. Although participants in the experimental condition reported significantly more perceived choice, this did not affect other aspects of motivation or their performance. The results did not show that it is better to give learners gradually more control over task selection than continuing teacher controlled education. Possible explanations, limitations and implications for educational practice are discussed.

Keywords: Learner control, Learning, Motivation, Self-regulated learning skills

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Effects of sequentially increasing learner control on students' achievement and intrinsic motivation

Schools have changed from an environment in which the teacher determined what is being learned to a more learner-controlled environment (Buchem, Tur, & Hoelterhof, 2014). Learner control could be defined as control of learners over their learning path and over their development of knowledge and skills. It gives learners an active role in their learning process (Carolan, Hutchins, Wickens, & Cumming, 2014; Corbalan, van Merriënboer & Kicken, 2010). In general, teachers believe that learner control positively affects achievement and motivation (Katz & Assor, 2006). Research, however, shows mixed results of learner control (Carolan et al., 2014; Katz & Assor, 2006; Sorgenfrei & Smolnik, 2016). Because there are advantages as well as disadvantages of offering instructional choices to learners, the discussion about offering learner control in classrooms has been intensified in the last years (Carolan et al., 2014; Katz & Assor, 2006).

In order to effectively use learner control, learners need self-regulated learning skills (SRL skills; Granger & Levine, 2010). Self-regulated learners are able to plan and adapt their thoughts, feelings and actions to the attainment of personal goals (Zimmerman, 2000). To put effort in learning and to use SRL skills, it is necessary that learners are motivated (Zimmerman, 2000). Without motivation, learners do not see the value of learning activities and will not come to action (de Brabander & Martens, 2014). Hence, it is important that learners become motivated to put effort in learning and to use and develop their SRL skills to make good learning decisions. Sequentially increasing learner control seems to be a good way to give learners the opportunity to appreciate the importance of SRL skills, and to learn how to deal with this control while

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developing SRL skills in the process (Paris & Paris, 2001). This study examines whether sequentially increasing learner control leads to better learning and higher intrinsic motivation.

For the necessary context, the different types of learner control and their effects on learning and motivation will be outlined. In addition, the mixed results of learner control over task selection and content will be discussed and possible explanations will be described. Finally, it is described how sequentially increasing learner control on task selection could prevent cognitive overload, while developing SRL skills.

Learner control

Learners can have control over different instructional variables, to different degrees, "which provide learners with varying degrees of active decision making" (Carolan et al., 2014, p. 1000). Learners can have control over single variables, like time or pace, but also over "what" and "how" to learn (Carolan et al., 2014; Kraiger & Jerden, 2007). Most meta-studies do not differentiate between different aspects of learner control and conclude that learner control, as a broad concept, yields mixed results for motivation and learning (Carolan et al., 2014; Katz & Assor, 2006, Sorgenfrei & Smolnik, 2016). According to Sorgenfrei and Smolnik (2016), learner control over time, pace, location and design, mostly has positive effects on learning. Sorgenfrei and Smolnik (2016, p. 158) described learner control over design as "learner control over the sequence and order of learning materials and the design of the delivery medium". A possible explanation is that, according to the self-determination theory, control over time, pace, location and design fosters feelings of autonomy, which is one of the three components to foster intrinsic motivation, but does not require much SRL skills and prior knowledge to prevent 'wrong' learning decisions concerning the content (Ryan & Deci, 2000, Sorgenfrei & Smolnik, 2016). The study of Sorgenfrei and Smolnik (2016) shows mixed results of learner control over task

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selection. A possible reason for this mixed findings regarding control over task selection is that this control leads to a much more complex control environment, and therefore learners need a lot of SRL skills, prior knowledge about the topic, a positive attitude toward the task and motivation to make good learning decisions (Sorgenfrei & Smolnik, 2016). Learner control over task selection could consist of determining the preferred content, the amount and difficulty of the instructional material and choosing between different forms of assessments (Sorgenfrei & Smolnik, 2016).

The study of Corbalan, Kester and van Merriënboer (2009) showed that only control over surface features (aspects of learning tasks that do not immediately contribute to goal attainment) increased the amount of perceived control; control over structural features had probably hardly any influence. Corbalan et al. (2009) argued that surface task features are more salient than structural task features and therefore easier to recognize for novice learners. The more salient the task features are, the better learners can choose personally relevant and varied tasks, which may enhances transfer of learning (Corbalan et al., 2009).

Possible explanations for mixed results of learner control

The confusing findings with regard to the results of learner control could be explained on the basis of views from different theories, namely, (a) cognitive load theory, (b) self-determination theory and (c) self-regulated learning and metacognitive skills.

(a) Cognitive load theory. The cognitive load theory is based on how human beings process, store and restore information in their long-term memory (van Merriënboer & Sweller, 2005). Learners use their working memory for learning, and this memory is limited. To use their working memory optimally, it is important to process relevant information for learning (also called germane cognitive load) and to minimize irrelevant cognitive load (also called extraneous

cognitive load; van Merriënboer & Sweller, 2005). Hence, for optimal learning to occur it is necessary to prevent cognitive overload, because this hampers deep learning. Learner control requires learners to put mental effort in making decisions. According to Carolan et al. (2014), this mental effort could be extraneous to the task being learned. Especially when a task entails many interactive elements and a learner has only little prior knowledge, learner control could easily lead to cognitive overload, resulting in less efficient learning (van Merriënboer & Sweller, 2005). Sequentially increasing learner control could probably minimize cognitive overload because learners can gradually build up their knowledge and skills which will help them deal with an increasing number of interactive task elements and learner control.

(b) Self-determination theory. Learner control is more effective when learners are motivated to do something (Sorgenfrei & Smolnik, 2016). The greatest predictors of achievement in education are intelligence and the type and amount of motivation (Steinmayr & Spinath, 2009). Different types of motivation were defined by Deci and Ryan (2000) within the self-determination theory: a-motivation (i.e. lack of motivation), extrinsic motivation and intrinsic motivation. Extrinsic motivation comes from outside, for instance the teacher; intrinsic motivation is about doing something because it is interesting, enjoyable and inherent to a learner's satisfaction. Learners are mostly not fully intrinsically motivated for doing educational activities, because choices in education are not determined by themselves (Ryan & Deci, 2000). In accordance with the self-determination theory, it is important that learners become autonomously motivated, by seeing the value of external goals for themselves. This is also called the internalization of external goals (Ryan & Deci, 2000). Intrinsic and higher autonomous motivation result in high-quality learning, better performance, more engagement, creativity and well-being (Ryan & Deci, 2000).

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Deci and Ryan (1985; 2000) argue that self-motivated and self-determined behavior depends on three basic psychological needs: autonomy, competence and relatedness. Most of the research into learner control focuses on the feelings of autonomy bolstered by it (Deci & Ryan, 2000; Katz & Assor, 2006). The perception of control is important because it has positive effects on involvement in learning (Corbalan et al., 2009). Sequentially increasing learner control could stimulate the perception of control and feelings of autonomy.

However, motivational choices are not warranted by autonomy only. The psychological needs for competence and relatedness are also important (Katz & Assor, 2006). According to Katz and Assor (2006), choices often do not stimulate feelings of competence and relatedness and these observations could be the background of the mixed effects of choices. To support feelings of competence, the available choices must not be too complex, too easy or too many (Katz & Assor, 2006). To support feelings of relatedness, available choices must not undermine group harmony (Katz & Assor, 2006) and close relationships with other people (Deci & Ryan, 1985; 2000).

(c) Self-regulated learning and metacognitive skills. The concepts of SRL and metacognitive skills are closely related and they partly overlap (Dinsmore, Alexander, & Loughlin, 2008). SRL includes cognitive, metacognitive, behavioral, motivational and affective aspects of learning (Dinsmore et al., 2008). Self-regulated learners are self-directive, proactive in their efforts to learn, monitoring their behavior in terms of their goals and self-reflective on their effectiveness (Zimmerman, 2002). Metacognitive skills can be defined as "thinking about thinking" (Miller, Kessel, & Flavell, 1970) and contain monitoring as a central focus (Baker & Brown, 1984). Metacognition involves checking outcomes, planning, monitoring effectiveness, testing, revising and evaluating learning strategies (Baker & Brown, 1984). Development of SRL

and meta-cognitive skills allows learners to learn more effectively and therefore could result in better performance (Zimmerman, 2002). Recent studies confirm that SRL and metacognitive skills are strong predictors of learning in learner controlled environments (Granger & Levine, 2010; Johnson, Gueutal, & Falbe, 2009). To help learners develop these skills, teachers could give explicit instruction to learners, for example on how to plan learning activities or how to analyze an article and they could give tasks that require SRL skills to learn in a process, like collaborative learning projects or learner control on task selection (Paris & Paris, 2001).

A poor fit between the amount of SRL skills and the amount of learner control may explain the observed mixed results of learner control on motivation and learning. One could say that learners need control over their learning path to develop SRL and metacognitive skills (Azevedo, 2005; Paris & Paris, 2001). However, on the other hand, learners need these skills for the maximal use of learner control (Granger & Levine, 2010). Corbalan et al. (2010) calls this the self-directed learning paradox and explains how shared control could be a solution. Shared control means that a computer program selects multiple learning tasks with the right level of difficulty and support and a learner chooses one of them (Corbalan et al., 2010). In computer-based learning this could be a good solution. However, in classroom education this is not realistic, because it is too time consuming for a teacher to make an optimal preselection of learning tasks for each individual learner at each moment in time. This brings us to another possible solution; sequentially increasing learner control.

Sequentially increasing learner control

The absence of learner control could lead to a greater availability of the working memory for learning processes (van Merriënboer & Sweller, 2005). Learners are not always ready to use a big amount of control effectively, because it asks a lot of cognitive load (Carolan et al., 2014)

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and requires well-developed SRL skills (Paris & Paris, 2001). However, providing learners with control could contribute to the basic psychological need of autonomy, a predictor of intrinsic motivation and learning (Deci & Ryan, 1985; 2000).

Well-developed metacognitive and SRL skills could decrease the amount of cognitive load that learner control requires (van Merriënboer & Sweller, 2005). For example, novice learners have to think about how to evaluate their competence, how to find out what is expected from them and how to select the right tasks. This requires investing a lot of cognitive load. On the other hand, expert learners know which tasks they need to learn something new, because they evaluate their competence automatically. Such automation reduces the cognitive load, because it does not require capacity in working memory (van Merriënboer & Sweller, 2005). This way, more capacity is available in the working memory for deep learning processes.

Current research has mostly focused on a high and fixed amount of learner control regarding the learning process, and this amount of learner control does not address the necessity of learners to develop their SRL skills (Carolan et al., 2014; Katz & Assor, 2006; Sorgenfrei & Smolnik, 2016). Carolan et al. (2014) emphasized the importance of an optimal balance between learner control and the costs of extraneous cognitive load. An optimal balance could probably be achieved by sequentially increasing learner control. This balance could enable learners to develop the necessary skills for dealing with this control while preventing cognitive overload. Sequentially increasing learner control could be a way out of the self-directed learning paradox mentioned above.

The leading questions in the present study are: does sequentially increasing learner control on task selection lead to better learning than teacher controlled education? And does

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sequentially increasing learner control influence students' intrinsic motivation? It is hypothesized

that sequentially increasing learner control lead to better learning and higher intrinsic motivation.

Method

Research design and participants

Seventy-seven learners (37 males and 40 females) in the English course in a secondary

education school in the Netherlands participated in this research. This choice depended on the

accommodating school, also called a convenience sample (Callaert, 2006). This method

diminished the possibility to generalize the results, but is seen as the most efficient method,

given the costs, effort and time (Marshall, 1996). This method was chosen because of the short

duration of this research. The English course included 16 lessons in 8 weeks and one exam week.

The average age of the participants was 15.9 years ($SD = 0.43$). The choice for this age was

based on the starting development of SRL skills and independent study skills in this age

(Bolhuis, 1996; Kitsantas & Cleary, 2016). To answer the research questions, the present study

compared an experimental group ($n = 40$) with a control group ($n = 37$). A power analysis, using

the G*power analysis program (Faul, Erdfelder, Lang, & Buchner, 2007), indicated that a total

sample size of 55 participants would be needed to detect medium effects (Cohen's $d = .5$; Cohen,

1992) with 95% power ($1 - \beta$), using an analysis of covariance (ANCOVA) to compare the

means of two groups, with one covariate and an alpha of .05 (two tailed; Faul, Erdfelder,

Buchner, & Lang, 2009). Therefore, the sample size of $N = 77$ will be adequate for the main

objective of this study (Cohen, 1992). Males and females were evenly distributed over both

groups. All participants in the experimental group ($n = 40$) and half of the participants in the

control group ($n = 17$) received education from one teacher and the other half of the participants

in the control group ($n = 20$) received education from another teacher. A quasi-experimental

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design was used because the assignment of learners to one of the conditions was synchronized with the existing classroom group classification for organizational reasons. All participants received a factual knowledge test before and after the course and received a questionnaire to measure intrinsic motivation before and after the course.

Procedure

Two weeks before the start of the course the parents of the learners were informed and asked to fill in a form whether they agreed with the participation of their child (Appendix A). At the start of the course all learners received verbal information about the course goals and knowledge tests, they filled in the Intrinsic Motivation Inventory (n.d.) (IMI) and did a factual knowledge test. Learners were not informed about the different conditions and the hypothesis, because this could affect the results (Neuman, 2014).

All learning tasks were carefully developed by the teachers. In the control group, the teacher determined for all learners when, how and in which order these learning tasks were to be used during the lessons. All learners followed this program in the same order and they had no control over task selection.

In the experimental group, the teacher made a preselection of learning tasks for each lesson. This preselection was the same for all learners. In the beginning of the course learners were able to choose between two tasks. During subsequent lessons learners were able to choose from gradually more tasks, to a maximum of four, to increase the autonomy, perceived control and deliberation (Corbalan et al., 2009; Schwartz, 2004). The background of this maximum was that offering more than four options does not contribute to better choices and satisfaction (Schwartz, 2004) and learners could even be overwhelmed and demotivated by a (too) high amount of choices (Corbalan et al., 2009). The learning tasks differed in surface features (i.e.

irrelevant aspects of the learning tasks concerning the goals), content and the amount of difficulty (Corbalan et al., 2009; Sorgenfrei & Smolnik, 2016). For example, in the primary stage participants could choose between written information and verbal instruction of the teacher, in the second stage leaners were also able to choose the level of difficulty and in the last stage choices between grammar or vocabulary activities were added. Research has shown that differences between choice opportunities positively affect the perception of control and involvement in learning (Corbalan et al., 2009). There was an exception in treatment in week four in the experimental condition, because all learners had to follow a fixed program. During the two lessons in week four, learners received no choice opportunities because of mandatory content that had been planned beforehand. In this week, the form of education was the same in the experimental and control condition.

All other aspects of the lessons, like introductions, information about the program and homework, were the same for both conditions. After the course all learners took a factual knowledge test and filled in the IMI.

Instruments

Factual knowledge tests. Learners in both conditions took two factual knowledge tests. Both tests were developed by the teachers. The tests are representative knowledge tests that reflect all topics of the course and are in line with the formulated goals of the course (Biggs, 1996). All participants took the same tests.

The first test contained 52 questions and examined the prior knowledge of the participants concerning all topics of the English course (Appendix B). All questions were semi-open; learners had to choose the correct syntax, a correct form of verbs, fill correct prepositions to complete the sentence and choose correct endings for phrases from a list. Two examples items

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are: "Put in the correct preposition: do you like to try ... new food when you're on holiday or do you prefer to play safe?" (Correct answer is 'out') and "Complete the sentence with the correct form of the verb: recently green groups suggested ... (turn) the old KTM railway corridor into a nature trail" (correct answer is 'turning'). Five items were not included in the analysis, because the proportion of participants who gave a correct answer was very low or very high. The item difficulty value (p) of these items was $p < .02$ and $p > .98$. Two of these items were too difficult: the questions could be interpreted as misleading; three items were too easy. Eleven items had a negative item-total correlation. On these items well-performing learners scored lower than expected and badly-performing learners scored higher than expected, based on the total score. For this reason these items were excluded from the analysis. The maximum test score was 36 points (mean score = 22.52, SD = 4.66). Cronbach's alpha for the 36 items of the first test was .71. Because the diversity of constructs being measured (grammar, conjugate verbs, vocabulary) the internal consistency was seen as sufficiently reliable (Field, 2013).

The second knowledge test consisted of 39 questions (Appendix C). The first 25 questions could yield one point and the last 14 questions could yield 2 points. This second test was relevant for learners because it contributed to their scorecards. The test consisted of open, semi-open and multiple choice questions. Two example items are: "Come up with an appropriate end to these sentences: If I were you ..." and "Explain in English what this word means: Anxious". Seven items were excluded from the analysis because they had a negative item-total correlation. Most of these items asked for creativity, besides their English language skills. Cronbach's alpha for the 32 items of the second test was .71 and therefore the internal consistency of this test was seen as sufficiently reliable (Field, 2013). The maximum test score was 45 points (mean score = 27.74, SD = 6.42).

*Motivation survey***.** To measure intrinsic motivation a Dutch translation of the IMI was used (See Appendix D; Intrinsic Motivation Inventory, n.d.). This instrument was chosen because it also measures perceived choice, an important feature of this research. In previous research this instrument has a high reliability (Cronbach's α =.78) and validity (McAuley, Duncan & Tammen, 1989). The instrument assesses perceived interest/enjoyment, feelings of competence, value/usefulness, felt pressure and tension and perceived choice. According to Deci and Ryan (Intrinsic Motivation Inventory, n.d.), the interest/enjoyment part is the most important part of the IMI, because this is the most direct measurement of intrinsic motivation. Perceived choice and perceived competence are seen as positive predictors and perceived pressure and tension are seen as negative predictors of intrinsic motivation. The questions of value/usefulness could measure the amount of perceived value.

29 statements were randomly organized and measured with a 7-point rating scale, rating from 1 (not at all true) to 7 (very true). The reliability of the IMI in this research was examined with Cronbach's α. The IMI as a whole was found to be very reliable with α = .87 (Field, 2013). Also each construct has a high reliability; interest/enjoyment (α = .87), perceived competence (α = .91), pressure/tension (α = .82), perceived choice (α = .86) and value/usefulness (α = .81) (Field, 2013).

*Logbook teachers***.** The teachers were asked to write some comments after each lesson about how the learning tasks were introduced to the participants, possible exceptions, particular reactions of learners and their experience with this lesson (Appendix E). This logbook was developed to remember particular situations and to interpret, complement or discus the findings (Halem, 2008).

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Analyses

The quantitative data analyses focused on answering the two hypotheses central to this study by comparing the experimental and control condition. The observations in both conditions were independent because all participants were participating in only one condition and all participants made the tests and filled in the IMI individually (Field, 2013).

To answer the question 'does sequentially increasing learner control on task selection lead to better learning than teacher controlled education?', the total scores of the factual knowledge tests were used. As no serious violations of assumptions were found, is was decided that ANCOVA could be used. The pre-test was used to test whether there was a difference in prior knowledge between the groups before the start of the course. The post-test was used to compare the control and the experimental group, with the pre-test as a covariate. The hypothesis was deemed to be confirmed if learners in the experimental group would score significantly higher on the last knowledge test than learners in the control group, controlled for the pre-test ($p < .05$).

Similar quantitative analyses were performed to address the second question. To answer the question 'Does sequentially increasing learner control influence learners' intrinsic motivation?', the perceived answers on the IMI's were compared between the experimental and control condition. The scores of the statements 2, 8, 10, 11, 15, 18, 20, 24, 28, 29 were reversed, because they asked for an opposite answer concerning the concept. Because each construct required a different amount of questions, the average score for each learner on each concept was calculated. To conduct an ANCOVA the dependent variable must be measured on interval scale. Because the distance between each point of the 7 point scale is approximately the same, the mean scores could be interpreted as an interval variable (Field, 2013). An ANCOVA was

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conducted for the five different parts of motivation (interest/enjoyment, perceived competence, pressure/tension, perceived choice and value/usefulness). The first questionnaire was used as a covariate and the second questionnaire was the dependent variable in the ANCOVA. Findings of a two tailed test were considered significant at the .05 level of significance.

Results

To examine the effects of sequentially increasing learner control on achievement and intrinsic motivation, an ANCOVA was chosen to maximize the power on the F-tests by statistically controlling for prior knowledge and the pre-scores on the IMI (Tabachnick & Fidell, 2001). This was important given that it was not possible to assign participants to conditions in a completely random fashion.

In this chapter, firstly the results of general analyses are described. Secondly, the assumptions and the way this research deal with violated assumptions are mentioned. Thirdly, the results of the main analysis are described. Finally, the logbooks of the teachers are evaluated.

Data screening

The most relevant comparison in the data screening concerns the values of the mean of the post-tests for the two groups, but adjusted for the pre-test. Therefore, these values are discussed here. Table 1 displays the descriptive data for the knowledge tests. Participants in the control condition ($M = 28.05$, SD = 6.20) and experimental condition ($M = 27.92$, SD = 6.04) have almost the same mean score on the adjusted post-test. Table 2 displays the descriptive statistics for the pre- and post-IMI. The scores of participants in the experimental condition on the adjusted post-test, compared to participants in the control condition, were higher for interest/enjoyment, perceived choice and perceived value/usefulness; lower for perceived

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competence; and exactly the same for perceived pressure/tension. With the exception of

perceived choice, the differences were not very large in view of the standard deviation.

Table 1
Means (SD) and adjusted means for pre- and post-knowledge test.

Condition	Achievement			
	n	Observed Mean pre-test (*SD*)	Observed Mean post-test (*SD*)	Adjusted Mean post-test
Experimental	40	23.10 (4.66)	28.39 (6.04)	27.92
Control	35	21.86 (4.63)	27.60 (6.20)	28.05

Table 2
Means and adjusted means for pre- and post IMI scores.

	Observed mean pre IMI scores (*SD*)		Observed mean post IMI scores (*SD*)		Adjusted Mean Post IMI scores	
	Experimental	Control	Experimental	Control	Experimental	Control
Interest / enjoyment	3.04 (1.14)	2.95 (0.76)	3.18 (0.94)	2.99 (0.77)	3.20	2.97
Perceived competence	4.65 (1.18)	4.51 (1.10)	4.85 (0.94)	4.92 (0.68)	4.86	4.91
Pressure / tension	1.88 (0.92)	2.03 (0.85)	1.79 (0.78)	1.89 (0.77)	1.84	1.84
Perceived choice	3.85 (1.12)	3.05 (1.01)	4.69 (1.08)	3.47 (1.14)	4.57	3.61
Value / usefulness	4.36 (1.23)	4.68 (0.77)	4.52 (1.20)	4.52 (0.98)	4.64	4.39

Table 3 shows the Pearson correlations between the different aspects of intrinsic

motivation. There was a significant positive correlation between interest/enjoyment and

perceived choice ($r(75) = 0.42$, $p < .001$), interest/enjoyment and value/usefulness ($r(75) = 0.45$,

$p < .001$), pressure/tension and value/usefulness ($r(75) = 0.51$, $p < .001$). There was a significant

negative correlation between perceived competence and pressure/tension ($r(75) = -.36$, $p = .001$)

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and perceived competence and value/usefulness ($r(75) = -.52$, $p < .001$). Other correlations

between the aspects of motivation were not significant.

Table 3
Correlations among different aspects of intrinsic motivation

		1	2	3	4	5
1.	Interest/enjoyment					
2.	Perceived competence	.11				
3.	Pressure/tension	.10	-.36*			
4.	Perceived choice	.42*	.08	.14		
5.	Value/usefulness	.45*	-.52*	.51*	.17	

*Note. n = 75. * p*-value $< .001$.

Assumptions concerning an Analyses of Covariance

Before running the ANCOVA the assumptions were checked: normal distribution of

dependent variable in each condition, homogeneity of variance, outliers, linear relationship

between covariate and dependent variable in both conditions, independence of the covariate and

treatment effect and homogeneity of regression slopes (Field, 2013).

Normality. To test the assumption of normality, histograms and Kolmogorov-Smirnov

tests were used. The histograms and the K-S tests showed that the scores on the second

knowledge test and the different aspects of intrinsic motivation were normally distributed in both

conditions ($p < .05$), with the exception of perceived pressure in the experimental condition

($D(36) = 0.20$, $p = .001$) and perceived value in the experimental condition ($D(36) = 0.16$, $p = $

.02). In the histograms only small deviations were visible. Because most studies indicate that an

ANCOVA is a robust method of analysis, which is resistant to such minor abnormalities, it was

decided to continue the analysis (Rheinheimer & Penfield, 2001).

Homogeneity of variance. To examine the assumption of homogeneity of variance, Levene's test was carried out. For the second knowledge test and all aspects of the motivation questionnaire, the variances were equal in the experimental and control condition (second knowledge test $F(1, 69) = 1.15$, $p = .70$, interest/enjoyment ($F(1, 66) = 1.97$, $p = .24$), perceived competence ($F(1, 66) = .3.98$ $p = .05$), felt pressure ($F(1, 66) = .66$ $p = .42$), perceived choice ($F(1, 66) = .05$, $p = .82$).

Outliers. The stem-and-leave plots detected no outliers in the prior knowledge test and one outlier in the second knowledge test, who scored significantly lower in comparison to other participants. For this reason this participant was excluded from the analysis of the knowledge tests.

Based on a visual inspection of the data it was decided to delete the data of one participant from the analysis of motivation aspects. The answers of this participant were inconsistent because he gave the same answer on many statements and did not mention the pooled questions. Probably this participant did not read the questions.

The stem-and-leave plots detected no outliers in perceived competence and a few outliers in interest enjoyment (2 outliers), felt pressure (3 outliers), perceived choice (1 outlier) and value /usefulness (1 outlier). One participant was marked 4 times as an outlier. This participant mostly filled in extreme values (1 or 7) and was therefore removed from the analyses. It is reasonable that SPSS considered the other outliers as extreme through the limited sample size (Hoaglin, & Iglewicz, 1987). To examine the influence of these outliers the ANCOVA was conducted with and without these outliers and the outcomes were not really different. Based on this comparison and the stem-and-leave plots it was decided to include the other outliers, because they didn't affect the results.

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Linear relationship. The next assumption was a linear relationship between covariate and dependent variable in both conditions. The grouped scatterplots made clear that this assumption was met for the knowledge tests and the five aspects of intrinsic motivation.

Independence covariate. To run an ANCOVA the covariate must be independent of the treatment effect (Field, 2013). The scores of prior knowledge test (T (73) = -1.16, p = .25), perceived interest/enjoyment (t(74) = -.42, p = .68), felt pressure (t(74) = .84, p = .46), the amount of perceived value/usefulness (t(74) = 1.32, p = .19) and perceived competence (t(74) = -.50, p = .62) on the pre-test were not significantly different between the experimental and control condition, and thus statistically independent. Therefore, these scores could be used as a covariate (Field, 2013). But in the experimental condition the learners scored significantly higher on perceived choice in the pre-test (M = 3.85, SD = 1.12) in comparison to the control condition (M = 3.05, SD = 1.01; t(74) = -3.26, p = .002). Because it is likely that this difference arose by chance and it is reasonable to believe the conditions and the covariate could not have affected each other, it is acceptable to use the scores of perceived choice on the pre-test as covariate (Miller & Chapman, 2001).

Homogeneity of regression slopes. The last assumption of homogeneity of regression slopes was met because the interaction term between the conditions and the pre-test on the post-test was non-significant; knowledge test F(1, 65) = .00, p = .97), perceived interest/enjoyment (F(1, 64) = .65, p = .42), perceived competence (F(1, 64) = .04, p = .84), felt pressure (F(1, 64) = .01, p = .92), perceived choice (F(1, 64) = .03, p = .87) and perceived value (F(1, 64) = 1.41, p = .24, Field, 2013).

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Main analysis

To examine whether sequentially increasing learner control influences students' learning and intrinsic motivation, a single-factor ANCOVA was performed for the knowledge test and all five aspects of intrinsic motivation (see Table 4). The mean scores of the second knowledge test and the second IMI were compared between the experimental and control condition, with the mean scores of the thirst knowledge test and first IMI as covariates.

Table 4
ANCOVA results for students' achievement and motivation aspects

Variable	Group	n	Adj. Mean *	F	DF	Prob.	η_p^2
Achievement	Control	33	28.05				
	Experimental	36	27.92	0.09	1, 66	.92	.00
Interest	Control	32	2.97				
	Experimental	35	3.20	2.10	1, 64	.15	.03
P. competence	Control	32	4.91				
	Experimental	35	4.86	0.13	1, 64	.72	.00
Pressure	Control	32	1.84				
	Experimental	35	1.84	0.00	1, 64	.98	.00
P. choice	Control	32	3.61				
	Experimental	35	4.57	12.87	1,64	.001	.17
Value	Control	32	4.39				
	Experimental	35	4.64	1.35	1, 64	.25	.02

Notes: Adj. Mean = mean of posttest score, adjusted for the pre-test.*

Knowledge test. The first knowledge test was significantly related to the second knowledge test ($r(69) = .50$, $p < .001$). As Table 4 shows, there was no significant effect of the conditions on the second knowledge test, after controlling for the first knowledge test ($F(1, 66) = 0.00$, $p = .92$, $\eta_p^2 = .00$). Also when the z-scores of the first knowledge test were subtracted from

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the z-scores of the second knowledge test, there was no difference between the scores the conditions (t(67) = 0.69, p = .49).

  Intrinsic motivation Inventory. On all five aspects of intrinsic motivation the covariate (pre-score on IMI) was significantly related to the dependent variable (post-score on IMI; $p <$ .01). After controlling for the first IMI, the effect of the treatment conditions was non-significant concerning interest/enjoyment (F(1, 64) = 2.10, p = .15, η_p^2 = .03), perceived competence (F(1, 64) = 0.13, p = .72, η_p^2 = .002), pressure/tension (F(1, 64) = 0.00 p = .98, η_p^2 = .00) and value/usefulness (F(1, 64) = 1.35, p = .25, η_p^2 = .02). Only the perceived choice was significantly different between the conditions, after controlling for the perceived choice measured in the pre-test (F(1, 64) = 12.87, p = .001, η_p^2 = .17). Both the observed and adjusted means (see Table 1) showed that participants in the experimental condition scored higher on perceived choice in contrast to participants in the control condition.

Logbook

  The teachers did not write comments about their experience with the lessons or detailed information about the program, learning tasks or introductions during lessons. The logbooks showed no exceptions in treatment in the control condition and no particular reactions of learners in the control condition. One of the teachers noted that she experienced more unrest in the experimental condition during lessons and while working on their learning tasks, participants were less concentrated when compared to the situation in the classrooms before treatment.

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Discussion

In this section, the findings in relation to the hypotheses are discussed, and possible explanations regarding these findings are described. Also, the limitations and implications for educational practice and future research are described.

Findings in relation to the hypothesis and research questions

Most teachers believe that learner control positively affects achievement and motivation (Katz & Assor, 2006). Previous research, however, showed mixed results of a fixed amount of learner control on motivation and learning (Carolan et al., 2014; Katz & Assor, 2006; Sorgenfrei & Smolnik, 2016). Sequentially increasing learner control has been suggested as a possible solution to these mixed results. This research has examined whether sequentially increasing learner control indeed positively influences learners' learning and intrinsic motivation, as compared to a teacher controlled environment. However, the results of this study do not confirm theses hypotheses. Although participants in the experimental condition reported more perceived choices, this perceived choice did not affect the other aspects of motivation or their performance. Some possible explanations for these findings are discussed.

Possible explanations

Lack of instruction or guidance to develop SRL skills. The participants could be seen as novice learners, because of their lack of experience with learner control and undeveloped SRL skills, according to the teachers (van Merriënboer & Sweller, 2005). Accordingly, sequentially increasing learner control was seen as a way out of the self-directed learning paradox mentioned in the introduction (Corbalan et al., 2010). However, the cognitive load theory states that novice learners need active guidance when faced with complex learning processes which are new to them (van Merriënboer & Sweller, 2005). It is important to prepare students to learn on their

own, for example using choice opportunities effectively (Kitsantas & Cleary, 2016; Zimmerman, 2002). Zimmerman (2002) also emphasized the importance of instruction about SRL skills and role models, like parents, teachers and peers, to develop SRL skills. Instruction about SRL skills could contain information about goal setting, estimating competence, self-evaluation and study strategies (Zimmerman, 2002).

In this study, learners did not receive direct or indirect instruction or guidance to deal with the control provided. Active guidance was facilitated to learners in neither the control nor the experimental condition, because it was hypothesized that only sequentially increasing learner control was enough to stimulate the development of SRL skills and to increase intrinsic motivation and learning. This lack of guidance could have led to undeveloped SRL skills: learners were probably unable to deal with the amount and different types of instructional choices in the experimental condition. It is reasonable that when learners cannot effectively use the instructional choices given to them, their intrinsic motivation and performance will not increase, because learners are not able to make efficient learning decisions.

In addition, the development of SRL skills requires a lengthy process (Kitsantas & Cleary, 2016). It is imaginable that the intervention was too short for the participants to develop SRL skills, especially without guidance. Still, despite this lack of guidance, learners did not perceive more pressure in the experimental condition. A combination of active guidance and sequentially increasing learner control over a longer period would probably have led to significant better learning and higher intrinsic motivation (Zimmerman, 2002).

Unfamiliarity and unrest. A second explanation is that more choice opportunities might have led to more unrest in the classroom and loss of education time. The type of choices given to the learners required some time in order to make efficient learning decisions. The teacher of the

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experimental condition reported that participants in the experimental condition seemed to be less

concentrated while working on their learning tasks. She mentioned two possible causes: firstly,

the extensive instruction of different tasks and secondly, the unfamiliarity to make instructional

choices during the lessons. To improve the effectiveness of instruction and stimulate active

learning processes, contents and tasks have to be organized and clear (Astleitner, 2005). The

unfamiliarity with choice opportunities in the experimental condition and the need for a

comprehensive explanation of the learning tasks possibly made the learning tasks less structured

and clear. This might have led to a decrease in achievement and motivation regarding the choice

opportunities in the experimental condition (Astleitner, 2005).

Meaningful choices. A third explanation could possibly be found in the extent to which

the participant experienced the choices as meaningful (Wigfield, Guthrie, Tonks, & Perencevich,

2004). The results showed a significant correlation between the most direct measurement of

intrinsic motivation (interest / enjoyment) and perceived choice (see Table 3). Based on this

correlation and in line with the self-determination theory (Ryan & Deci, 2000), intrinsic

motivation was expected to increase with choice opportunities. However, the results showed no

differences regarding intrinsic motivation between the conditions, although participants received

and perceived more choice opportunities in the experimental condition. Probably, the choices

were not personally meaningful for individual participants. According to Wigfield et al. (2004),

to stimulate the intrinsic motivation of participants, it is necessary that instructional choices are

meaningful. A choice is meaningful when learners could choose a method to answer self-

generated questions (Wigfield et al., 2004). In this research it could be that the choices were not

personally meaningful, because there was no attention for self-generated questions. A lack of

meaningful choices may have led to more perceived choice, but not to higher intrinsic

motivation. The self-determination theory argued that intrinsic motivation is determined by feelings of autonomy (Ryan & Deci, 2000). The lack of finding a significant effect could indicate that providing learners with choice opportunities only is not enough to affect perceived autonomy (Sorgenfrei & Smolnik, 2016). The fact that there also was no significant difference regarding perceived value, supports this idea. Future studies could analyze the choices learners made and patterns in task sequence to examine the impact of decisions regarding choice opportunities on learning and motivation.

In addition, perceived autonomy cannot be separated from other aspects according to the self-determination theory, like relatedness and feelings of competence (Sorgenfrei & Smolnik, 2016). According to Sorgenfrei and Smolnik (2016), it is necessary to stimulate feelings of autonomy, relatedness and competence together to increase intrinsic motivation, because these predictors of intrinsic motivation are linked to each other.

Knowledge transfer. A final possible explanation is that learner control does not necessarily lead to more factual knowledge, but it could probably lead to better transfer and integration of this knowledge (van Merriënboer, 2016). Transfer could be defined as "the use of knowledge in a new situation, different from where it was originally acquired" (van Merriënboer, Kirschner, Fischer, Hmelo-Silver, Goldman & Reimann, 2018. p. 36). The second knowledge test judged just factual knowledge. Because learners in the experimental condition received control over task selection, it could be that they learned as much factual knowledge as participants in the control condition, but were better able to transfer this knowledge. Unrest and less available time for effective instruction in the experimental condition could have led to a decrease in motivation and learning. Presumably, learners in the experimental condition could have developed SRL skills, because of the sequentially increased learner control over task

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selection. The development of SRL skills could help to integrate and transfer new knowledge and skills to new situations (van Merriënboer, 2016). Using SRL skills, for example trying out different approaches to a task, could probably have negative effects on the performance on that task, but positive effects on learning and transfer. Van Merriënboer (2016) called this the "transfer paradox". The application of knowledge in new situations or after a long period was not measured in the present study. Future studies could examine the impact of sequentially increasing learner control on knowledge transfer.

Limitations and future research

The present research measured performance and intrinsic motivation before and after the course. These results did not give insight in the development of intrinsic motivation and learning aspects during the treatment, as this was beyond the scope of this study. For example, the study did not collect information on whether students could have experienced higher motivation during treatment (e.g., after two weeks) and perhaps this motivation was decreased at the end of the treatment. Additionally, the qualitative information provided by the teachers was limited: they made only a few notes in their logbooks. This complicated the process of data interpretation. Future research could take this into account through weekly measurements to follow the development of motivation and learning. Interviews with teachers and learners could provide explanations for the findings.

Moreover, 20 participants, all participating in the control condition, received education in the English course from another teacher than the other 57 participants, divided between the conditions. Both teachers tried to balance all aspects (like introductions, information about the program and homework) between the two conditions. However, individual features of the teachers, like differences in the way of teaching, could have affected the performance and

intrinsic motivation of the participants, for example the perceived choice. Participants in the experimental condition scored significantly higher on perceived choice in the pre-test in comparison to participants in the control condition (see Table 2). Possibly, the teacher in the experimental condition was naturally inclined to give learners more control over their learning path in comparison to the other teacher. When future studies use a similar research design, it is important that all participants receive education from one teacher, to minimize the influence of individual features of teachers. In addition, a pure experimental research design is preferred in future research, to minimize the influence of existing patterns in classrooms.

An assumption in this research was the positive effect of sequentially increasing learner control on the development of SRL skills and preventing cognitive overload. However, both concepts, SRL skill and cognitive load, were not measured in this research. This limits the interpretation of the results, because there was no data to confirm the underlying theories. In future research it is important to collect data about SRL skills and perceived cognitive load to confirm or to criticize underlying theories.

Future research could investigate the function of SRL skills on learning and motivation, while sequentially increasing learner control. Active guidance could help to develop SRL skills (van Merriënboer & Sweller, 2005; Zimmerman, 2002). Future research could examine whether sequentially increasing learner control leads to higher motivation and better learning when learners receive guidance to learn to use choice opportunities effectively. In addition, future studies might investigate the importance of feedback on the selection of learning tasks by learners (Butler & Winne, 1995) and different aspects of learner control. In the present study leaners received gradually more choice opportunities and gradually more differences between these opportunities, regarding content and difficulty of learning tasks. Future research could

differentiate between these elements by employing different conditions, in order to examine which aspects of learner control positively affects learning and motivation.

The present study was carried out in a single school, in one course with one level of education and with all participants in one age category. It is unclear how much these limited differences between the participants in the sample impact the generalization of the findings. A replication of this study in another context could give information about the external validity. This is important because age and level of education could affect the development of SRL skills, motivation and achievement (Bolhuis, 1996; Kitsantas & Cleary, 2016).

Implications for educational practice

In current educational settings there is a lot of attention for learner control and the development of SRL skills (Oostdam, Peetsma, & Blok, 2007). However, there is no consensus about which learning methods are effective in giving learners control over their own learning path (Oostdam et al., 2007). The present study shows no adverse effects of teacher controlled or learner controlled education. However, when implementing learner controlled education, it is important to pay attention to several conditional aspects. Firstly, a build-up of learner control is necessary because learners need time to develop SRL skills to be able to use this control effectively and to become familiar with the new educational setting (Kitsantas & Cleary, 2016). Secondary schools could consider adaptive learner control in order to adapt the amount of learner control to learners' expertise and SRL skills (Corbalan et al., 2006). Secondly, beside choice opportunities, novice learners need probably guidance to become self-regulated learners (Kitsantas & Cleary, 2016; van Merriënboer & Sweller, 2005; Zimmerman, 2002). Schools could implement active guidance, like direct instruction about SRL skills and feedback on the choices made by learners, while sequentially increasing learner control (Butler & Winne, 1995;

Zimmerman, 2002). Thirdly, teachers have to develop instructional methods to minimize the unrest in classrooms when instructional choices are provided. A short, but clear and organized instruction of the lesson and the different tasks could probably prevent cognitive overload of learners and unrest (Astleitner, 2005). Finally, teachers could think of offering meaningful choices to enable learners to choose learner tasks to answer self-generated questions, for example questions generated by learners about a topic they want to investigate further (Wigfield et al., 2004).

Offering choices in education is limited, because educational goals are determined by governments and not by learners themselves (Oostdam et al., 2007). In addition, learners in secondary education are not able to assess their own knowledge and skills without guidance, what could result in less efficient instructional choices (Kitsantas & Cleary, 2016). In the present study, learners could be seen as novice learners, without self-assessment skills and therefore, did probably not recognize the consequence of different choice opportunities concerning their learning process (Kostons, van Gog, & Paas, 2012). Moreover, besides control over surface features, learners received in the present study also control over difficulty and content, which may have led to a too high cognitive load which resulted in less efficient learning decisions. Furthermore, novice learners do not have the ability to assess their own work (Panadero, Jonsson, & Botella, 2017). Accurate self-assessment skills are needed to regulate own learning and make efficient instructional decisions regarding difficulty and content (Panadero et al., 2017). Learner control over difficulty and learning content of learning tasks may only be effective if a teacher invests time to guide individual learners in their learning processes, and this guidance was not facilitated in this research (Kitsantas & Cleary, 2016). Even with personal guidance, the development of self-regulated learning skills requires a long-term approach in

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secondary education (Kitsantas & Cleary, 2016). Presumably, it could be better to give secondary education learners only control over surface features, instead of meaningful choices, at the beginning, because these features do not harm the important and necessary learning content (Corbalan, Kester, & van Merriënboer, 2006), require less valuable time of the teacher for guidance (Kitsantas & Cleary, 2016) and could prevent inefficient learning decisions (Sorgenfrei & Smolnik, 2016). When there is sufficient time for personal guidance, secondary schools can design a buildup from a teacher controlled learning environment, through a shared controlled environment, to a learner controlled environment. In a shared controlled environment, the teacher and the learner share the control over the learning path and work toward increasing learner control (Corbalan et al., 2006). In a shared controlled environment, a teacher could adapt the amount of learner control to relevant task knowledge, self-assessment and SRL skills of the learner (Corbalan et al., 2006). Kicken, Brand-Gruwel, van Merriënboer and Slot (2009) developed a Structured Task Evaluation and Planning Portfolio (STEPP) to help learners in their process of developing SRL skills. A portfolio could help teachers and learner in developing self-assessment skills, determine learning goals and making efficient learning decisions (Kicken et al., 2009).

Final conclusion

To conclude, this study showed that sequentially increasing learner control led to more perceived choice, but no significant differences were found regarding learning and intrinsic motivation. These findings are particularly relevant for curricula designers and teachers, because they tend to give learners more and more control over their own learning path. The current study does not show positive or negative consequences of sequentially increasing learner control, but

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advocates instruction and active guidance of learners in their process of developing self-regulated learning skills while sequentially increasing learner control.

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EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

Appendix A. Informed consent

Beste ouder/ verzorger,

Ik ben Colin Goudappel en ben bezig met de studie onderwijswetenschappen. Voor mijn masterscriptie doe ik onderzoek naar hoe de motivatie en leerprestaties van leerlingen verbeterd kunnen worden. Voor dit onderzoek word ik vanuit de Universiteit Utrecht begeleid door dr. Gemma Corbalan.

Wat houdt het onderzoek in?
Tijdens het vak Engels krijgen leerlingen een aantal keer keuzemogelijkheden in de leertaken waaraan ze willen werken tijdens de les. De leerlingen vullen voor en na het vak een motivatievragenlijst in en maken twee keer een kennistoets. Deze kennistoetsen en vragenlijsten worden gebruikt om na te gaan welke effecten onderwijsmethodes hebben. Het onderzoek is na periode 3 afgelopen. Het onderzoek heeft alleen betrekking op het vak Engels en leerlingen hoeven niet te worden voorbereid op dit onderzoek.

Privacy en vertrouwelijkheid
Alle gegevens van leerlingen worden vertrouwelijk behandeld en anoniem verwerkt. De docent krijgt de antwoorden van de leerlingen op de motivatievragenlijsten niet te zien. De gegevens worden alleen voor opleidings- en onderzoeksdoeleinden gebruikt. Leerlingen kunnen zelf ook aangeven of ze wel of niet mee willen doen.

Mogelijkheid tot vragen, informatie en toestemming
Als u nog vragen heeft over het onderzoek of als u op de hoogte gehouden wilt worden over dit onderzoek, stuur dan een mail aan Colin Goudappel: colingoudappel@hotmail.com of belt u naar: 06-49491176. Voor verdere vragen over de masterthesis en deze opdracht kunt u ook contact opnemen met: Gemma Corbalan: g.corbalan@uu.nl.

Graag horen we of u toestemming geeft voor deelname van uw kind aan dit onderzoek. Wij vragen u onderstaand strookje in te vullen en mee te geven aan uw kind. Het strookje kan op **maandag 28** of **dinsdag 29 januari** worden gegeven aan de docent Engels.

U mag het strookje ook inleveren in postvakje nummer: ....

Met vriendelijke groet,
Colin Goudappel en .... (docent Engels)

Ik vind het **wel goed / niet goed** dat mijn kind meedoet aan dit onderzoek:
(omcircel wat van toepassing is)

Uw naam:	Datum:
Naam kind:	Handtekening:
Klas kind:	School: Heemlanden

Geef dit strookje mee aan uw kind naar de eerste les Engels op 28 of 29 januari, of lever het in in postvakje nummer.

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

Appendix B. Prior knowledge test, English term 3 and Key

Prior knowledge test

Exercise A
Choose the correct form of the verbs to complete the extract.

The funny thing about the younger generation is that on the one hand they seem very aware of global problems with natural resouces. If you ask them about the rain forests, for example, they *1. will say / would say* 'Oh, I wish people *2. stopped / would stop* cutting down the rain forest. They are destroying the planet.'
But on a personal level, they don't seem to be so aware. For example, it seems they would rather *3. leave / left* the TV on standbay than *4. swich / switched* it off. If the central heating was on too high, they *5. would be / would have been* more likely to open a window than turn it down!
We parents are partly to blame for this. If we *6. Were / had been* stricter with our children when they were young, they *7. would know / would have known* how to act now. I wish also that they *8. had / had had* more energy-saving education when they were at school. As parents, we'd all rather schools *9. teach / taught* these things because when we try out children just think we are nagging!

Exercise B.
Work in pairs. Find the odd one out in each group of words. Explain why it doesn't fit.

10. Conserve	Waste	Save	Preserve
11. Natural	Abundant	Scarce	Inexhaustible
12. Oil refinery	Oil slick	Oil rig	Oil tanker
13. Sunlight	Minerals	Air	Wind
14. Majestic	Tall	Obsessed	Desperate

Exercise C
Complete the article with the correct form of the verbs. Use prepositions where necessary.

Big cities are often criticized 15_____(be) big polluters. But it is generally considered that Singapore 16_____(be) an exception to this rule. For a long time the government has encouraged developers and conservationists 17_____(think) of ways to increase the island's green spaces. Recently green groups suggested 18_____(turn) the old KTM railway corridor into a nature trail. But perhaps the most striking project is *gardens by the bay*, a futuristic park near the city's financial centre which includes eighteen *Supertrees*. When it is complete it said that each of the eighteen trees 19_____(be covered) in more than 200 varieties of plants.

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

The government invited various companies 20_____(submit) ideas for the project and this was chosen as the most exciting. A spokesman for the government complimented the designers 21_____ (come) up with a 'truly innovative' design. The Supertrees are between 25 and 50 meters tall and mimic the function of real trees, absorbing sunlight though photovoltaic cells and collecting rainwater. The photographer who took this picture admitted 22_____(feel) skeptical about the project until he sow it for himself. 'It looks like something from the film *Avanter*: almost too good to be real!'.

Exercise D
Work in pairs. Find the odd one out in each group of words. Explain the reason for your choice.

23. Film	Photo	Snapshot	Picture
24. Column	Feature	Scandal	Editorial
25. Inspiring	Amusing	Optimistic	Encouraging
26. Lens	Shutter	Flash	Camera
27. Urge	Promise	Encourage	Persuade
28. Objection	Suggestion	Proposal	Recommendation

Exercise E
Complete the conversation using a phrase with *not* in each space.

M = Marina; P = Pauline
M: You're planning to go to Mexico for your holidays, 29_____ ?
P: That was the plan, but I've 30_____ (decide / go) now. I thought to myself 'You're always travelling to exotic places. Why 31_____(find) out something about your own country for a change?'
M: That's interesting. That's called a *staycation*, 32_____? You'll certainly save a lot of money.
P: Well, I hope so. But I 33_____(want / stay) at home. I'm going to travel around the north of France. Giverny, the garden where Monet painted his water lilies, is one place I'd really like to go. I 34_____(hope / rain) a lot.
M: Where are you going to stay? Or have 35_____(decide) yet?

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

P: I'll take a tent with me, but I 36_____(think / I will use) it all the time. Let's 37_____(be) too ambitious! I'll stay in guest houses sometimes.

M: Well, I think it sounds like a great idea. It means you 38_____(have to / worry) about visas and changing money and vaccinations and all that sort of thinks.

Exercise F
Put in the correct preposition to complete these questions about holidays.

39. Do you prefer to cater for yourself or do you generally eat _____when you're on holiday?

40. Do you like to try _____ new food when you're on holiday or do you prefer to play safe?

41. Do you generally join _____ with group activities and organized excursions or do you prefer to do things alone?

42. If you had two weeks _____ work, how far would you consider travelling on holiday?

43. Before you can enter the country, you have to fill _____ an immigration form.

44. Try not to stay _____ too late, we have an early start tomorrow.

Exercise G
Work in pairs. Find the correct ending from list B for each phrase in list A.

List A	List B
45. I'm coming in	A. in traffic.
46. The easiest thing is to hop	B. my own way.
47. I'll pick you up	C. ride.
48. I'll call if I get held op	D. to your house?
49. Look out for the Hoover building	E. by train.
50. I can easily make	F. on a bus.
51. It's only a ten-minute	G. on your right.
52. How do I get	H. from the station.

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

Prior knowledge test, English term 3, Key.

Exercise A
1. will say
2. would stop
3. leave
4. switch
5. would be
6. had been
7. would know
8. had had
9. taught

Exercise B.
10. Waste: the other three are about protecting things
11. Natural: the other three are about quantity
12. Oil slick: the other three are all equipment
13. Minerals: the other three are in the atmosphere
14. tall: the other three are all extreme adjectives

Exercise C
15. for being
16. is
17. to think
18. turning
19. will be covered
20. to submit
21. on coming
22. (to) feeling

Exercise D
23. Film: the others are all words for photo
24. Scandal: the others are all types of article
25. Amusing: the others all look to a better future
26. Camera: the others are all parts of a camara
27. Promise: the others are to make someone else do something
28. Objection: the others are all giving ideas

Exercise E
29. aren't you
30. decided not to go
31. not find
32. isn't it
33. don't wont to
34. hope it doesn't rain

35. haven't you decided
36. don't think I will use
37. not be
38. don't have to

Exercise F

39. out
40. out
41. in
42. off
43. in
44. out

Exercise G

45. I'm coming in by train.
46. The easiest thing is to hop on a bus.
47. I'll pick you up from the station.
48. I'll call if I get held op in traffic.
49. Look out for the Hoover building on your right.
50. I can easily make my own way
51. It's only a ten-minute ride.
52. How do I get to your house?

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

Appendix C. Second knowledge test, English term 3 and Key

Atheneum 4 English test term 3
Units 6,7 & 8 – Life Upper Intermediate

Year: Atheneum 4
Subject: English
PTA number: 431
Points: 71
This test is made up of 4 parts:
- Grammar – 15 points
- Vocabulary – 18 points
- Reading – 20 points
- Writing – 18 points

Make sure you read all the instructions carefully!

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

Grammar (15 points)

Exercise 1 – Reporting verbs
Complete the text using the correct form of the verbs. Use prepositions where necessary.

In the past, photographers have been criticised …….1……(invade) people's privacy or
……..2……..(take) pictures that did not reflect the reality of a situation. But nowadays, in the
age of digital photography, there is a new problem. How do we know that the photo has not been
altered after is has been taken? It would be wrong to blame the photographer
………3………(manipulate) some of the photos that appear in our newspapers and magazines.
A photo editor might be asked ……….4……..(alter) a photo digitally in order to make a good
story. For example, someone might suggest ………..5………..(touch) up the photo of a film
star's face to make them look more attractive. Or they might urge the photo editor
………..6……………(add) an image of a frightened child into a photo of a street protest. You
can perhaps forgive the editor ……..7…………(make) the first alteration, but what about the
second? That is a practice people should possibly refuse ……….8…………..(accept).

Exercise 2 – conditionals 1,2 & 3
Come up with an appropriate end to these sentences.

1. I wouldn't have dreamed of eating that cake …
2. If I were you …
3. I'm sure she will never talk to him again …
4. If it rains …

Exercise 3 – negative and tag questions
Complete this conversation.

1. A) The volunteer organisation used to take younger volunteers, .…?
       B) Yes, but their policy has changed.
2. A) So, as a teacher, there might be possibilities for me to volunteer, .…?
       B) Absolutely, for a long-term post if you want.
3. A) And I'd have to be flexible about where and when I could go, .…?
       B) Well, yes, flexibility helps.

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

Vocabulary (18 points)

Exercise 1 Write down the correct words on your answer sheet. (5 points)

The Amazon rainforest in South America has long been largely …1… and therefore its natural resources remained untouched and unspoilt. Unfortunately, times changed. Despite repeated calls for …2… of the enormous area, there has been a lack of adequate …3… . People should realise the forest's natural resources are not …4… . Trees are being cut down, legally and illegally and minerals are extracted from the ground. Hopefully governments realise in time that time is running out and that they should invest in …5… energy sources and stay clear of our natural riches.

      Hints:
1. has no people living in it
2. the protection of plants and animals, natural areas, and interesting and important structures and buildings, especially from the damaging effects of human activity
3. trying to make sure no damage is done
4. existing in very great amounts that will never be finished
5. forms of energy can be produced as quickly as they are used

Exercise 2 - Explain in English what these words mean. (5 points)

1. Anxious
2. Inexperienced
3. Permission
4. A guided walk
5. An oil well

Exercise 3 – Create meaningful and grammatically correct sentences with the following expressions. (8 points)

1. Mind's gone blank
2. In two minds
3. Give their word
4. Lost for words

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

Reading (2 texts - 10 questions - 20 points)
How much carbon dioxide does your computer emit?

1. AVIATION has long been blamed for its share of global warming caused by humans. Indeed, some travellers now ask themselves whether their flight is strictly necessary and, if they decide it is, ease their consciences by paying for the planting of trees. These, so they hope, will absorb the equivalent of their sinful emissions. But you, dear reader, indulge regularly in an activity that is just as polluting as air travel: using a computer.

2. According to a report published by the Climate Group, a think tank based in London, computers, printers and mobile phones accounted for the emission of 830m tonnes of carbon dioxide around the world in 2007. That is about 2% of the estimated total of emissions from human activity. And that is the same as the aviation industry's contribution. According to the report, about a quarter of the emissions in question are generated by the manufacture of computers and so forth. The remaining three quarters come from their use.

3. …2... computing can also be used to tackle climate change. For example, domestic consumption could be cut by the large-scale employment of smart meters in houses and flats. Households are the biggest users of electricity after manufacturing and transport. In Britain, they accounted for 29% of consumption in 2004, according to a government report.

4. Small and medium-sized businesses, meanwhile, could save electricity by switching to distributed computing, rather than running their own servers. The delivery of computer services over the internet, from vast warehouses of shared machines, enables firms to hand over the running of their e-mail, customer databases and accounting systems to someone else. Companies that do so use computers more efficiently and thus …3… not only their costs but also their carbon footprints.

5. Another way to …4… the situation is virtualisation — the creation of "virtual" machines — so that multiple operating systems and programs can run on the same computer. Sun Microsystems, a maker of servers, reckons that 70% of the servers in most organisations have only one program running on them. Running these applications on fewer and fewer machines, by virtualisation, would be more efficient and thus greener.

6. **Ironically**, of course, environmental research itself relies heavily on computers. So, perhaps the best thing the home user can do is donate his inefficiencies to the cause by signing up to climateprediction.net, which uses the idle capacity of home computers to test the accuracy of various computer models of the climate.
    www.economist.com, 2009

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

Answer the following questions.
1. Waarom betalen mensen voor het planten van bomen? (Antwoord in het Nederlands)

2. Which of the following fits the gap in paragraph 3?
   A. Yet
   B. In conclusion
   C. Unfortunately
   D. Furthermore

3. Which of the following fits the gap in paragraph 4?
   A. Increase
   B. Reduce
   C. Inflate

4. Which of the following fits the gap in paragraph 5?
   A. Improve
   B. Construct
   C. Decrease

5. Wat is er ironisch aan de hele situatie? (Paragraph 6) (Antwoord in het Nederlands)

6. Worden er in de tekst methodes/mogelijkheden genoemd om de uitstoot van kooldioxide te verminderen door computers in te zetten?

Zo nee, antwoord "Nee". Zo ja, noteer het nummer van de alinea waarin dit voor het eerst aan de orde komt.

Can changing what you eat SAVE THE PLANET?

1. MOST OF THE FIVE MILLION people in the UK who are wholly vegetarian or eschew red meat choose their diet on the grounds of ethics (intensive farming, animal welfare) or health (high blood pressure, cholesterol). Those in the ethical camp are often passionate about green issues, but a non-meat diet as a way to combat climate change has only recently been suggested. A UN report, *Livestock's Long Shadow*, argued that beef and dairy farming globally create more climate-changing gases (18 per cent) than the world's transport system (13 per cent). Although some have questioned the details of this report, there is no doubt that the carbon footprint of livestock production is hugely significant ─ and

growing.

2. The Vegetarian Society (VS) claims cattle rearing causes the most environmental damage of any non-human species, through overgrazing, soil erosion, deforestation and emissions of methane ─ a greenhouse gas 33 times more damaging than carbon dioxide ─ but also through the manufacture of fertilizers needed to grow the crops to feed the livestock.

3. Soy is a mainstay of animal feed, its cultivation entailing rainforest destruction in South America, which releases carbon when trees are chopped down. But while 90 per cent of soy is for animal consumption, it is also a staple of the vegetarian diet, used in meat substitutes such as tofu. A study commissioned by World Wide Fund for Nature (WWF) concluded controversially that this and other vegetarian favourites such as chickpeas and lentils were more harmful to the environment, because of the food miles incurred, than British-reared beef and lamb. **..8..** , vegetarians who only eat local produce but continue to eat dairy products are still contributing to the rise in greenhouse gases; only a vegan diet (no animal products) could make a difference in this respect.

4. The National Farmers' Union (NFU) warns that if there was a shift to a vegetarian diet, our beleaguered farmers would go out of business and the industry would move overseas where the ethical and animal health standards could be questionable. This would be a threat to our food security ─ we currently produce only 60 per cent of our food, a figure that has decreased substantially in the past two decades.

5. So is there a middle way? Research by Compassion in World Farming (CIWF) found that reducing meat consumption to three times a week would allow animals to be reared in free-range conditions and greener farming methods to be adopted. "Provided land is not overgrazed, longterm pasture traps carbon and therefore livestock farming can be a

benefit. The true cost of eating too much meat is animal suffering, environmental damage and obesity," says a CIWF spokesperson. "We have the power to save our planet and be kind to animals. All we need to do is change our diets to a healthier, fairer option."

Country Living, 2010

7. What conclusion about vegetarianism does paragraph 1 lead up to?
A. It has harmful side-effects people tend to overlook.
B. It is the lifestyle chosen by a growing group of people.
C. It may well contribute to improving our environment.
D. It will lead to a substantial increase in traffic worldwide.

8. Which of the following fits the gap in paragraph 3?
A. Besides
B. For example
C. Therefore

9. Aan welke organisatie kan elke van de volgende uitspraken gekoppeld worden?
Kies uit: *UN* (alinea 1), *The Vegetarian Society (VS)* (alinea 2), *World Wide Fund for Nature (WWF)* (alinea 3), *The National Farmers' Union (NFU)* (alinea 4), *Compassion in World Farming (CIWF)* (alinea 5).
1. If more and more people adopt a vegetarian lifestyle, Britain will increasingly have to rely on imported food.
2. One of the harmful consequences of meat production is that forests are cut down.
3. The production of meat and milk is more harmful to the environment than traffic.
4. The transport of vegetarian foodcrops damages the environment considerably.

Noteer achter elk nummer op het antwoordblad de juiste organisatie.
Let op: er blijft één organisatie over.

10. How does the author round off the article in paragraph 5?
A. by arguing that vegetarianism is the only solution to the problem
B. by presenting a compromise between two different approaches
C. by promoting a revolutionary new fix for the matter discussed
D. by quoting an expert who opposes the author's view on the matter

THE END ☺

Atheneum 4 English test term 3 KEY

Grammar (15 points)
Exercise 2 – conditionals 1,2 & 3
1. for invading
2. (for) taking
3. of manipulating
4. to alter
5. touching
6. to add
7. for making
8. to accept

Exercise 2 – conditionals 1,2 & 3
1. I wouldn't have dreamed of eating that cake …HAD + VOLT DW
2. If I were you …WOULD + INFINI
3. I'm sure she will never talk to him again …PRES SIMPLE
4. If it rains …WILL + INFINI

Exercise 3 – negative and tag questions
1. Didn't it/they?
2. Mightn't there?
3. Wouldn't I/shouldn't I

Vocabulary (18 points)
Exercise 1 Write down the correct words on your answer sheet. (5 points)
1. Uninhabited
2. Conservation/preservation
3. Protection
4. Inexhaustible
5. Renewable

Exercise 2 - Explain what these words mean in English. (5 points) WE LETTEN NIET OP GRAMMAR EN SPELLING
1. Anxious
2. Inexperienced
3. Permission
4. A guided walk
5. An oil well

Exercise 3 – Create meaningful and grammatically correct sentences with the following expressions. (8 points)
1. Mind's gone blank
2. In two minds
3. Give their word
4. Lost for words

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

Reading (20 points)
1. Waarom betalen mensen voor het planten van bomen? (Antwoord in het Nederlands) OMDAT ZE HUN VLUCHT WILLEN COMPENSEREN/OMDAT ZE IETS TERUG WILLEN DOEN VOOR HET MILIEU.
2. A. Yet
3. B. Reduce
4. A. Improve
5. Wat is er ironisch aan de hele situatie? (Paragraph 6) (Antwoord in het Nederlands) HET GEBRUIK VAN COMPUTERS IS OOK NOODZAKELIJK OM MILIEUPROBLEMEN IN KAART TE BRENGEN.
6. Worden er in de tekst methodes/mogelijkheden genoemd om de uitstoot van kooldioxide te verminderen door computers in te zetten? JA, ALINEA 3

Winds of Change
7. C. It is exploited by the local residents.
8. C. They pursue rather ambitious environmental goals.
9. B. paradox of
10. A. It finances and organises environmentally friendly projects.

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

Appendix D. Intrinsic Motivation Inventory

The following items concern your experience with the course. Please answer all items. For each

item, please indicate how true the statement is for you, using the following scale as a guide:

Not at all true   somewhat true   Very true

1   2   3   4   5   6   7

Interest/enjoyment

1. I enjoyed doing this activity very much.

2. This activity was fun to do.

3. I thought this was a boring activity. (R)

4. This activity did not hold my attention at all.(R)

5. I would describe this activity as very interesting.

6. I thought this activity was quite enjoyable.

7. While I was doing this activity, I was thinking about how much I enjoyed it.

Perceived competence

8. I think I am pretty good at this activity.

9. I think I did pretty well at this activity, compared to other students.

10. After working at this activity for a while, I felt pretty competent.

11. I am satisfied with my performance at this task.

12. I was pretty skilled at this activity.

13. This was an activity that I couldn't do very well. (R)

Pressure/tension

14. I did not feel nervous at all while doing this. (R)

15. I felt very tense while doing this activity.

16. I was very relaxed in doing these. (R)

17. I was anxious while working on this task.

18. I felt pressured while doing these.

Perceived choice

19. I believe I had some choice about doing this activity.

20. I felt like it was not my own choice to do this task. (R)

21. I didn't really have a choice about doing this task. (R)

22. I felt like I had to do this. (R)

23. I did this activity because I had no choice. (R)

24. I did this activity because I wanted to.

25. I did this activity because I had to. (R)

Value/usefulness

26. I believe this activity could be of some value to me.

27. I would be willing to do this again because it has some value to me.

28. I believe doing this activity could be beneficial to me.

29. I think this is an important activity.

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

Intrinsieke Motivatie Inventaris (IMI) (Dutch version)

Hieronder volgen 29 stellingen over de **opdrachten tijdens de lessen Engel**s in periode 3.
Omcirkel per stelling in hoeverre je jezelf in die stelling herkent. Er is geen goed of fout antwoord.

Naam:	Leeftijd:	Jongen/meisje
Klas:	Docent:	Leeringnummer:

	Helemaal <u>**niet**</u> mee eens			Beetje mee eens			Helemaal mee eens
1. Ik vind de opdrachten tijdens de lessen erg leuk om te doen.	1	2	3	4	5	6	7
2. Ik voel mij **niet** nerveus terwijl ik bezig ben met opdrachten.	1	2	3	4	5	6	7
3. Ik doe de opdrachten omdat ik het wil.	1	2	3	4	5	6	7
4. Ik geloof dat de opdrachten tijdens de lessen voor mij van waarde kunnen zijn.	1	2	3	4	5	6	7
5. Ik ervaar druk tijdens de opdrachten.	1	2	3	4	5	6	7
6. Ik denk dat ik best wel goed ben in de opdrachten die we tijdens de lessen doen.	1	2	3	4	5	6	7

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

	Helemaal **niet** mee eens			Beetje mee eens			Helemaal mee eens
7. Ik vind de opdrachten tijdens de lessen erg interessant.	1	2	3	4	5	6	7
8. Ik voel mij gespannen tijdens de lessen Engels.	1	2	3	4	5	6	7
9. Ik denk dat ik best wel goed ben in de opdrachten, vergeleken met andere leerlingen.	1	2	3	4	5	6	7
10. Ik had het gevoel dat het **niet** mijn eigen keus was om deze opdrachten te doen.	1	2	3	4	5	6	7
11. Het zijn leuke opdrachten om te doen	1	2	3	4	5	6	7
12. Ik ben ontspannen tijdens de opdrachten in de les.	1	2	3	4	5	6	7
13. Ik ben **niet** erg goed in de opdrachten tijdens de lessen.	1	2	3	4	5	6	7
14. Ik zou het nog wel eens willen doen, omdat het waardevol is voor mij	1	2	3	4	5	6	7
15. Ik heb **niet** echt een keuze om deze opdrachten te doen.	1	2	3	4	5	6	7
16. Ik ben tevreden met hoe ik het doe bij de opdrachten in de lessen.	1	2	3	4	5	6	7
17. Ik ben nerveus tijdens de opdrachten.	1	2	3	4	5	6	7
18. Ik vind de opdrachten erg saai.	1	2	3	4	5	6	7

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

	Helemaal **niet** mee eens			Beetje mee eens			Helemaal mee eens
19. Ik heb het gevoel dat ik doe wat ik wil doen terwijl ik bezig ben met de opdrachten.	1	2	3	4	5	6	7
20. Ik doe de opdrachten omdat dit moet.	1	2	3	4	5	6	7
21. Ik voel mij competent* bij het doen van opdrachten.	1	2	3	4	5	6	7
22. Ik geloof dat het doen van opdrachten voordelen voor mij kan hebben	1	2	3	4	5	6	7
23. Opdrachten houden mijn aandacht **niet** vast.	1	2	3	4	5	6	7
24. Ik heb voor mijn gevoel de keuze om opdrachten te doen.	1	2	3	4	5	6	7
25. Ik heb het gevoel dat ik de opdrachten moet doen.	1	2	3	4	5	6	7
26. Ik denk dat de opdrachten belangrijk zijn.	1	2	3	4	5	6	7
27. Ik vind het erg leuk om opdrachten te doen.	1	2	3	4	5	6	7
28. Ik doe de opdrachten omdat ik **geen** keuze heb.	1	2	3	4	5	6	7
29. Nadat ik enige tijd bezig ben met de opdrachten tijdens de lessen, voel ik mij best competent.	1	2	3	4	5	6	7

EFFECTIVENESS OF SEQUENTIALLY INCREASING LEARNER CONTROL

Interest/enjoyment: 1, 7, 11, 18, 19, 23, 27.

Perceived competence: 6, 9, 13, 16, 21, 29.

Pressure/tension: 2, 5, 8, 12, 17.

Perceived Choice: 3, 10, 15, 20, 24, 25, 28.

Value/Usefulness: 4, 14, 22, 26.

Appendix E. Logbook teacher

Beste naam docent,

Zoals afgesproken gaat u de komende weken aan de slag met leerlingen in twee verschillende condities. Mogelijk kunnen er lessen anders lopen dan afgesproken, of zijn er bijzonderheden over de lessen te vermelden. Om de uiteindelijke resultaten van dit onderzoek goed te kunnen interpreteren of te kunnen aanvullen, wil ik u vragen om na elke les onderstaande logboek in te vullen. In het logboek kunt u invullen welke les u heeft gegeven, aan welke klas en op welke datum en kort de gestelde vragen beantwoorden.

Wanneer u hier vragen over heeft kunt u altijd contact met mij opnemen op 06-49491176 of per mail: colingoudappel@hotmail.com.

Alvast bedankt!

Colin Goudappel

Logboek Docent		
Weeknummer of datum:	**Klas:**	**Controle/experimentele groep**
Bijzonderheden m.b.t. introductie van de les:		
Zijn er uitzonderingen gemaakt t.o.v. afspraken:	Ja/nee Zo ja, leg kort uit:	
Specifieke reacties leerlingen:		
Uw ervaring met deze les:		

Logboek Docent		
Weeknummer of datum:	**Klas:**	**Controle/experimentele groep**
Bijzonderheden m.b.t. introductie van de les:		
Zijn er uitzonderingen gemaakt t.o.v. afspraken:	Ja/nee Zo ja, leg kort uit:	
Specifieke reacties leerlingen:		
Uw ervaring met deze les:		

Appendix F. FETS

APPLICATION FORM FOR THE ASSESSMENT OF A RESEARCH PROTOCOL BY THE FACULTY ETHICS REVIEW BOARD (FERB) OF THE FACULTY OF SOCIAL AND BEHAVIOURAL SCIENCES

General guidelines for the use of this form

1. This form can be used for a single research project or a series of related studies (hereinafter referred to as: "research programme"). Researchers are encouraged to apply for the assessment of a research programme if their proposal covers multiple studies with related content, identical procedures (methods and instruments) and contains informed consent forms and participant information, with a similar population. For studies by students, the FERB recommends submitting, in advance, a research programme under which protocol multiple student projects can be conducted so that their execution will not be delayed by the review procedure. The application of such a research programme must include a proper description by the researcher(s) of the programme as a whole in terms of the maximum burden on the participants (e.g. maximum duration, strain/efforts, types of stimuli, strength and frequency, etc.). If it is impossible to describe all the studies within the research programme, it should, in any case, include a description of the most invasive study known so far.
2. Solely the first responsible senior researcher(s) (from post-doctoral level onwards) may submit a protocol.
3. Any approval by the FERB is valid for 5 years or until the information to be provided in the application form below is modified to such an extent that the study becomes more invasive. For a research programme, the term of validity is 2 years and any extension is subject to approval. The researcher(s) and staff below commit themselves to treating the participants in accordance with the principles of the Declaration of Helsinki and the Dutch Code of Conduct for Scientific Practices as determined by the VSNU Association of Universities in the Netherlands (which can both be downloaded from the FERB site on the Intranet[1]) and guarantee that the participants (whether decisionally competent or incompetent and/or in a dependent relationship vis-a-vis the researcher or not) may at all times terminate their participation without any further consequences.
4. The researcher(s) commit themselves to maximising the quality of the study, the statistical analysis and the reports, and to respect the specific regulations and legislation pertaining to the specific methods.
5. The procedure will run more smoothly if the FERB receives all the relevant documents, such as questionnaires and other measurement instruments as well as literature and other sources on studies using similar methods which were found to be ethically acceptable and that testify to the fact that this procedure has no harmful consequences. Examples of studies where the latter will always be an issue are studies into bullying behaviour, sexuality, and parent-child relationships. The FERB asks the researcher(s) to be as specific as possible when they answer the relevant questions while limiting their

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[1] See: https://intranet.uu.nl/facultaire-ethische-toetsingscommissie-fetc

answers to 500 words maximum per question. It is helpful to the FERB if the answers are brief and to the point.

6. **Our FAQ document that can be accessed through the Intranet provides background information with regards to any questions.**

7. The researcher(s) declare to have described the study truthfully and with a particular focus on its ethical aspects.

Signed for approval[2]:
Date:

A.   GENERAL INFORMATION/PERSONAL DETAILS

1. Name(s), position(s) and department(s) of the responsible researcher(s):
   a) Master-student: Colin Goudappel. Universiteit Utrecht, Educational Science.
   b) Dr. G. (Gemma) Corbalan. Docent Universiteit Utrecht, Educational Science.

2. Effects of sequentially increasing learner control on achievement and motivation
   - Single research study
   - Study for the final thesis in a master's degree course

3. Quasi experimental study.
The present research will compare an experimental group with a control group. The participants will be in the age of 15 to 16 and will participate in secondary education.
   - The experimental group will receive gradually more control on task selection.
   - The control group will receive no control over tasks: the teacher determines what students do during lessons.

4. No grant provider

5. Intended start and end date for the study:
Period 3 of secondary education: Start on 28 January, end on 15 April.

6. Research area/discipline:
Cognition, Learning, and Instructional Design in Education

7. For some (larger) projects it is advisable to appoint an independent contact or expert whom participants can contact in case of questions and/or complaints. Has an independent expert been appointed for this study?
No, because it is a single research study.

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[2] The senior researcher (holding at least a doctoral degree) should sign here.

8. Does the study concern a multi-centre project, e.g. in collaboration with other universities, a GGZ mental health care institution, a university medical centre? Where exactly will the study be conducted? By which institute(s) are the executive researcher(s) employed?.
There is one researcher (Colin Goudappel, student Educational Science) and one supervisor (dr. G. Corbalen). Both are connected with the Utrecht University. The study will be conducted in an secondary school or secondary vocational education.

9. Is the study related to a prior research project that has been assessed by a recognised Medical Ethics Review Board (MERB) or FERB?
No.

B.   SUMMARY OF THE BACKGROUND AND METHODS

Background
1. What is the study's theoretical and practical relevance? (500 words max.):
        Choice opportunities are intended to give learners control over their learning path and over their development of knowledge and skills (Corbalan, Kicken, & van Merriënboer, 2010). In general, teachers belief that offering choices positively affects achievement and motivation (Katz & Assor, 2006). Learner control gives learners an active role in their learning process and this active role could result in more engagement in learning (Carolan, Hutchins, Wickens, & Cumming, 2014). Research, however, shows mixed results of learner control (Carolan et al., 2014; Katz & Assor, 2006; Sorgenfrei & Smolnik, 2016). Because there are both advantages and disadvantages of offering choices, the debate over offering more learner control in classrooms has intensified in the last years (Carolan et al., 2014; Katz & Assor, 2006).
        Learners need self-regulated and metacognitive skills to be able to handle learner control (Granger & Levine, 2010). To put effort in learning and use this skills, it is necessary that learners are motivated (Zimmerman, 2000). Without motivation learners do not come in action (De Brabander & Martens, 2014). But learners also need an environment in which they could learn this skills. Teachers have to think about offering choices to learners, fitting the development of learner skills, to affect motivation and achievement.
        Sequentially increasing learner control is probably a good way to give learners the opportunity to learn dealing with this control and to develop the necessary self-regulated and metacognitive skills in a process (Paris & Paris, 2001).

2. What is the study's objective/central question?:
The leading question in the present study is: does sequentially increasing learner control on task selection lead to better learning than non-adaptive learner control? And how does this strategy affect students' motivation?

3. What are the hypothesis/hypotheses and expectation(s)?:
Sequentially increasing learner control on task selection lead to better learning than non-adaptive learner control and affects students' motivation positively.

        Design/procedure/invasiveness
        4. What is the study's design and procedure? (500 words max.):

Seventy-seven learners (37 males and 40 females) in the English course in a secondary education school in the Netherlands participated in this research. This choice depended on the accommodating school, also called a convenience sample (Callaert, 2006). This method diminished the possibility to generalize the results, but is seen as the most efficient method, given the costs, effort and time (Marshall, 1996). This method was chosen because of the short duration of this research. The English course included 16 lessons in 8 weeks and one exam week. The average age of participants was 15.9 years ($SD = 0.43$). The choice for this age was based on the starting development of SRL skills and independent study skills in this age (Bolhuis, 1996; Kitsantas & Cleary, 2016). To answer the research questions, the present research compared an experimental group ($n = 40$) with a control group ($n = 37$). A power analysis, using the G*power analysis program (Faul, Erdfelder, Lang, & Buchner, 2007), indicated that a total sample size of 55 participants would be needed to detect medium effects (Cohen's $d = .5$; Cohen, 1992) with 95% power ($1 - \beta$), using an analysis of covariance (ANCOVA) to compare the means of two groups, with one covariate and an alpha of .05 (two tailed; Faul, Erdfelder, Buchner, & Lang, 2009). Therefore, the sample size of $N = 77$ will be adequate for the main objective of this study (Cohen, 1992). Males and females were evenly distributed over both groups. All participants in the experimental group ($n = 40$) and half of the participants in the control group ($n = 17$) received education from one teacher and the other half of the participants in the control group ($n = 20$) received education from another teacher. A quasi-experimental design was used because the assignment of learners to one of the conditions was synchronized with the existing classroom group classification for organizational reasons. All participants received a factual knowledge test before and after the course and received a questionnaire to measure intrinsic motivation before and after the course.

Two weeks before the start of the course the parents of the learners will be informed and asked to fill in a form if they do agree with the participation of their child (Appendix C).

At the start of the course all learners will receive verbal information about the course goals, knowledge tests, they will fill in the Intrinsic Motivation Inventory (IMI) and will do a factual knowledge test. Learners will not be informed about the different conditions and the hypothesis, because this could affect the results (Neuman, 2014).

All learning tasks will be carefully developed by the teacher. In the control group, the teacher will determine for all learners when, how and in which order these learning tasks are used during the lessons. All learners will follow this program in the same order and have no control over task selection.

In the experimental group, the teacher will make a preselection of learning tasks for each lesson. This preselection will be the same for all learners. In the beginning of the course learners will be able to choose between two tasks. During the next lessons learners will be able to choose from gradually more tasks, to a maximum of 4, to increase the autonomy and perceived control and deliberation (Corbalan et al., 2009; Schwartz, 2004). Offering more options does not contribute to better choices and satisfaction (Schwartz, 2004) and learners could even be overwhelmed and demotivated by a (too) high amount of choices (Corbalan et al., 2009). The learning tasks will differ in surface features (i.e. irrelevant aspects of the learning tasks concerning the goals), content and the amount of difficulty (i.e. depending on the course material and course purposes) (Corbalan et al., 2009; Sorgenfrei & Smolnik, 2016). Research has shown that differences between choice opportunities positively affects the perception of control and involvement in learning (Corbalan et al., 2009).

All other aspects of the lessons, like introductions, information about the program and homework, are the same for both conditions. After the course all learners make a factual knowledge test and fill in the IMI.

5. Which measurement instruments, stimuli and/or manipulations will be used?[3]:

Factual knowledge tests. The first test contained 52 questions and examined the prior knowledge of the participants concerning all topics of the English course (Appendix D). All questions were semi-open; learners had to choose the correct syntax, a correct form of verbs, fill correct prepositions to complete the sentence and choose correct endings for phrases from a list. Two examples items are: "Put in the correct preposition: do you like to try ... new food when you're on holiday or do you prefer to play safe?" (Correct answer is 'out') and "Complete the sentence with the correct form of the verb: recently green groups suggested ... (turn) the old KTM railway corridor into a nature trail" (correct answer is 'turning'). Five items were not included in the analysis, because the proportion of participants who gave a correct answer was very low or very high. The item difficulty value (p) of these items was $p < .02$ and $p > .98$. Two of these items were too difficult: the questions could be interpreted as misleading; three items were too easy. Eleven items had a negative item-total correlation. On these items well-performing learners scored lower than expected and badly-performing learners scored higher than expected, based on the total score. For this reason these items were excluded from the analysis. The maximum test score was 36 points (mean score = 22.52, SD = 4.66). Cronbach's

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[3] Examples: invasive questionnaires; interviews; physical/psychological examination, inducing stress, pressure to overstep important standards and values; inducing false memories; exposure to aversive materials like a unpleasant film, video clip, photos or electrical stimulus; long-term of very frequent questioning; ambulatory measurements, participation in an intervention, evoking unpleasant psychological or physical symptoms in an experiment, denial, diet, blood sampling, fMRI, TMS, ECG, administering stimuli, showing pictures, etc. In case of the use of a device (apparatus) or administration of a substance, please enclose the CE marking brochure for the relevant apparatus or substance, if possible.

alpha for the 36 items of the first test was .71. Because the diversity of constructs being measured (grammar, conjugate verbs, vocabulary) the internal consistency was seen as sufficiently reliable (Field, 2013).

The second knowledge test consisted of 39 questions (Appendix E). The first 25 questions could yield one point and the last 14 questions could yield 2 points. This second test was relevant for learners because it contributed to their scorecards. The test consisted of open, semi-open and multiple choice questions. Two example items are: "Come up with an appropriate end to these sentences: If I were you ..." and "Explain in English what this word means: Anxious". Seven items were excluded from the analysis because they had a negative item-total correlation. Most of these items asked for creativity, besides their English Language skills. Cronbach's alpha for the 32 items of the second test was .71 and therefore the internal consistency of this test was seen as sufficiently reliable (Field, 2013). The maximum test score was 45 points (mean score = 27.74, SD = 6.42).

Motivation survey. To measure intrinsic motivation a Dutch translation of the IMI was used (See Appendix A; Intrinsic Motivation Inventory, n.d.). This instrument was chosen because it also measures perceived choice, an important feature of this research. In previous research this instrument has a high reliability (Cronbach's α =.78) and validity (McAuley, Duncan & Tammen, 1989). The instrument assesses perceived interest/enjoyment, feelings of competence, value/usefulness, felt pressure and tension and perceived choice. According to Deci and Ryan (Intrinsic Motivation Inventory, n.d.), the interest/enjoyment part is the most important part of the IMI, because this is the most direct measurement of intrinsic motivation. Perceived choice and perceived competence are seen as positive predictors and perceived pressure and

tension are seen as negative predictors of intrinsic motivation. The questions of value/usefulness could measure the amount of perceived value.

29 statements were randomly organized and measured with a 7-point rating scale, rating from 1 (not at all true) to 7 (very true). The reliability of the IMI in this research was examined with Cronbach's α. The IMI as a whole was found to be very reliable with α = .87 (Field, 2013). Also each construct has a high reliability; interest/enjoyment (α = .87), perceived competence (α = .91), pressure/tension (α = .82), perceived choice (α = .86) and value/usefulness (α = .81) (Field, 2013).

Logbook teachers. The teachers were asked to write some comments after each lesson about how the learning tasks were introduced to the participants, possible exceptions, particular reactions of learners and their experience with this lesson (Appendix B). This logbook was developed to remember particular situations and to interpret, complement or discus the findings (Halem, 2008).

a. What does the study's burden on the participants comprise in terms of time, frequency and strain/efforts?:

Students: fill in the motivation questionnaire two times and one extra factual knowledge test at the start of the course.

Both conditions are common in secondary education schools. Most school teach their students in one of the designed conditions. In previous research this conditions are not compared.

b. Will the participants be subjected to interventions or a certain manner of conduct that cannot be considered as part of a normal lifestyle?:
No.

c. Will unobtrusive methods be used (e.g. data collection of uninformed subjects by means of observations or video recordings)?:
No.

d. Will the study involve any deception? If so, will there be an adequate debriefing and will the deception hold any potential risks?:
No.

6. Will the participants be tested beforehand as to their health condition or according to certain disorders? Are there any inclusion and/or exclusion criteria or specific conditions to be met in order for a participant to take part in this study?:
   No.

7. Risks for the participants -
   a.   Which risks does the study hold for its participants?:
Both conditions are common in education, but not both available in one school. The greatest risk is that learners in one condition learn less than in the other condition.
   b.   To what extent are the risks and objections limited? Are the risks run by the participants similar to those in daily life?:
Yes, the risks are not higher than in normal educational situations.

8. How does the burden on the participants compare to the study's potential scientific contribution (theory formation, practical usability)?:
The risks are limited and the outcomes of this study could be of great importance to teachers and it fills a gap in the research because there is no concrete possibility to clarify the mixed results on learner control to motivation and achievement.

9. Will a method be used that may, by coincidence, lead to a finding of which the participant should be informed?[4] If so, what actions will be taken in the case of a coincidental finding?:
No. The findings will be general analytics of average scores.

Analysis/power
10. How will the researchers analyse the data? Which statistical analyses will be used?:
   The data will be analyzed with the statistical program SPSS. To answer the question

'does sequentially increasing learner control on task selection lead to better learning than non-

adaptive learner control?', the total scores of the factual knowledge tests will be used. To answer

the question 'does sequentially increasing learner control on task selection lead to better learning

than teacher controlled education?', the total scores of the factual knowledge tests were used. As

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[4] For instance: dementia, dyslexia, giftedness, depression, extremely low heartbeat in an ECG, etc. If

coincidental findings may be found, this should be included in the informed consent, including a description of the

actions that will be taken in such an event.

no serious violations of assumptions were found, is was decided that ANCOVA could be used. The pre-test was used to test whether there was a difference in prior knowledge between the groups before the start of the course. The post-test was used to compare the control and the experimental group, with the pre-test as a covariate. The hypothesis was deemed to be confirmed if learners in the experimental group would score significantly higher on the last knowledge test than learners in the control group, controlled for the pre-test ($p < .05$).

Similar quantitative analyses were performed to address the second question. To answer the question 'Does sequentially increasing learner control influence learners' intrinsic motivation?', the perceived answers on the IMI's were compared between the experimental and control condition. The scores of the statements 2, 8, 10, 11, 15, 18, 20, 24, 28, 29 were reversed, because they asked for an opposite answer concerning the concept. Because each construct required a different amount of questions, the average score for each learner on each concept was calculated. To conduct an ANCOVA the dependent variable must be measured on interval scale. Because the distance between each point of the 7 point scale is approximately the same, the mean scores could be interpreted as an interval variable (Field, 2013). An ANCOVA was conducted for the five different parts of motivation (interest/enjoyment, perceived competence, pressure/tension, perceived choice and value/usefulness). The first questionnaire was used as a covariate and the second questionnaire was the dependent variable in the ANCOVA. Findings of a two tailed test were considered significant at the .05 level of significance.

11. What is the number of participants? Provide a power analysis and/or motivation for the number of participants. The current convention is a power of 0.80. If the study deviates from this power, the FERB would like you to justify why this is necessary:

A power analysis, using the G*power analysis program (Faul, Erdfelder, Lang, & Buchner, 2007), indicated that a total sample size of 55 participants would be needed to detect medium effects (Cohen's $d = .5$; Cohen, 1992) with 95% power ($1 - \beta$), using an analysis of covariance (ANCOVA) to compare the means of two groups, with one covariate and an alpha of

.05 (two tailed; Faul, Erdfelder, Buchner, & Lang, 2009). Therefore, the sample size of $N = 77$ will be adequate for the main objective of this study (Cohen, 1992)

C.   PARTICIPANTS, RECRUITMENT AND INFORMED CONSENT PROCEDURE

1. The nature of the research population (please tick):

> **1. General population without complaints/symptoms**
> 2. General population with complaints/symptoms
> 3. Patients or population with a diagnosis (please state the diagnosis)

2. Age category of the participants (please tick):

- 18 years or older
- **16-17 years**
- **13-15 years**
- 12 years or younger

The average age of participants was 15.9 years ($SD = 0.43$).

3. Does the study require a specific target group? If so, justify why the study cannot be conducted without the participation of this group (e.g. minors):
No.

4. Recruitment of participants -

> **a.** How will the participants be recruited?:

The researcher will contact schools and teachers. All the learners in 4 groups of the founded teacher will participate in the research, except if their parents do not agree).

> **b.** How much time will the prospective participants have to decide as to whether they will indeed participate in the study?

Two weeks.

5. Does the study involve informed consent or mutual consent? Clarify the design of the consent procedure (who gives permission, when and how). Does the study involve active consent or passive consent? If no informed consent will be sought, please clarify the reason:
Yes, active consent. Two weeks before the start of the course the parents of the learners will be informed over this research and enabled to fill in a form if they do of do not agree with the participation of their child in this research.

6. Are the participants fully free to participate and terminate their participation whenever they want and without stating their grounds for doing so?:
Yes.

7. Will the participants be in a dependent relationship with the researcher?:
No.

8. Compensation

   a. Will the participants be compensated for their efforts? If so, what is included in this recompense (financial reimbursement, travelling expenses, otherwise). What is the amount?

No compensations.

   b. Will this compensation depend on certain conditions, such as the completion of the study?

No.

D.   PRIVACY AND INFORMATION

1.

   a. Will the study adhere to the requirements for anonymity and privacy, as referred to in the Faculty Protocol for Data Storage[5]?:

- anonymous processing and confidential storage of data (i.e. storage of raw data separate from identifiable data): **yes**/no
- the participants' rights to inspect their own data: **yes**/no
- access to the data for all the researchers involved in the project: **yes**/no

     If not, please clarify.

   b. Has a Data Management Plan been designed?

Yes.

2.

   a. Will the participant be offered the opportunity to receive the results (whether or not at the group level)?:

Yes.

   b. Will the results of the study be fed back to persons other than the participants (e.g. teachers, parents)?:

     No.

       If so, will this feedback be provided at the group or at the individual level?

3.

   a. Will the data be stored on the faculty's data server?: **yes**/no

   b. Will the data that can be traced back to the individual be stored separately on the other faculty server available for this specific purpose?:

     No.

     If not, please clarify where will the data be stored instead?:

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[5] This can be found on the Intranet: https://intranet.uu.nl/wetenschappelijke-integriteit-facultair-protocol-dataopslag

E.   ADDITIONAL INFORMATION

-

F.   FORMS TO BE ENCLOSED (CHECKLIST)

- Text (advert) for the recruitment of participants
- Information letter for participant
- Informed consent form for participants
- Written or oral feedback information (debriefing text)
- (Descriptions of) questionnaires
- (Descriptions of) Literature/references
- measurement instruments/stimuli/manipulations

Signature(s):[6]   Date and place: January, 2019

Name, position: Colin Goudappel-Fokker, Student (F132557)

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[6] The senior researcher (holding at least a doctoral degree) should sign here.

Appendix G. VSNU: 3 dilemma's

Drie dilemma's in de huidige studie worden toegelicht vanuit de VSNU code.

Dilemma 1: Onderdeel III van VSNU. Controleerbaarheid

Definitie: gecontroleerd kunnende worden. Controleren: toezicht oefenen op enig beheer, beleid, gedrag, op een werking of werkzaamheid; nagaan, nazien (of iets klopt, of het zo is)].

Handelen is controleerbaar als het voor anderen mogelijk is om na te gaan of het voldoet aan relevante maatstaven (bijvoorbeeld van kwaliteit of fatsoen).

Huidige dilemma: De uitvoering van beide condities is afhankelijk van de betreffende docent. Het is slecht na te gaan in hoeverre deze condities uitgevoerd zijn zoals afgesproken. Daarnaast hebben scholen behoefte aan duidlijkheid met betrekking tot hun aanpak en zouden graag resultaten van mijn onderzoek willen zien. Dit zou de houding van een docent, en daarmee de onderzoeksresultaten kunnen beinvloeden.

Mijn aanpak: Zelf aanwezig zijn bij de kennistoetsen en afname van de motivatievragenlijst en daarmee invloed uitoefenen op de manier waarop er gecommuniceerd wordt richting beide condities, zodat hier geen verschil in zit tussen de condities.

Dilemma 2: Onderdeel V van VSNU. Onafhankelijkheid

Definitie: Van niemand afhankelijk, aan niemand ondergeschikt of onderworpen, in doen en laten door niemand beperkt; niet in iemands macht of te zijner beschikking staande; niet door iets bepaald of geregeld worden.

Bij de presentatie van inzichten als juist en relevant is een wetenschapsbeoefenaar onafhankelijk als hij zich daarbij alleen laat beïnvloeden door het oordeel van anderen in de mate waaraan aan dat oordeel wetenschappelijke autoriteit toekomt

Huidige dilemma: In de huidige studie is beschreven dat het onderzoek uitgevoerd gaat worden op een middelbare school, echter heeft een MBO school aangegeven veel problemen te hebben met de huidige vraagstelling in hun dagelijkse praktijk. Dit maakt het praktisch relevant en interssant om de studie op deze school uit te voeren. Het vraagt wel aanpassingen in het theoretisch kader: wijziging van argumantatie voor doelgroep. Dit is mogelijk, maar is dit etisch.

Mijn aanpak: Gezien deze wijzing naast de praktische relevantie, ook vanuit de literatuur is te legitimeren is sta ik open voor deze wijziging.

Dilemma 3: Onderdeel IV van VSNU. Onpartijdigheid

Definitie: Onvooringenomen, niet door persoonlijke belangen, voorkeur of genegenheid zich bij zijn oordeel latende leiden.

Een wetenschapsbeoefenaar is onpartijdig als hij zich bij zijn oordeelsvorming en beslissingen niet laat leiden door persoonlijke belangen, voorkeur, genegenheid of vooroordeel

Huidige dilemma: De meewerkende scholen zitten verlegen om nieuwe inzichten en willen graag input ontvangen vanuit mijn onderzoek. Zij hopen op positieve onderzoeksresultaten. Het zou kunnen dat zij mij hierin willen aansturen.

Mijn aanpak: Ik ben onpartijdig en onafhankelijk van de scholen en hun doelstellingen. Voor mij maakt het niet uit welke onderzoeksresultaten uit de huidige studie voortvloeien. Om deze reden verwacht ik niet dat dit onderzoek in de praktijk ter discussie zal staan.