Reconsidering off-task: a comparative study of PDA-mediated activities in four classrooms

L. Mifsud* & A.I. Mørch†
*Department of Information Systems, University of Agder, Kristiansand, Norway
†InterMedia, University of Oslo, Oslo, Norway

Abstract

Mobile technology is ubiquitous and diverse and permeates many aspects of daily life at home, during leisure activities, and in public spaces. The study presented here is of two sixth grade classes in Michigan, USA and two seventh grade classes in Norway. The students and the teachers in these four classrooms were equipped with mobile technologies (PDAs). We found that the students’ PDA-mediated actions in the classroom were not exclusively used for the tasks and activities set by the teacher, but that the students also used the PDAs on their own initiative – so-called ‘off-task’ activities. We analyze the findings by reconsidering off-task activities from a sociocultural perspective.

Keywords

classroom study, mediating artefacts, mobile technologies, off-task activities, socio-cultural perspective.

Mobile technology is ubiquitous and diverse and permeates many aspects of daily life during leisure activities, at home and in public spaces. The study presented here is of two sixth grade classes in Michigan, USA and two seventh grade classes in Norway. The students and the teachers in these four classrooms were equipped with mobile technologies [personal digital assistants (PDAs)]. We found that the students’ PDA-mediated actions were not exclusively used for the tasks and activities set by the teacher. Our analysis suggests that it is more productive to consider PDA-mediated actions as two broad types: teacher-defined activities1, which are part of the curriculum intended by the teacher, and student-defined activities, which are activities carried out when the students are not involved in the activities defined by the teacher. In this paper, we focus on the latter and discuss their educational value. These types of activities are often described as ‘off-task’ (i.e. what students do when not occupied with teacher-defined tasks). The label of off-task activities focuses on the negative implications of this type of activity, often described in terms of disruption to the lessons. We argue that this perspective needs to be updated because it is rooted in the assumption that learning is restricted to the classroom, teacher-defined learning activities (Resnick 1987; Engeström 1991; Miettinen 1999) and ‘established’ criteria for assessment (Sefton-Green 2003). This resonates with a question that Ludvigsen (in press) raises: ‘What counts as knowledge?’ While some of these activities may be disruptive, we believe that there is a need to recognize that they exist, possibly with positive consequences. When taken advantage of, they can provide educational gains. From our observations outlined below, we suggest using the term ‘student-defined’ activities rather than ‘off-task’ to describe ‘non-curricular’ activities.
inside the classroom. The goal is not to replace teacher-defined activities, but to explore the ways they can be extended, to identify the challenges off-task activities bring to education and to turn some of them into new contexts/opportunities for learning. In order to address this issue, we have studied and analysed PDA-mediated actions and interactions in four classrooms and have posed the following questions:

- What kind of PDA-mediated activities did the students engage in on their own initiative?
- What were the contexts of these actions (and activities)?

The paper is organized as follows: we survey related research in mobile learning. Then, we present the concepts we use for analysis, which are taken from a socio-cultural perspective. Next, we discuss our findings and the educational value of student-defined activities.

Related research

Learning supported by mobile technologies (mobile learning) has had, in general, a somewhat technocentric focus, driven by features and affordances (Norman 1999) of the new devices. These features have included portability, flexibility, ease of access, in-situ data entry, social interactivity, data exchange and customization to individual use (Roschelle & Pea 2002; Vahey & Crawford 2002; Norris & Soloway 2003; Naismith et al. 2004; Chan 2006).

A review of mobile learning indicates two broad types of application domains: within the classroom and outside the classroom. Within-the-classroom studies have focused on the role of collaboration and interactions in the classroom (van’t Hooft & Kelly 2004; Zurita & Nussbaum 2004, 2007; Roschelle et al. 2005; Liu & Kao 2007) where students were reported to have increased subject-domain knowledge as well as increased technological skills. Mobile learning has also addressed participatory simulation through collaborative tasks and activities (Colella 2000; Danesh et al. 2001; Shields and Pfotak 2002) and studied the potential of mobile technology to enhance both the personal and social aspects of learning with Information and Communications Technology (Sharples 2000; Vahey et al. 2006). Outside-of-the-classroom studies have involved contexts with access to subject matter content and activities such as museum visits (Gay et al. 2001; Hsi 2002; Hall & Bannon 2006; Pierroux 2009) and observations in the field (Chang & Sheu 2002; Chen et al. 2002; Lai et al. 2007; Rogers & Price 2008), positioning systems for participatory simulation and to provide contextual information (Facer et al. 2004; Klopfer et al. 2005; Kurtti et al. 2008) and data collection (Bannasch & Tinker 2002; Vavoula et al. 2007).

A review of the literature shows that student-defined activities have not been the focus in previous work. Vahey and Crawford’s (2002) study reported that teachers had concerns about students using the PDAs inappropriately, such as for game playing and off-task beaming (p. 17; 48–49), as well as spending increased time on ‘voluntary learning activities’ (p. 39). A question that can be raised here is, ‘Which kind of student-defined activities can be defined as ‘learning activities?’ Our aim is to show the importance of the socio-cultural context: namely, that the contexts of the activities are crucial for understanding the implications of student-defined activities and, consequently, highlighting what can be gained from a better understanding of those contexts.

Socio-cultural approach to the analysis of off-task activities in the classroom

We approached our data from a socio-cultural perspective. Drawing on the works of Vygotsky (1978, 1986), this perspective focuses on the interdependence of social processes, tools and mediated actions (Wertsch 1991, 1998; Säljö 2001). Tools from this perspective are culturally, institutionally and historically situated, which means that we need to study the context to understand them fully. Meaning and purpose are given to tools by the socio-cultural context to which they belong (Wertsch 1998, p. 29). An example of this are the symbols ‘<3’, which mean ‘less than three’ to the authors; Norwegian teenagers use the same symbols to communicate ‘love’ or the symbol of a heart. Thus, the context contributes to understanding the use of the tool.

From a socio-cultural perspective, understanding the mediating role of cultural tools is a prerequisite for understanding how they contribute to learning (Vygotsky 1978, 1981). Wertsch (1998) argues that all actions are mediated and that one can say, ‘I and the cultural tool I employed did’ (p. 29) it, instead of just, ‘I did...
it’. Together with conventional tools, mediated action includes pictures and texts, as well as conversations and entire activities (Bødker & Andersen 2005). Therefore, in order to gain a deeper understanding of the implications of using mobile technologies in the classroom, we should study not only the activities that are defined by the teacher, but also the activities that the students engage in on their own initiatives, the off-task activities – the conversations, pictures and texts, and actions mediated by the PDAs.

While the socio-cultural perspective is useful for analysing PDA-mediated off-task activities, it is not sufficient because it ‘black boxes’ the mediating artefact. We propose more focus on the tool itself by including affordances (Gibson 1986) and constraints (Norman 1999) of the tools in the unit of analysis. A PDA is a computerized tool with features that set it apart from previous educational tools. According to Wertsch (1991), researchers have a tendency to focus on the affordances of educational tools and how they can overcome perceived shortcomings without taking into account the limitations that the new tool may introduce. Examples of this can be found in the literature on mobile learning, which largely profiles mobile learning driven by the affordances of the new devices. Naismith et al. (2004) point out that this is not unexpected, as these new capabilities in a new technology inspire new practices. Previous research in Human Computer Interaction (HCI) has also pointed out that the constraints of a new tool also influence how it will be used (Norman 1999). The constraints provide the ‘what not’ of a tool. What cannot be done with a tool is useful in analysing and evaluating a tool’s contribution to learning. Together with context of the action, they provide a more comprehensive set of indicators of learning without taking into account the limitations that the new tool may introduce.

From a socio-cultural perspective, learning is understood as mastery and appropriation of cultural tools (Wertsch 1998, Säljö 1999, 2001). Mastery and appropriation, as we understand them, describe the relationship between a cultural tool and an individual or group. Wertsch (1998) defines mastery as ‘knowing how’ to use a tool with facility. Appropriation is making a tool ‘one’s own’ (1998, p. 55). From this, one can see that mastery describes the ability to use the tool, while appropriation describes a process that provides the tool with ‘a personal sense’ (Wertsch 2002, p. 120). Wertsch (1998) notes that in many situations, higher levels of mastery are correlated with appropriation (p. 58), but there are plenty of counterexamples. Furthermore, Wertsch (2002) notes that when appropriation occurs, it may take different forms and operate on different levels. Whereas some indicators, such as exams, indicate aspects of mastery, indicators of appropriation are more difficult to establish. In understanding learning as mastery and appropriation of cultural tools, we find it necessary to ask, ‘Can there be appropriation without mastery?’ and, ‘What characterizes appropriation when mastery is not in place?’ Polman (2000) suggests that appropriation without mastery occurs when a learner becomes committed to an interest or way of thinking in a field that is not necessarily mastered. Polman compares this to ‘opening a new file folder’. What kind of indicators can be identified? From the perspective outlined above, we view context as an indicator for understanding appropriation, as well as an understanding of the tools’ affordances and constraints. We need to understand the affordances and constraints of the cultural tools involved and the multiple contexts in which appropriation of these tools occur. In asking, ‘What counts as learning?’ one is also implicitly asking, ‘Which cultural tools are valued?’ and, ‘In which contexts do they apply?’

Data collection

We collected data in four classrooms: two sixth grade classes in Michigan, USA and two sixth to seventh grade classes in Norway. In Norway, the students were equipped with PDAs for two years, while in Michigan, the students kept them for a single school year. Data were collected by means of observations (video supplemented by field notes), on-the-spot conversation with the students and focus-group interviews with the students at the end of the observational period. Data were collected by the first author.

The need for longitudinal studies and for more observational in-class studies has been previously noted (Naismith et al. 2004; Shin et al. 2007). In attempting to address this concern, our study followed the students at Headland Primary, Norway, for three consecutive weeks in one semester and four consecutive weeks in
the following semester. In 2004, the two classes were joined to form one class with 41 students in total. There were three main teachers: Owen (English and General IT), Elisabeth (English, Norwegian and Social Science) and Stephen (Maths, Norwegian and Science). The PDAs were not in a network. There were four desktop computers in the classroom for synchronizing with PAAM, uploading programs and Internet browsing. In the second school, Midlands Intermediate, USA, students were observed for a period of two weeks in 2003 and three weeks in 2005. These were two sixth grade classes, which, at the time, had 25 students each and two teachers who worked together in a team, Mrs S and Ms G. The two teachers were responsible for different parts of the curricula. Mrs S taught Social Science and Science, while Ms G taught Language-Arts and Maths. During the first visit, the students and teachers had the same kind of PDAs as Headland Primary (i.e. not networked), while during the second visit, they had PDAs with Internet cards. Students synchronized their work with PAAM.

The data corpus totalled 47 h of video material. Video observations were first content-logged (Jordan & Henderson 1995) and then categorized. The categories emerged by open coding, starting with a predefined idea that was later elaborated by iteratively screening the data. A subset of these categories was transcribed and analysed. For example, PDA-mediated activity was the initial (predefined) idea of the study, whereas student-defined activity was a category that emerged in the video material. The categories we analyse below are personalization and exploration. Observation and interview material in Norwegian was translated into English by the first author. In this paper, we have taken data mainly from the second period of observation in both Norway and the USA.

In our study, we made extensive use of zooming in on single students and small groups of students in order to provide close-up data and capture the students’ PDA-mediated actions and interactions. The zooming was necessary in order to capture screen activity, such as tapping, pictures and text because of the small size of the PDA displays. However, this kind of zooming raises certain issues with respect to capturing context because observation from the back of the classroom did not give this kind of data, as the actions were too far away and, as such, ‘lost’. One can say that a ‘slice’ of reality is captured in this way and that the context has been ‘attached’ to the data a priori through categorization, or, alternatively, retrospectively added. By using a multi-methods approach/triangulation (combining video data with observation notes, interviews and ‘on the spot’ conversations), we have tried to circumvent this problem.

Data and findings

From studying the video material of our classroom observations, a pattern emerged: the students used the PDAs for their own purposes in the classroom and not only for the activities that were defined by the teacher. We will briefly describe some of the teacher-defined activities. At Headland Primary, the teacher-defined PDA-mediated activities observed were writing sentences in English (e.g. similes: ‘as white as snow’), keeping their weekly logs (a paragraph describing the student’s week at school) and using simultaneous beaming for maths and vocabulary recall. At Midlands Intermediate School, the teacher-defined PDA-mediated activities included Internet searching, concept mapping and animations. For example, in Social Science, the students were given the task of collecting information on a particular topic from their textbook and the Internet to present the information in a concept-map along with an animation. In Mathematics, the students collected data and then created graphs from the data.

While the teacher-defined PDA-mediated activities in the two countries were different, the student-defined activities in the four classrooms had similar patterns. We will first give a short overview of the types of student-defined activities and then analyse some of these activities in more detail.

At Headland Primary, the students drew animations that they beamed to each other. They personalized the PDAs using stickers and customized the content in the PDAs by organizing it in personally meaningful ways. The students explored and experimented with programs that were available on the PDA but not used in class, such as virus simulation (Cooties), quizzes (BubbleBlasters) and a spreadsheet (Cells). The students also played games that came with the PDA and downloaded games from the Internet, which were then beamed and shared around the classroom. When the teachers removed the animation program (Sketchy) on the grounds that the animations took up too much
space on the PDAs, the students sent drawings to each other using a simultaneous beaming program instead.

At Midlands Intermediate, the students played computer games and drew animations, not unlike the Headland students. They also revisited animations that they had made in the classroom for specific curricular purposes. We find this interesting because previous research has shown that students do not often revisit their work without being asked to do so (Arnseth et al. 2007). The students downloaded backgrounds and defined user information in order to personalize their PDAs. They ‘figured out’, by trial-and-error, the programs that were available on their PDAs but not used in the classroom (e.g. the chemistry program e-Chem) and explored trouble-shooting strategies. We observed that the teacher followed up on the students’ figuring out and, in doing so, involved the whole class in the process.

We focus primarily on two of the activities that, apart from game playing, were the most frequent student-defined activities according to the students, and confirmed by our observations – namely, personalizing and exploration (figuring out). In fact, some of the programs were used almost exclusively for student-defined purposes. We have selected extracts of the situations that were typical in both settings (Norway and USA) and that represented all four classrooms.

Personalization

We observed different forms and different levels of personalizing activities. For example, the students at Headland personalized their PDAs by organizing data and programs into files and folders, called ‘<my things>’ (‘mine ting’) or ‘<student’s name>’ (see Fig 1).

The students at Headland also personalized their PDAs by pasting stickers on the covers. This kind of personalization was also apparent in the first (2003) study at Midlands Intermediate where the students had access to similar technologies (non-networked PDAs). It should be noted that pasting stickers is not the focus of this study, but we mention it in order to contrast it with the Midlands 2005 study where the PDAs were personalized in a different way as a result of different affordances for networking.

At Midlands, the students personalized their PDAs by setting ‘owner information’ (i.e. personal details) because ‘people then know’ whose PDA it is, as one student, Greta, put it. In addition to this, they also created shortcuts from their screens to for example their ‘to-do’ list. Another personalization technique at Midlands (during the 2005 study) involved downloading backgrounds from the Internet. Through classroom conversations and interviews, the students acknowledged that this was a popular activity in the classroom, and all the students engaged in this form of activity in some form or other, often on a daily basis. The students reported that these backgrounds served as a way of establishing ownership of the devices:

[... To show that your pocket pc is different from someone else’s. (Karen, interview)]

According to the students, the main reason for personalizing was to be able to distinguish between otherwise identical PDAs. Moreover, it was the backgrounds that most visibly reflected the users’ interests and individuality, as the following quote by Karen shows:

[... I think the backgrounds show your personality and what you like (Karen, interview).]

At Midlands, downloading backgrounds was a group activity, and looking for relevant backgrounds could engage a group of four or five students. During this activity, they would help each other by looking for a particular background for one of the students. In addition to being a group activity, it was also individual-oriented, as the following extract illustrates.
Extract 1

*It is the end of the lesson (5 minutes until lunch), and Michael is looking at a webpage. The teacher’s voice is heard in the background. I ask what he is doing:*

1. Researcher: Where did you go to look for the webpage? [Michael is scrolling on the PDA]
2. Michael: I went to Google. [Points to a specific place on the screen with his stylus]
3. Researcher: OK.
4. Michael: And then just typed . [Scrolls]
5. Researcher: Which words did you write down?
6. Michael: Like pocket-pc, backgrounds and stuff like that. [Taps on a link from Google results page (text in blue) and stops on this new site without scrolling for 0.9s. Then he starts to scroll down the page, still staying on the same site]
7. Researcher: Why did you choose that one?
8. Michael: (0.2) Mm::: just looked interesting.
9. Researcher: How does something look interesting?
10. Michael: Well, I read it, and it said all kinds of things, like backgrounds and themes. [Scrolling]
11. Researcher: So there were some words in the first paragraph that looked interesting?
12. Michael: Yeah, (0.4) like theme games and stuff or free downloads. [Taps on link]

Michael knows what he is looking for, and goes to Google (2) to search for backgrounds. His search includes the words *backgrounds* and *pocket-pc* (6). He chooses a specific site because it ‘just looked interesting’ (8). The website contains ‘backgrounds and themes’ (10) and ‘free downloads’ (12), which echo the words that he has used for searching. Because of the small size of the PDAs, it was difficult to see which pages Michael chose, but from the transcript, we can see that he scanned some of the pages for some time, suggesting that he was reading or skimming web-page information.

From a curricular point of view, one implication emerged from this. Michael’s search for backgrounds can be viewed as reinforcing an activity that is becoming established in schools (Internet searching). He is using an appropriate technique for accessing and evaluating information as defined in the curriculum.

To personalize their PDAs, the students at Midlands made use of one of the affordances that their PDAs offered. Internet searches and downloading backgrounds were immediate actions. The Headland students, on the other hand, did not have direct access to the Internet from their PDAs, and the action of downloading backgrounds meant searching from a networked desktop PC and later synchronizing it to their PDAs. In other words, two different approaches to personalizing the PDAs were observed. The mediated action of personalization differed in the two schools, partly because of the PDAs’ affordances and constraints during deployment.

Personalization is quite common with cultural artefacts. For example, many students personalize their books, notebooks, pencil cases, rucksacks, and mobile phones. Personalizing artefacts is an activity that is culturally widespread, because it indicates individuality and ownership. One does not personalize a borrowed artefact. By personalizing their PDAs, the students do to their PDAs what they would have done with the cover of their notebooks. This is different from what they would have done with desktop PCs in a computer lab.

Personalization is not only associated with affordances and constraints. It is also about two different contexts of appropriation: (i) curriculum and (ii) student-defined. Personalizing requires not only ‘know-how’ on how to search for relevant information. It is also about the engagement with the tool, which may extend towards learning, e.g. by offering new opportunities for learning to occur. Personalizing an artefact that is intended as a pedagogical tool is an area that deserves more attention in future work on mobile learning, indicating that we need to take into account both affordances and constraints in multiple educational contexts.
Exploration

Another type of student-defined activity was exploration or ‘figuring out’, as described by the students. We observed different types of exploration related to the new tool:

- Exploring programs on the PDA.
- Trouble-shooting or ‘fixing’ technical problems.
- Exploring different forms of PDA-mediated interactions.

The teachers were aware that the students tried out programs and figured out different ways of interacting with each other using the PDAs. The teachers at Headland and at Midlands encouraged exploration activities. For example, Ms G at Midlands notes in the following excerpt that some of her students used the calendar function and wrote in their friends’ birthdays.

... They all figure that out on their own. ‘Cause we don’t show them that stuff.

In this section, we present two conversation extracts that illustrate how students explore PDA content (programs).

Exploration activities were observed when the students encountered new programs or programs that were not intended to be used for curricular purposes. In Extract 2, a student at Headland discovered a spreadsheet program called ‘Cells’ on his PDA (see Fig 2). The teachers had not yet introduced this program to the class.

The following excerpt shows the researcher observing Alex tapping on his PDA while the rest of the class is working on its weekly work-plan. The researcher initiated the conversation by a question to Alex:

Extract 2

1. Researcher: What are you doing? [standing behind Alex with camera in hand]
2. Alex: It’s eh ‘Cells’, a kind of program where you can add things together or something like that. [taps on main page and opens ‘Cells’]
3. Researcher: Sorry, I didn’t catch that.
4. Alex: That you can add something together at least. [tapping on different cells, marking them, tapping on pull-down menu]
5. Researcher: Oh(.) Is it the first time you’re using it? [the program]
6. Alex: Yes, I got it today. (0.3) Put seven, eight, like this, like that, seven, seven, ok, no, not quite sure, not quite sure how it works. [tapping] [taps on a column, which is then marked in black] [gets a pull-down menu on screen. Continues to tap on different cells and pull-down menu without saying anything. He stops tapping when the student sitting opposite asks him a question about the Swiss flag]

Fig 2  Screenshot of cells.

Alex reads the pull-down menus and taps on the screen. It is obvious that this is the first time he is using the program because he says that he received it ‘today’. From line 2, we can see that he has ‘figured out’ that he can ‘add things together or something like that’. Alex seems to recognize the program as similar to a spreadsheet (2, 4). We cannot be certain whether Alex has used a spreadsheet prior to these observations, but it seems that he knows the outcome of tapping, selecting from menu bars, and other related actions. Even though he is not quite sure how the program works (6), he continues to tap on the program until he is interrupted by a girl sitting in the same group.
What strategies does he employ in order to explore the ‘Cells’ program? He appears to make use of what he knows about the PDA, which rests on his familiarity and skills with the PDA. It is a student-defined activity that builds on previous knowledge.

We did not observe the program used in a teacher-defined context, and we do not know if Alex used ‘Cells’ as a mathematical tool, but we did observe that the interaction between curricular contexts (e.g. creating a table in a spreadsheet) and the contexts defined by the students’ themselves were dynamic and interdependent. There seems to be a dialectic relationship of tool-mediated actions. On one hand, they are student-defined activities, and on the other, there are ‘legitimate’ (curricular) activities. Drawing on this, we can pose the following questions, ‘What were Alex’s next steps after the initial stage of trial-and-error?’ ‘How did they progress?’ and, ‘Did Alex and the other students who figured-out the programs suddenly stop exploring, explore them further, or were they told to use them for specific tasks?’

The above data do not allow us to answer these questions directly. We address it by another data excerpt by a student who was well rehearsed in using a program without having been taught how to use it by the teacher. In the following extract from Midlands Intermediate, the teacher, Mrs S, started the session by showing the class the previous year’s students’ animation work on the topic of the atmosphere. The teacher then connected her PDA to a large screen in the classroom so that everything on her screen and the operations she made were visible to the whole class. One of the programs that appeared on the teacher’s screen was e-Chem\(^6\) (Fig 3), and the following conservations started:

**Extract 3**

1–10 \[. . .\]
11. Andrew eChem. Do we have eChem?
12. Student Chem what?
13. Mrs. S: No we don’t. [eChem comes up on screen]
14. Students: What’s eChem?
15. Mrs. S: eChem is a simple program that just shows the molecule of water and you can (. . .) usually [\(\ldots\)]
16. Student: \(\ldots\)
17. Andrew: [You can delete them and add them.
18. Mrs. S: Well, you can move it around [moving her cursor] \(\ldots\) It’s not doing it.
19. Andrew: No, you use the little silver thing in the bottom.
20. Mrs. S: What?
21. Student: No really.
22. Mrs. S: [Andrew moves from his seat and goes over to Mrs. S at the front of the classroom. He starts to do something on the PPC] OK, you teach. [Moves away from her seat] You know better than me.

From this extract, we see that Andrew recognizes the program as e-Chem. It is not a program that the students have on their PDAs. Therefore, the students ask what ‘e-Chem is’ (14). The teacher answers by saying that it is a program that ‘shows the molecule of water’ (15). This sentence was supplemented by Andrew who commented that one can add or delete parts of molecules (line 17). Even though the other students did not have access to this program, we can see from the extract that Andrew has used this program prior to this conversation. It is interesting that Mrs S takes the time to show the students the program even though it deviates from what she had planned to show them (i.e. last year’s students’ work).
Mrs S further explains how to move the molecule around, and she starts to demonstrate this on the screen. However, the activity she wanted to engage in on the PDA did not result in the action that she intended. Andrew then intervenes and says ‘No’ and points out she has to use the ‘little silver thing in the bottom’ (19). Andrew now moves from his place over to the teacher in the front of the classroom, and Mrs S moves to the side to allow him to take control. When Andrew reaches the front of the classroom, he starts to move the atoms of the molecule around, and Mrs S comments:

23. Oh . . . really (. . .) Is that the way to move it?

While Andrew is moving a part of the molecule around, and, in effect, changing the molecule, Mrs S involves the rest of the class. She asks them what sulphur and water make, and later responds to the students’ further questions with a ‘we’re going to find out’ and finally asks Andrew to revert the present molecule to the original H2O. The teacher takes time to discuss the program with the rest of the class, perhaps an indication of the bridging between student-defined and teacher-defined activities. Later on, when Andrew moves from his seat to show Mrs S how to move the molecule around, we see a transition between the two contexts (line 22). Andrew explained later that he found out how to use the program because it was on his PDA one day after he had synchronized it:

I was just playing around with it [. . .] I found out and looked at it for a long time. (Andrew, classroom conversation)

From the above description, what kind of tool is mastered and what is appropriated? We see a partial understanding of the subject domain even though our study did not include measures/indicators for such knowledge at the outset. The student-defined activities on the PDAs appeared to encourage an active approach to learning, even if those activities were not part of a predefined curriculum. Andrew had now been introduced to the domain of chemistry by one who is not an ‘expert’. Mrs S explicitly says that she:

51. [. . .] is trying to remember chemistry from college.

Together, the teacher and the students have come to an understanding that a molecule is three-dimensional and can be manipulated according to how some atoms fit together with others. The teacher takes the role of a learner, trying out the program with the students and even promising the students to make the program available for the whole class. What indicators are at work here? There are two contexts that depend on each other, with a student-defined context as the more dominant of the two.

Conclusions

We started this paper by posing a question, ‘What kind of PDA-mediated activities did the students engage in, and in which contexts?’ We addressed this question by studying, identifying, analysing and positioning PDA-mediated student-defined activities in the classroom.

In the classroom, the students in both countries engaged in PDA-mediated activities that were similar in nature. They explored the educational programs, searched for information and personalized their PDAs. We focus on appropriation as an activity in its own right, which deserves independent study. Whereas mastery has many known indicators, like exams, appropriation has not yet. By using a socio-cultural perspective and HCI, we have proposed two sets of indicators: contrasting contexts and appropriation and constraints.

First, these indicators are subsumed under the general notion of mediated action. Mediation implies interaction across contexts and at the same time allows the tool to be visible in what it does to the action. Second, a socio-cultural perspective makes analysis of students’ contextual interactions possible. Student-defined activities are complex, originating in one (student) context, but placed in another (classroom). Our data indicate how the introduction of a new tool makes visible new socio-cultural contexts. It demonstrates how the new tool and the actions integrate with existing (well-defined, curricular) contexts. Third, an understanding of the constraints and affordances of the new tool gives an understanding of the ‘why’ of an action. The context and the tool’s affordances and constraints influence the activity.

Students in four classrooms in Norway and the USA appropriated the PDAs for their own purposes – in particular, personalization and exploration. Andrew, one of the students, has not mastered chemistry, but he is in the
process of appropriating e-Chem. It seems appropriation might be a step towards mastery, which is more engaging than many forms of training towards mastery of school subjects. This remains a hypothesis that needs to be further developed and elaborated in subsequent work.

We found that the borders between ‘legitimate’ actions (i.e. those that are curriculum-defined) and those that are not (i.e. those that are student-defined) are porous. Thus, we argue in this paper that student-defined activities need not necessarily be isolated and categorized as off-task, but instead should build on established contexts shared by both teachers and students in order to create new contexts for teaching and learning and increased motivation for students.

Our study brings into focus the possibility for promoting student engagement and active learning. We also highlight findings that point towards student-defined activities in the classroom that can approximate educational value. It is therefore misleading to refer to those activities as ‘off-task’.

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Notes

1Since this paper is theoretically placed within a broader socio-cultural framework (and not an activity theoretical orientation), we use activity and actions to a certain extent interchangeably. In general, we have tried to differ between action (as in mediated action) to describe the process of acting and activity to describe the type of action (as in student-defined activity). The tasks defined by the teacher can be writing activities, but the actions themselves are, for example, mediated a PDA. The activity describes the type of mediated action.

2Palm Archive and Application Manager, website http://sitemaker.umich.edu/hice/paam

1Note on transcription conventions

The names of all children in the transcriptions have been changed, as have the names of the schools. Transcripts are punctuated to make them as readable as possible. The following conventions have been used:

() Short pause
(0.2) Pause of around two seconds
::: Colons indicate the lengthening of the sound just preceding them
0 Talk appearing within the degree signs is lower in volume relative to surrounding talk
- A hyphen indicates an abrupt cut-off or self-interruption of the sound in progress

That is Underlining indicates stress or emphasis
[ ] Overlapping utterances
(…) Inaudible
[…] Taken out
[comments] Researchers comments, movement descriptions, etc. are placed in square brackets and italicized

4Numbers in parentheses refer to utterance number.
6A chemistry program: http://www.umich.edu/~hiceweb/eChem/index.html

References


