

evaluatie, monitoring, effectonderzoek en data



Value Added of Windows 8 Tablets

Study into the use of Windows tablets in education

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Summary

In this study into the value of Windows 8 tablets (W8T) for education, the main focus was on how to gain insight into the benefits of the W8T for teachers and pupils. Here, variables at school level and at teacher level play a role. Prerequisites at school level include IT policy and IT infrastructure. At teacher level, this relates to experience with IT, views regarding education and IT, ambitions, the selection of content and activities, and the application of IT in lessons. All of this can have an impact on teachers (work pressure, motivation, quality instruction, catering for personal needs and professionalism) and pupils (motivation, active learning, cooperation and learning results). The study was carried out in three schools. These schools have each used W8T in three different cases (or series of lessons). The data collected was based on interviews with the teachers and the school management, observations in the classrooms and classroom discussions with pupils.

The results have shown that the schools use the W8T in different ways. This is mainly related to the existing infrastructure and the experience of the teachers and students with IT. Schools that have already made extensive use of IT use the tablets differently than schools which have less experience with IT. In the latter case, the tablet was initially used for practising and automating spelling, whereas the school with a lot of experience with the tablets immediately introduced the tablets for working independently via a weekly task schedule. Despite the difference in use and initial situation, all schools strive to increase motivation in students and teachers, to encourage more independence in pupils, to cater for the differences between students and to improve learning performance. In this respect, the content and activities used by those schools are very diverse. It was observed that the W8T component has become part of the daily the curriculum in all of these schools. The pupils use the tablets to practise or for automating, to create applications or to plan and schedule tasks. The way in which the tablet is used also depends on previous experiences and the infrastructure.

Important prerequisites for the deployment of the W8T, besides the aforementioned infrastructure and experience, are the ease of use, the willingness to invest time and the availability of appropriate content and materials. The ease of use of the W8T is high and the fact that programs already used by the schools run well on the W8T was quite frequently mentioned. In contrast, a lot of time was spent installing the tablets (and keeping them regularly updated). Teachers indicate that this investment will be earned back by the motivation of the pupils. The teachers expect that they will 'reclaim' more time if the tablets are used increasingly for providing feedback. However, the teachers find the number of apps available rather disappointing. This could be an explanation for the low number of didactical changes that have been found: if there is very little available, this restricts the options to introduce changes in the lessons.

The effects on teachers are visible in the form of workload, motivation and the extent to which teachers can provide for the personal needs of pupils. Although the workload is increased when the tablet is first deployed, the teachers expect that the tablet will ultimately reduce the workload and, in some cases, this was already the case. The motivation of teachers to provide education with the use of the tablet is high, mainly due to the positive feedback from the pupils. Custom teaching content is reflected in more opportunities for knowledge construction instead of the transfer of knowledge, and in applications that provide more room for individual choices to be made and the ability to adapt to the results of the pupils.

The effects on pupils are especially visible in the way of motivation and the degree of active learning. Pupils really enjoy working with tablets, but motivation may decrease when the tablet is no longer a 'novelty'. In this respect, variation is also an important aspect. Active learning is encouraged by the kind of assignments the pupils are given. The benefits of using the tablets have not yet been quantified in terms of learning results. The number of participants is not large and a good comparison with previous results is not yet possible. At any rate, the W8T delivers time savings and it makes it easier to cater for the differences between pupils.

1 Introduction

In 2012, the first tablet computer was introduced that uses the Windows 8 operating system (hereinafter designated as the W8T). Now that the interest in the use of tablets is growing in education, EAPAF has carried out a project in which the W8Tablet was tested in three primary schools. EAPAF is a partnership between suppliers of software licenses in the Dutch education system and Microsoft. The project was funded by SURFmarket, APS IT-Diensten, SLBdiensten, Acer and Microsoft. Project management and the support of schools was in the hands of 'Tipping Point'. The ITS was responsible for describing and analysing the way in which schools have introduced the W8T. Three primary schools participated in the study project. The following criteria were applied in the selection of the schools: The school has a recognizable pedagogical-didactic profile and a clear ambition. The school has experience in the use of ICT has a sound IT infrastructure, management and maintenance programme. It also has clear ideas regarding the use of the W8T and how it can contribute to the realization of the ambition of the school. The Rivierenwijk school in Deventer, the Paasberg school in Oosterbeek and the Oostwijzer in Zoetermeer took part in the project. The main point of departure was that the introduction of the W8T was restricted to one group in each school, where the pupils had the opportunity to work with their own W8T. During the course of the school year, the W8T was used in three series of lessons in which each of the schools indicated which aims they wanted to achieve using the W8T and how those aims could be achieved. This resulted in three "case scenarios" in which the W8T was deployed in three different ways.

The ITS has investigated the value of the W8T in education. The main aim of the study was to gain insight into the benefits of W8T for pupils and teachers in primary education. Moreover, the study must provide insight into the ease of integration and versatility of the tablet in terms of applications and applicability.

This final report describes the results of the study. In chapter two, we outline the background of the study and in Chapter 3 we describe the design. The results are presented in Chapter 4. Finally, in Chapter 5, we answer the questions relating to the study.

2 Background

2.1 The integration of IT in education

Information and communication technology (ICT) has been considered as a commitment to education for decades already. IT can be used in processes involving knowledge transfer, where the teacher plays a central and directive role, but IT can also stimulate processes of knowledge construction, where the central focus is on the pupil who also controls an important part of the learning process (Niederhauser & Stoddart, 2001). Proponents of this last approach point out the possibilities of IT to encourage active learning and higher order thinking (Jonassen, 1999). Others are of the opinion that clear guidance by the teacher or learning material is needed in order to initiate the desired learning processes (Kirschner, Sweller, & Clark, 2006). This is also an area in which IT can play a role.

How IT is introduced depends on numerous factors. Views by teachers about how education should be given and the possible contribution of IT in education play an important role (Higgins & Moseley, 2001; Hokanson & Hooper, 2001; Mumtaz, 2000). In addition, the school's policy on IT, skills and support are also significant (Becta, 2004; Mumtaz, 2000; Stuart, Mills, & Remus, 2009; Tondeur, Van Keer, van Braak, & Valcke, 2008, Yuen, Lee, & Law, 2009). Another important aspect is the liaison between IT and the school curriculum (Voogt, 2008). In order to give rise to changes, it is important that the team has the feeling that improvement is needed. Teachers should be involved in the development and implementation of the changes and they must have or acquire sufficient knowledge and skills, receive adequate support and have adequate facilities at their disposal. The head teacher should lead the innovation process and encourage the involvement and participation of the team (Berman & McLaughlin, 1978; Ely, 1999).

Many research projects have demonstrated that IT in education is used mostly in a traditional way, to support the existing educational practice and that it is primarily focused on knowledge transfer (Van Gennip, Rens & Smeets, 2009; Hayes, 2007; Smeets, 2005; Smeets & Van Rens, 2012, 2013; Tondeur, 2007). This implies that IT does not contribute to the powerful learning environments that were anticipated by many. IT is used more frequently for knowledge transfer at middle and upper primary levels in primary education. However, IT is used much less frequently to encourage knowledge construction. If this is the case, this is generally at upper primary levels (Smeets & Van Rens, 2012, 2013).

2.2 The effects and benefits of IT in education

The expectations of IT in education are high. Even so, not all of those expectations are met. This is often related to the imbalance between the elements of vision, expertise, content, as well as applications and infrastructure. This means that there can be a discrepancy, for example, between the objectives pursued and the way in which IT is applied (Knowledge network, 2013). This can be caused by a lack of vision, but also, for example, by the absence of an infrastructure adapted to the vision. Research shows that if there is a clear vision (of what is needed) whereby expertise, content, applications and infrastructure are adapted to that vision, this will work better than taking infrastructure or content as a starting point. An 'educational pull' is better than a 'technology push' (Ten Brummelhuis & Kuiper, 2008). Ultimately, it is the teachers who are decisive: they must realise the usefulness of the adoption of IT. Schools that focus on infrastructure, but not on the needs of teachers, run the risk that teachers will resist and ignore the facilities (see, for example, Ten Brummelhuis & Van Amerongen, 2011). The willingness to deploy IT depends much more on the views teachers hold regarding good education (Ertmer & Ottenbreit-Leftwich, 2009). Over time, it should eventually become clear whether and how the achievements of pupils improve (Hattie, 2009).

The benefits of IT, however, may also be influenced by the way teachers deploy IT. This deployment might well be adapted to the views of the teacher but is perhaps not the most appropriate way to convey the content chosen by the teacher. According to Koehler and Mishra (2008), teachers must be able to integrate content-related and pedagogical knowledge (what education and how) with technological knowledge (resources). Context also plays a role, as well as the conditions that result from those contexts. If teaching content, didactics and technology and reinforce each other, the chances of a good output (motivated pupils, learning performance and such) are much greater.

Kennisnet (2008) subsidised ten projects where IT was implemented in secondary education. The schools were required to formulate the ambitions they wanted to achieve with the use of IT. The schools often chose to adopt IT to improve student motivation, to provide better guidance and/or custom work, and to improve learning performance. The "Vier in Balans Monitor" (Kennisnet, 2013) states that the correct use of IT results in increased motivation, improved learning performance and a more efficient learning process for the pupil. Moreover, IT can help the teacher professionalise and improve the organisation in the school so that there is more transparency and increased control.

A lot of research has been done into the impact of IT on learning performances, with varying outcomes. Results of comparisons between classes with and classes without IT can be misrepresented by variables which cannot be kept or are difficult to keep under control. Examples are differences in education material and the influence of different teachers. Large-scale studies conducted in the United Kingdom (Harrison, Lunzer, Tymms, Fitz-Gibbon, & Restorick, 2004) however, have concluded that there really is a correlation between the deployment of IT resources and better learning results. As far as other points of interest are concerned, there are fewer positive conclusions. Walraven (2008), for example, concluded that information skills

(the skills needed for searching for and selecting, assessing and processing information) are still frequently insufficiently developed at pupil-level. Teachers are of the view that the 'media knowledge' of their pupils is often insufficient (Smeets & Wester, 2009; Wester & Smeets, 2011). The Royal Dutch Academy of Science (2013) stated recently that students are still insufficiently digitally literate. They lack the specific skills required for handling information, as well as a critical attitude towards information.

2.3 Tablets in education

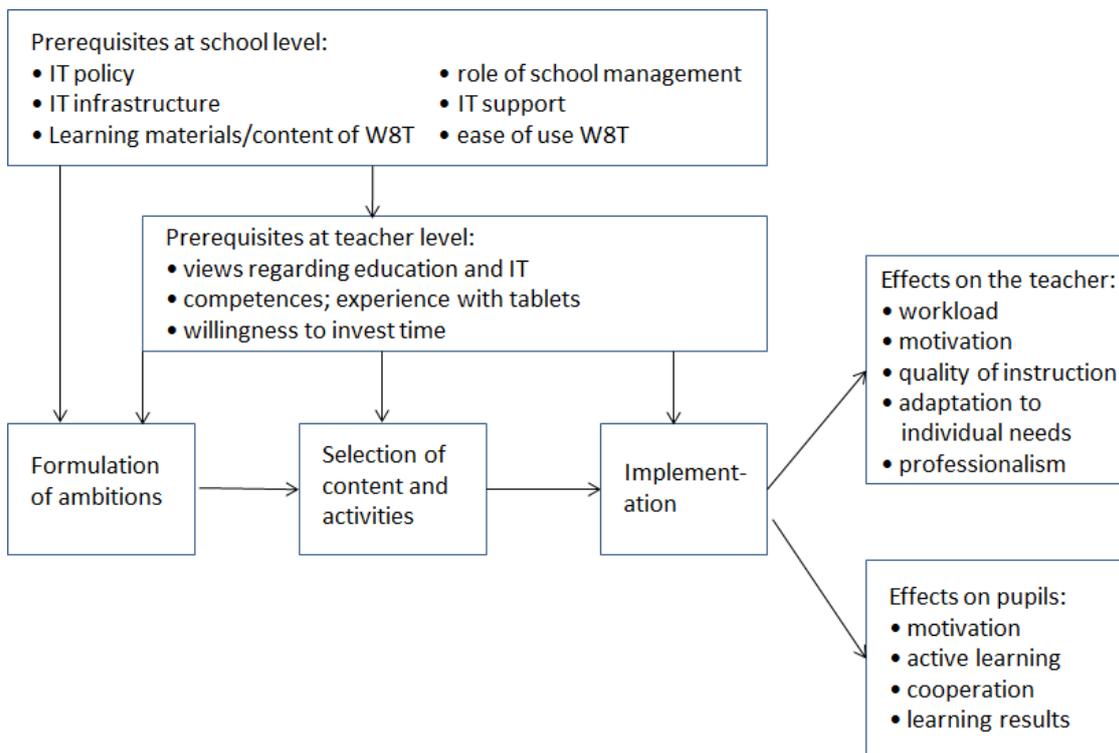
The use of mobile technology in the form of tablet computers is increasing. Schools also show an interest in the possibilities of tablets in education. Both teachers and pupils find tablets useful and user-friendly, as was clear from research conducted at the first 'iPad school' in Flanders (Montrieux, Raes, & Schellens, 2013). Observations in one primary school in Norway showed that tablets stimulate active and cooperative learning. In the interviews that were held, teachers and students were enthusiastic about working with tablets. Intensive cooperation increased the skills of teachers in teaching with the use of tablets (Gudmundsdóttir, Dalaaker, Egeberg, Hatlevik, & Tømte, 2014). Henderson and Yeow (2012) conclude that the most important benefits of iPads are that they provide quick access to information and encourage cooperation between pupils. Rea (2014) carried out research in one class of one primary school into the correlation between the use of tablets and learning results. Her conclusion on the basis of this small-scale study is that tablets can have a positive effect on learning results if used by well-trained teachers in combination with qualitatively high-quality applications. Research at a school in the Netherlands which introduced tablets in the pre-secondary class, examined how teachers integrated the tablets in education and what knowledge and skills were needed to do this (Voogt, Boonen, Walraven, & Fisser, 2013). The teachers appeared to use the tablet especially as an e-reader, to search for information, to encourage cooperation and to create presentations. They found that they had insufficient didactic skills to integrate the tablet in their teaching processes and they continued to teach in the role of instructor, hardly ever allowing the pupils to take control of the learning process. Ifenthaler and Schweinbenz (2013) conducted a pilot project study with the use of tablets in three schools for secondary education in Germany. To most of the teachers, it was unclear as to how they should use the tablets as best they could to support learning and instruction. Only a minority expected that their teaching would improve by the use of tablets and the expectations regarding the effect tablets would have on the learning results were mixed. Everyone mentioned well functioning IT resources as a prerequisite and the majority expressed their need for support.. Other studies have shown that hardware and content also present challenges to schools which want introduce tablet computers (Tondeur, Pareja, Mathieu, Brugge-man, & Van Braak, 2013). Moreover, issues such as leadership, cooperation and support, and the professionalisation of teachers are of vital importance when introducing tablet computers in education. The schools in question had not developed a clear view on the use of tablet computers and the conditions that were required in order to form a view. The authors refer in this respect to Li (2010), who states that the integration must be adapted to the individual character of the school. In a study into the use of tablet computers in infant schools, it has been observed that teachers are indeed enthusiastic concerning the tablet computers, but that they have a need

for recommendations concerning the effective use of apps (Van Houte & Devlieger, 2013). It seems, therefore, that the bottlenecks which occurred previously during the introduction of computers in education, are now re-occurring with the introduction of the tablet computers.

2.4 Relevant variables

From the preceding, numerous relevant variables arise from the implementation of IT in education. These will play a role in the introduction of the W8T in primary schools. Figure 2.1 shows an overview of important prerequisites at school and teacher level, of steps in the introduction process and of the anticipated effects.

Figure 2.1 – Implementation of IT in the classroom: prerequisites, steps and possible effects



3 Research questions and research design

3.1 Research questions

The main focus of the study was the following hypothesis: *Used in conjunction with the correct content, the W8T enables teachers to provide a more customized approach to teaching assignments and increases the learning output of pupils.*

On the basis of this hypothesis, the following questions have been formulated for the present study:

1. What are the ambitions teachers and pupils wish to achieve by means of teaching with the use of the W8T?
2. Which content and activities do they choose to realise these ambitions?
3. How do they integrate W8T in practice?
4. Which function does W8T fulfil in the preparation of lessons and in professionalisation activities?
5. What effect do prerequisites have at teacher and pupil level when integrating W8T?
6. What impact does the use of W8T have on teachers in combination with chosen content?
7. What impact does the use of W8T have on pupils in combination with chosen content?
8. Can an indication be given of the benefits of W8T in combination with chosen content?

3.2 Design of the study

The study was conducted in the form of case studies. During the design phase of the study, three target groups were distinguished:

- IT coordinators;
- teachers;
- pupils.

During the implementation of the study, it appeared that IT coordinators played no substantial role in the activities in the schools. In one school, one of the teachers concerned was an IT coordinator. In another school, the IT coordinator had hardly been involved in the implementation of the W8T-project and in the third school there was an upper school IT co-ordinator who had only very limited time for the school. However, some interviews took place with the head teachers of the three schools.

The different target groups were questioned in several data collection rounds. We describe here which activities were carried out in each round and which target groups were questioned.

First round of data collection

In this round, an impression was formed of the prerequisites at school and teacher level, the ambitions that the schools wanted to reach by participating in the project and the specific aims and activities in the first series of lessons. Data was collected during day visits to each of the schools. The diagram below shows which questions in the study the activities were related to.

Activity	Research questions
Request for the school guide	5
Request for the didactic implementation plan of case 1	1, 2, 3
Interview with IT coordinator	1, 2, 3, 4, 5
Interview with teacher and director	1, 2, 3, 4, 5

Second round of data collection

In the second round of data collection, at the end of the duration of case 1, issues that arose during the last case are discussed with the teacher and the head of the school and in a talk with the IT coordinator. In those discussions, the ambitions and prerequisites for the following cases were also addressed. Cases 2 and 3 were prepared and implemented at the same time for organisational reasons. By means of a observation, the research workers were able to obtain a picture of the way W8T has been integrated into classroom practice, of group formation and work methods, and of the effects this had on the teacher and pupils. Moreover, the introduction of the W8T and its effects were also addressed in a class discussion with the pupils.

Activity	Research questions
Request for the didactic implementation plan of next case	1, 2, 3
Interview with IT coordinator	1, 2, 3, 4, 5, 6, 7, 8
Interview with teacher and director	1, 2, 3, 4, 5, 6, 7, 8
Classroom observation	3, 6, 7
Collective discussion with pupils	3, 7

Third round of data collection

The third - and last - round of data collection took place at the end of the third case. This round was the same as round two, but was extended with a reflection on the insights which the whole school year had produced. Also, an estimation was made of the effects, benefits, bottlenecks and advantages of the project.

3.3 Data collected

Case descriptions and ambitions

In the first months of the project, three meetings were held which were attended by schools, EAPAF, Tipping Point, content expert Tessa van Zadelhoff and ITS. During the first meeting, a presentation was given by Tessa van Zadelhoff concerning different types of apps, and the schools then started to set out their ambitions and the description for the first case by means of a template. During the second meeting in September 2013, the schools presented their ambitions and their first case, and the ITS presented its research design strategy. As a result of this meeting, the schools made adjustments to the description of the first case, and the descriptions were then forwarded to the ITS. During the third meeting, in February 2014, the schools exchanged views on their experiences with the W8T and Microsoft gave a presentation regarding possible applications to use. Tessa van Zadelhoff then advised the schools concerning the activities for the following series of lessons. Finally, there was also a fourth meeting in May 2014 when experiences were discussed and agreements were made with regard to additional activities.

Interviews

At the beginning and end of case 1 and at the end of case 3, an interview was held at each school with the teachers, management and, where possible, with the IT coordinator.

Observations

Observations were made in the participating classes of each school whilst pupils worked with tablets according to their use in case 1 and case 2, or case 3.

Classroom discussions

During classroom discussions in each of participating classes, pupils were asked about their experiences working with tablets according to their use in case 1 and case 2, or case 3.

4 Results

Firstly, the different cases in each school are described, followed by an overview of the prerequisites that were needed, experienced or lacking, and the effects this has on teachers and pupils.

4.1 School A: Rivierenwijkschool, Deventer

The Rivierenwijk school is a primary school in Deventer with a large number of foreign pupils (85 per cent), many of them with low educated parents (71 per cent). Many pupils only speak Dutch when at school, but not outside school. Two groups (8a and 8b) participated in the W8T project. Two fulltime group teachers and approximately 40 pupils were involved.

IT is used a lot at the school. There is good infrastructure. All pupils have had their own device since 2009. Each class has its own access point. The work is done in the cloud, not over a network connection. Pupils in the upper classes of the primary schools were all able to use a net-book. The school was asked to participate in the project, as it clearly had a head-start in the field of IT.

4.1.1 Description of case I

Information from the talks

Initially, vocabulary was to be the central focus of the lessons. Apart from vocabulary training using a glossary app during language classes (Taal in Beeld), the pupils were asked to work on the creation of an online glossary for the class. The teachers would compile a glossary in a OneNote file and put it online. They would then include the additional words from the word clusters in the glossary. The aim was to allow the pupils to complete it further. The underlying concept was that the pupils themselves would look up words which they find difficult and put them in the glossary. For the sake of explanation, the pupils were asked to include a synonym or place word in context, with the further option of adding an image. This activity was moved to the third series. In the first series of lessons, the focus was on working independently. From a technical point of view, this was easier to achieve. The teachers first wanted to reflect on the best way to create and set up the online glossary. During the first series of lessons, teachers opted to work with the weekly assignment. The weekly assignment was set up in OneNote by the teacher. The task consisted of additional work stipulated by the teacher that had to be completed by the pupil, as well as optional work (which could be chosen by the pupil). Three levels were distinguished for the weekly assignment in the form of assignments with one, two or three stars. There were also pupils working at a lower level than one star. Their task was set exactly

every day. Group 8 had never worked on a weekly assignment, so this approach was completely new to them.

The weekly assignments also included optional tasks that the pupils could complete in pairs. Once the red light was switched on as the pupils worked on the weekly assignment, the pupils were required to continue work independently. If the light switched to amber, pupils were allowed to confide with others or work together. Classroom work is also done (using Linoit, an online environment which enables brainstorming, and using Nieuwsbegrip, to send messages). Pupils can write what they already know on little yellow post-it notes. This is then displayed on the interactive whiteboard. Socrative can be also used at the beginning of the lesson to do automation exercises. This is a pupil response system. The teacher asks questions and the pupils respond (or 'vote') via the website. The results of the poll are then displayed (either to the whole class or only the teacher). A game element could also be introduced (who provided the most correct answers). An advantage of the applications used was that the weekly assignment of the pupils could be displayed on the interactive whiteboard.

The pupils worked every day for more than an hour with the tablets. The bulk of this time is spent on working independently. Among other things, the first series of lessons focused on language assignments. For example, the pupils read news articles that they could then summarise and express their opinions on. This was evaluated in the classroom. Pupils also practised vocabulary. In some cases, pupils submitted assignments by e-mail and in other cases on paper. The teachers selected several different apps. These were primarily educational games. The teacher can see on his/her tablet what the pupils are doing via Meraki. If a pupil does something that is not allowed, his/her tablet is confiscated for a while.

Classroom observations

During the first observation, the pupils worked for almost half an hour independently with the W8T in order to complete their weekly assignment. Everyone works on his/her own assignments and can choose from several applications. The orange light indicates to the pupils that they can confide in each other if they want. This occurs now and again. Afterwards, the teacher shows an educational game with the aid of Socrative in connection with the observation. In this case, the pupils work in pairs. The teacher explains the objectives. The pupils then log on and perform a race with sums. They are allowed to do this using a calculation sheet. The race is all about providing the right answers and not about speed. Each pair has its own symbol on the interactive whiteboard (a coloured rocket). The rocket progresses in single increments as a correct answer is given. On completion of the task, the teacher shows the results in a spreadsheet on the interactive whiteboard. The teacher then asks several pupils to explain how they reached the correct answers. The program shows each pair whether the outcome of each sum is correct or incorrect.

During the second observation, the pupils also work on their weekly assignment independently with the W8T. During the first five minutes, pupils are not allowed to confide (red light); during the remainder of the time they can confide with each other (amber light). Several applications are used to complete the tasks, including Taal in Beeld and Nieuwsbegrip. Some pupils work on

topography. One pupil completes an assignment centred around the Travel Planner of the NS (national railways). Three pupils work without the use of a tablet. After half an hour, the class continues to work using Socrative. The teacher has put several difficult words in Socrative. The pupils are required to answer (individually) multiple choice questions concerning the meaning of those words. On completion of the task, the results are discussed with the whole class. On the interactive whiteboard, each of the pupils can view which questions they answered right or wrong.

4.1.2 Description of case 2 and 3

Information from the talks

The approach is largely the same as in the first series of lessons. In the beginning, a lot was learnt. The weekly assignment works in much the same way. The pupils still work for approximately an hour each day using the tablets. The bulk of this time is spent on working independently. The weekly assignments included working with arithmetic apps, brain teasers, puzzles, word searches, verb spelling, Bloon and news articles. The pupils also carried out exercises using yellow notes (Linoit). Not much arithmetic was done on the tablet. This was primarily related to activating foreknowledge with sum 1. The tablets was used for language and for understanding news articles, by writing texts or summarising. The aim was to encourage pupils to think a lot more about the tasks they were given than they would otherwise do when carrying out normal tasks. An attempt was also made to enable star pupils to become more familiar with more exacting subjects like world affairs and world orientation. These pupils were given additional material for the geography tasks. The aim was to provide more “compact” task sets, by omitting certain content and replacing this with other tasks and assignments. According to the teachers, some content in the weekly assignments could be done by working together, such as vocabulary tasks (race in Socrative). The pupils indicated that they would like to work together more often. The pupils are allowed to consult with each other, but they say that this doesn’t often happen.

The weekly assignment also formed the most important component of the second series of lessons. This creates more time and space for interactive working methods and for the retrieval of constructive knowledge (Socrative). In the third series of lessons, the teacher starts with the creation of the online glossary. This is done using OneNote. When working with Nieuwsbegrip or when working with the method, pupils choose two difficult words to put in the glossary. They search for the meanings, construct example sentences and can also choose to add an image. If necessary, corrections can be made during the class-level discussions. You can see who the author is. Pupils can also correct their own mistakes.

Classroom observations

For the observations, both teachers assigned their group the task of selecting two difficult words from Nieuwsbegrip, a book or journal and asked the pupils to enter these words in the online glossary. The pupils work independently, looking up meanings and creating example sentences in online glossaries or by means of Google and then search for images. In one group, the light is

switched to red during this assignment. In the other group, the light is on amber and pupils are allowed to consult. This occurs now and again. This group can continue working on the weekly assignment. Several words are then discussed at class-level. In one group, pupils take turn in choosing a word and whose turn it is is determined by throwing dice. In the other group, the teacher asks the whole class for a nice word to discuss at class-level. The pupils then continue with their weekly assignment. In one group, pupils may not consult each other during the first five minutes, but the other group is allowed to consult. In this group, pupils consult each other more often if the opportunity arises. In the first group, the teacher goes around the classroom after five minutes and then switches the traffic light to amber. There is yet another round after ten minutes. In the second group, independent work is completed after ten minutes and followed up by a class discussion between the researcher and the pupils. Finally, ten minutes are spent on a race with addition and subtraction sums, where pupils work in pairs using Socrative. Some pupils work well together, whereas others just concentrate on doing their arithmetic.

4.1.3 Prerequisites

Most of the teacher's work is to produce an overview of what the pupils have done. This has always been the case. Teachers monitor this on paper. An improvement here is that pupils no longer need to send e-mails, as they did in the first series of lessons. They all have their own file in OneDrive. Each pupil has his/her own file with all of the week's work. This is shared with the teacher. The teacher generally discusses this at the end of the week. It is the responsibility of the pupils to keep their work in good order and neat and tidy. Evaluation by the teacher can be done during school time. The task for the following week is set on the Friday afternoon. The teachers have an empty format that they can fill in and one large file containing all information about the tasks. They can use this file to copy components from and add them to the weekly assignments/tasks of the pupil. There is more than enough material to use for the weekly assignments. There's a lot to be found online. This can be used as an information source. The teaching method also includes plenty of material. However, the teachers find the availability of apps for use in the classroom rather disappointing. This also applies to the iPad. The demand is still very small. The teachers select everything themselves. They search for and select the appropriate apps and discuss this afterwards with the IT coordinator. They themselves also have a tablet, which is nice.

There are very few technical issues to resolve. There were many more issues when pupils still worked with netbooks. However, pupils do sometimes indicate that the server can't cope if everyone wants to do vocabulary work at the same time. Furthermore, there was a loss of the internet connection for a period of two weeks because a glass-fibre utility cable had been damaged. Office365 has a lot of the things that are used at school. If the internet connection fails, you can't carry out the weekly assignment and have to revert to working on paper.

4.1.4 Effects on the teacher

Digital work can be more easily adapted than work on paper. It can be reviewed much quicker and you can also see if pupils are ready (for example in Socrative). The large gain here is also that everyone is busy working at the same time and that pupils do not need to wait for each other. The teachers views this as a major advantage, that pupils work more independently than they did before. You can put them to work independently for half an hour. This is much easier to do, but this was not always the case before the introduction of the tablets. This decreases the workload for the teacher and it gives the teacher more time to observe pupils. When using Meraki, the teacher can follow the progress of pupils on his/her own tablet. This enables the teacher to ask the pupil questions from time to time. Pupils then know that they are being monitored. Working independently also enables teachers to pay particular attention to pupils when needed.

4.1.5 Effects on the pupil

According to the teacher, an important advantage of the tablets is that they are much more intuitive than the netbooks which were previously used. The teachers can see an increase in the motivation of the pupils. There is also a time gain, as pupils can work more effectively. A lot of work is done during the weekly assignments. It is difficult say what the effects are on the learning results of pupils. This is not yet measurable.

The pupils indicate that the tablet has advantages in comparison with the use of netbooks. This is especially the case for technical issues: the screen is larger, the tablet is faster and there are no problems with WiFi, whereas the netbooks always lost the WiFi connection. Pupils indicate that they are able to work faster with the tablets and therefore learn a lot more. They also indicate a content-related benefit: They learn more from the weekly assignment, which they didn't have before. They do much more work independently and can determine themselves which tasks they want to do and what to look up. Working with tablets is nicer than it was before and the pupils still think it's nice.

There are also disadvantages, which are related to technical imperfections: tablets which sometimes restart again, the keyboard on the screen always emerges while a real keyboard is being used, the delayed response of the arrow keys of the keyboard when playing games, and there are also imperfections in some features of Internet Explorer, such as the zoom feature and the inability to drop and drag words. Another disadvantage mentioned was the fact that pupils had to be very careful not to drop the tablets and that the tablet could also be confiscated as a form of punishment.

4.1.6 Summary of results for School A

If we view the results of school A in the light of the variables from figure 1, then it becomes clear that the prerequisites at school level and teacher level are certainly present. This led also to the formulation of rigorous ambitions for Case 1. However, at first, this case did not seem to be technically feasible. The teachers had to explore the best options for producing an online glossary/dictionary to which the pupils could contribute. During the selection of content and activities for the first case, an approach had to be assessed which would be easier to achieve. This is related to the weekly tasks of the pupils, which needs to be specifically tailored to individual needs, so that pupils can work independently. The implementation went very well. This approach was continued for the remainder of the school year, supplemented by additional interactive work methods and emphasis on the collection of constructive knowledge (in the second series of lessons) and with the online dictionary in the third series of lessons. The teachers have expressed their desire to work in the same way next year.

The effects on the teacher are generally related to the decrease in workload. They can monitor the progress of pupils much faster, obtain a better understanding of the results and pupils are all at work at the same time. This creates more space during the lesson for observations to be made and for providing additional help to pupils. It can be observed that the pupils appreciate the tablet more than the netbooks they had previously been using. The pupils claim to learn more because they work faster with the tablets. This also had a positive impact on the weekly assignment.

4.2 School B: Paasberg school, Oosterbeek

The Paasberg school is a Christian primary school in Oosterbeek. The school has approximately 200 pupils, hardly any of whom are “weighted”. The parents of these children generally have a higher education than the national average. There is an upper school IT coordinator and an upper school IT policy. Participation in the project has financial benefits: 30 per cent discount on the tablets, free WiFi, maintenance, etc. The choice of tablet was made on the recommendations of the IT coordinator.

4.2.1 Description of case I

Information from the talks

In the first series of lessons, the tablets in group 8 were used to improve spelling using the software called Taalzee. Following group 7, the pupils appeared to be lagging behind as far as verb spelling was concerned. This was blamed on the method applied. When the software was selected, particular attention was paid to the option of checking the progress of pupils. Taalzee is an adaptive exercise programme. The program adapts to the level of the next task, depending on the results of the pupil. The teacher can see in an overview which tasks pupils need to do and what the results are.

Working with the tablet is part of the weekly assignment and not all pupils work with the tablet at the same time. Pupils work at least twice a week with the tablet. In comparison with last year, pupils now spend more time on verb spelling. Pupils can also log in from home, and there is also an extended learning period. At school, pupils work for about two times 20 minutes each day on their Taalzee assignments. Because the tablet is also used for other things (for example Nieuwsbegrip, Wereld in Getallen and Topomania), each pupil uses the tablet approximately 45 minutes each day.

Classroom observations

During the observation, all pupils work independently with Taalzee. The teacher calls a pupil a couple of times to his/her desk to discuss the results of the pupil. Taalzee presents an overview of the activities and results of all pupils, and the teacher uses this overview to indicate to a pupil which components require additional practise, or to monitor and indicate the progress of a pupil. Pupils are concentrated on their work and show each other their work now and again. They sometimes ask the teacher a question.

4.2.2 Description of Case 2

Information from the talks

Group 8 includes so-called three-star children: these pupils are ahead with their arithmetic but often lack insight into the correct arithmetic strategy. The aim of the case was to make these “three-star” children aware of arithmetic strategies and how to learn. The star pupils worked in pairs to create short instruction films to show lower groups how to count. Each pair shows how to do long divisions, how to calculate the content of a figure, or how to round off numbers.

The films were made using Active Inspire. Pupils created the films in pairs. They found this task very enjoyable, and some pupils indicated that they had to really think hard about how they wanted to “tell” others how to do the sums. They also doubted sometimes whether they had done it well.

Pupils indicated, in particular, that they gained a lot of knowledge about working with computers and, according to the pupils, they had already mastered the arithmetic. They indicated that the task was nice to do now and again, but that it shouldn’t replace normal arithmetic work. “Doing sums is easy, but explaining how to do them is much more difficult.” Solving the technical problems was experienced as being the less enjoyable part of the assignment. It was not possible to make a film and to record the voice-over at the same time with the tablet. In the end, the short films were made on computers. The teacher indicated that working like this was new to both the teacher and to the pupils. Unfortunately, the software selected for this assignment was not really suitable, so next time they would choose a different program.

Classroom observations

No observations were made of this case. However, the pupils who made the films were asked several questions.

4.2.3 Description of Case 3

Information from the talks

Case 3 consisted of the English lessons of group 7. The pupils made short films for this subject in which they introduced themselves and showed their school and surroundings. When they wanted to tell a story about the climbing frame in the school playground, for example, they needed to look up the correct words in English first. For this case, pupils used a camera, the Google Translate site and Windows Moviemaker. That latter was used by the pupils to create, edit and arrange short films and photographs. Pupils were very positive about this assignment because they could work together a lot, could go outside and because they learned ‘in a different way’. They experienced more freedom with respect to how they would normally have worked in the English lessons. During English lessons, they mainly listened to sentences, and the theme of the chapter they were reading determined the sentences they learned. During this case, the pupils were responsible for the stories they wanted to tell and had full control of the sentences and words they wanted to use and learn. This resulted in a more active involvement. They frequently looked up the words they wanted to use.

Classroom observations

During the observation phase, pupils made films in groups of 4 in the school playground or in the classroom. They first discussed what they wanted to film and what stories they wanted to tell. In the period preceding the assignment, they had already prepared and written the scripts for the films. The pupils also used the tablets to look up certain English words (such as the English word climbing frame [Dutch: klimrek]). In most of groups there was one cameraman or woman who operated the tablet. After recording the film, they would examine the results and, if necessary, record the scene again, or continue on to the next scene location. The teacher accompanied all the groups and answered any questions that arose.

4.2.4 Prerequisites

An important prerequisite was that everything operated well. However, at the start of the assignment, there were some technical problems: internet wouldn’t work on one of the tablets and another tablet had a broken charger. The installation was cumbersome. One tablet needed to be sent back for repair and it took a long time before it was returned again. Several teething pains were eliminated while working with the tablets, such as using the chargers and good agreements were made regarding, for example, closing down the tablets and putting them away properly. The school works with pupil contracts regarding the use of tablets. This agreement includes restrictions like prohibiting downloads without asking for approval first. If pupils make recommendations for certain apps, the teachers look at the apps first and then decide whether or not to give permission to download the apps. This works well.

The initial set-up of the tablets took far too long. One issue raised by those concerned was that Microsoft should provide more support. There were no user’s guides to revert to and the tablets were not pre-installed. The teachers indicated that they were relatively new to working with the

W8T tablet. They had to do their own research and had the feeling that they sometimes needed to re-invent the wheel. Microsoft could provide more support to improve this. According to the teachers, this was rather discouraging. A pupil was called upon in order to install everything and to get things working properly.

One bottleneck, according to the teachers, is that there are no standard MS Office applications installed on the tablets. The fact that the teachers didn't have a tablet was also considered as a drawback. As a result, teachers were unable to prepare at home or search for apps that might be useful. This is why teachers have not yet prepared themselves properly or studied the options for apps and applications that could be used in more detail. In case 2, it appeared that the software chosen was not the most suitable, and this could have been avoided if the teacher had had a tablet to try out beforehand. Teachers are currently dependent on the recommendations of others. The teachers observed that the children were more skilful in the use of the tablet than they themselves were. From the start, teachers needed to spend a lot more time to familiarise themselves with the use of the tablets. Pupils also need a lot more guidance. After a number of weeks, however, this was no longer the case and both teachers and pupils quickly became familiar with how to use the tablets.

The school has a limited budget and there are possibilities to purchase educational apps, for example, but their budget is not inexhaustive. There is IT support available, but (at upper school level) teachers do a lot themselves.

4.2.5 Effects on the teacher

During case 1 the tablets were actually used separate from the instruction. Taalzee was used on the tablets to practise, whereas instruction was given in the way it was usually given before the introduction of the tablets. After case 2 and 3, both teachers indicated that the tablets enable the pupils to gain more ownership of their own learning process. They are more motivated, work more independently, and have more space. The tablets make it easier to adapt to the different needs of the pupils (it is clearly visible what goes well and what doesn't, and this makes it easier to allocate specific tasks). This also enables pupils to give feedback on each other's performance (for example, with regard to the short films each of them made). According to the teacher of group 7, the use of the tablet does not replace other work and so still leaves plenty of room to use worksheets instead of tablets. However, this has not decreased the workload. This is related to the fact that no apps or applications have yet been chosen to replace a certain teaching method. If this had been the case, the workload would have decreased. In the meantime, the teacher of group 8 has replaced certain things and 'sometimes throws out the worksheets'.

The teachers feel more skilful in the field of IT and find it motivating when they see how enthusiastic the pupils are. Especially in case 2 and 3, a difference was observed in group formations, and according to the teachers, the pupils now work together a lot more.

4.2.6 Effects on the pupils

Pupils seem to be highly motivated and “glow” with enthusiasm. It is playful, nice to do and something new. According to the teachers, the pupils have learnt how to work more actively and more independently. They can reflect on their own learning process, become more involved in the process, and also practise in a home setting.

With regard to case 3, the teacher of group 7 indicated that pupils venture outside more often and speak more English. Pupils are motivated because they have more options to explore, and because working with tablets results in learning more skills than ordinary lessons do. Pupils are more active and have more responsibility. They can also assess each other’s performance.

The learning results from case 1 are visible in the form of test results: in the test that preceded the case, there were 7 pupils with insufficient marks out of a class of 23 pupils, and in the test after the case, there were only 6. Pupils also spent more time on the subject, so this could also explain the positive results. However, there is clearly an increase in pupil motivation for practising classwork.

Case 2 and 3 were not extrapolated in terms of learning results. Teachers indicate that the assignments were a good addition normal classwork. Case 2 is a challenge to the thought process of the pupils (explaining something to others) and case 3 appeals in a different way to English language skills.

During the class conversation in case 1, pupils indicated that the software used - Taalzee - does not allocate the same tasks to everyone. This was a pity, but on the other hand it also meant that pupils could not copy from each other. Pupils experienced more variation in classwork and found this motivating. It’s always a challenge when you can win “money” or bonus games. Not having to write is enjoyable and pupils view the tablets as modern, faster and easy to use. Pupils find it disappointing that the software Taalzee does not provide explanations, but indicated that the teacher gave the explanations instead. One pupil says: “One disadvantage of the tablets is that they run out of energy, but fortunately the teacher never does.” Pupils indicated that they learn from the work done on tablets and that verb spelling is now improving. They also indicated that they didn’t want to do everything on the tablet. After time, this would quickly bore the pupils. And a lesson on fractions and slicing a cake into parts, for example, is much nicer. The tablet must offer something extra. Case 2 and 3 seem to offer that little bit extra. Pupils experience a different approach to the way they work, as well as more autonomy and more responsibility.

4.2.7 Summary of results for School B

Prerequisites at this school were present to a lesser degree. In particular the fact that the teacher did not have his own tablet played a role when it came to formulating ambitions. The teacher indicated that a content specialist like Tessa van Zadelhoff was quite important for inspiration

and knowledge. After a cautious start in case 1 (exercises and replacement of worksheets), the tablets are introduced in case 2 and 3 in order to provide a different approach to teaching. During the English lessons English, the words and sentences given in the book are not learned. Instead, pupils tell their own story and in doing so learn words which they themselves use every day in the Dutch language. The star pupils have never before been required to explain things to other pupils. That the new approach did require them to do this, was felt as a challenge which they were not accustomed to. The adoption of the tablet in the classroom has an impact on the motivation and workload of the teacher. Pupils are more motivated and become familiar with active learning. However, pupils did indicate that variation is also important when using the tablets.

4.3 School C: Oostwijzer School, Zoetermeer

The Oostwijzer is a catholic primary school and an affiliate of the Unicoz educational group in Zoetermeer. The school also has pupils whose parents are not catholic but who nevertheless respect the identity of the school. The educational tools used in the school are modern and are adapted as much as possible to the needs of the children. Each class in the school has its own set of computers, arranged in a network environment. Various software is available to meet the needs of each age category. All available computers operate via a central server and make use of the Internet and method-related software.

The school has an IT policy in place, but this needs to be updated. The tablets must form part of that IT policy. The desire is to look at where the school stands and what is feasible in the field of finances, knowledge and technology. There is also a space set aside for experimentation. There is technical support for the network, but not for the tablets. Class 6a participated in the project and the teacher is also the IT coordinator. In the group of schools involved in the study, this school is well ahead with its views on IT.

4.3.1 Description of case I

Information from the talks

The subject of the first case was practising multiplication tables. The class was divided into two groups: one group worked on paper and the other with the tablets. Pupils were divided on the basis of an initial score which was proportional across the groups. Pupils practise sums for 10 minutes, three times a week in an attempt to improve their score. The apps Utopia and Rekenkamer were used on the W8T. It was clear from the results that all pupils were making good progress. According to the teacher, it seems as though the pupils with tablets are making a bit more progress, but this has not been determined statistically.

Apart from being used to practise the times tables three times a week, the tablet is also used as a means of communication (e-mail, sending completed tasks to the teacher) and for language lessons. The tasks and assignments in the books are easier to transfer to the tablets (e.g. compo-

sitions, short essays, language comics). Topography is practised on the tablet and pupils are encouraged to conduct searches, for example, in Wikipedia. This is often done at the beginning of the lesson; pupils look up and gather information relating to a person or topic relating to the lesson given in the classroom. Generally speaking, the pupils work for between half an hour and two hours a day on the tablets.

Classroom observation

During observations, some pupils work with the tablets, while others work on paper. The teacher encourages the pupils every ten minutes to keep up the speed and to complete as many sums as possible. It is quiet in the class and the pupils work concentrated and independently.

4.3.2 Description of case 2 and 3

Information from the talks

In the second and third case, the main focus was on language skills. The tablets were used for a period of six weeks in all language lessons. The school wanted to assess motivation and learning results. In case 2, all pupils were involved. The book sets out various tasks related to each topic. During case 2, the teacher did not adapt the content of the tasks and instruction and kept very close to the original tasks and questions set in the teaching method, as was required by the school management. The tablet was used, for example, for creating products in MS Word and PowerPoint. Several Internet sites were also used, as well as a QR-scanner and photo camera. Specific apps were not used, however, only from Internet sites and methods like Bloon. When pupils had completed their tasks, they were allowed to play the educational game called Woordament. Pupils wrote a poem and could adapt the letter types and colours in MS Word. A QR knowledge quest was organised by the school, where pupils scanned a QR-code and had to answer the question that was given. Pupils also took photographs and were asked to create captions for the photos (a normal caption and a funny caption). Essays were also made in MS Word, and pupils looked up words in the online glossary, images on the internet and made Powerpoint presentations. During QR knowledge quest, pupils worked in groups in the school, with one tablet for each group. The code was scanned and the answer was written down in an exercise book. While one group was walking around during the quest, other pupils remained in the classroom and carried out other tasks and assignments. The groups then switched roles.

Case 3 applied to two pupils with dyslexia and two pupils who had difficulties with spelling. These pupils still need to practise their spelling a lot more, but don't really like it. During this case, a method was sought which would motivate these pupils with their spelling exercises. The games that were chosen (for example, Woordament) were found to increase motivation in these pupils. As far as we know, these four pupils have completed their additional spelling exercises on the tablet.

Classroom observation

During the observed lessons, pupils learned how to use a TV guide. They were asked to answer several questions about when a film was scheduled to begin on a certain channel and how long a

programme lasted etc. The teacher introduced the task by means of the book, and talked with students about their favourite TV programmes. The class then discussed the differences between a printed version of a TV guide and a digital TV guide. The task assigned to the pupils consisted of downloading the app on tv-gids.nl and answering a number of questions on paper ('at what time...?'). What is the title of the film that starts at 20.30 hrs on Net5?). After answering the questions concerning the TV guide, the pupils were then asked to look up the meaning of various words in an online dictionary. Pupils enjoyed participating in the talks relating to TV programmes and several types of guides. Downloading the app went well in the most cases and the teacher helped the pupils select a suitable TV guide app from those that were available.

4.3.3 Prerequisites

Windows has a number of restrictions, as was indicated by the pupils. The occasional requested or unrequested updating of the tablet presents problems, as well as the execution of operations or functions not requested by the user (using the narrator, for example). Adapting the settings requires the use of Windows 8 and this is not an easy system to work with. A major disadvantage is the 'persistence' of Microsoft: apps by other developers are not permitted (e.g. Google Chrome, Mozilla Firefox). The version of Explorer installed on the tablet does not appear to work well with the school's mail server. These are practical experiences which ensure that, if a choice is to be made, that choice would not be for a tablet, but for a personal computer or laptop. Some problems are only encountered in practice. These can be resolved, but this has to be done on all of the tablets individually, i.e. 23 times. The installation of the tablets was cumbersome. Installation management is not easy and it cost a few days before the tablets were ready for use. The teacher was baffled by the fact that some tablets would allow the installation of apps while others would not. It is also time-consuming to install things manually 23 times. However, the tablets do run well when everything is finally installed. They are fast devices and the children find them easy to work with.

The keyboard ('projected' on the tablet screen) is often too small and there is insufficient useful screen space left for other features. Children using the tablets are often unable to see what they are doing. The keyboard takes up half of the screen. Soft cases with keyboards would be a solution. When children have the choice between a mouse and a touch-screen, they will often opt for the mouse. Especially for selecting a location on the screen for the input of text.

4.3.4 Effects on the teacher

As yet, the tablets have had little effect on the way the teacher provides instruction. In this respect, the teacher gives preference to the use of the Smartboard and PC. However, the teacher has indicated that he wants to film an explanation in the future and make that film available to the pupils (refer to: flipping the classroom).

For the time being, the teacher wants to use various methods (books) but will probably try to present the assignments in a different way, as was the case with the QR knowledge quest. The dream is to create an electronic learning environment in which tasks and assignments can be set specifically for each individual pupil.

Halfway through the project, the teacher had reservations with regard to the technical problems encountered: “This was not what I expected”, he says, but now he can see that there are major benefits.

The teacher thinks he can use the tablets to adapt to the specific needs of pupils. There are large differences in his classroom, and the tablets would make it easier to adapt tasks. Some pupils are given a different task (for example, an explanation of a drawing in English), or the use of an English app. Pupils who are not so advanced can practise more often in a playful way (for example, with Woordament).

However, the investment in time (installing, selecting, pupil guidance) has resulted in an increase in workload this year. The teacher indicates that is not necessarily a negative effect because he sees that his pupils respond positively: “Making lessons more enjoyable in this way, is really quite energising.”

4.3.5 Effects on the pupils

The teacher indicates that both pupils and parents are enthusiastic. The pupils are enthusiastic because of the faster feedback they get (they can see almost immediately whether their answers are right or wrong). Discovering various options (for example, adding smileys to e-mails) is also very motivating. Because the pupils differ in their approach, some pupils pay very little attention to the end-product, whereas others show creativeness with colours, character types and such. However, it was observed that pupils become less enthusiastic once they have become “accustomed” to working with the tablets. “You need to make it exciting for them and this is easier to do with a tablet than with a book”. According to the teacher, pupils are more active and independent. Pupils work with an app, talk about what they see in the app and are therefore more focused on the content.

It is still difficult to say what the effects are on the learning results. As far as Case 1 is concerned (multiplication tables), the teacher indicates that both groups are making good progress by practising, as was to be expected. Pupils who use the tablet to do exercises find more enjoyment in the exercises. With regard to results, these pupils seem to be making a bit more progress than the pupils who work on paper. During case 2 and 3, the teacher gave the pupils tests to do, but there was no significant improvement observed. Spelling was practised a lot and pupils scored well on those tests.

The pupils themselves indicated that there are advantages and disadvantages when using the tablet. Working with the arithmetic app, for example, is motivating because it offers different

ways to complete the sums (several types of games that can be used to practise the same skills). Quite often, only one form is offered for working on paper and so it “often remains unchanged”. This advantage was also observed in case 2 and 3: the tablet gives them “other exercises”, i.e.: instead of writing answers, pupils could also scan and choose from the answers displayed.

Games are motivating, but always wanting to achieve a higher score also has its disadvantages. If you go too fast you make mistakes and it’s therefore easy to accidentally select the wrong answer. When you want to reflect on a sum, this is sanctioned by the loss of points. When you do sums on paper, you have more time to think about the answer. Also, an advantage of working on paper is that you see how many sums you still have to do on your worksheet before you are done. The tablets keep generating sums and you can see exactly how many sums you still need to do.

Another advantage indicated by the pupils is that the tablet can be used to write neatly and that it is more useful and faster. They find typing texts more enjoyable than writing. A disadvantage is that they don’t learn to write ‘more nicely.’ That the tablet has built-in word recognition also makes it easy, but you must first type in four characters before you see a word appear on the screen.

Some pupils indicate that you can choose more on the tablet and therefore learn more. However, the pupils like facing the challenge to obtain a higher score and it gives them confidence that they can achieve that goal. But, as one pupil says, you actually only learn how to work quicker but not ‘more’ or ‘better’, and looking up a word in a real dictionary is of course exactly the same as online, so you don’t learn ‘more’. Even so, it is now easier to look up words, and pupils indicate that they now look up words more often than they would have done before. ‘Because the tablet indicates when you make a spelling mistake, you pay more attention’, says one pupil. Pupils also indicate that they do their exercises in a different way, and therefore learn differently. One pupil says: “A tablet is always nicer, even though you still have to work.”

4.3.6 Summary of results school C

The ease of use of the tablets is very important for this school. The tablets could not be integrated immediately into the existing infrastructure. The ambitions formulated in case 1 assumed knowledge gaps in pupils, whereas in case 2 the unique, mobile aspects of a tablet were also taken into consideration. These mobile aspects were used within the normal method, without major changes to the tasks. Effects at teacher-level were found in the field of workload and motivation. At pupil-level an effect was observed in motivation.

4.4 Summary

We see in all of the schools that the W8T has become part of their daily classroom learning routine. The amount of time the pupils work with the tablet every day does not vary a lot from school to school. However, the chosen content and activities are quite diverse. This is mainly related to the existing infrastructure and the experience of the teachers and students with IT. What all of the schools have in common, is the aim to increase motivation in pupils and teachers, to encourage more independence in pupils, to bridge the gap between the differences in the pupils and to improve learning performance. With exception of the latter, a change was observed in all these aspects in all of the schools.

Important prerequisites for the deployment of the W8T, besides the aforementioned infrastructure and experience, are the ease of use, the willingness to invest time and the availability of appropriate content and materials. According to all schools, the ease of use of the W8T is high and the fact that programs already used by the schools run well on the W8T was mentioned quite frequently. In contrast, a lot of time was spent installing the tablets (and keeping them regularly updated). Teachers indicate that this investment will be earned back by the motivation of the pupils. Using the tablets more and more for providing feedback, can result in more time being gained. However, the teachers find the number of apps available rather disappointing.

The effects on teachers are visible in the form of workload, motivation and the extent to which teachers can provide for the personal needs of pupils. Although the workload is increased when the tablet is first deployed, the teachers expect that the tablet will ultimately reduce the workload and, in some cases, this was already the case. The motivation of teachers to provide education with the use of the tablet is high, mainly due to the positive feedback from the pupils. Custom teaching content is reflected in more opportunities for knowledge construction instead of the transfer of knowledge, and in applications that provide more room for individual choices to be made and the ability to adapt to the results of the pupils.

All schools indicate that the pupils are motivated when working with the W8T and they are learning more actively. This is expressed in the way of more frequent exercises in arithmetic, for example, because the app offers such a nice game, and because of the other tasks the pupils are given. The tablet makes it easier for the teachers allocate tasks to enable pupils to create short films. All schools are quite aware of the fact that that motivation and commitment may also decrease if the lessons with the tablets become too “plain”. Variation in the way the pupils work, with and without the use of a tablet, is therefore important.

The benefits of using the tablets have not yet been quantified in terms of learning results. The number of participants is not large and a good comparison with previous results is not yet possible. At any rate, the W8T delivers time savings and it makes it easier to cater for the differences between pupils.

5 Conclusions and discussion

5.1 Introduction

This chapter addresses the issues raised relating to the eight questions which were formulated for the purpose of this study. It is on this basis that a conclusion is drawn regarding the central hypothesis. In the discussion paragraph which follows, the results are discussed and set against the results of other studies.

5.2 Conclusions

Here, we summarise the results of the study for each of the questions included in the study.

What are the ambitions teachers and pupils wish to achieve by means of teaching with the use of the W8T?

The nine cases showed that schools and teachers strive to increase motivation in pupils and teachers, to encourage more independence in pupils, to cater for the differences between students and to improve learning performance.

Which content and activities do they choose to realise these ambitions?

The schools made conscientious choices with regard to content, activities and application in the cases described here. However, the tablets were not only used for the cases; many more applications were used throughout the course of the year. Figure 5.1 shows the applications which were used specifically for all of the cases. In addition, the schools also used MS Office applications (such as MS Word and Powerpoint), method-related software (for example, Wereld in Getallen, Taal in Beeld) and internet sites (Bloon, Wikipedia).

How do they integrate W8T in practice?

At all of the schools, the tablets have really become part of the daily practice. The tablets are primarily used by the pupils to practise or to automate skills (for example, the arithmetic app called Rekenkamer), to create products (for example small films and work projects), or to complete personal assignments (weekly assignments in OneNote). There is little question of real replacement of methods or adaptation of didactics. At schools B and C, however, a shift was observed in the use of the tablets for exercises, towards using the mobile aspects of the tablet (search quest) and the use of the creative possibilities of the tablet.

Figure 5.1 - Content, activities and applications related to the cases

Content	Activities	Application used
Weekly assignment	Students see which tasks and assignments they must complete in the week to come.	OneNote
Arithmetic and vocabulary	Practising sums and words and providing correct answers using spelling	Space race in Socrative
Activities of pupils	The teacher can see what the pupil is doing on the screen.	Meraki
Vocabulary	Creation of online glossary	OneNote
Exercises, knowledge retrieval	Brainstorming	Linoit
Spelling	Several language games and automation exercises	Taalzee (Language sea)
Arithmetic	Explanatory films for lower classes	Active Inspire
English language skills: speaking and vocabulary	Creation of films about the school, the local surroundings and classes.	Camera and Moviemaker
Arithmetic multiplication tables	Arithmetic games	Utopia and Rekenkamer (Utopia and the Court of Auditors)

Which function does W8T fulfil in the preparation of lessons and in professionalisation activities?

The teachers of school A use the tablet to schedule and present the weekly tasks of the pupils. Teachers of school B and C do not use the tablet for preparing lessons. The teachers of school B do not have their own tablet. Professionalisation activities do not yet take place with the use of the W8T. Therefore, the tablet plays no significant role in the preparation of lessons and in professionalisation activities.

What effect do prerequisites have at teacher and pupil level when integrating W8T?

Of all the prerequisites at school-level, the IT infrastructure, teaching materials/content and the ease of use of the W8T seem to be the most decisive facts. In the interviews that were held, it was stated that the tablet was easy to use, even though an external keyboard and mouse are needed. The installation of the tablets took a considerable amount of time, and updating the device (especially if this needed to be done on each tablet) is also time-consuming. Sometimes, it is quite awkward when using an external keyboard and a keyboard keeps emerging on the screen of the tablet. It is an advantage that many of the programs already being used, such as MS Word and Powerpoint, can also be used on the tablets. The educational materials/content already being used, ran well on the tablet. The teachers felt rather disappointed by the lack of educational apps available. Despite the barrier caused by the lack of material, this wasn't a major issue, as many of the programs already in use ran well on the tablets. In the future, however, it could well cause a stop in the development of education.

A good infrastructure is required. This was in place in all of the schools. However, the schools are quite dependent on the infrastructure and use an internet connection when they work in the cloud or use apps that require an internet connection. Support of the school management is considered as pleasant but is not decisive for the use of the tablets. Support by an IT coordinator was also not decisive at these schools. In school A, the teachers themselves selected everything. In school C, the teacher himself was the IT coordinator and in school B, there was only an upper school IT coordinator who had very little time. At this school, a pupil was involved in installing the tablets. The presence of knowledge of and affinity with IT is therefore necessary, but it is of less importance who is responsible. The willingness and motivation of the teachers is much more important. All teachers indicated their willingness to invest time. This investment is also crucial. The teachers of school B and C indicated that the investment of time required was immense, but at the same time that the enthusiasm of the pupils justified that investment. The expectation was also that there would eventually be gains from this investment, because pupils already had feedback from apps, which meant that teachers spent less time on the follow-up. School A indicated that monitoring progress costs time, but that this was always the case. And because all pupils have their own device, it costs less teaching time to get all pupils to do method-related exercises than it would with a limited number of computers in the classroom.

What impact does the use of W&T have on teachers in combination with chosen content?

Effects were observed with regard to workload, motivation and the degree to which teachers can provide tailored content to meet the individual needs of pupils. In the first instance, the workload of most teachers increased, but they expect that this will diminish as more experience is gained.

The motivation of the teachers to provide education with the use of the tablet is high, mainly due to the positive feedback received from the pupils. Because the pupils are very enthusiastic, the teachers are also positive. An important advantage also mentioned, was that pupils worked more actively and more independently. If pupils work more independently, teachers have more time and space to observe or to help individual pupils.

During the course of the project, it was observed that the tablets were more frequently introduced for the purpose of knowledge construction (for example, the pupils use the tablets to create short films in order to explain things, or look up words which they want to use in their English films) instead of knowledge transfer. Knowledge transfer, however, still remains the primary focus, for example, practising sums (arithmetic) and words (vocabulary). The tablets provide more opportunities to focus on the needs of individual pupils.

What impact does the use of W&T have on pupils in combination with chosen content?

Pupils are clearly motivated to learn and work with the tablet. The question is, however, whether this motivation will remain high once the pupils had become accustomed to using the tablets. Both pupils and teachers indicate that variation is important. Teachers and pupils indicated that pupils learn more actively when using the tablets. This is because the assignments the pupils are given encourage active learning. Teachers indicate that the tablet makes it much easier for them to give such active assignments. The tablets are used individually, in pairs and in

groups. The emphasis is on individual use. However, the pupils indicated that they would like to cooperate more often.

Concerning the learning results, no hard judgements can be done. The ease of use and the attraction of the tablets have in many cases ensured that more time could be spent on certain content and/or skills (for example vocabulary) and this can give a misrepresentation if the learning results are compared with previous results. Moreover, the participating group of pupils has been limited in scope and several other factors may therefore give a misrepresentation of learning output.

Can an indication be given of the benefits of W8T in combination with chosen content?

The tablets were used to automate skills, create products and to encourage pupils to execute assignments independently. Many different applications were available and the schools executed a number of tasks that were new to them. The weekly assignment in school A, the creation of short films in school B and the search quest in school C are examples of this. In the first instance, this results in a gain in time. In addition, it can be concluded that it gives the teachers the opportunity to take a more personal approach when teaching. Providing different assignments to do (and at the same time adapting to personal needs and differences between pupils), or providing tasks that encourage the creativeness of the pupils, has now become much easier.

Hypothesis

The following hypothesis was formulated for the study: Used in conjunction with the correct content, the W8T enables teachers to provide a more customized approach to teaching assignments and increases the learning output of pupils.

One of the conclusions of the study is that teachers can provide more personalized tasks and assignments thanks to the use of the W8T. However, the availability of content is still considered as an issue requiring further improvement. As yet, conclusions regarding the learning benefits cannot be drawn. However, a positive effect on motivation and active learning was observed. So, the conditions for increased learning benefits do seem to be present. The hypothesis can therefore be accepted, albeit with some reservations.

5.3 Discussion

Finally, we compare the most important results of the study with the conclusions which have been drawn on the basis of other studies. This is done for three different themes: integration into classroom practice, prerequisites and effects and benefits.

Integration into classroom practice

All teachers believe that the use of IT must always have an educational aim. These results correspond to studies conducted by Sheingold and Hadley (1990), which concluded at that time that motivation and devotion, heartfelt support and access to the required amount of technology are important factors for the integration of IT into education. Ertmer (2005) concluded that it is the

pedagogical beliefs of the teacher that are particularly decisive in the use of IT in classroom practice. The willingness to deploy IT depends much more on the views of teachers with regard to good education (Ertmer & Ottenbreit-Leftwich, 2009). This explains the very different choices which have been made within the schools for content and applications. Moreover, one of the conditions for participation in the project was that the schools were required to draw up a plan for the use of the tablets in each of the series of lessons. In this respect, the didactic use of the tablets needed to be well-considered before they were put to use.

Prerequisites

A lot of study went into the prerequisites for and barriers against the introduction of IT in education. The school policy centred around IT, competences, technical infrastructure, material, time and support are important factors, as well as self-confidence, attitudes and ambitions, as well as a culture which encourages teachers to experiment (Becta, 2004; Mumtaz, 2000; Stuart et al., 2009; Tondeur et al., 2008, Yuen et al., 2009). Studies into the introduction of tablets in education have focused on various factors such as hardware and content, which present challenges, as well as leadership, cooperation and support and the professionalisation of teachers (Tondeur et al., 2013; Montrieux et al., 2013).

Specific requirements have been drawn up for the schools who participated in this study concerning the (development of) views on the introduction of IT, competences and IT infrastructure. Moreover, provisions were made for upper school meetings and content-related support. As far as the prerequisites were concerned, the schools scored very positively. Technical problems arose only to a limited extent, notably in a few cases during the installation of the tablets. Lack of time was not an issue, although the teachers did indicate that they had invested a lot of time. One key issue is the lack of educational apps, which is partially compensated for by the fact that much of the software already in use ran well on the tablets and that applications could be used directly from the internet.

Effects and benefits

Kennisnet (2013) states that correct use of IT results in increased motivation, improved learning performance and a more efficient learning process for the pupil. Research shows that both teachers and students find tablets both useful and user-friendly (Montrieux et al., 2013), that tablets provide quicker access to information and stimulate active and cooperative learning (Gudmundsdóttir et al., 2014; Henderson & Yeow, 2012). Many of the studies conducted into the use of tablets in education are small-scale and conclusive results and views regarding the benefits and effects are still absent. A number of studies have shown that teachers in the schools concerned did not have sufficient skills or self-confidence to integrate tablets into their educational practice. This led to a less than optimum use, where there was a lack of transfer in the guidance of the learning process (Ifenthaler & Schweinbenz, 2013; Voogt et al., 2013).

The study described here was also small-scale and does not allow conclusions to be drawn with regard to learning results. Results that correspond with the results of other studies include the increase in teacher and pupil motivation and a more active attitude of pupils. The focus in the three schools was not on cooperative learning, even though there was good cooperation between

pupils when this was opted for. As indicated previously, the lack of skills or confidence on the part of the teachers was not an issue at these schools. There were sufficient conditions present for the optimum use of the tablets.

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