Future Classroom - Summary

Do innovative technologies have the potential to transform presence registration?
A collaboration between Skellefteå Municipality, Anderstorp Gymnasium and Tieto.

September - December 2018, Skellefteå
Short recap

Future Classroom project
What has happened so far?

Background

In May 2018 we ran an initial discovery phase at Anderstorp Gymnasium during which we investigated the current registration process and gathered data about problems and frustrations pupils and teachers have with the status quo.

**Reporting the presence of every pupil seems to be a necessary evil.** During that discovery phase we learned that teachers would like to be free of the responsibility and automate the process. Registration time at Anderstorp Gymnasium sums up to a quite incredible number of hours: **17 280 per year**, which are the equivalent of 10 full time positions. Pupils should know when they have been registered as present to give them a minimum of certainty. At the moment however, they have to ask the teacher, interrupt lessons and worry about wrong or missing registrations. Teachers on the other hand should be able to focus on teaching, not registering pupils.

Different types of technology could automate the process. The goal of our testing phase was to investigate how suitable, reliable and accepted different technologies would be if replacing the current method of registration. This is a brief summary of our findings.

**Automate the registration process**

**Give pupils control**
High level investigation goals
An overview

- Reduce time
  Can we give teachers more time for actual lessons?

- Responsibility
  Can we give pupils control of their presence/absence registration?

- Accurate data
  Can we identify patterns of absence with reliable data?

- Focus
  Can we eliminate distractions and interruptions during lesson?

- Communication
  Can we improve communication with parents and guardians?
Our approach
Test, evaluate and adjust
What did we test?

Two automated ways of presence registration
After giving consent, every pupil was assigned a numbered tag to carry with them and a small computer called a Raspberry Pi was placed in their classroom. The Raspberry Pi would pick up the signals from the tags at a set time interval and in a certain radius. Through a series of iterations we fine-tuned the method by changing the range and time interval. In the end of each testing week we compared the registrations from the numbered tags with the registrations from the current system and compared the data to establish what setup was the most reliable.
We placed a camera in the classroom. Before starting the test phase, we gathered the required consents from pupils, teachers and parents/guardians and then let the system register each participating pupil’s face. The data was stored on a local database. When pupils walked in, the system matched their faces with the data stored on the database and registered them in the system. In the end of each week we compared the data from the facial recognition registration with the registrations from the current system.
**Structure of the report**

The four crucial questions we set out to answer

**SECTION 1**

**Can we build it?**
We looked at the technical possibilities, challenges and limitations of each method from a pure technical point of view.

**SECTION 2**

**Will users love it?**
We studied the way users perceived the two technologies, how well they were accepted and if they improved the day-to-day registration process.

**SECTION 3**

**Will it add value?**
We analysed if the methods were feasible from a cost and quality perspective, how much time would be saved and if expenses would be reduced.

**SECTION 4**

**Should we build it?**
We analysed the ethical and legal impact of the two technologies on the users day-to-day at school and evaluated if that impact was acceptable or not.
Findings

Salient points
Set up of the research
How to use this report

The research span for a duration of 8 weeks. The short amount of time influenced the set-up of the technologies and the focus of the investigation. This report is therefore a brief glimpse into 2 possible ways of automating the registration process with the respective advantages and drawbacks. It should by no means be considered exhaustive.

Further research into the beacon and face recognition technology would be necessary. Especially the number of classrooms, pupils, and teachers participating in the testing should be increased to verify the presented findings and to understand implications and drawbacks of each method more in depth.
1. Can we build it?
Comparison of the two registration methods

**The Beacon method is easier to install than facial recognition and will need less iterations.**
When scaling the technology there will be a need to assess the placement and range of the Raspberry Pi to make sure registrations are accurate and reliable. The biggest disadvantages is that the data is only as reliable as the pupils are. If they forget their tag, registrations and gathered data won’t be accurate. An alternative is to build a mobile solution, which would increase the time for development and add to the costs of the solution.

**Facial recognition is seamless, doesn’t require any specific action by its users, and makes it very difficult to fool.**
Facial recognition requires more iterations and testing to get a technically reliable system in place. The placement of the camera(s) largely depends on the physical environment (classrooms) which will vary. Future iterations should consider to use professional or 360 degrees cameras to avoid some of the problems we encountered during this testing phase.
2. Will users love it?
Comparison of beacon and facial recognition

The collected data from surveys and interviews allows us to conclude that pupils and teachers feel comfortable with both technologies. Of course, they have individual preferences depending on their emotions towards the new technology, which have little to do with the efficiency of the two registration methods. This is especially true for facial recognition. As an innovative technology it had a “cool” effect. Pupils were so enthusiastic and eager to use it that some of the shortcomings were explained away or ignored by the class during the interviews. Therefore, we looked at a variety of parameters and used different research methods to guarantee the quality of our final conclusions.

The beacon technology places the responsibility of the registration in the pupils’ hands, while facial recognition takes it a step further relieving both pupils and teachers from the responsibility of registration. During the testing phase we gave pupils feedback on their registrations in 2 different ways: for the beacon they could use a UI to check registrations, for face recognition we used a little USB lamp which was blinking when a pupil was registered. The feedback for both was very rudimentary due to the iterative nature of the testing phase. However, we can conclude that feedback of their registration makes pupils feel more in control, independent of the method they use.
2. Will users love it?
Comparison of beacon and facial recognition

During the first week of testing (week 41) 38% of pupils didn’t bring their tag at each lesson, while in the second week of testing (week 42) 47% forgot it. It turns out to be quite a challenge for the pupils to remember the tag. In the survey they stated that they felt annoyed about the technology because of this. It also created a feeling of unreliability. In reality the beacon method was very reliable and the registration data we gather was very accurate. It seems pupils have transferred their shortcomings (forgetting or losing the beacon) to the technology.

There was a positive change in attitude towards the technologies. Being more innovative and new, facial recognition has encountered greater enthusiasm. Very few expressed feelings of unease or worry about privacy and security. Experiencing the technology first hand changed the way they saw and related to it. Before testing the technologies pupils rated automatisation with innovative technologies as scary and controlling. Once they had tried both methods ‘scary’ was replaced by futuristic and fun.
3. Will it add value?
Comparison of beacon and facial recognition

Automation frees up time for teachers. With the data we have gathered we estimate that teachers would spend 40-60% less time on absence registration once the method is fully developed. This estimate is valid for both technologies. Teachers will still need to perform some control over the system, but the time spent would be less. By automating registration, teachers can focus on the lesson without interruptions, have less administrative tasks, and can use gained time focusing on their core task: teaching.
3. Will it add value?
Comparison of beacon and facial recognition

Automated registrations and accurate data have the potential to support preventive work with high absence rates. This can lead to a reduction of the number of drop-outs (pupils leaving school without an exam). If successful related costs for the school, the municipality and society could be reduced in return. The mentioned advantages are the result of automation. Both technologies automate the registration process and therefore both methods add value in that regard.
4. Should we build it?
From an ethical and legal perspective

From an ethical perspective: Skeptical users had a positive change in attitude towards both technologies (but particularly with facial recognition) after the first-hand experience compared to before the testing phase. However, there still are uncertainties on how the technology will affect people and processes in the long run, which are hard to estimate or foretell. Those uncertainties have to be investigated further over time.

If a decision to scale up the tests is made, we recommend to do a deeper ethical evaluation using clear assessments tools. This is more relevant for facial recognition than the beacon technology since the former is more connected to questions around human rights than the latter.

From a legal perspective facial recognition is a bigger challenge because it leaves us with bigger question marks on how to introduce such a technology in a school environment. If there is an intention to scale up the test, we strongly recommend to start a dialog with the Swedish Datainspektionen.

Both technologies demand transparency and documentation on how the supplier of the technology is storing the data to fulfil GDPR requirements. This responsibility lies with the data controller, which in this case is the municipality of Skelleftea. In addition there needs to be clear rules on how to handle if a user is opposing registration, doesn’t want to be part of or doesn’t have the means to be part of an automated solution (f.e. pupils without mobile phone).
4. Should we build it?
Consent as part of our legal obligation

**Paper consent was slow with many pupils forgetting to bring it back.** As part of handling data under the GDPR regulations the project has actively asked pupils and guardians for their consent to handle sensitive data. Going forward, this is a process that needs to be repeated on a regular basis as part of handling personal data.

To get the consent for the beacon technology test we used a paper consent that was handed out to the pupils. It took over a week to gather the necessary consent with many pupils forgetting to get it signed and bring it back to us. **26 out of 30 pupils participated, the remaining 4 didn’t deliver the consent form back to us and as a consequence didn’t participate.**

With the digital solution Tieto Dynamic Consent it was a very quick process to gather the consents for the facial recognition test. We still gave the opportunity to use the paper form. **21 pupils of 30 participated, 15 gave digital consent, 6 paper consent, 9 did not answer and one parent declined consent stating that both him/her and the pupil felt uneasy with participating.**

The data around consent doesn’t give us a complete picture on how well each technology will be accepted. We should therefore consider that introducing facial recognition as registration method could provoke some negative reactions and a percentage of pupils or parents might not give consent for it. That means that they need to fall back to a different registration method.
What’s next?
Next steps in the future classroom project

Further research into each technology would be necessary to ensure an inclusive, reliable and unbiased system for registrations. Especially the number and type of classrooms, pupils, and teachers participating in the testing should be increased to verify the presented findings and to understand implications and drawbacks of each method more in depth.

Scaling the beacon technology will require assessing the placement and range of the receiver in the classrooms to make sure registrations are accurate and reliable. As an alternative a mobile solution could be build, which would increase the time for development and add to the costs of the solution.

Facial recognition also requires more iterations and testing. The placement of the camera(s) largely depends on the physical environment (classrooms) which will vary. Future iterations should consider to use professional or 360 degrees cameras to see if that could help avoid some of the problems we encountered during this testing phase.

If a decision to scale up the tests is made, we also strongly recommend to do a deeper ethical evaluation using clear assessment tools to secure that the solution is compatible with GDPR article 22 as well as article 21 in European Human Rights Commission on Discrimination and Equality. Also, if there is an intention to scale up the test, this should be done in dialog with the Swedish Datainspektionen.

Finally, clear rules on how to handle if a user is opposing registration, doesn’t want to be part of or doesn’t have the means to be part of an automated solution (f.e. pupils without mobile phone) needs to be in place if the solution is to be used as the primary tool for registration of presence and absence.
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