Is Technology a Magic Wand?
When Tablets’ affordances meet Teaching Practices:
Insights on Didactic Design

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Abstract
This text presents and discusses results of empirical research conducted during 3 school semesters (1.5 of school year) in a primary school in Poland. The research focused on the introduction of tablets (iPads) to didactic design and aimed at the observation of learning processes of the entire school community in connection with the appearance of a new educational actor. We used a qualitative research approach, mainly video-ethnography (60 hours of recorded material). This research approach resulted in the identification of maps of teaching and learning practices and their meanings in the changing school field.

Keywords: mobile technology, teaching, didactic design, SAMR model, transformation

Introduction
Analyses of the integration of technology into classrooms have a long tradition in research (Pachler, Bachmair, Cook, Kress, 2010; Pegrum, 2014) and a well tried and tested set of research approaches (Cerratto-Pargman, Nouri, Milrad, 2017). When analysing the existing corpus of empirical research, it seems that studies insufficiently represent the process of changes taking place in the learning and teaching practice in a longer perspective, at different stages of the process of the
appropriation of mobile devices (Pegrum, 2014). This article aims at the provision of knowledge and a new insight into the learning and teaching practices in the classroom in a Polish primary school observed over a longer perspective, i.e., during three school semesters.

**Theoretical framework: didactic design**

For the purposes of our research, we adopted the mixed theoretical framework developed in the field of digital didactic design and by Puentadura (2014). The process of analyses covers three components: teaching, learning, and the integration of technology (Jahnke, Bergström, Mårell-Olsson, Häll, Kumar, 2017). It is worth analysing the mutual relationship between the following elements:

a) type of adopted educational goals;
b) type of planned learning actions;
c) use of didactic resources, including technologies;
d) anticipated role of the learner;
e) anticipated role of the teacher;
f) assessment and feedback.

The SAMR model, which makes it possible to take into account the relationship between the educational goals and the planned use of technology, i.e., various manners of the integration of technology into the processes of learning in the classroom, is another theoretical source.

The **SAMR** model developed by Puantedura (2014), in which the author defined several levels of the integration of technology into the education process: substitution (S), augmentation (A), modification (M) and redefinition (R), seems to be helpful in the understanding of the place, role and importance of technology at school.

**Research Methodology**

In order to broaden the knowledge on what actions emerge in the tablet-mediated classroom, and how these actions change over time, we carried out empirical research in a primary school located in a city in the region of Pomerania, northern Poland.

In this article we are referring to one main research question:

What is the map of teaching and learning practices at different stages of the process of the introduction of new technologies into a school?
Sampling

The school we selected for research was chosen in view of the fact that in 2015 it decided to invest in wireless internet connectivity and to purchase Air iPads (using their own financial means), which were to be used as a part of the 1:1 model. For the purposes of our research, we selected teachers who volunteered to conduct classes using tablets. In this school, women constitute over 90% of the teaching staff. A detailed structure of the sample is presented in Table 1.

<table>
<thead>
<tr>
<th>Teacher symbol</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 (mathematics)</td>
<td>59 years</td>
</tr>
<tr>
<td>T2 (Polish)</td>
<td>58 years</td>
</tr>
<tr>
<td>T3 (IT)</td>
<td>45 years</td>
</tr>
<tr>
<td>T4 (English)</td>
<td>34 years</td>
</tr>
<tr>
<td>T5 (nature)</td>
<td>29 years</td>
</tr>
<tr>
<td>T6 (religion)</td>
<td>27 years</td>
</tr>
</tbody>
</table>

The collection of empirical data was commenced in September 2015 and was completed in December 2016.

Data collection method

We participated in the collection of more than 60 classroom observations documented with field notes and videos showing the lessons (more than 60 hours of video material) during three school semesters (Derry, Pea, Barron, Engle, Erickson, Goldman, Hall, Koschmann, Lemke, Gamon-Sherin, Sherin, 2010). During this time, the same groups of learners and the same teachers were observed, which made it possible for us to maintain a certain continuum and document the real changes in the ways tablets are used for educational purposes within the existing framework and in the longitudinal perspective.
Operationalisation of the adopted theoretical models – development of the coding scheme

The coding scheme originates from the didactic design theory extended with the SAMR model, from which the names of the analysed categories were taken (from A to G). Then, on the basis of knowledge on the stages of advanced learning strategy and the possible stages of the integration of technologies in the classroom, values (on a 1–5 scale) symbolising identifiable and separate ranges of the actions of teachers and learners, and the manner of the use of technology during classes were assigned. The coding scheme containing the area of variation of the observable practices is presented in Table 2.

Table 2. Coding scheme

<table>
<thead>
<tr>
<th>Category</th>
<th>Description of the adopted coding scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Type of adopted educational goals</td>
<td>1. unclear; coverage of the lesson topic</td>
</tr>
<tr>
<td></td>
<td>2. provision of knowledge, consolidation of knowledge/ skills</td>
</tr>
<tr>
<td></td>
<td>3. search for information and its use within the framework defined by the teacher</td>
</tr>
<tr>
<td></td>
<td>4. search for information and its independent processing, recontextualisation, etc.</td>
</tr>
<tr>
<td></td>
<td>5. production of knowledge in a new form/shape</td>
</tr>
<tr>
<td>B. Type of executed learning actions</td>
<td>1. individual watching of illustrative materials (presentation prepared by the teacher)</td>
</tr>
<tr>
<td></td>
<td>2. individual/group exercises, consolidation of skills</td>
</tr>
<tr>
<td></td>
<td>3. individual/group activity consisting in the reorganisation of knowledge under the teacher’s control</td>
</tr>
<tr>
<td></td>
<td>4. group activity consisting in autonomous processing of knowledge from sources indicated by the teacher</td>
</tr>
<tr>
<td></td>
<td>5. group activity consisting in the processing of knowledge</td>
</tr>
<tr>
<td>C. Use of didactic resources</td>
<td>1. domination of textbook; tablet used for displaying materials</td>
</tr>
<tr>
<td></td>
<td>2. domination of textbook, applications closely subordinated to the textbook material</td>
</tr>
<tr>
<td></td>
<td>3. breaking textbook monopoly through a multitude and variety of applications</td>
</tr>
<tr>
<td></td>
<td>4. breaking textbook monopoly through applications designed to reorganise knowledge</td>
</tr>
<tr>
<td></td>
<td>5. use of applications used for the production of knowledge and balancing of textbook knowledge</td>
</tr>
<tr>
<td>Category</td>
<td>Description of the adopted coding scheme</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| D. Learner's role        | 1. recipient of the ready educational content  
2. exercising and consolidation of the supplied knowledge and skills (memorisation)  
3. reproducer of educational content with elements of independent knowledge processing using an indicated source  
4. reorganisation of knowledge, transformation and group negotiation of knowledge, opinion expression skills  
5. group transformation of knowledge, independent search for materials and information and assessment of sources, cooperation and involvement in the learning team, negotiation of ways in which technology can be used |
| E. Teacher's role        | 1. expert, controls short time of activity with tablet through additional procedures  
2. expert, limits tablet use time and controls the correctness of the use of applications, provides technical support if necessary  
3. expert-controller with elements of facilitation, supports learners’ involvement, provides substantial and technical support to learners, strong relationship of control of the learning process  
4. consultant, monitors the subsequent stages of group work, provides feedback  
5. companion, observer (mentoring elements) of learners’ independent actions |
| F. Assessment and feedback | 1. no feedback, no assessment  
2. comments concerning classes, a kind of a general summary  
3. assessment addressed to an individual or group and concerning the result of work  
4. assessment and feedback during the particular stages of individual or group work and after the end of work  
5. assessment criteria announced at the beginning of classes, feedback at the subsequent stages of work, assessment after the end of work, elements of advisory assessment |
| G. Educational goals in connection with the role of technology | 1. making knowledge transmission more attractive  
2. substitution – streamlining  
3. extension – improvement  
4. modification – considerable change  
5. redefinition – transformation |

The determination of the coding scheme for the substantial research material helped us to avoid the methodological charm of “raw data” and the related trap of anecdotes, which consists in the reporting of the content of the video or the most interesting, non-typical issues, while skipping those elements which are ordinary.
Data analysis

A coding procedure was applied to every recorded lesson. Having watched it, we performed coding on the basis of a list of categories (A-G), making sure that the code selected best represented the character of both the recorded material and the actions observed.

Analysis of the video-ethnographic material was performed using the following four steps:

1. Applying a coding scheme to the entire video material
2. Calculating code values in the particular categories for the particular teachers for each semester

During the procedure, the values obtained by the teachers in the particular categories were totalled, and the result was subsequently divided by the number of the recorded observations. In this way, a mean result for the particular teacher in the time period under analysis was obtained. Keeping the division into semesters, we obtained two collective tables presenting the mean values obtained by the teachers.

**Table 3. The mean values obtained by teachers in the first semester (I)**

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Number of observations</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>T2</td>
<td>4</td>
<td>1.75</td>
<td>2.25</td>
<td>2</td>
<td>2.25</td>
<td>2</td>
<td>2</td>
<td>2.25</td>
</tr>
<tr>
<td>T3</td>
<td>4</td>
<td>1.75</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>T4</td>
<td>4</td>
<td>2.5</td>
<td>2.75</td>
<td>2.75</td>
<td>2.75</td>
<td>2.75</td>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td>T5</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>T6</td>
<td>3</td>
<td>2.3</td>
<td>2.3</td>
<td>1.6</td>
<td>2.3</td>
<td>1.6</td>
<td>1</td>
<td>1.6</td>
</tr>
</tbody>
</table>

**Table 4. The mean values obtained by teachers in the third semester (III)**

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Number of observations</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2.25</td>
</tr>
<tr>
<td>T2</td>
<td>4</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4</td>
<td>2.5</td>
<td>4.5</td>
</tr>
<tr>
<td>T3</td>
<td>3</td>
<td>1.75</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>T4</td>
<td>3</td>
<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
<td>4.6</td>
<td>3</td>
<td>4.6</td>
</tr>
<tr>
<td>T5</td>
<td>3</td>
<td>4.3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>T6</td>
<td>2</td>
<td>2</td>
<td>3.5</td>
<td>3</td>
<td>3.5</td>
<td>3</td>
<td>1.5</td>
<td>3</td>
</tr>
</tbody>
</table>
3. Placing the values obtained by the teachers on diagrams for each semester  
As a next step based on the coding scheme, the calculated mean values were placed on the diagrams representing the particular semesters during which our research was carried out.

4. Analysing transformations in the teachers’ practices  
Before performing analyses for this dimension, we determined the thresholds of the mean values defining the boundaries of the orders in which the teachers’ practices are located.

We identified the mean values between 1 and 2.49 as practices representing the order of the transmissive school. The mean values ranging between 2.50 and 3.49 as tension areas being a part of the existing culture of education experiencing the first serious “cracks” in its practices.

The mean values ranging between 3.0 and 5 as a symptom of the culture of education experiencing a progressive transformation, with new teaching and learning practices appearing relatively frequently in connection with the integration of new technologies.

Research Results

This section presents the results of the video-ethnographic research in the form of diagrams – maps of the emerging teaching and learning practices in the classrooms during the three semesters of our analyses. The maps result from the coding, which was related to seven categories. In the picture of the results, we kept the time axis since it is significant for the emerging changes in the area of the teaching and learning practices in the tablet-mediated classroom.

1st semester: Disappointment  
For the majority of the teachers, the first semester of research in the classroom involved the experience of disappointment and a conviction that iPads “are a failure in the conditions of Polish schools” (T5). The teachers considered the investment into the purchase of iPads as not having been fully thought-out. We are convinced that the main problem evident in the first semester of the video-ethnographic analyses consisted in attempts at the fitting of the new tool into the framework of the heretofore existing practices and activities and subordinating it to them.

As shown in Diagram 1, teaching practices are almost entirely contained in the knowledge transmission order. The collective table for this cycle shows that almost
all the teachers’ results ranging from 1 to 2.49 points. Only one teacher participating in the project – the teacher of English – exceeded the threshold determined as transmissive. Staying in this framework can be interpreted as a process independent of the teacher’s age and his/her private (positive or negative) attitude to modern technologies.

A: Most often these included the transmission and consolidation of knowledge or the training of specific skills. Educational goals were not always clearly determined by the teachers. They were most often related to the execution of the subsequent topic of the lesson, about which the learners were informed at the beginning of the lesson, while the range of skills and exercises to be done were not announced at all.

B: During the first semester, the learners most often used iPads for watching illustrative materials (fragments of videos or presentations prepared by the teacher). In this sense, the learners’ iPads were transformed into small, immobile TV sets, on which they could watch a video or a presentation when looking closely (these presentations were also always additionally shown on the interactive whiteboard). During mathematics, English or religion lessons, learning practices were more clearly connected with the exercising and consolidation of skills in an individual or group manner (e.g., exercising addition and subtraction skills during a fixed time, followed by a comparison of results).

C: The teachers considered the textbook and the workbooks as the leading resources of knowledge and sources of skills. The applications selected by the teachers were strictly subordinated to the leading didactic materials (most often

Diagram 1. Map of emerging practices (semester I)
a single type of mathematical operations or a certain defined group of English vocabulary were exercised).

D: In their actions, the learners did not step beyond being passive recipients ready for the knowledge prepared for them by the authors of textbooks and the teachers. They played a more active role during exercises, where they were expected to perform efficiently, fast, and correctly. The scope of their activity was dominated by actions related to the memorization and consolidation of knowledge.

E: During the first stage of our research, the teachers did not go beyond the role of experts transmitting knowledge or equipping learners with skills. The teachers had an additional task to carry out: the organisation of activities in connection with the use of iPads, i.e., handing the devices out to the learners, controlling the time determined for the activity selected and making sure that the learners did not use independently any other applications available in their devices.

F: In this cycle of analyses, practices in the scope of assessment and feedback were presented sporadically in the form of a general summary of the classes. It was often the case that the element of assessment and feedback for the learners was entirely absent.

G: It seems that the goals of the lessons under analysis could be well achieved without any iPads, which were reduced to the role of a substitute of a screen displaying video material. The tablets were used during a very short, clearly limited time span of up to 10 minutes. During this time, the learners had a chance to exercise some concrete skills such as addition, note-taking, or consolidation of English vocabulary. The use of technology did not move beyond the narrowly-understood substitution and streamlining of the heretofore undertook learning actions.

3rd semester: Emerging progressive teaching and learning practices

The last cycle of research carried out in the third semester was, on the one hand, marked by the effort to deeply reconstruct teaching practices in connection with the appearance of technology in learning (with results over the 3.5 threshold), whilst on the other hand, our research revealed that some teachers did not manage to reorganize their practices and continued obtaining results fitting the knowledge transmission logic (i.e., below the 2.49 threshold) in the same period under analysis. The collective results are shown in Diagram 2.

A: On the one hand, educational goals were not at all verbalised or were signalled unclearly, but without any doubt the new teaching practices included those covering clearly defined goals related to the learners’ independence as creators of knowledge.
B: Learning practices continued to include the well-established individual exercises based on many fast repetitions (mathematical applications). The emerging new practices included, without any doubt, group activity consisting in the independent negotiation-based creation of knowledge by the learners from sources indicated by the teacher or from other sources. What was appreciated here was the learners’ personal knowledge and experience.

C: Strategies of the use of the available resources were also very diverse. On the one hand, there is the dominating role of the textbook, but also some clear attempts at breaking down this domination by balancing and multiplying sources. From the point of view of the process of the construction of knowledge by the learner in connective contexts, this emerging practice is of huge significance (results over 3).

D: In this category, both the traditional role of the learner as the recipient of the ready knowledge (results under 2.49) and the emerging new framework of the learners’ roles were identified. The learners benefited from being causal agents processing or creating knowledge. This reorganisation of the learners’ role consisted in granting them a higher degree of independence and appreciating their technical competence, which resulted in the mandate for the creation of their own content.

E: What showed in the case of this category was both a conservative tendency – the teachers’ attachment to the role of an expert transmitting knowledge (results
under 2.49) – and efforts to change this role. By acknowledging the learners’ higher agency in the area of the creation of knowledge, the teachers “moved” their own role towards consulting and mentoring practices, which facilitated the emergence of new teaching practices (results equal to and over 4.0).

F: Surprisingly, in this category all the teachers obtained results turning towards the traditional direction (up to 3), which means that practices in the area of assessment and feedback are not a highly reconstructed aspect of the teachers’ practices. Although there were single cases of evaluation in stages, assessment most often concerned the effect of work, or the teachers limited themselves to a general summary of classes. From the point of view of the learners’ independent construction of knowledge, this collection of the teachers’ practices raises concerns, as it leaves the learners without adequate feedback on the quality of their own work.

G: In the case of this category, we can see both the use of technology in the substitution and augmentation model (such as the frequently applied game-based approach: the Kahoot! application used for the checking of the learners’ knowledge), but also clear attempts at the modification of learning practices through technology (designs of books prepared with the help of the Book Creator), and designs of presentations to do with explanation of natural phenomena (Aurasma). Also, iMovie applications combining narration, image and sound were used. The teachers also developed visual competences and algorithmic thinking through the practice of changing a tale into a game plot (Bloxels application) as well as narrative games.

Discussion

Our analyses document two processes taking place in the community in question. We managed to grasp the order of slow transfer from the logic of transmissive teaching to practices focused on the learners and their learning. The order can be observed in the area of the emerging practices such as the organisation of group-learning situations, the reorganisation of knowledge, indication of alternative sources of information, use of new strategies in the field of the assessment of the creation of new frameworks of reference to the learner’s role and a more comprehensive use of technology. The relationship between the process of didactic design and technology is very clear here. We also managed to grasp the process of transfer by analysing the order in which the teachers expressed their dilemmas. Initially, these concerned the teachers’ work time and their involvement, as well as the entertaining (and thus not educational) role of tablets, but they subsequently
evolved towards the recognition of tablets as educational tools, but also still retained concerns relating to the educational value of the learners’ knowledge and their technically-mediated skills in the perspective of the requirements of the system of education. It also seems that the practices of assessment and provision of feedback on the learners’ projects, which were reconstructed in relatively the poorest way, are somehow related to this “empty space” in the Polish system of education.

However, we cannot possibly disregard the existence of teachers who made some other choices in the scope of their own practices and indicated “incompatibility” between the tool and their subject area. Interestingly, one of them was the IT teacher. Obviously, we may guess that personal preferences concerning the use of technology may play a role here, but analyses carried out in the group of “progressive teachers” showed that their private attitudes to technology were also varied (from neutral to positive). It seems that the key to the understanding of the reserved attitude towards a fuller use of tablets during mathematics or IT lessons lies in the package of skills defined in the core curriculum for the primary school in the scope of their teaching subjects rather than their personal deficits or preferences.

**Conclusion**

This study was aimed at the showing of the process of the emergence of new teaching and learning practices in the tablets-mediated classroom. We showed the huge amount of work which followed a non-reflective expectation that the technology itself would produce educational effects without the teachers’ involvement. We have also presented the teachers’ disappointment with technology and the drawbacks of technology in terms of helping the teachers, as well as contexts in which technology made it possible for the teachers to develop a new pedagogical approach and further reconstruct their own practices.

**Acknowledgments**

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