

Evaluating Human Values in the Adoption of New Technology in School Environment

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Abstract

This paper describes the results of a value analysis of adopting a technology-supported attendance control service in a primary school. The results are based on a case study that explored a 14-week trial where two classes of elementary school children used an attendance control system that was implemented using networked technology components, including smart cards, NFC-enabled mobile phones and card readers, a web-portal, and SMS messaging. Even though the design goals of the system were directed towards creating value primarily for the parents and teachers, the analysis of subjective perceived value showed that the children were the most satisfied user group of the system. A model of human values adopted from social psychology was used for modeling and interpreting the value experienced by the children.

1. Introduction

The vision of ubiquitous computing [25] depicts that computing and technology-supported services will be available and used everywhere and by everyone. Technology will integrate with practically all the imaginable and yet unimaginable areas of our lives. During the last decades, technology has fast escaped the context of offices and professional users towards more versatile usage settings.

This paper presents a case study that explores adoption of new technology in the school environment. The study took place in Finland, where the school system is based on public schools. The community administration is responsible for maintaining schools that adhere to the educational and operational requirements set by the state. Therefore, public authorities play an important role in adopting new technologies in the school environment. This means that investments are covered with public funding and decisions for adopting new technologies are done through public decision making processes. In the case

of public services, goals and criteria for adopting may differ significantly from the private business environment, where the goals usually deal with maximizing profits and can be justified with economical reasons. With public services, it can be difficult or meaningless to show the created value only through economical measures.

Evaluating the value of adopting new technology in an environment that is fully financed by public authorities, and serves a wide variety of people with different needs, is challenging. The schools do not operate in a business environment, trying to generate revenues and operate at minimum cost level. Instead, schools create value for the society and the families using their services on a whole different scale. The benefits of adopting new technology in such settings must include other value parameters in addition to traditional cost or time savings. Human values are often difficult to articulate unambiguously [13]. In this paper, we explore how Schwartz's [24] value model could be used in modeling and articulating the value created for the end users.

2. Research focus and methods

As the focus of the project was on analyzing and exploring adoption of a novel technology-enabled service concept, we chose to use a case study method in order to access information about real-life context. We were able to follow and analyze the adoption of attendance control system at one Finnish primary school. The attendance control system was trialed in one school in Oulu, Finland on September 2008, continuing until December 2008. The trialing phase lasted 14 weeks. Trial was conducted at a local primary school, where two classes and total of 23 pupils between ages of six and eight (majority just starting at school), participated in the trial. Parents' permission for their children to participate in the trial and to the adjacent research had been asked in advance. One of

the participating classes represented a ‘normal’ first grade class. In this class, 16 children out of 19 attended the trial. Parents of three children chose not to allow their children to participate. The group consisted of nine girls and seven boys. The other trial class was a special-need class consisting of special-need school children. All seven children at the special-need class were boys. Four of the boys were first-graders and three second-graders. All children at the special-need class attended the trial. The children at special-need class were diagnosed with minor conditions affecting their learning, such as dyslexia, difficulties with concentration or troubles with perceptive skills. At the same time, a similar kind of trial was done at a local secondary school with more advanced technology and more complicated application features. This second trial will not be covered in this paper.

Our research focus was two-folded. First, our goal was to evaluate the subjective user experience and value created for the end users. The results could then be used in making decisions on designing or adopting similar systems in other contexts. Secondly, our goal was to try out how Schwartz’s value model [24] could be used in evaluation of value creation in these kinds of contexts. If the model seems to provide valuable help for understanding and modeling end user values, it could be further explored to understand and model value creation in adoption of new technologies or services.

The methods we used for evaluating and modeling the value created by the new system to the user were based on collecting information on subjective user experience. Therefore, we assume that the value for the end user is composed of the perceived, subjective experience of the user in interaction with the service and technology. In this study, we concentrated solely on perceived value, i.e. the value the users themselves judged and experienced. We define the subjective user experience to cover both the sensory experience evoked by the interaction, and the subjective interpretation of the experience. Ramachandran and Blakeslee [19] call this “qualia”; the raw feeling of subjective sensations. For this reason, we have adopted phenomenological approach for understanding user experience, i.e. we understand the user experience as a subjective, first-person phenomenon [15] that cannot be experienced as such by another person.

Methodologically, the problem is how to capture objective research data about subjective experience for accurate and correct interpretation. In our study, the primary sources of data were the humans subjectively experiencing the user experience, i.e. the teachers, the children, and their parents. Research on psychology and experience design show that describing your subjective experiences has its challenges, for example,

through recall problem [21], or difficulty to verbally describe one’s emotions [7, 20]. However, our hypothesis is that subjective, first-person description of an experience is still the most reliable source available for understanding and characterizing subjective user experience, as it is impossible for another person to experience the subjective experience of another person [15].

2.1. Data collection methods

Druin et al. [10] have argued that design work in school is subject to difficulty due to the school setting and the embedded power relations between adults and children. Children have few experiences in their lives where they can contribute their opinions and see that adults take them seriously [10]. When a respect is fostered, it changes how children see themselves [1]. Williams et al. [26] implemented an exploratory workshop with ten 11-12 year old children for exploring and developing the interface between children and new mobile ‘wearable’ ICTs, and found that the children are valuable, adaptive and creative users in the participative design of ubiquitous computing experiences and devices that might enable them.

Druin [9] has developed a typology of roles that children may have in the design of new technologies: user, tester, informant, and design partner. For each role she also presents three underlying dimensions: the relationship to adults, the relationship to the technology and the goals for inquiry. The role we sought from the children was essentially that of an informant, i.e. the children provided us with information that could then be used in the design process. As the trial objective was concerned with the potential benefits of the attendance control system, the actual usage of the technology was an essential prerequisite to the children’s articulation of potential use and for the informant role as well. Therefore in the case of this trial the children’s role was both that of a user and an informant.

Given difficulties that need to be overcome in describing and understanding user experience, we decided to collect data during the actual use of the system and to combine a variety of data collection methods that were complementary [27] in order to increase reliability and validity of the results [17]. Data collection methods used and data collected during the field study are presented in the Table 1.

Table 1. Data collection methods used in the trial

Data collection method	Number of valid cases
First classroom observation and interviews with first grade class	16 pupils 1 teacher
Second classroom observation and interviews with first grade class	16 pupils 1 teacher
Classroom observation and interviews with special-need class	7 pupils 1 teacher 1 special needs assistant
Phone interviews with parents of special-need class	6 parents
Paper questionnaires for 16 first-graders' parents whose children participated in the trial	14 parents
Paper questionnaires for 3 first-graders' parents whose children did not participate in the trial	3 parents

2.1.1. Classroom observations. Classroom observations were made to collect information about how the children learned to use the technology and service, what kind of routines they had established after using the system for some time, and what kind of spontaneous reactions and discussion took place in using the attendance control service. Children in the first grade class were observed two times over the course of the research. The first visit happened in a very early phase of the trial: the attendance control system had been taken in use only a day before the visit. At the time of the second observation the attendance control service had been in use for two weeks. The special-need class was observed only once, when they had used the attendance control service for two weeks. Observations with both classes were conducted during a normal school day by attending the first lesson in the morning. The login process was observed from the back of the classroom to minimize the disturbance caused by researchers' presence. During the observation children's behavior and actions were videotaped.

2.1.2. Interviews. All the children participating in the trial as well as their teachers were interviewed in order to investigate their thoughts and experiences about the technology and service concept under evaluation. The interviews took place on same days as the classroom observations. After attendance markings were done and children started their school work, interviews were conducted very informally by chatting with a few children at a time either in the classroom or in a separate place. Children in the first grade class were interviewed twice over the course of the research. The teachers were interviewed informally partly in the midst of teaching, partly during breaks between classes.

Parents of six (out of seven) participating children (two fathers and four mothers) at the special-need class were interviewed via a telephone. Parents of one child did not give their contact information for the interview. Interviews lasted from fifteen minutes to half an hour. Interviews were conducted after one and half months from the beginning of the experiment. The aim of the phone interview was to collect parents' thoughts on the service concept, opinions about possible added value the attendance control service brought to the families, and how the service could be developed further to have a positive impact on their lives.

2.1.3. Questionnaires. Two separate short questionnaires were created for the first-graders' parents, one for the parents whose children participated in the trial and the other for parents who chose not to allow their children to participate in the trial. Questionnaires were delivered to parents after one and half months from the beginning of the trial. Total of 17 parents (out of 19) answered the questionnaire. All parents who chose not to participate in the trial returned the questionnaire. The goal of the questionnaire sent to the parents of the children who participated in the trial was to collect stories about experiences during the trial period, opinions and attitudes towards the concept, and possible development ideas. The goal of the questionnaires sent to the parents of the children who did not participate was to explore reasons behind the decision to decline.

2.2. System description

Designed to simplify attendance monitoring and to replace manual roll calls, the trialed attendance control service does not require teachers to manually mark absences in the backend system leaving thus more time for teaching. In the attendance control trial pupils were given contactless smart cards named "Robo" containing the pupil ID. What separated the technology

used from many other RFID-based school attendance control systems (such as surveillance initiatives conducted in school environments in the United States [23, 16]) was that the system was based on NFC (Near Field Communication) technology. This means that the identification embedded in the smart card cannot be read from distance. The user needs to physically touch, or bring the card very near to the reader device in order to allow the identification number to be read (as shown in Figure 1).



Figure 1. Pupil touches a reader device with a contactless smart card in order to log in the school.

Upon arriving at school pupils in the first grade class touched a smart card reader device with their cards (as shown in Figure 1) and pupils in the special-need class touched a mobile phone integrated with a NFC reader (as shown in Figure 2) to mark that they have arrived at school. At the end of the school day pupils touched the reader devices again to mark their departure. The same attendance control system was also used in extended day care programs where some children went after school.

At a local secondary school in a concurrent trial, students followed a similar procedure for marking their attendance for classes. However, they used NFC-enabled mobile phones to mark their arrivals. The younger primary school children were using smart cards instead of mobile phones, because the parents and teachers were worried that children could lose or accidentally break more valuable mobile phones. However, none of the children lost a smart card during the trial period.



Figure 2. Children log in the school in the morning by touching the NFC phone with their contactless smart cards.

A log of arrivals and departures was automatically compiled by a background system, and could be read by a teacher in a classroom in real time. If a login did not occur, the child was marked absent by default. If a child logged in late, the backend system recorded the time when the child marked the arrival.

Parents were able to get information of their children's attendance details via an online 'citizen's portal', and, in the later phase of the trial, also through text messages sent to their mobile phone. The school health department, special education teachers, curator or other school staff members could update the backend system; for instance, should the pupil have a dental appointment. In this case, the pupil did not need to worry about being absent. The service prevented truancy by informing tutors, administrators, and parents of absences in real time, enabling instant intervention.

Figure 3 shows an overview of the attendance control service at primary school and in the extended day care programs.

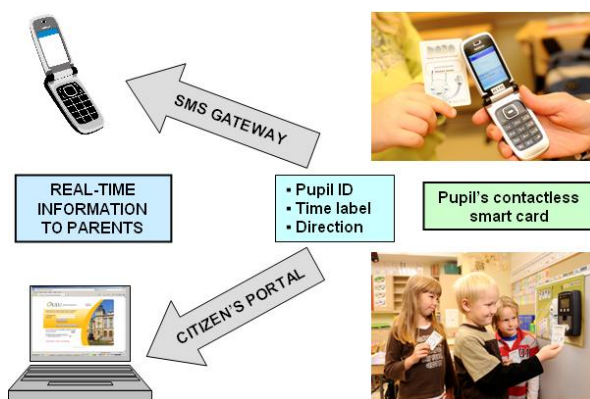


Figure 3. Overview of the attendance control system.

3. Schwartz's model of human values

In this paper, we apply Schwartz's value modeling framework [24] for modeling and creating an understanding of the value created by the new system to the children participating in the trial. We have done the same analysis also for modeling and describing the value created for parents and teachers, but decided to leave those out of the scope of this paper. We chose to present here the value analysis from the viewpoint of children, as the contrast of expected value of researchers and designers of the system and the perceived and experienced value of children was so striking. We hope that this example shows the potential of modeling human values in the context of adopting new technology for public services.

Schwartz's value model structures human values into ten value types, and nearly 60 individual values (see Figure 4). Schwartz's view of values was that they are used as the criteria people use to evaluate and justify actions. His value model is based on the principle that values are always ordered by relative importance. Interaction or technology that helps users to achieve end-state or behaviors that correspond with the values that are high on their personal hierarchy of importance can provide the highest value benefit. On the other hand, if the technology successfully provides value on an area that is not high on the personal value hierarchy of the user, the perceived benefit is not significant for that person.

Power, Achievement, Hedonism, Stimulation and Self-direction value types serve primarily individual interests. Power value type includes values related to wealth, authority, social power, preserving public image and social recognition. Achievement value type emphasizes demonstrating competence, especially for obtaining social approval. Hedonism includes values related to pleasure and sensuous gratification, whereas Stimulation value type is based on a need for arousal and variety that keeps the level of activation and attention at an optimal level. Self-direction value type includes values related to independent thought and action, e.g. freedom, creativity and choosing one's own goals.

Benevolence, Conformity and Tradition serve primarily collective interests. Benevolence refers to values contributing towards the wellness of close ones in everyday interaction including, for example, helpfulness, loyalty, honesty and responsibility. Conformity value type includes values related to restraining actions likely to harm or upset others, or violating social norms. Tradition values emphasize respect towards customs and ideas that have been accepted to represent shared experience and fate.

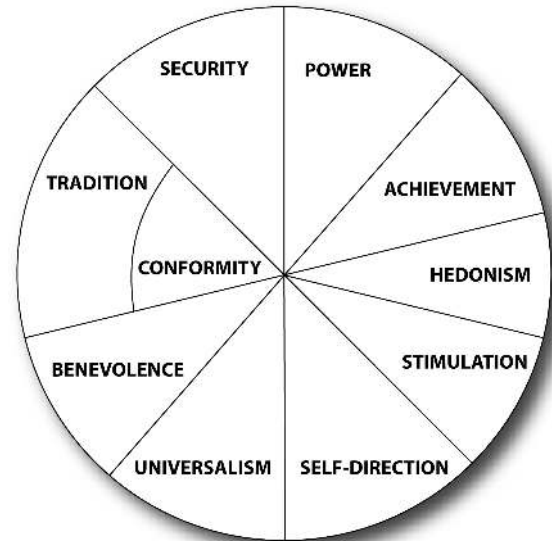


Figure 4. Schwartz's value types (adapted from Schwartz [24]). The representation illustrates the conflicts between value types, e.g. hedonism versus conformity and tradition.

Schwartz locates Universalism and Security on the boundary of values serving individual and collective interest, and hypothesizes them to have features from both. The goal of Universalism is to appreciate and protect the welfare of all people and nature. Security value type contributes towards safety, harmony and stability in the society. It can have both individual (e.g. health) and group focus (e.g. family or national safety).

Ross et al. [22] have used Schwartz's value model for providing a common ground for viewing people in order to design technology mediated interaction. They use human values as a means for understanding ethics of individuals. They argue that human value theory can meet designing for meaningful mediation, as they can be used for achieving desirable end-states and behaviors.

Value sensitive design has called for accounting human values in a principled and comprehensive manner and throughout the design process [3, 14]. Human values may often seem to conflict with economical goals, and can be often difficult to describe unambiguously [14]. In the work presented in this paper, we apply Schwartz's value model for articulating and describing the value that can then be translated into design and adoption decisions.

We did not use Schwartz's model and related survey instruments for modeling or analyzing the value priorities of our users. Instead, we have applied the value model for analyzing how the value created through adopting the new service corresponded to

value priorities of our trial users. Our hypothesis was that when describing their subjective experiences and analyzing the trial service, the value priorities of the trial users would become visible through the descriptions of user experience and their subjective analysis of perceived value.

4. Analysis of value creation

The Schwartz's value model [24] was used to interpret and structure the subjective user experience data from the perspective of value creation. Here, we analyze value creation from two viewpoints:

1. The value that was expected or assumed to be created for the end users by adopting the new service. This is a viewpoint of the designers during the planning, design and implementation phases. The service design used participatory design methods, where the teachers and school administration played a strong role of design partner with technology providers.
2. The value created for the children using the service. Two groups of children participated in the trial studied here.

In addition to these two viewpoints, we did use the same human value modeling technique to analyze the value created for the parents of those children who participated in the trial and for the teachers who taught the children using the service during the trial period. However, these viewpoints are left outside the scope of this paper.

We restricted our focus only on those users who were first-hand users of the system. For example, other family members and people working in the school administration were left outside the scope of this paper. We also explored value creation only from the viewpoint of subjectively experienced value, i.e. the value that can be identified through the subjective experiences of the users. Here, we do not evaluate the created value through objective measurement, e.g. we did not evaluate whether the adoption of the system actually decreased the amount of check calls from parents to teachers, nor did the service save time for the teacher through objective measurement of time used for teaching.

In our analysis we concentrate only on value types that were relevant for the users in the context of trialed service, and leave other value types outside the discussion. We also prioritize the value types to reflect the order of importance for the user group in question.

4.1. Expected value

Traditionally, teachers conduct pupils' attendance monitoring every morning with manual roll calls, and mark absences and delays in the backend system. This requires time and effort every school day that could be used for teaching. Human errors in attendance markings are possible and difficult to prevent. Children beginning school in Finland travel to school (after the first few weeks) largely on their own, either on foot, by bicycle, or by bus. Therefore, parents of young children regularly call to their children's or teachers' cell phones to ensure that the child has made his/her way to the school safely. The daily journey between school and home has been found to be important for families of school children, especially from the time management viewpoint [12]. Answering parents' calls employs teachers and consumes their resources that could be used for teaching. Some research indicates that modern parents are getting more worried about road safety of children, even when the accidents involving children have actually decreased during last decades [18].

Therefore, the guiding design goals that were used during the design phase were the following:

1. to increase the reliability of absence control by eliminating the errors caused by manual recording,
2. to save the time of the teacher in marking absences by giving full responsibility of marking arrivals and departures to the children, and
3. to provide parents with real-time information on whether their children have arrived at school or not, and when they have left the school.

4.2. Value for the children

In this chapter, we present the analysis of user experience data from the point of children using the service. The relevant value types (illustrated in Figure 5) identified during the analysis are presented in the order of relative importance. The value type that we analyzed to be most important and relevant for the children, i.e. Benevolence, is described first. This value type seemed to be most dominant and valued over the other value types. The other value types that were identified relevant for the children in the context of attendance control service adoption are Achievement, Power, Conformity and Self-direction. The Achievement and Power value types seemed to be somewhat stronger than the last two.

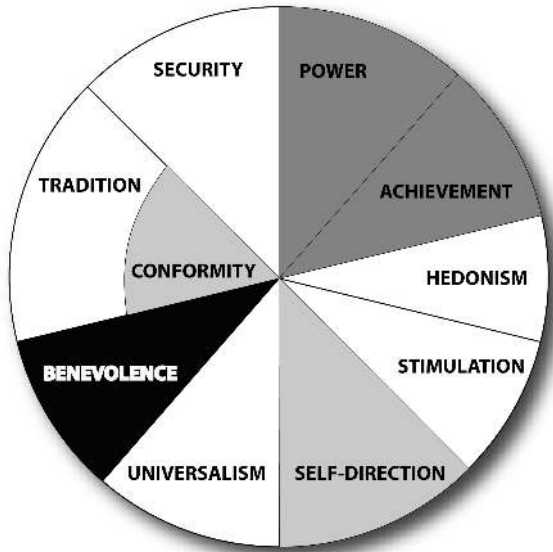


Figure 5. Summary of the value types found relevant for children using attendance control service. Black represents the highest priority and lighter shades respectively lower priorities.

4.2.1. Benevolence. The value that came most profoundly visible when children described their experience with the service was that of Benevolence. The children appreciated that they could be helpful and use the service for positive interaction in order to assist and be of help for people they had close contact with, i.e. the parents and the teachers.

When asked why they used the service, the children usually replied that the service was used because the parents could then get information about their school day. A typical response is illustrated in the following comment made by one child during classroom observation and related discussion:

“Mom and Dad know at what time you have arrived at school and left home, and if you have stayed in detention.” (a comment of a child participating in the trial)

4.2.2. Achievement. The technology-supported service seemed to provide the children with a way to demonstrate competence. The children were proud that they were given responsibility to take care of their very own smart contactless cards and that they were able to master the technical components used. For many children the trust of the adults seemed to be a boost for their self-esteem, which has also been shown by previous research in school environment [2]. Also Schwartz argues that achievement and power value types together contribute to self-esteem [24].

One of the teachers showed two children how to operate the reader device and the needed PC application, which allowed the children to master the whole process needed for marking attendance from turning on the reader device to being in charge of marking their own arrival at and departure from school. The service and related technology provided children with special opportunities for achievement. One of the children in the special-need class designed the visual outlook of the smart card and named it. This was a source of special pride for the whole class and especially for that child. Also, the children who were taught to operate the reading device were able to demonstrate their special skills with technology by being trusted with this task. This can be seen in the following comment made by other children in the class:

“...they were chosen because they use computer also for other things as just playing games.” (a comment made by a child of a first-grade class where two children were taught to operate the reading device)

4.2.3. Power. As the whole school did not participate in the trial, the trial provided the children a means for status differentiation. Possession of the smart card was valued by children to be ‘cool’ and something to be proud of among their peers. Using the service gave them social power and recognition. This is well illustrated in the following comment made by the teacher of the class participating in the trial:

“For children this has been an important and big thing, since not all the classes have these cards in use, so in that way children now have a chance to stand out and they have something that others do not have.” (comment of a teacher during informal discussion related to classroom observation)

As many children had seen their parents carrying similar identification cards because they needed them at work, they associated the card being a sign of power and authority. However, this was seen negative by some parents, who thought that children should not hurry to be like adults, and smart cards would better suit adult lives. One parent stated in the feedback questionnaire:

“Children of this age should not need to be rushed into the world of cards and codes. They can do that later. The amount of new things in the first-graders’ world is already big enough.” (comment of a parent whose child did not participate in a trial from the feedback questionnaire)

Using technology as a means for status differentiation and positioning oneself in a social system became visible also when the children compared their smart card based service with the same service that was used in the secondary school. In the

secondary school, the user identification was done with an NFC-enabled mobile phone – not a smart card. The mobile phone clearly possessed a higher status value than the smart card, and children complained about that:

“The secondary school children should have been given the smart cards so that we could have had the touch cell phones.” (a comment of a child participating in the trial during interview)

Power values were observed in a smaller scale in cases where the service was used as a tool of control and dominance. The child could choose not to mark the arrival to the school as a sign of rebellion. However, using the service to create authority value did not come out strongly in our trial group, as Benevolence value type was much stronger in our trial groups (also observed in children of this age-group by Borland et al. [4]). We assume that this might be different with older children and teenagers.

4.2.4. Conformity. The children did not seem to question or impugn the use of the service, but rather confirmed to the expectations of the teachers and parents. They seemed to think that using the service was ‘part of the game’ if the teachers and parents said so.

4.2.5. Self-direction. Even though the children primarily valued Benevolence, i.e. being helpful and responsible by positive interaction that created value for parents and teachers, the service also gave them opportunities for self-direction. There seems to be a conflict between Benevolence and Self-direction combined with the Power value type. The children seemed to primarily value Benevolence, but sometimes showed signs of rebelling through the power the service gave them over their parents (e.g. throwing the smart card away and regretting it soon after) or, on the other hand, they valued that they were given an opportunity to be independent and responsible for marking their attendance.

The service provided the children with a possibility to act autonomously and independently when marking their attendances, and even to choose not to do that, if they wanted. Also, children were trusted to keep the smart card with them. The children usually took pride of taking care of the card and stored it in a special place so that they would always remember to keep it with them. One parent commented:

“A proud and eager child has remembered it well.” (comment of a parent given through the feedback questionnaire)

This is a value that did not come up strongly within our trial group. However, we assume that Self-

direction values would become more profound with older children and teenagers.

5. Limitations and validity

As the children were aware that they were studied and observed during the trial, the variables suggested responsible for the Hawthorne effects, such as effects of special treatment or attention, change in routine, novelty, enthusiasm related to trying out something new, etc., probably have an effect on the results. The parents, children and teachers all knew that the goal of the trial was to study the effects of adopting the attendance control system, and therefore knew that their behavior was observed and opinions were valued. Particularly with young children, their reaction to testing situations, interesting new strangers, change to normal routines, teacher’s striving for ensuring that their children perform well in testing situations all set challenges for arranging controlled testing environment and interpreting the results [8].

In this setting, the following procedures were taken to tackle these challenges. Firstly, the uncontrolled novelty effects were addressed through a relatively long trial period, i.e. 14 weeks. Studies made on the novelty effect of media comparison studies with pre-teen and teenage children suggest that longer duration studies dissipated the novelty effect. In studies lasting four weeks or less, novelty effects were estimated to be one-half of a standard deviation. This reduced to two-tenths of a standard deviation after eight weeks of data collection, accounting for less than one percent of the variance [5]. Secondly, the researchers did not visibly interfere with the trial during the 14 week trial period to reduce the effect of special attention by interesting outsiders. The data collection methods requiring face-to-face interaction with the trial users were arranged at the beginning and at the end of the trial. In any case, the modeling and analyzing the values helped the researchers and designers in understanding the perceived value of each user group better, and therefore was helpful also in identifying value that was created through the trial setup.

In addition, the users knew that the trial was planned to last a fixed period. This reduced the need for creating strategies for integrating the new practices into the everyday lives of the users, and probably affected the psychological processes related to irrevocability of the decision. Research on psychology indicates that irrevocability of the decision is likely to intensify [6] the processes of reducing cognitive dissonance [11] caused by the decision, and thus affects the attitudes towards the decision to match the behavior. In addition, our observations indicate that users were quite tolerant towards minor

inconveniences as they knew they would not have to deal with them for a long time, and therefore did not choose to invest time and energy for attempts to correct them.

6. Conclusion

As our research goal was two-folded, we present our conclusions in two parts. The first part discusses the issues we learned from exploring the value creation of adopting technology-supported attendance control in school environment. The second part concludes the methodological findings on using Schwartz's value model [24] in understanding and modeling the value created by adopting technology to support everyday life.

6.1. Adopting attendance control at school

Our analysis shows that a technology-supported attendance control system can bring value for all end user groups. Initially, it seemed that the system would serve primarily the teachers and the parents (see the design goals in chapter 4.1.), whereas the children would do all the work without getting direct benefits. Perhaps surprisingly, children seemed to be the most pleased group with the service. When describing their experiences towards the service, their descriptions were positive and enthusiastic. With Schwartz's model of human values, we were able to interpret and understand the value children themselves perceived they received from using the service.

Of course, the value evaluation presented here does not prove that the system actually changed or improved the security of the children, or saved the time of the teachers for something more important. Subjective perception of value does not necessarily correlate with objective measurements of the same parameters. For example, previous studies have revealed that while statistics show a reduction in the number of road accidents involving children during the past decades, Danish parents report an increase in their concerns about their children's road safety [18]. As the focus of this paper is solely on subjective perceived value, the trial presented here cannot show if the system actually did increase security, safety or save time of the teachers.

Another issue that arose during the study was an ethical one: surveillance of children inevitably raises privacy concerns and other ethical questions. We leave this discussion outside the scope of this paper.

6.2. Methodological conclusion

Schwartz's value model [24] provided us with a framework for modeling and understanding the value created for end users in this trial. The model can help in articulating human values as it provides a structure and vocabulary for modeling and describing value. Our experience shows that the model can be powerful in identifying what are the relevant values for each user group, and in prioritizing them.

Even though the original design goals assumed that the service would create value primarily for the parents and teachers, the result of the value analysis provided the richest set of values for the children. This can be partly caused by unbalanced data collection (i.e. the user experience data collected from children might have been richer than the data collected from parents and teachers). However, we feel that it can also be caused by poor understanding and lack of design consideration of values that were not directly related to functional utility created by the service. The design goals of the service were very much concentrated on utility (as can be seen from design goals described in chapter 4.1). For example, the role of technology as a component of creating social power structures was not understood nor addressed during the design phase.

The trial conditions clearly affected the value priorities and could also have had an effect on what values were considered relevant. For example, if the service was used by all the classes in the school, it would no longer provide the same level of social power and would not act as a status differentiator. Therefore, the relative importance of the Power value type would be lower to the children. On the other hand, the trial showed how technology can act in very versatile ways in the social power play of children. Had this been known in the design phase, it could have been used to create a more subtle and creative system design.

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