

# Word Score: A serious vocabulary game for primary school underachievers

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**Abstract** This paper describes a study of “Word Score”, a serious game designed to extend the vocabulary of pupils in upper primary school in the Netherlands. Word Score was used in one school community as part of the national project “Educational Time Extension” (ETE). In ETE class time is extended beyond normal school hours with the aim of improving the learning outcomes of under-performing pupils. The study showed that the use of Word Score can be effective during ETE. The vocabulary of the pupils who played the game outside the regular class time significantly increased. The experiences of both pupils and teachers were very positive. The pupils liked playing Word Score and the teachers were very enthusiastic about the game and the pupils’ results.

**Keywords** Serious games · Vocabulary education · Primary education · Underachievement

## 1 Introduction

### 1.1 Word Score

Word Score is an online serious game with supporting educational materials. It is designed to extend the vocabulary of pupils in primary schools aged 10–12 in a playful way. The design of the game and the associated materials is based on Verhallen and Verhallen’s (1994) model in which new words are presented in four

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stages: activating previous knowledge, explaining new words, consolidating (practising) the new words and testing to see if the new words have become part of every-day vocabulary. While playing the game, pupils encounter about 400 words related to soccer. There are words that are very specific to soccer/sport such as stadium, penalty, and referee, but there are also words that can be used in other contexts such as journalist, crowd, and administration. The entire game, covering the 400 words and the accompanying lessons, occupy teachers and pupils for about 15 h.

The game starts at a meeting with the general manager of the Dutch professional soccer club FC Twente. He has to leave suddenly and the pupil has to take over the manager's job to ensure that the soccer match can go ahead that night—see Fig. 1a. As the pupil takes a virtual walk around the stadium, he/she finds different mini games. Success in these games allows the pupil to enter new areas of the stadium where, eventually, they find the 400 words. During the games the pupils are tested to see if they know the meaning of the words. Apart from the word itself and the meaning of the word, there is also a video or a picture of the word—see Fig. 1b. This ensures that the pupil has a visual image of the meaning of the word; this is very important for children with a limited vocabulary.

The development of Word Score was initiated by the FC Twente “Scoring in the Community” Foundation. The Foundation was established because the soccer club believed that it should engage with society, especially in the immediate vicinity of the stadium, in order to enhance solidarity between all the “neighbours in the community”. One of the projects that the Foundation initiated was Word Score, the aim being to address the vocabulary deficiencies of pupils living near the stadium in lower socio-economic status homes. The Foundation invited the University of Twente to assess the educational value of the game and to evaluate its use in practice.

**Fig. 1** a The start of the game. b Giving meaning to words



Smit (2008) reports that Word Score has been piloted twice. The first pilot in 2008–2009 was designed to gain experience with Word Score on a small scale (77 pupils). The evaluation of the first pilot showed that Word Score reflected the educational perspective of the teachers (“Vocabulary” is a separate subject within language teaching and words have to be practised repeatedly) and it also showed that the teachers were positive about the game. However, it was also clear that pupils were given insufficient opportunity to rehearse the knowledge and skills that Verhallen and Verhallen (1994) highlight. The first pilot demonstrated that further in-service training was needed in order to explain the model in detail and to explain the learning activities that the pupils were expected to complete. The evaluation of the first pilot also showed that pupils could work independently with the game and were enthusiastic about it. The boys appeared to be motivated by the context (FC Twente and soccer), while the girls liked the language-related aspects of the game. The second pilot (2009–2010) with 249 pupils demonstrated that Word Score has a positive effect on pupil vocabulary. Pupils and teachers were, once again, enthusiastic about the game.

This paper presents the results of a study in 2011 in which Word Score was used in the context of a national project called Educational Time Extension (ETE). As part of ETE class time is extended beyond normal school hours with the aim of improving the learning outcomes of under-performing pupils.

## 1.2 Educational time extension

This study was initiated by the director of a group of community schools in Enschede, the home-base of FC Twente. The schools in this community have a relatively high population of pupils who underachieve at school in both reading and mathematics. As a consequence the schools are participating in the Dutch Ministry of Education’s national Education Time Extension project. As part of the project primary schools, secondary schools and the municipality work together to combat underachievement by a) focusing on upper primary pupils who are underperforming and/or suffer from educational disadvantage, b) extending the regular teaching time in primary schools, and c) improving the transition from primary to secondary education. The extension of regular teaching time in primary schools is primarily focused on extra time for reading and mathematics. This is realized through summer schools, weekend schools and extensions to the normal school day. Pupils are selected to participate in ETE either because they achieved a low score on literacy and mathematics tests or because they have been assessed as underachievers who have the potential to become high achievers.

## 2 Theoretical framework

Leemkuil (2006) suggests that games are competitive, situated, interactive learning environments based on a set of rules and/or on an underlying model. Working within certain limitations and conditions, players set out to achieve a challenging goal. In other words, a game has a purpose and a set of rules that provide a framework that enables a goal to be achieved. Juul (2003) argues that the outcome of a game is

variable and may be assigned different values. Consequently, the player makes an effort to influence the outcome and feels emotionally attached to that outcome. Games can be very attractive to students and can often keep them focused and concentrating for long periods of time.

The enormous impact of commercial games has attracted significant interest from educators and researchers in the Educational Science and Technology research area (Kirriemuir and McFarlane 2004). Analysis of the impact of games in education has found that games can promote higher order learning, such as an increase in meaningful dialogue between students (McDonald and Hannafin 2003), and that games can have an effect on social skills (Kirriemuir and McFarlane 2004). However, as Kirriemuir and McFarlane (2004) claim, the research evidence for the impact of games on learning is complex and has not been fully explored. Research evidence for the impact of games on motivation is more widely reported. One of the most important characteristics of games is that they are intrinsically motivating. Learners are said to be intrinsically motivated when their engagement arises from personal interest (Verloop and Lowyck 2003) and this is achieved by giving them a sense of control. That sense of control comes from having clear goals, immediate feedback, and an environment in which the learner can fully concentrate on the task with effortless engagement.

Research has shown that the challenge to solve cognitive puzzles is the main motivation for playing games (Bom 2011). The challenge of a game is to overcome obstacles and hurdles in pursuit of a goal; the challenges may be visible (explicit) or hidden (intrinsic) or both. Visible challenges include tasks that the player must perform. Intrinsic challenges include the discovery of the particular rules of the games, the opportunities it provides, the constraints it imposes and the strategies that it permits. In order to overcome the visible challenges players must first master the hidden ones and this, in turn, requires the player to create a mental model of the obstacles built into the game. Learning in this environment is active, complex, and learner-centred. Challenges may seem frustrating at first, but they can lead to high levels of concentration (Boyan and Sherry 2011a). In addition, Hirumi et al. (2010) claim that if a player overcomes the challenges and enjoys playing the game he or she will make an effort to play more frequently and at a higher level.

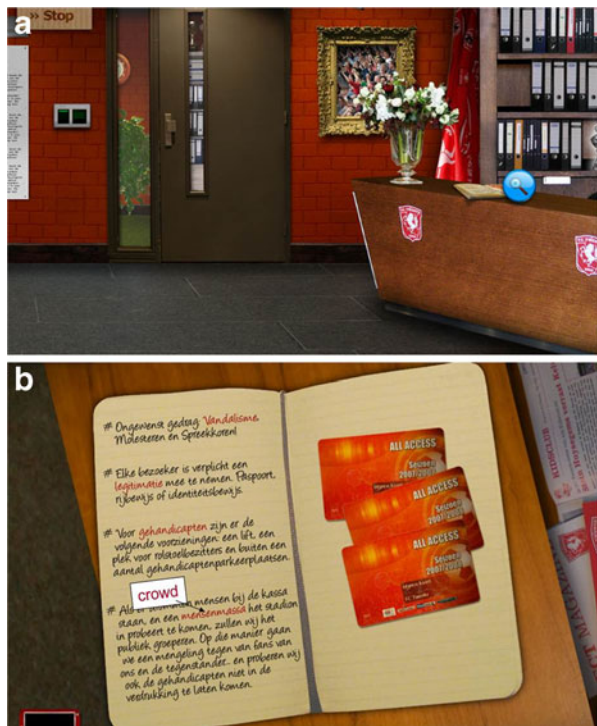
Bom (2011) suggests that there are many different games and different ways to classify them. Meyer (2009), for example, distinguishes between three categories of games that can be used in education: a) games that are based on learning theories that are free of a specific didactical approach and which can be used without the intervention of a teacher, b) games in which learning theory is used to shape a particular didactical approach and where some help is required from a teacher, and c) games which are not designed for educational use but which may be used for educational purposes. Kebritchi and Hirumi (2008) categorize games according to the underlying instructional theory. They identify five instructional theories: direct instruction, experiential learning, discovery learning, situated learning and constructivism. In games based on direct instruction the player is told exactly what to do. Players of games based on experiential learning learn by gaining experience while performing tasks. With discovery learning players learn as they explore a game and create goals, or missions, for themselves. Situated learning is associated with games that are highly contextualised. Constructivism draws attention to the role of the

learner in constructing their own knowledge; the term is linked to games where the player is, to some extent, involved in game design.

Bom (2011) explored the use of serious gaming for vocabulary education. She concluded that games based on any of the instructional theories mentioned above could be appropriate as long as several key features were present. The key features are: the provision of corrective feedback to the player, an appropriate level of interaction with the player and the use of dialogue within the game. Players must not only learn the meaning of words, but must also use them in dialogue and interaction with the various characters in the game. Corrective feedback is needed to ensure that pupils learn the correct meaning of each word. When evaluating Word Score, Bom (2011) classified it as an adventure game; at the start a story is presented and players then go on to explore the environment created by the game (see Fig. 2a). During their explorations players encounter challenges, in the form of mini games, which they have to overcome. The instructional theory underpinning the game is discovery learning because players are expected to discover what to do and how to do it. Guidance is built into the program—players get immediate feedback as they play (see Fig. 2b).

Some of Bom's (2011) requirements for a language game are only partially met in Word Score: there is no dialogue in the game (players listen to the manager and the soccer players, but do not communicate with them); there is corrective feedback, but only as "right" and "wrong". The game provides a clear structure and explicit goals; pupils, as players, are fascinated by the story and the characters. Their challenge is to find all the words (the visible challenge), to understand the rules of the game and to

**Fig. 2** **a** Exploring the environment. (Note the magnifying glass that is available for the player to use). **b** Discovering what to do. (Explanations are available for key words)



discover the order in which the embedded games have to be played (the intrinsic challenges). Against this assessment Bom (2011) concluded that Word Score was, at least in theory, a serious game for vocabulary education.

### 3 Research questions

In order to evaluate the effectiveness of Word Score in practice the following research question was formulated:

“To what extent can Word Score, when used as a serious game within Educational Time Extension, extend the vocabulary of pupils in grades 4–6?”

Three subsidiary questions were also formulated:

1. What is the effect of Word Score on the vocabulary of the pupils who participate in Educational Time Extension?
2. What are the experiences of teachers in relation to the game and Educational Time Extension?
3. What are the experiences of pupils in relation to the game and Educational Time Extension?

### 4 Method

#### 4.1 Research design

The purpose of the study was to investigate the extent to which Word Score, when used as a serious game, increases pupil vocabulary when used as a component of Educational Time Extension. A quasi-experimental approach was adopted. Word Score (the intervention) was used with two experimental groups but not with a control group. Pupils were placed in the three groups on the basis of prior educational achievement. Pre and post intervention measurements were made; the study also assessed users' experiences with Word Score, the support they received, the time they spent using it and details of the location.

#### 4.2 Respondents

The respondents in the study were pupils, teachers and supervisors. Pupils were split into three groups: pupils who played the game and participated in ETE (experimental group A), pupils who played the game during normal class time (experimental group B), and pupils who were in the same class as experimental group A but neither played the game nor participated in ETE (the control group). The children were drawn from five primary schools in Enschede. Supervisors and teachers formed the second group of respondents; the role of both teachers and supervisors was to guide pupils while they played the game. Table 1 summarizes the respondents by category.

Table 2 details the number of pupils by school and age (grade). Table 2 also identifies the criteria that were used to select pupils for the ETE programme.

**Table 1** Summary of respondents by category

N	Respondents	
46	Pupils	ETE: experimental group A
36	Pupils	Word Score in regular class time: experimental group B
60	Pupils	No ETE: control group
2	Supervisors	Only present during ETE
6	Teachers	Present during teaching time and ETE
2	Teachers	Present during regular class time

### 4.3 Instruments

Classroom observation, a vocabulary test, teacher interviews and a pupil attitude questionnaire were all used to collect data for the study.

In order to assess the effect of Word Score the pupils took a previously developed vocabulary test as both a pre-test and a post-test. The test's Cronbach alpha reliability coefficient was .87 when used originally and was .85 in this study. De Vellis (2003) suggests that a reliability coefficient above .80 is very good. Table 3 gives some examples of the questions in the test.

The pupils also completed a questionnaire concerning their attitude towards a) Word Score (Cronbach's  $\alpha = .82$ ), b) ETE ( $\alpha = .72$ ), c) language/vocabulary education ( $\alpha = .72$ ) and d) school ( $\alpha = .77$ ). The questions about language/vocabulary education and school have been used in previous studies of Word Score; they measure attitudes using 4-point Likert scales. The items concerning ETE and Word Score were developed by the research team in a similar way; these items were only included in the post-intervention questionnaire. The pupils in the control group did not answer the

**Table 2** The number of respondents by school, group and selection criteria

School	Grade (age)	Number of pupils (experimental groups A & B)	Number of pupils (control group)	Supervision	Selection criteria
School A	5 (10–11)	12	12	Teacher grade 5	Low score on national vocabulary test
School A	6 (11–12)	12	6	Teacher grade 6	Low score on national vocabulary test
School B	4 (9–10)	16	–	ICT coordinator & Teacher grade 4	No ETE but regular class time
School B	5 (10–11)	20	–	ICT coordinator & Teacher grade 5	No ETE but regular class time
School C	6 (11–12)	6	17	ICT coordinator & Teacher grade 6	“High-potential”
School D	6 (11–12)	9	8	Teacher grade 6	“High-potential”
School E	5 (10–11)	7	17	ICT coordinator	Low score on national vocabulary test
Total	–	82 pupils	60 pupils	8 supervisors	

**Table 3** Examples of questions in the vocabulary test

Question type	Question	Possible answers
Missing word	The ... of a club provides money for new competition outfits	(A) coach (B) scout (C) sponsor (D) soccer player
Connecting	Commercial Polite Construction	The way something is build Making a profit Having good manners
Meaning	What are emotions?	(A) Feelings (B) Issues (C) Activities (D) Commotion
Description	Where you go to get inside the stadium:	(A) Entrance (B) Admission (C) Presentation (D) Premiere

questions about ETE and Word Score, as they did not participate in these activities. On the questionnaire statements such as “I like school” and “I’m good at learning words” were scored on the scale ‘strongly agree’, ‘agree’, ‘disagree’ or ‘strongly disagree’. The questionnaire was administered twice and at the same time as the vocabulary pre-test and post-test.

Word Score implementation and use was evaluated by checklist-based classroom observation. The observation checklist had sections focusing on teachers, pupils and technology. Statements within each section could be checked “Yes” or “No”—for example, “The teacher helps pupils who ask questions”, “Pupils ask the teacher for help”, “Pupils encounter technical problems”. The first observation was carried out during the first Word Score session and the final observation was carried out during the final Word Score session.

The supervisors and teachers of ETE were interviewed. The semi-structured interviews covered a number of topics: ETE, using games in education, the importance of vocabulary education, and the impact of Word Score.

#### 4.4 Procedure

The project started with the vocabulary pre-test and the attitude questionnaire. Pupils in the experimental group played Word Score for 4 weeks, either once a week for 2 h or twice a week for 1 h. While playing the game the pupils were observed at least three times. After 4 weeks all pupils completed the post-test and the supervisors and teachers were interviewed.

The responses of the vocabulary test and the attitude questionnaire were analysed using SPSS. t-tests were used to examine the pre-intervention differences between the two experimental groups and the control group. t-tests were also used to make post-

intervention comparisons, including an assessment of the changes in pupil vocabulary.

The observations from each school were compared in order to get an overview of practice. All comments were transcribed and important points were summarized. The interviews with the teachers and supervisors were recorded and analysed using a concept-clustered matrix (Miles and Huberman 1994). The matrix rows identify the interview topics, the columns identify the respondents, and the cells provide a brief summary of the responses.

## 5 Results

### 5.1 Impact on pupil vocabulary

The results from the vocabulary test were analysed in order to assess the impact of Word Score on pupil learning. The experimental groups included all the pupils who played the game; the control group consisted of the pupils who did not play the game. The t-tests, detailed in Table 4, show that the vocabulary of the pupils in the experimental group improved significantly, but the vocabulary of the control group did not.

Looking in more detail, the data in Table 4 show that it was the pupils in the ETE group who made significant progress as measured by the vocabulary test. Whilst the pupils in the “Regular class time” group also made progress it was not statistically significant.

Table 4 also shows that the control group had a higher pre-test score than the experimental group. We therefore examined the change in vocabulary for each group; the results are presented in Table 5.

Table 5 shows that there is no significant difference between the experimental group as a whole and the control group. What is more, there is no significant difference between the two experimental groups. There is, however, a significant difference between the ETA group and the control group; this is discussed later.

Changes in vocabulary scores were also explored for pupils of different ages who used Word Score. Table 6 shows that older pupils did better than younger ones; pupils in grades 5 and 6 made significant progress but those in grade 4 did not.

**Table 4** Vocabulary test scores for pupils in the experimental and control groups

Group	N	Average number of correct answers on the test		Standard deviation		t	df	Significance (1-sided)	Cohen's d
		<i>pre</i>	<i>post</i>	<i>pre</i>	<i>post</i>				
Experimental group	82	26.77	29.13	6.639	7.757	-2.098	162	0.019 <sup>a</sup>	0.3
Regular class time	36	23.47	24.81	5.256	7.147	-0.902	70	0.185	0.1
ETE	46	29.35	32.52	6.509	6.470	-2.346	90	0.011 <sup>a</sup>	0.5
Control group	60	30.12	31.53	6.298	6.419	-1.220	118	0.113	0.2

<sup>a</sup> Significant difference

**Table 5** Between groups comparison of changes in vocabulary

Group	N	Average growth <sup>b</sup>	Compared with	Standard deviation	t	df	Significance (1-sided)
Experimental	82	2.38	Control	0.881	1.243	140	0.108
ETE	36	3.20	Control	0.924	2.070	104	0.021 <sup>a</sup>
Regular class time	46	1.33	ETE	1.218	1.529	80	0.065
Control	60	1.28	Regular class time	1.126	0.044	94	0.483

<sup>a</sup> Significant difference<sup>b</sup> post-test score minus pre-test score

## 5.2 The teacher experience of games and of Word Score

The teachers in the study were positive about using games in education. Most of them indicated that whilst games were welcome in their classroom it was essential for the game to have a learning goal. Teachers would not tolerate games where violence is a feature. They suggested that games helped pupils to develop particular skills and to learn new facts. They also recognised that the “fun factor” of games helped pupils to become involved in their learning. Despite that, the teachers also highlighted several disadvantages and problems when using games in the classroom. They particularly mentioned the technical and organisational challenges that had to be addressed. Overall, most of the teachers felt that playing games could be advantageous for pupils but they also felt that they should only form a small part of the curriculum.

All the teachers and supervisors who saw Word Score used in the classroom were positive about it. They thought it was fun and effective and that the role of FC Twente, the children’s’ favourite soccer team, helped to motivate pupils. They also pointed out that the pupils played close attention to details in the game such as the presence of players who were no longer playing for FC Twente. The teachers suggested that Word Score makes a positive contribution to vocabulary lessons. Vocabulary is one of the most important aspects of language education; some teachers pointed out that pupils need a good vocabulary not just for communication but also as a key to success in other subjects. The teachers suggested that they thought that the pupils did learn from Word Score and that the pupils enjoyed this approach to learning. This is consistent with the results from the statistical tests.

**Table 6** Vocabulary test scores for grade 4, 5 & 6 pupils in the experimental group

Grade (age)	N	Average number of correct answers on the test		Standard deviation		T	df	Significance (one-sided)
		<i>pre</i>	<i>post</i>	<i>pre</i>	<i>post</i>			
Grade 4 (9–10)	16	23.56	23.13	5.151	7.702	0.189	30	0.426
Grade 5 (10–11)	40	25.73	28.55	6.524	6.816	−1.894	78	0.031 <sup>a</sup>
Grade 6 (11–12)	26	30.35	33.73	6.235	6.422	−1.928	50	0.030 <sup>a</sup>

<sup>a</sup> Significant difference

### 5.3 The pupil experience

The results from the pupil attitude questionnaire were analysed with SPSS. The analysis showed no significant differences between the pre- and the post-test results for the group as a whole on the parts of the questionnaire concerning attitudes towards language/vocabulary and attitudes towards school. However, some significant differences were evident when the post-intervention attitude questionnaires from the different groups were compared. These results are shown in Table 7.

Higher scores on the “School” scale suggest a more positive attitude towards school; similarly, higher scores on the “Language/vocabulary” scale suggest that pupils enjoy this work and find it easy to do. Table 7 shows that whilst there were no other significant differences, there was a significant difference between the scores on the “School” scale for the control group and the ETE group. The results suggest that the pupils in the control group were more positive about school than the pupils in the ETE group.

The post-intervention questionnaire also assessed pupil attitudes towards ETE and attitudes towards school. Table 8 presents the results, on all four attitude measures, from the post-intervention questionnaires that were completed by the experimental group. The data relating to the attitude towards Word Score, in contrast to other data, suggests some age related differences. Whilst these differences have not been tested for statistical significance they are recorded in the table.

Table 8 shows that the average scores on the “Language” and “School” scales were above the neutral score of 15; the average score on the ETE scale was close to the neutral score of 10.

The average score on the “Attitude towards Word Score” scale was 20.54 and the Standard Deviation was 3.20. The scale maximum is 24 and the neutral response score is 15; from this it is clear that the pupils were positive about Word Score. Pupils indicated that they liked the game, understood what they needed to do and felt that they had learnt something. The data in Table 8 suggests that older pupils were more positive about Word Score than younger ones.

**Table 7** Pupil attitudes towards language/vocabulary and towards school: a between-groups comparison of post-intervention scores

Group	N	Averages		Standard deviation		Compared with	Significance (2-tailed)	
		Language	School	Language	School		Language	School
Experimental group	82	18.37	19.03	3.079	3.141	Control group	0.404	0.030
ETE	36	18.00	18.67	2.757	2.974	Control group	0.148	0.009 <sup>a</sup>
Regular class time	46	18.84	19.50	3.430	3.325	ETE	0.223	0.240
Control group	60	18.79	20.13	2.748	2.640	Regular class time	0.935	0.306

<sup>a</sup> Significant difference

**Table 8** Post-intervention scores for the experimental group on the four attitude scales

Attitude scale	N	Average	Standard deviation	Maximum score <sup>a</sup>
Language	82	18.55	2.94	24
School	82	19.50	2.98	24
ETE	82	10.89	2.36	16
Word score	82	20.54	3.20	24
Grade 4	16	19.05	3.49	24
Grade 5	40	20.80	3.54	24
Grade 6	26	21.06	2.14	24

<sup>a</sup> The Likert scale response “Strongly agree” scored 4; “Strongly disagree” scored 1. On the 6 item “Language” and “School” scales scores consequently ranged from 6 to 24 with a score of 15 as a neutral response. For the 4 item “ETE” scale the scores ranged from 4 to 16, with a score of 10 as a neutral response

## 6 Summary of results

The aim of this study was to investigate the effectiveness of Word Score, as a serious game, in extending the vocabulary of pupils in grades 4 to 6 when used within Educational Time Extension (ETE). The data from the study supports several conclusions. Firstly, using Word Score did lead to an increase in pupil vocabulary but only for pupils who participated in the ETE programme. There was no significant improvement in the vocabulary of pupils who used Word Score during normal class time.

Pupils were enthusiastic about Word Score. This was clear from their reactions in class and from their questionnaire responses. Pupil reactions suggest that they were challenged and motivated by the game. The game’s setting, the FC Twente stadium, had a positive impact on pupil engagement.

The teachers who participated in the programme were very positive about ETE and also about Word Score. Teachers agreed that serious games, such as Word Score, have the potential to support the important area of vocabulary learning and they also said that the motivational aspect of Word Score might help pupils to think less negatively about ETE. Teachers also said that they were keen to use the next version of Word Score.

Overall, the data from the study demonstrated that Word Score is a suitable game to increase children’s vocabulary when used as part of Educational Time Extension. The pupils who played the game in ETE significantly improved their vocabulary and, apart from a few minor technical problems, the game proved to be easy to use. The experiences of both pupils and teachers were positive.

## 7 Discussion and conclusions

The Educational Time Extension (ETE) programme seeks to address underachievement by primary school pupils by extending teaching time for pupils with low scores on literacy and mathematics tests. Underachieving pupils thought to have “high potential” are also included in the programme.

Pupils in this study were not very enthusiastic about ETE; what is more, they were less enthusiastic about school in general than the pupils in the control group. Given that the ETE pupils had to stay at school when their friends were going home to play this is unsurprising. Despite this, the pupils, including the ETE ones, were very positive about Word Score. They were challenged, fascinated, and intrinsically motivated by the program. As suggested in the earlier discussion, this is probably because they had a sense of control (they could move around the stadium as they completed tasks and games with clear goals) and they were provided with immediate feedback on their responses. In addition, it was also clear that the context provided by FC Twente was very appealing to the pupils.

Playing Word Score resulted in a significant growth of vocabulary for the ETE-pupils who played the game outside the regular class time. The likely reasons for this are that a) pupils who played Word Score in normal class time spent less time using the program, and b) the pupils in the ETE group were specifically selected because it was thought that they would benefit from using the program. This suggests that Word Score can be effective but only when used for an appropriate length of time and with a well-matched target audience. This may be true for any educational program, serious game or otherwise, but the results also point to the motivational significance of a serious game.

The version of Word Score used in this study only includes words relating to soccer. Whilst many of the words are relevant in other contexts this is clearly a limitation of the program. A new version of Word Score is being trialled in 50 schools and this features 10 different themes (soccer, history, the weather etc). Each theme includes 60 words at each of 3 levels (grades 4, 5 and 6); hence 1,800 words are introduced rather than the 400 words introduced in the first version.

This study was conducted with a very specific target group of pupils and a set of words that were specific to a single context. Whilst this raises questions about the generalizability of the results it should be noted that the results from Smit's (2008) pilot study with grade 4, 5 and 6 pupils working in normal class time also showed a positive impact on vocabulary. A recent study with the new version of Word Score (Heitink et al. 2012) reached a similar conclusion. We therefore conclude that Word Score, a serious game, can have a positive effect on the vocabulary of pupils in grades 4 to 6. The results from the study also suggest that further research into the effectiveness of serious games as motivators of under-achieving pupils is called for.

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