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Checkpoints for Integration of a One-to-One Tablet Configuration in a School Learning Environment

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Abstract: The hereby given article focuses on challenges and potentials of the integration of a one-to-one tablet computer environment in schools. On the basis of advantages and disadvantages of the use of tablet computers in learning scenarios and especially in classroom use, actual approaches to implementation of one-to-one tablet configurations in formal education system will be discussed in a practice-driven way by exemplarily starting from the point of given technological, organizational, personal and educational preconditions from a southern German Community School. These will be generalized and thus lead to a comprehensive view on the integration of one-to-one tablet computer configurations in given complex settings of institutions in formal education system. This article will therefore result in general and system-independent conclusions and recommendations practicable for school institutions, which are presented in terms of Checkpoints for One-to-One Tablet Integration in Schools.

Keywords: Tablet Computers, iPads, Learning Environment, Schools, ICT Infrastructure.

1. Introduction

Tablet Computers are supposed to bring one of the groundbreaking changes to learning inside and outside classrooms (cf. Johnson et al., 2013; and McLester, 2012;), even though their integration in school systems is far from natural or unproblematic (Armstrong, 2014). Since the 2010 introduction of the iPad, tablet computers grew immensely in importance, in private life as well as in professional settings (Griffley, 2012, p.8), which is for instance shown by the school tablet project map of Germany (Ludwig, 2014). Speaking of the field of education, approaches related to the use of tablet computers are mostly project-oriented, offering students a device for testing purposes but not for long-term use (cf., e.g., Hahn and Bussell, 2012, p.43).

Actually it can be stated that there are two main directions of research going into the use of tablet computers in formal education system: On the one hand side, the devices are being offered by institutions representing the educational system, such as schools or media centers. This can be the case in terms of tablet devices being used in a specific subject or project for some time, where students are using the technology just in classroom. The initial point for this procedure regularly is to be seen in the strong financial limitation of most educational institutions leading to a missing capability to comprehensively introduce one single device for all of the students, as well as in the comparatively low effort that has be invested before using the devices. Unfortunately, the additional benefit is also strongly limited because of missing continuity and missing opportunity for the students to get in contact with the devices in every day grid.

To overcome these issues, on the other hand side, there is another approach being discussed called BYOD (Bring-Your-Own-Device), which is partially seen as forward-looking approach because private available and already existing devices are being integrated in learning scenarios. Advantages are obvious: Since students are allowed to use their own technical devices, schools are not confronted with large costs for the purchase of these and, furthermore, students are responsible for the maintenance of the devices. The most important disadvantage of this approach is the integration of a variety of different

devices and different operating systems. This is not only challenging on a technical layer, but also from a pedagogical point of view, since educators have to check whether a specific app is available for Apple iOS, Google Android and Microsoft Windows Mobile. Furthermore, not every student might be equipped with a respective device, what strengthens the well-known digital devide (e.g., Ritzhaupt, Feng, Dawson, and Barron, 2013).

This article will further discuss a third possibility, a combination of these two approaches in terms of an one-to-one tablet computer equipment, which is supposed to combine strong advantages and minimize disadvantages that have been named above.

2. Learning with Tablet Computers

Mobile devices in general and Apple iPads in specific have been proposed for a while now as an enhancement for classical school and class setting. Corresponding approaches may be classified into one-to-many and one-to-one configurations (Hahn and Bussell, 2012, pp.46; Pamuk et al., 2013; Miller, 2012, pp.54). In one-to-many settings, specific classes or projects are equipped with such devices. Also, class-sets may be made available for lending for use in specific subject fields. In one-to-one settings, on the other hand, schools or other institutions either target to equip each student with an individual device, possibly also for private use, or they allow for the use of privately owned devices in school. The latter approach is typically denoted as Bring-your-own-technology (BYOT) or Bring-your-own-device (BYOD) (Lee and Levins, 2012).

Different forms of this will be shortly presented in the following, which will be followed by the description of the specific situation at a southern German school, the Alemannen Community School Wutöschingen (ASW).

2.1 One-to-One Tablet Computer configurations

While most experiences from the use of mobile devices in schools originate from one-to-many settings and pilots (for instance, Culén and Gasparini, 2011), corresponding studies and experiences in the one-to-one-field are less prevalent. The Portuguese Magellan initiative represents an example for the state-wide introduction of mobile technology in schools on a one-to-one basis. In this initiative, primary school children were provided with a low-cost laptop between 2008 and 2009. While this project received much recognition in the public, the results were less satisfying: The Magellan laptops were little used by teachers and students, on the one hand because of the lack of access to wireless Internet in schools, on the other hand apparently due to a leck of appropriate teacher training (Carvalho, 2011). These experiences highlight the imperative of appropriate infrastructure and teacher support when trying to implement a one-to-one strategy.

Foote (2012) describes a district's approach in the direction of establishing a one-to-one iPad program and first positive results from a pilot. For instance, 88% of the students reported an enhancement of learning experience, and 90% stated a somewhat positive or positive effect on their motivation to learn. Foote also highlights the value of supporting activities, such as the installation of a help-desk and voluntary after-school meetings. The Steve Jobs Schools in the Netherlands represent a recent case for the implementation of a one-to-one configuration with iPads at elementary school level (O4NT, 2014). The O4NT approach without doubts can be seen as exemplary, since here the focus is on a new pedagogy, leading to a novel curriculum, where iPads play a crucial role. However, evaluations of this approach are still missing.

BYOT or BYOD initiatives at school level are more rare, and reports on the implementation of such programs even more. McPhail and Paredes (2011) report from some pilots in this area, the development of a corresponding district's policy, and directions to successful implement a BYOD approach.

2.2 Situation at ASW

Tablet-related situation at schools often is that students are just punctually equipped with the devices in terms of specific lessons or short-term projects. They thus are regularly confronted with a short usage time of the devices and extensive potentials of these aren't used, because they are not understood as personal learning environment (PLE). At ASW, school and commune found a way to cooperatively offer students the proposal to lease a tablet computer (in this case, an Apple iPad Air). Students are allowed to use the devices for private life, leading towards a personal device, which is also used for

learning purposes. For the leasing itself, a public advertisement was offered and the computer leasing company offering the best proposal was chosen. For the specific understanding of the next steps of tablet integration at ASW, a short excursus on the school system at ASW itself is of relevance.

2.2.1 Excursus on ASW School System

Over the past five years, school system in the German federal state Baden-Württemberg changed immensely. While the classic German educational school system mostly differentiates three school forms (low track, middle track and high track), some schools in Baden-Württemberg chose to move beyond this manifested external differentiation and integrated all tracks in one school, implying huge requirements related to individual learning and advancement. At ASW, this new system was integrated for fifth graders four years ago and was continued the following years. For now, students of the fifth grade, sixth grade as well as seventh grade (and from September 2014 on also 8th grade) are learning in this self-directed way. In total, about 450 students are visiting the ASW.

2.2.2 Technical Requirements

Before the students are equipped with and actually can use the devices in their daily grid in school, the school has to make different technical as well as pedagogical arrangements. In a first step, the availability of an adequate internet connection has to be named, which is capable of offering an enduring and stable internet connection via wireless networks. An adequate internet connection with good data transmission as well as router devices with the respective capacity are necessary (Armstrong, 2014, p.45). At ASW, we use a 120 mbits/s connection in combination with an Apple MacMini Server is caching the internet data to improve the connection. Additionally, web access monitoring is necessary.

Besides these aspects related to the internet connection, the maintenance of the devices is another aspect of particular importance. Not only related to the procedure in case of problems or technical failures, but also related to installed apps, updates and general software settings. The respective school has to decide what aspects it can come across by own employees (mostly teachers) and which aspects should be outsourced. Accordingly, system administrators have to think of effort neutral ways to keep the systems up-to-date, what points towards installed apps and software settings. One interesting and helpful endpoint management software package which is being used at ASW for the management of Apple products is the Casper Suite offered by JAMF Software.

Although the above described technical requirements are themselves extensive in preparation and lots of additional work where ICT-experts are needed, the real challenge is not to offer the technological framing of learning processes, but to amend the given school system in a reasonable way.

2.2.3 Pedagogical Requirements

Anyway, to achieve this added value, a pedagogical concept, which names concrete procedures how to come across the technical possibilities and problematic issues besides the technical aspects, has to be developed. It has to begin at the school-specific situation, including teachers, involving different existing committees (with students, parents and teachers), to consider the peculiarities of different departments, taking into account technical infrastructure and furthermore. The situation often differs a lot, because schools in German federal state Baden-Württemberg are often missing in a media development concept, leading to technology being irregularly used, not finding its way into every-day use at schools.

At this point, a concept has to be developed, connecting the given resources and technological surroundings to the capacity of teachers as well as students. While professional training programs especially for teachers are (independent of the teachers' age) necessary and have to support teachers in integrating new technology in their working schemata, students regularly need introductory courses to be aware of critical aspects of the devices. Ideally, students would use their own tablet device without extensive software-based restrictions, but are self-consistently aware of the use of their device. Limiting the access of internet (in school or at home) or specific apps are said to possibly lead to a reduction of interest in using the devices (Pamuk et al., 2013, p.1819).

3. Educational Concept at ASW related to tablet computers

As we are speaking of the ICT-related training of students: Every ICT-affine teachers knows that there are always some kids around, which are good in using ICT. Sometimes, they are even better that the respective teachers. While some teachers see this as challenge of their authority, the relation between

student and teacher should be understood as educational partnership, where both can learn from each other. So why not taking some ICT-competent learning partners and give them some challenges in terms of providing other students or even teachers in case of ICT-related questions? At ASW, we are about to integrate a student ICT team called "Junior IT-Supporter" in our concept. But this is just one point of the respective concept, which will be extensively discussed in the following.

3.1.1 Situation at the time of tablet integration

As was described above, the tablet-related concept is closely related to the general pedagogical concept of the ASW, which is pointed towards the individual development and promotion of the students. They are learning in a self-directed way and teachers are more or less understood as educational companion who can be asked in case of uncertainty or questions. For this system, equipping every student with his own digital device seems to be a proper way of facilitating the learning processes.

One aspect worth mentioning is the decision for really equipping every single student with one Apple iPad Air using a leasing model, which leads towards the discussion whether students are allowed to use the devices in private context, too. Since especially the private using space allows for extensive media educational experiences, we decided that students are not only allowed to use the devices in private context, but also that they are being motivated to do so. Following this argumentation, it's both the teachers and the parents who have to support students in case of problems and questions. Since parents are just partially involved in these digital devices, workshops for parents of students are an aspect of particular importance, too.

Another aspect of importance is the personal responsible for the introduction of the new devices, which in the case of ASW are two regular teachers. Integration of the tablet computers had to take place during regular school semester, causing demands from the teachers, students and especially the organizing team. Of course, respective teachers had to do most of the related work besides their regular lessons, depicting the given system-dependent limitations. This also shows the meaning of an early and sufficient development of a detailed technical as well as pedagogical tablet computer concept. Without it, the necessary work might overwhelm respective teacher personal.

3.1.2 Educational Concept

To enable to relate to the situation at ASW, a short timetable should be given at this point presenting the first steps towards the tablet-integration at the school (see table 1). Because of the immense demands, all teachers of ASW were trained in terms of an Apple Professional Development (APD) training, including first steps towards using tablets, but also including specific subject-related ideas for classroom use. By this procedure, anxiety and skepticism of most participants could be reduced. As was described above, the students need some sort of training, too, especially related to technical possibilities of the devices but also to security issues such as password security or the use of mobile and wireless connected internet. In specific, the amount of training at the beginning of iPad integration is supposed to be higher than some time after the beginning. This leads to the punctual necessity of support, which supposedly cannot be given by regular teacher stuff.

At this point, one possibility is an external company, which regularly is way too expensive for schools and, thus, in most cases unrealistic. Another opportunity is the development of the above mentioned concept of Junior IT-Supporters, which have to be trained in advance but can be motivated by, e.g., a certificate. These might be able to answer some of the basic questions of students, and thus are supposed to massively lower the long-term every-day involvement of respective teacher personal.

In a long-term view, most of the below mentioned requirements are from time to time coming back again, at least every year where new students are coming to school and have to get equipped with tablets, too. Furthermore, concepts like this are in need of an ongoing critical evaluation, analyzing and supporting the related processes. Extensive information about the evaluation of the presented concept cannot be given at this point, because the related concept is just at working status at the moment. Nevertheless, it is planned to include quantitative paper-based questionnaires as well as qualitative interviews with students and teachers.

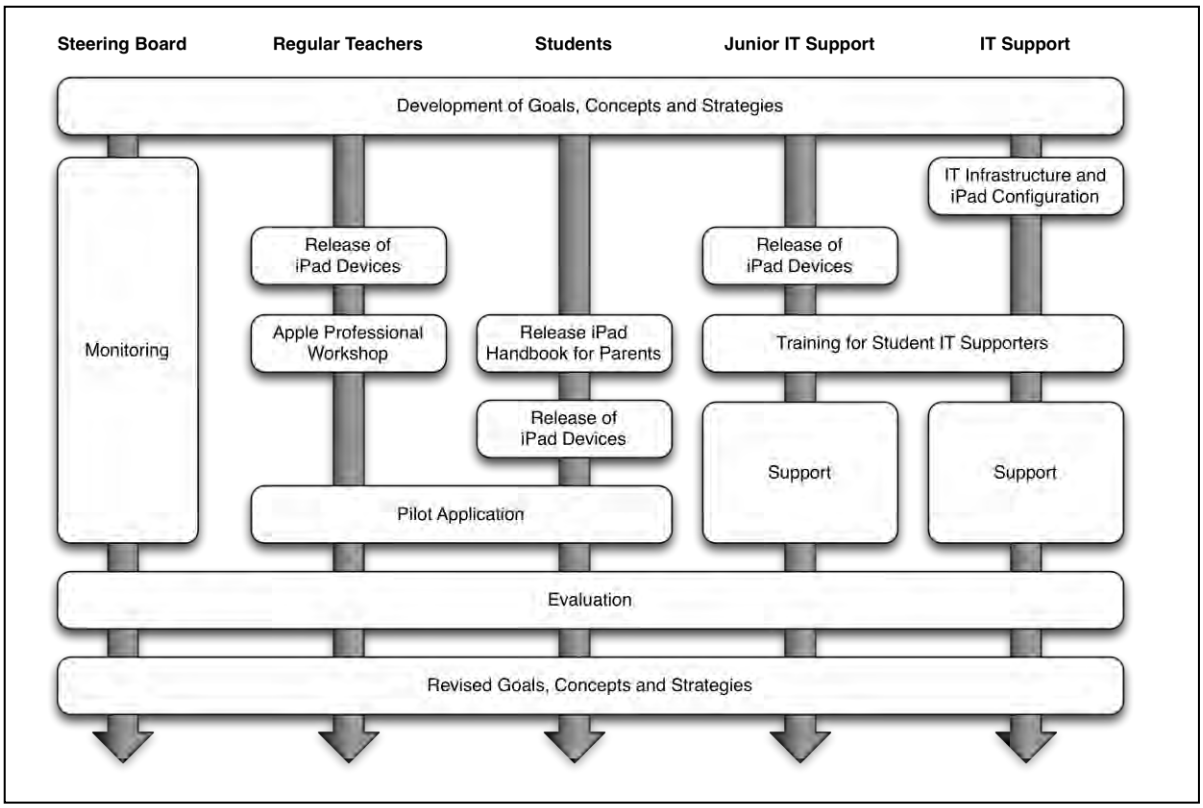

Table 1: First steps towards the implementation of a One-to-One tablet solution at ASW.

3.1.3 Resulting Checkpoints for the Integration

From the actual point of decisions and experiences during the first months before introduction of the tablet devices, some advices can be given for implementing a One-to-One tablet learning solution. It is supposed that these checkpoints are covering all necessary aspects, but whether or not these aspects proved to be good in the given context, is to be proven in terms of the evaluation. At this point, we cannot give extensive information on evaluation results or else, since first evaluation results will be available at the end of September, 2014.

- ***Think about the effort that comes with the tablet PC integration.*** How can the tablet devices be organized? Is it practicable for your school to administrate the devices, do you need an extern supporter? What are the consequences for the technical equipment at school (e.g., the network?).
- ***Decide, which system you will use.*** This decision has to be carefully taken in respective of the given preconditions. Because of the variety of possibilities, some helpful hints might be: What system do you use on your school computers? In case you use Apple iOS, it's a lot easier to use iPads than, for instance, Google Android tablets. What is your local ICT supporter good at? What's the opinion of students, parents and teacher stuff?
- ***Carefully choose the point of delivery.*** It's not important to deliver the devices as fast as possible to teachers and students, but to have a practicable implementation concept before delivery. At least, some stepstones should be clear. Otherwise, the risk of missing structure is at hand what might lead to long-term problems such as missing use standards or missing support structures.
- ***Don't leave the students alone with the new device.*** Students will be motivated and interested, but will also need support related to, e.g., security issues or taking responsibility for the device.
- ***Discuss the concept in advance.*** The respective concept is to be discussed with teachers as well as with students to broaden the acceptance of the devices as well as the concept. This is a factor of underestimated importance in terms of really changing individuals internalized procedures and thinking (cf. El-Gayar, Moran, and Hawkes, 2011), which is linked to literature on technology acceptance and the corresponding theories (Fishbein & Ajzen, 1975).
- ***Don't forget the parents!*** In this case, students were also allowed to use the devices at home, (and not to forget: parents are supposed to pay the leasing fee in our case!). It's thus an essential part to keep the parents involved. They need training, support and understanding for their sorrows, too – just the way students and teachers need it, when they are confronted with a new device.

- ***Teachers need ongoing support!*** They are in need for trainings related to the new devices. It's not just how to privately use the device and to learn some basic facts on it, but also how to implement the devices in different learning scenarios and working schemata.
- ***Use given resources!*** There's always the question how the effort can be overcome. Think about ICT literate students supporting other students and thus minimizing the effort for teacher personal.
- ***Question your way.*** Think about the possibility of a practicable and ongoing evaluation with low additional effort to reveal problems of integration of tablet computers in schools.

Keeping these checkpoints in mind during the integration of technical devices in learning scenarios, chances are good that new devices really get integrated in learning. Furthermore, these aspects are not just applying for the tablet device integration at schools, but also for other technical devices such as laptop computers or smartphones.

4. Future Work and Conclusions

The presented article discusses the potential of One-to-One tablet configurations in terms of formal educational system and finally highlights the relevance of different dimensions which have to be taken into account when thinking about an One-to-One tablet equipment. On this basis, it finally presents checkpoints for the integration of tablet computers in schools, which resulted from an adequate literature review as well as extensive discussions with school principal and respective teachers. These can also be understood as dimensions fostering or restrain the integration of tablet computers, showing a good starting point for the development of respective qualitative and quantitative research approaches. Nevertheless, the above named aspects are in need of evaluation in short-, middle- and long-term view. First experiences as well as first evaluation results will be named in the forthcoming presentation.

References

Armstrong, A. (2014). Technology in the Classroom It's Not a Matter of 'If,' but 'When' and 'How'. *Education Digest*, 79(5), 39-46.

Carvalho, A. M. A. (2011). Laptops for Students: Strength and Weakness of the Portuguese Initiatives. Proc. ISATT 2011. Braga, Portugal. Online: http://repositorium.sdum.uminho.pt/bitstream/1822/15931/1/ISATT2011_Laptop_Students.pdf (Last checked: 18.5.2014).

Culén, Al. L., and Gasparini, A. (2011). iPad: A New Classroom Technology? A Report From Two Pilot Studies. In Clive Billnness; Annette Hemera; Vladimir Meteljan; Mihaela Banek Zorica; Hrvoje Stancic & Sanja Seljan (ed.), Information Sciences and e-Society. Department of Information Sciences, University of Zagreb. pp. 199 - 208

El-Gayar, O., Moran, M., and Hawkes, M. (2011). Students' Acceptance of Tablet PCs and Implications for Educational Institutions. *Educational Technology & Society*, 14 (2), 58–70.

Fishbein, M., and Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesey.

Foote, C. (2012). *The Evolution of a 1:1 iPad Program*. Online: www.internetatschool.com, (Last checked: 15.5.2014).

Griffley, J. (2012). Gadget and Gizmos: Libraries and the Post-PC Era – The Rise of the Tablet. *Library Technology Reports*, 48(3), 7-13.

Hahn, J., and Bussell, H. (2012). Curricular Use of the iPad 2 by a First-Year Undergraduate Learning Community. *Library Technology Reports*, 48(8), 43-47.

Ludwig, L. (2014). Tablet-Schools in Germany. Online: http://www.luise-ludwig.de/tabletprojekte/ergebnisse/ (Last checked: 21.8.2014).

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A. and Ludgate, H. (2013). *NMC Horizon Report: 2013 Higher Education Edition*. Austin, Texas: The New Media Consortium.

Lee, M., and Levins, M. (2012). *Bring Your Own Technology*. Acer Press.

McPhail, J., and Paredes, J. (2011). One urban district's digital learning revolution. Leadershop, September/October. Online: http://riversidevirtualschool.net/JaysLeadershipArticle--Sept2011.pdf (Last checked: 15.5.2014)

Miller, W. (2012). iTeaching and Learning – Collegiate Instruction Incorporating Mobile Tablets. *Library Technology Reports*, 48(8), 54-59.

O4NT (2014). Schoolmodel Steve JobsSchool. Online: http://o4nt.nl/wp-content/uploads/2013/01/o4nt_Boekje_V7.pdf. (Last checked: 15.5.2014)

Ritzhaupt, A. D., Feng, L., Dawson, K., and Barron, A. E. (2013). Differences in Student Information and Communication Technology Literacy Based on Socio-Economic Status, Ethnicity, and Gender: Evidence of a Digital Divide in Florida Schools. *Journal of Research on Technology in Education*, 45(4), 291-307.