Learning from User Experience in the Design of a Playful Peer Feedback Tool

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ABSTRACT
Today's youth thrive in informal participatory communities where they not only consume but also act as contributors or producers. In a participatory culture of learning, students' active contributions to their learning are stressed and peer assessment is considered as an important component. In this paper we investigate which user experiences should be supported in a playful peer feedback tool within a participatory culture of learning.

Keywords
User Experience (UX), participatory culture of learning, active learning, peer feedback.

INTRODUCTION
Today's youth participate in a variety of social media where they create and disseminate ideas or news, collaborate and connect with people. Examples of social media software are numerous and enable communication, collaboration, multimedia and entertainment through blogs, and social networking (Facebook, MySpace), wikis, Flickr, YouTube, Second Life, etc. Through their participation in these informal communities today's youth develop new media skills [28]. In their 2006 report on *Confronting the Challenges of a Participatory Culture* Jenkins et al. [15] identify 10 new skills—Play, performance, Simulation, Appropriation, Multitasking, Distributed Cognition, Collective Intelligence, Judgement, Transmedia Navigation, Negotiation, Networking—developed through collaboration and networking.

While there is an increasing view of learning as a participative activity in the learning community [17], schools and institutions have been slow to react to the emergence of this new participatory culture [15]. An important component in the design of learning environments is implementing this contemporary culture of learning [17]. Peer assessment is used as a means to empower students and peers by enabling students to take charge of their learning and become active learners who take responsibility for, and manage, their own learning [1].

In our work on peer assessment we are inspired by the ease and playfulness with which participants interact and give each other feedback in participatory environments . We try to harness this and draw on the new media skills the students are developing in our design of a playful peer assessment tool. A review of current research in the field of peer assessment and feedback, and observation of user experiences during a field trial, are used to inform the design of a playful peer feedback tool in a participatory culture of learning.

LEARNING IN SCY
The EU 7th framework SCY (Science Created by You; www.scynet.eu) project addresses learning in science offering learners a learning experience based on real life, challenging assignments [3]. In SCY-Lab (the SCY learning environment) learners work individually and collaboratively on "Missions" which are guided by socio-scientific questions such as "How can we design a climate-friendly house?" [3]. Learners have to gather and process information, design and conduct experiments, make interpretations and abstractions, communicate their conclusion or, in other words, engage in processes of active learning, based on inquiry, knowledge building, and learning by design [28].

SCY uses a pedagogical approach that centres around products called "emerging learning objects" (ELOs) that are created by learners [3]. The ELOs, such as a CO_2-friendly house design or a concept map, are the vehicles for gaining an understanding of the general science skills, social and presentations skills, and domain concepts the student has developed [28]. Thus assessment in SCY is centred on these ELOs.

PEER ASSESSMENT IN A PARTICI-PATORY CULTURE OF LEARNING
Peer assessment enables students to take charge of their learning, and become active learners who could take responsibility for, and manage, their own learning [1, 2, 4, 26, 30]. For example, it enables students to learn to assess and to develop assessment skills, either when they enact peer assessment themselves or when receiving an assessment from their peers, and at the same time, it enhances students' learning through knowledge diffusion and exchange of ideas, even when they are incorrect [28].

Peer assessment has also been found to motivate students to engage in the learning process [22]. Research on students' views about peer assessment has shown that students are motivated by the fact that they want to impress their peers [11] and by the fact that peer assessment is productive. It makes them think, learn more, be critical, and be structured [2, 6, 23, 24]. In addition, peer assessment introduces the students to the perspective that the focus of instruction is not only on the end product(s) but also on the process, and it highlights the value of collaboration (e.g., social interactions, trust in others; [19]. Peer feedback is a form of peer assessment where peers give opinions, suggestions for improvements, ideas, etc. to each other. It has been found that students are more willing to accept feedback given in "student-speak" and students may be more willing to accept feedback from peers [7]. It has also been emphasized that the accuracy of the peer feedback may not be that crucial [9] and that the consequence of variety of accuracy in peer feedback might just be a benefit [26].

A PLAYFUL PEER FEEDBACK TOOL
In our work in the SCY project we are focused on providing "playful" peer assessment possibilities in a science learning environment and in this manner empower the users to become active learners who take responsibility for, and manage, their own learning [29]. The tool is "playful" because it is lightweight and designed to take advantage of new media skills.

User experience
Over the last decade "user experience" became the buzzword in the field of human-computer interaction (HCI) and interaction design [14]. It has become a catchphrase, calling for a holistic perspective and an enrichment of traditional quality models with non-utilitarian concepts, such as fun [18, 5], joy [10], pleasure [16], hedonic value [12] or ludic value [8].

Good user experience (UX) is the goal of most product development projects today [20]. Hassenzahl [13] argued that future HCI must be concerned about the pragmatic aspects of interactive products (i.e. fit to behavioral goals) as well as about hedonic aspect, such as stimulation (i.e.) personal growth, an increase of knowledge and skills), identification (i.e. self-expression, interaction with relevant others) and evocation (i.e. self-maintenance, memories). Focus on the positive aspects of technology use has also been a trend in psychology [21] and within UX this idea has been adopted outlining one of HCI's main objectives to contribute to our quality of life by designing for pleasure (by creating outstanding quality experiences) rather than for absence of pain (or preventing usability problems) [14].

How to sustain a good user experience?
Many UX researchers argue that good UX comes from the value and meaning of the product concept itself [20]. In order to select the right concept, we need to evaluate the concept ideas, the potential value of the concept idea itself

(experiential evaluation) and how the concept idea would fit into participant's own context of living [20]. According to Roto *et al.* [20] the value of the anticipated interaction outcome can be evaluated even thought there is no user interface or interaction design available.

In this paper we address: How can we design a playful peer feedback tool to sustain good user experiences?

FIELD RESEARCH
During a March 2010 field trial of the SCY Mission "Create a CO_2 Friendly House" we observed how peers interact and give each other feedback. The trial was arranged at Sandvika Upper Secondary School in Oslo. It ran for 20 hours, divided over 4 successive Wednesdays, 5 hours each day.

Participants
Three science classes of approximately 30 first year high school students (16-17 years old) were introduced to the SCY project and volunteers for the 4-week field trial were solicited. A selection of 20 students from the volunteers across these classes was chosen to participate. The 3 teachers divided the students in 4 person design teams, each of which chose their own name:

- BioNorway (3 girls and 1 boy)
- New energy (3 boys and 1 girl)
- Power puff (4 girls)
- PikenesJens (2 girls and 2 boys)
- ThumbsUp (2 girls and 2 boys)

Learning Environment
The learning environment comprised SCY-Lab (with its resources and tools) Google search engine, Google SketchUp (for 3D drawings), PowerPoint and Word. No feedback tool was available in SCY-Lab; feedback was given spontaneously and orally within and between groups Figure 1 shows a student working with SCYSimulation in SCY-Lab.

Figure 1. Student working with SCYSimulation in SCY-Lab

The Student Mission and Tasks Given
The Mission challenge given to the students, "Your job is to design a CO_2 friendly house", included 9 tasks:

1. Create one concept map where you explain the importance of reducing global CO_2-levels.
2. Create one concept map where you brainstorm on the design aspects of a CO_2-friendly house.
3. Make an initial plan on how your design group will proceed with the tasks to ensure a successful project.
4. Become an expert in one of the four fields:
    a. Production of energy,
    b. Laws of energy,
    c. Solar cells and solar thermal collectors, and
    d. Heat pumps.
5. Experts present their work in their original design groups.
6. Revise the initial plan.
7. Design, build and analyze your CO_2 friendly house using different tools that will be provided for you.
8. Write a report for the mayor of your town.
9. Present your group's findings in front of your classmates.

Data Collection
Empirical data, collected during the field trial through observations, videos, and data recordings, included: field notes, video recordings, reports, power point presentations and the collection of ELOs.

Analysis for Assessment Design
During the field trial we were interested in the following questions: Are the students active and take initiative in their own learning process? Do they look at each others ELOs and engage in peer interaction? Do they give feedback? Do they need any support to share and give feedback on each other's ELOs?

Thus the analysis of the empirical data focused on whether the students:
1) shared their ELOs
2) asked questions or presented an argument
3) gave feedback to one another
4) took the feedback into consideration
and the implications of these for the design of a feedback tool.

Episode 1:
Student Jens looked at another team's house design on their screen and asked a question. The other student, Magnus, pointed at their ELO (see Figure 2) on his computer screen.
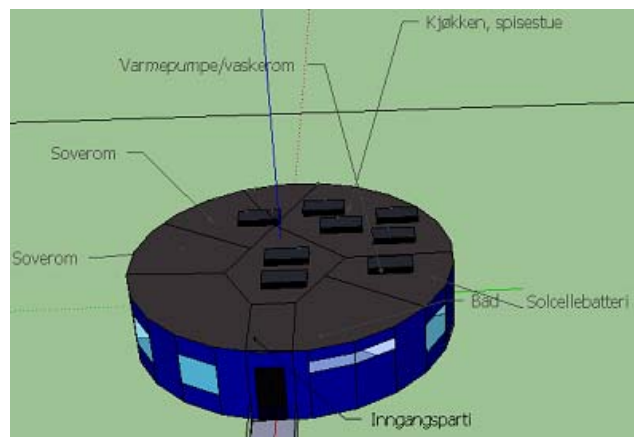

Figure 2. Team NewEnergy House Design ELO

Excerpt 1 (from Field Notes):
Jens (PikenesJens): Do you have a CO_2 reason for building a round house?

Magnus (NewEnergy): We have chosen to design a round house with one floor. We did this to save area and by this also energy. Because the smaller square footage of exterior walls we don't need to insulate as much. We also chose to only use one floor in the house. In this manner we don't have the problem that the heat rises to the 2nd floor and we get an even heat throughout the whole house.

Excerpt 1 shows the how a student question "Do you have a CO_2 reason for building a round house?" triggered a discussion about why Team New Energy made a circular house.

The relevance of this for the design of SCY assessment is that:
1) This dialogue should be supported by a SCYFeedback tool
2) The content of the dialogue illustrates that a) Jens can ask a question (skill: formulate questions) and b) Magnus can explain and argue for their choice of design (skill: argumentation/reasoning). This shows some of the skills that the teacher will look for in a summative evaluation.

Episode 2:
Student Jens looked at other team's house simulation in SCY-Lab (see Figure 3) on his own computer and got a reply from the teacher.
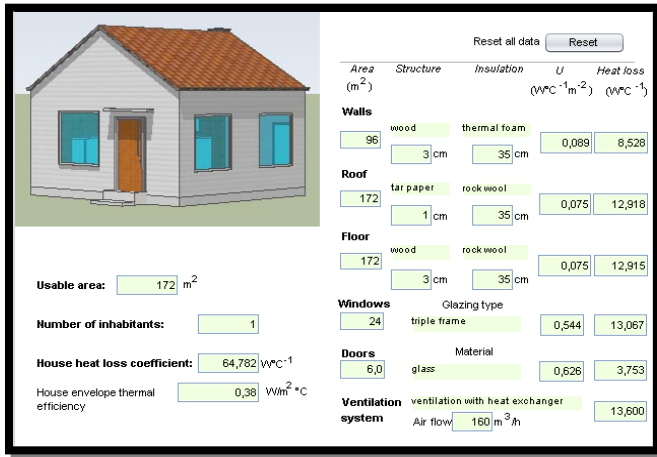
Figure 3. Team New Energy house simulation

Figure 4. Team New Energy house simulation showing heat loss coefficient of their house

Excerpt 2 (from Field Notes):

Jens (PikenesJens): How can the walls have less surface area (96 m^2) than the floor and roof (both 172 m^2)?

Teacher: You have to use the formula for calculating the surface area for circles instead of rectangles.

Jens (PikenesJens: What is the forumula?

Teacher: $A = \pi r^2$

Jens (PikenesJens): I have now calculated and I think that their answer is correct. The walls do have less surface area when using a circle than a rectangle!!!

Teacher: Laughing. Yes that is correct. You did not expect that did you?

Jens (PikenesJens): No, humm well then I guess that I have understood something new.

Excerpt 2 shows how a student question "How can the walls have less surface area (96 m^2) than the floor and roof (both 172 m^2)?" triggered a discussion between the student and the teacher.

The relevance of this for the design of SCY peer feedback is that:

1) This dialogue should be supported by the SCYFeedback tool. The peers designing the round house could just as well as the teacher help the students with information about how to calculate the surface area of a circle.
2) The content of the dialogue shows that Jens found that Team New Energy correctly had used the formula and calculated the area and volume of a circle (mathematics domain). It is also plausible that after the communication with the teacher Jens also has gained this skill in geometry of calculating area and volume from complex shapes.

Episode 3

Students' sharing of house simulations generates discussion around the elements in the data simulation of a CO$_2$ friendly house. Figure 4 shows the house simulation of
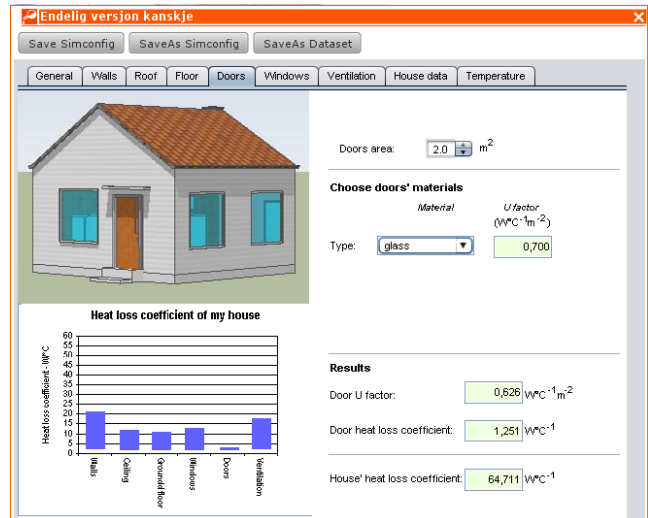
Excerpt 3 (from Field Notes)

Jens (PikenesJens): Wow! Your graph bar for the door is very small compared to ours! The door area is 2 m^2 and the doors material is glass. How many m^2 does a door need to be? Is 2 m^2 enough? Is glass door better than wood?

Teacher: I would think that wood is better isolation material than glass.

Jens (PikenesJens): I have checked and you get better values for glass than for door. But the glass is triple!!!

Teacher: Ok that might explain it. Tipple glass door might provide better isolation than a single wood door.

Jens (PikenesJens): But is 2 m^2 enough for the door?

Teacher: How big is the door into the classroom? And how big are you?

Jens (PikenesJens): Checking the classroom door and walking through it. I do not think that it is more than 2 m^2. Great then I can reduce the door sixe and get a better heat coefficient. I will also experiment will various door materials.

Excerpt 3 shows that the student Jens displays general science skills such as being able to visualize, interpret and make judgements about data. By investigating the simulation of another team and comparing this with their own a student gains experience in interpreting data and in investigating how the house simulation variables are related to the overall heat transfer coefficient. The application of the concept of overall heat transfer coefficient with the transfer of heat is a skill within Physics and Thermodynamics. The student discussion and application

of this concept in their house simulation model could demonstrate that they have gained this skill.

The skills of interpreting another team's (Team ThumbsUp) house simulation proved to be useful for Jens (Team PikenesJens) as he got a new perspective on how low the heat loss coefficient for the door could be. Based on the comparison of the two teams' simulation model and feedback from the other student Team ThumbsUp changed their values and managed to reduce the heat loss coefficient for their door.

The relevance of this for the design of the SCY assessment is that:
1) The commenting and questioning of a student made ELO could be supported by the SCYFeedback tool. The students in team New Energy might just as well as the teacher answer questions related to their simulation ELO and the choices behind their selection of values.
2) The ELO sharing led to changes in student ELO and the discussion shows that the student displays skills like for example being able to visualize, interpret and make judgements about data.

Episode 4
Students' presentation of their house design gave a good opportunity for peer feedback in a plenum. Figure 5 shows the students in Team New Energy presenting their use of isolation in their house design.

Figure 5. Team New energy presenting their house design

Excerpt 4 (from Field notes):
Team ThumbsUp: *We see that you have chosen tar paper for roof but is that an environmental friendly material?*

Team New Energy: *It is perhaps not the most environmental friendly, but it is very isolating and thus we do not have to use too much electricity to heat the house.*

Team ThumbsUp: *We think that you should avoid using a material that is not environmental friendly.*

Excerpt 3 shows that Team ThumbsUp is questioning the environmental friendliness of their choice of tarpaper as one of the roof materials. Team ThumbsUp and New Energy discuss if a material that is not environmental

friendly can be used. The discussion and peer feedback could be supportive for the students in gaining general science skills such as being able to reflect on one's own knowledge and interpret data.

The relevance of this for the design of SCY assessment is that:
1) This student dialogue should be supported by the SCYFeedback tool.

2) The student questions would then be documented and the teacher could look back at the student dialogue when assessing the student skills.

CONCLUSIONS AND SUMMARY
In this paper we have explored which user experiences should be designed for and supported by a playful peer feedback tool within a participatory culture of learning. Today's youth participate in a variety of social media and develop new skills (e.g., play, simulation, judgement, multitasking). Within learning research the view of learning as a participatory activity where the students themselves participate actively in the learning community has been increasing. Peer assessment has been suggested as a method to be used to empower students to take charge of and manage their own learning.

UX researchers argue that good UX comes from the value and meaning of the product itself. The concept of participatory peer feedback has been further investigated in a school setting with the SCY-Lab learning environment and "Create a CO_2 friendly house" Mission in order to see if the concept idea would fit into participant's own context of learning.

The field study showed that:
- students were looking at each others products (ELOs) and took initiative by asking each other questions
- students naturally engaged in peer feedback dialogues
- students were able to make judgements about other students ELOs and use this to further develop their own skills
- the students seemed to be comfortable with switching between working on own ELOs and investigating other students ELOs
- the students seems to be motivated by playing with other students simulations
- students need support to communicate with each other and give each other feedback on ELOs
- students showed skills in their discussions (e.g. collaboration, formulate questions, argumentation, reasoning, mathematical calculation, judgement, simulation)

The idea of creating a good user experience and also cultivate the students as active learners with a peer based assessment tool seems promising. Findings show that students act, take initiative and they also seem to take pleasure in sharing their products (ELOs) and engaging in

peer discussions. Students do not seem to need instructions and guidance as this playfulness falls naturally for them. However, a need for a means to link peer feedback to ELOs was identified. The goal for the design of the playful SCYFeedback tool for peer assessment should be to facilitate student sharing of ELOs together with opportunities for student feedback on the ELOs. The tool should lay the foundation for a good user experience where student themselves can engage in ELO sharing and take charge of having fun and creating their own pleasure.

Figures 6 and 7 show screenshots of how the ELO display and linking of peer feedback comments to an ELO could be facilitated. Figure 6 shows the ELO Gallery where the students can find published ELOs while Figure 7 shows an ELO and how students could give peer feedback and score the ELO.
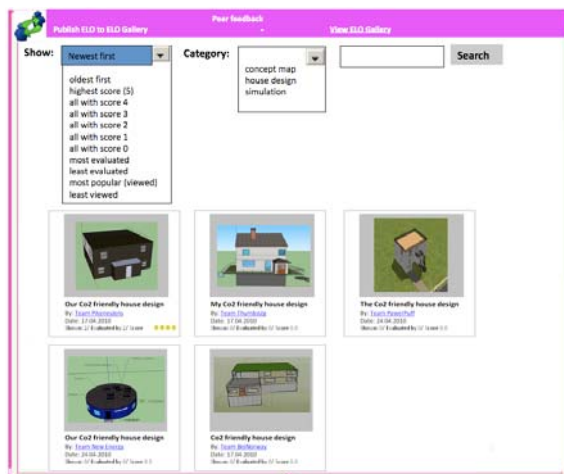

Figure 6. ELO Gallery showing students published ELOs

Figure 7. ELO feedback screen with comment and score field

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