Develop open operative system services for Smartphones that facilitate new evaluation methods, and enhance the use of immediate feedback on evaluation results obtained in tests as a creative learning tool (Done-IT)
Develop open operative system services for Smartphones that facilitate new evaluation methods, and enhance the use of Immediate feedback on evaluation results obtained in tests as a creative learning tool

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Executive Summary

AIMS
Today, students are unable to immediately verify their learning during tests/exams as feedback is published after several days or even weeks. This is particularly important in vocational education and training, and in higher education in Europe. Educational institutions usually don’t have access to a high number of computer science laboratories from which it is possible to run digital multiple-choice tests for all campus students. On the other hand, within a few years a majority of students will have access to cheap and easy-to-use Smartphones with high-resolution touch-sensitive screens.

METHOD
The new Peer Learning Assessment System (PeLe) for Smartphones gives the teacher a new learning tool, allowing him/her to either give verification or elaborative feedback to individual students or groups of students immediately after a test. Students will, at a time when they still have the test questions fresh in memory, learn why the correct answer is correct and why the other ones are incorrect. Thus, mobile technology provides new assessment and testing criteria for education and training.

RESULTS
Each student uses Smartphones to answer and mark multiple-choice tests with a number of questions. An embedded automatic marking system is included.

During the post-assessment phase the test results for a class are turned into an interactive, creative and collaborative peer learning process by the use of immediate feedback:

- Verification by the teacher: why is the answer correct and why are the others incorrect?
- A peer learning discussion where the teacher displays the results and invites the class to take part in a 2nd chance voting. Each student decides whether to participate in the 2nd voting process, or to participate in a learning process that doesn’t affect his or her final score.
Develop open operative system services for Smartphones that facilitate new evaluation methods, and enhance the use of Immediate feedback on evaluation results obtained in tests as a creative learning tool

**IMPACT**

Students may improve their skills through active communication and interaction through immediate post-assessment peer learning processes. Students will, at a time when they still have the test questions fresh in memory, learn why the correct answer is correct and why the other ones are incorrect. Thus, mobile technology provides new evaluation and assessment criteria for education and training.

During the exploitation phase in the second year of the project, services and methods are going to be disseminated to Vocational Education and Training school, industry companies, universities and high schools in many European countries. Institutions wanting to test PeLe and the new assessment methods from Done-IT, are welcome to do that and may contact the project coordinator.

![Figure 1. Demonstration of the Peer Learning Assessment System at Online Educa (OEB) 2011 (left); the HiST stand at OEB (right).](image)

The left picture in Figure 1 shows the response from a group of teachers, who have just noticed in the post assessment phase after a short discussion, that they have completely misunderstood a question and answered 100% wrong. However, after completing the peer learning process carried out immediately after the test, the correct answer was sorted out.

*PeLe is fun!*
Develop open operative system services for Smartphones that facilitate new evaluation methods, and enhance the use of Immediate feedback on evaluation results obtained in tests as a creative learning tool

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1. Project Objectives

Material testers and material engineers frequently need to conduct visual inspections test and assess the quality of products in a range of mechanical fabrication processes. ISO 6520 is used to distinguish 80 types of material defects like cracks and gas pores. For each type, the defects could be grouped or classified into different degrees of severity and complexity, and students are required to master knowledge of multiple characteristics of materials. Thus, in technical and science foundation courses in Europe, learning largely consists of the acquisition of factual information.

According to contemporary models of learning, individuals understand and remember new material best when they are given a chance to elaborate on that material in some manner. Elaboration can take the form of adding details to the information, clarifying an idea, explaining the relationship between two or more of the new concepts, making inferences, visualizing an image of some aspect of the material, applying an analogy relating the new ideas to familiar things, or in some other way associating the new material with tests. A guided questioning strategy may facilitate learning by prompting students to solve specific thought-provoking questions pertaining to the material to be learned, and those questions in turn elicit relevant explanations. Characteristic of the questioning strategy that accounts for these effects is the critical-thinking nature of the question prompts and the high degree of learner autonomy and independent learning within the structure of such a strategy.

However, today students are unable to immediately verify their learning during tests/exams as feedback is published after several days or even weeks. This is especially the case for learning skills in vocational education and training, and in higher education in Europe. Usually educational institutions don’t have access to a high number of computer science labs from which it is possible to run digital multiple-choice tests for all campus students. On the other hand, within a few years a lot of students will have access to cheap mobile phones with high-resolution touch-sensitive screens.

The Done-IT project wants to develop and validate a new evaluation and assessment model where test results for a class are turned into an active, creative and collaborative learning process by the use of immediate feedback:

- Verification feedback led by a teacher: why is this particular answer correct and why are the others incorrect.
- An elaborate feedback discussion run by students: the answers are displayed but they don’t know which are the (in)correct ones.
- An elaborative feedback discussion led by one student: the deviation from the correct answer without addressing why this is correct and the other ones are incorrect.
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The new assessment system for Smartphones should give the teacher a new tool, allowing him/her to either give verification or elaborative feedback to individual students or groups of students immediately after a test. This is a key factor helping students to improve their skills by the use of active collaborative supported learning. Students will, at a time when the test questions are still fresh in memory, learn why the correct answer is correct and why the other ones are incorrect. Thus, mobile technology provides new evaluation, testing and assessment criteria for education and training.

Thus, Done-IT aims to foster innovation by providing a new model for assessing and expanding students learning skills and knowledge, since the results from multiple tests may be interconnected. Students understanding of problems are measured and collected in real time, so that the traditional final exam may be replaced by a system of multiple tests during the year. The evaluation model uses modern mobile devices that can easily track the students’ behaviour during a peer learning elaborative feedback process (e.g. detect if they change their minds during the process), and this may in turn improve the assessment process:

*The teacher may display the class results of a test question without explaining details about what are (in)correct results, and let individual- or groups of students discuss the alternatives. After this active learning process some students may decide to change their mind and correct their feedback!*

Due to the potential of connecting peer learning processes with new assessment methods, we have given the services the name: Peer Learning Assessment Services (PeLe).

The target groups include:

- Mechanical industry training providers within material testing
- Providers of Vocational Education and Training (VET)
- Higher educational institutions
- Secondary schools
2. Project Approach

Done-IT is an EU-funded LLP/KA3-ICT project that brings together 7 partners from different European countries. The partnership has close contact with industry across Europe. It aims to disseminate Peer Learning Assessment Services (PeLe) into 2 lifelong learning sectors, by developing new response technology services for Smartphones, pads, PCs and Macs. The PeLe is going to add significant benefits to both instructors and students: the instructor gets immediate feedback on how well the students answer a test; while the students get instant feedback on their understanding of the questionnaires in the tests when they still remember the errors they made.

The project introduces immediate elaborative and/or verification-based feedback processes and learning methodologies to students based on tests, and new tools for collecting and marking their tests in the context of problem- and inquiry based learning by using modern mobile handheld devices. The services use advanced web technologies such as XML security, and implement XML authentication, confidentiality, and integrity. A database is used for management of system operation, while data storage servers secure fast operation.

Done-IT directly addresses the transversal policy framework of the European Commission by focusing on the development of new evaluation and assessment methods which require new, novel learning and teaching methods based up on active learning approaches in VET and higher education. The aim is to bring evaluation closer to real-world needs as it introduces a didactical methodology that combines immediate feedback after student tests by using Smartphones, and elaborative and verification-based learning processes, in combination with problem solving approaches. Remote, autonomous, independent learning is achieved by supporting the cases with graphical interfaces and online tools where students may immediately apply their knowledge to practice by elaborating and verifying a "what happens if..." approach in specific areas of an industrial fabrication process. This new evaluation method develops analytical and creative thinking, and has the potential to reach a wider educational community than currently used approaches based on final exams.

The traditional final exam may be replaced with a system of several tests that may be carried out in all types of rooms with Wi-Fi network access, including inquiry-based and problem solving approaches where learners may use laboratory experiments as cases during/after tests. Today, evaluation approaches can only be carried out in computer labs with a high number of PCs. This is an expensive solution for educational institutions, as they must be replaced within a few years.

- The new “assessment for learning” system may be used for in-class, laboratory experiments, but also for distance training purposes. The two latter features being an entirely new option in for tests (and exams). Notice that remote, autonomous, independent learning occurs when learners put their post-evaluation feedback into practice by applying and extending the case-based learning approach to new experiments and scenarios.
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- The system solution gives the teacher a new tool which he/she may use to give either verification or elaborative-based feedback to single students or groups of students immediately after a test. This is a key factor helping students to improve their skills by use of active, collaborative supported learning. Students will, when they still remember the questions in the test, learn why the correct answer is correct and why the other ones are incorrect.

The “assessment for learning” system is designed to provide a gateway to active learning for students. Students use Smartphones to answer and mark multiple-choice tests containing a number of questions. An embedded automatic marking system is included. The training method includes using cases and/or experiments demonstrating what to do, how it works, and what the deviation will look like. The new open mobile technology-based evaluation services helps improving certification processes, due to the automatic markup system.

The PeLe services should be fast to use. When reviewing the test, the teacher can at each question decide whether to use a traditional verification feedback, or instead an elaborative feedback solution. The latter includes peer instruction learning processes, where students can change their mind during the process!

**The assessment phases include several stages**

1. During the assessment the students are handed the test on paper, and respond to it using a web-enable device like a Smartphone, iPod and pad. The teacher may monitor the activity in real time as the students respond.

![Figure 2. A prototype version of the monitoring interface giving online information about student progress and results.](image)
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The monitoring interface displays the student responses in real time, including individual responses on each question, and accumulated responses and trends in the form of histograms. This gives the teacher an early warning about questions that caused problems and need more work. Monitoring also reassures the teacher that the technology is working properly.

2. After the test is submitted, the students get a short break. This will be the result consideration phase. Once the assessment has been completed by the students, the teacher uses this phase to obtain a complete overview of the results submitted by the students.

Figure 3. A prototype interface displaying the results and the process of selecting questions for running 2nd chance votes, while the students have a short break.

The interface provides an at-a-glance overview of how the students answered the assessment, and in particular identifies the problematic questions. It also helps identify students that have more problems than others and who need special attention. This interface is designed to as a teacher tool which ensures that the post-assessment activities can be done as effectively as possible. A question with a high proportion of incorrect answers is highlighted, so that the teacher may spend more time on it when reviewing the test. The teacher uses this interface to select a subset of the questions (the problematic ones) and prepares for the most important part, from a learning perspective: the post-assessment activities.

3. In the post-assessment phase, a subset of the questions has been highlighted, and the teacher may start providing verification or elaborative feedback in order to enhance new learning activities. Thus, the assessment system is used to reveal the
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test results and promote and enhance the peer-learning process. The teacher can invite and engage the students to take part in a process where they learn from the problems they have just spent time trying to solve.

Figure 4. Students utilizing peer learning. They work in a group in the post-assessment phase to solve one of the test problems that proved most difficult.

It is the goal to design the PeLe system in such a way that it may be used to grade assessments carried out by certification bodies. Certification bodies require a test system where the questions are stored in a question data bank, from which they're retrieved when starting a test. There are no post-assessment activities. The certification bodies can be totally disconnected from the teaching process, as they test the knowledge after a teaching period has been completed. The requirements here are different from the teaching approach where learning is in focus. Students enter the room, use an electronic device and respond to questions on a printout. Questions and alternatives are randomized and gathered automatically and the results are given without comments or elaborations after the test. However the requirements for such assessments are much bigger. The sets of questions may be large and the question sets often relate to different sections.
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3. Project Outcomes & Results

Done-IT adapts, disseminates and implements in two lifelong learning sectors a completely new learning and training approach to VET schools and higher educational institutions in Slovenia, Hungary, Romania, Sweden and Norway. It uses industrial production flow as an educational framework, and implements generic and modern response service technologies to promote use of peer learning assessment methods immediately after completion of test and exams.

Figure 5. Acquisition of knowledge in a typical higher education course of 15-16 weeks. The dotted line indicates the skills obtained. Such courses are usually terminated with a traditional (handwritten) exam.

Lack of feedback on the students’ performance is often a challenge in higher education. Courses usually contain a number of exercises, and a final exam for assessment of knowledge, as displayed in figure 4.

Done-IT wants to introduce peer learning assessment solutions through verification or elaborative learning processes that utilize immediate feedback after tests and/or exams. The traditional exam may be replaced with a number of tests that provide feedback from the student to the teacher, and from the teacher to student. The course may be completed with a smaller final exam, as illustrated in Figure 5.

Figure 6. Acquisition of knowledge in a course using several smaller tests in combination with PeLe. The dotted line indicates the skills obtained. The course may be terminated with a small exam, since the test contributes to the final score from the course.
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Done-IT poster

Done-IT has delivered the following results during the first year of the project:
1. Dissemination of project results and peer learning assessment methods in workshops, seminars and international conferences in Norway, Sweden, Romania, Slovenia, UK, Hungary, Portugal and Spain. This includes Online Educa 2011, The International INTED 2011 and EduLearn conferences in Spain, the international CELMA conference in UK, June 2011, the INTER-ENG conference in Romania in November 2011, the WILMA workshop in Romania, and two mobile learning workshops in Trondheim (May 2011) and Østersund (October 2011), and the international workshop "Modern Tools for Education and their Implementation into Education of Welding Personnel", Organized by VuZ in Bratislava, Slovakia, October 18-19.

2. Development and initial testing and evaluation of the peer learning assessment method and the peer learning assessment services that provides immediate feedback to students after test and exams.

3. Deliverance of instructor training in Norway and Sweden

4. Adaptation of course material for use with PeLe

5. Instructional video material for demonstration of skills, training methods and mobile learning technology solutions

6. Quality project plan

7. User requirement specification report

8. Draft of peer learning assessment methodology report

9. Online PeLe with a user interface and back end

10. Project web-site for dissemination of project results

11. Leaflet and poster for dissemination of project results in English and Slovenian

12. Scientific articles that have been published in conference proceedings

13. Arranged two project meetings, and regular Skype meetings for development of services

14. Completed partner agreements with all partners

Figure 8. Pascal Pein from HiST demonstrates PeLe to a visitor who is working in a research organization in Mid-Norway.
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The first prototype of the PeLe services was constructed during month 1-7 of the project. During month 8-12 the functionality of the services has been tested and improved with three focus groups (10 students in total) and 18 teachers. This has been done as a continuous feedback evaluation process where students test the services every Tuesday, and the programmers update them during the following week. Testing with teachers has been done in a similar way. On October 25 a test with 18 teachers from Norway and Sweden was carried out in Østersund, Sweden. They used the PeLe services to complete a test with 8 questions. The system test was successful.

Figure 9. More than 40 teachers and instructors from Hungary, Slovakia, Portugal, Norway and Slovenia testing response technologies during a workshop addressing the use of new training methods in VET, Bratislava, October 2011.

Figure 10. 18 teachers from Norway and Sweden answering a test using PeLe during the Scandinavian Mobile Learning seminar in Østersund, October 2011.
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It has been very important to include student and teacher opinions during the development phase. This has been achieved by conducting interviews in order to develop services that accommodate their feedback as to how the new peer learning assessment method should work. The results show that students will select different strategies, depending on whether the peer learning assessment results should be part of the test, or just used to enhance learning by using Student Response Services that were developed in the previous KA3-ICT project EduMecca (2009-2010).

Figure 11. One focus group with students is carrying out an early usability test of the peer learning assessment system.

Figure 12. The teacher control interface on a digital blackboard, and the student interface on an iPhone, October 2011. The student may “flag” a question to inform the teacher that this question needs particular attention in the post assessment phase. Question “flagging” is done by pressing the star-shaped icon ⭐ at the bottom.
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Figure 13. The teacher control interface operated from an iPad, and the display of student responses from at the end of the test, November 2011.

Figure 14. Demonstration of services and methods from the Done-It project at Online Educa 2011 in Berlin.
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4. Partnerships

The consortium consists of:

- Sør-Trøndelag University College, Trondheim, Norway
- HiST Contract Research, Trondheim, Norway
- MHTE, Budapest, Hungary
- IzV, Ljubljana, Slovenia
- University of Huddersfield, Huddersfield, UK
- Centrum for flexible training, Söderhamn, Sweden

The consortium has a strong industrial presence and includes two national certification bodies with strong ties to mechanical industry and industrial networks. These partners have experience in training standards with regards to VET in industry, as well as experience in interacting with the European Welding Federation, of which MHTE and IzV are members. The participating certification bodies have a large number of contact points throughout Europe. This industrial approach ensures that the results will be implemented in practical industry cases, as well as in additional knowledge transfer programs.

The Done-IT project results have been presented at important events during the first year of the project. This includes the European Welding Federation workshop meeting in Lisbon in November, as well as the important international industry conferences in Hungary and Slovenia.

Furthermore, Done-IT has during the first year of the project been presented at three workshops and seminars (Norway, Sweden and Romania); one conference in UK, as well as the main international conference within the e-learning sector, including Online Educa 2011 in Berlin.

Figure 15. Internal evaluation of the assessment system carried out by project participants who answer a test by using mobile devices during the project meeting in Trondheim, September 2011.
5. Plans for the Future

Testing and validation of the PeLe services in classes in two educational sectors will be carried out during month 1-6, 2012 in Sweden, Hungary, Slovenia, Romania and Norway. Final results with methods and services from the project will probably be demonstrated in a workshop at Online Educa 2012 in Berlin for the e-learning sector, and at the international Welding- and Material testing conference in Oslo in October 2012. This conference addresses industry in Norway, Sweden and Denmark, and the presentations are given in English. HiST is currently working together with the Norwegian Welding Federation in order to make up a session related to use of new training methods and new online mobile learning services.

During the first year of the project, the focus has been towards developing an easy and fast-to-use prototype. This prototype is now ready for use after an extensive testing period in several classes, and this makes it is easier to disseminate it to organizations outside the consortium.

The international e-learning community has drawn their attention towards the Done-IT project, and the new assessment methods. In the beginning of month 12 of the project, personnel from 33 organizations from Europe, Africa, Middle-East, Asia and North-America have signed up for testing the PeLe system. This includes many universities, VET training bodies, and industrial training companies. Additionally, 9 other universities, VET providers and high schools have signed up for getting more info about the Done-IT project. These activities are going to be included in the exploitation strategy of the project.

The Done-IT project will during the second year try to let as many as possible of these organizations test and use the services for free, on the condition that they provide feedback to the Consortium to improve the services. We have made up a separate agreement for this testing.

Figure 16. Testing of one of the first PeLe prototypes by CFL in Søderhamn, August 2011
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6. Contribution to EU policies

The Done-IT project supports the development of innovative ICT based services in combination with development and validation of new “assessment for learning” methods, which may use fast-to-use, cheap and (soon) widely deployed Smartphones. The assessment process is turned into a creative learning process by using immediate verification or elaborative feedback. The services may contribute to bridging the world of work with education and training, by utilizing assessment methods that recognize the value of peer learning.

This Peer Learning Assessment framework has been designed to change the way higher educational institutions; VET and high schools evaluate and grade exams. This is accomplished by replacing the final exam with an assessment model based on a number of multiple tests where students get instant feedback through active learning approaches. The latter includes creative collaborative peer learning processes where students, on a limited number of test questions, may get a 2nd chance, and immediately apply their peer learning knowledge into practice, thus improving their score. PeLe directly addresses creativity and promotes innovation by letting students collaborate through peer learning assessment processes, whereby it has the potential to improve quality in VET and higher education.

The PeLe services support the realization of a European area of lifelong learning, by enhancing easy and fast-to-understand interfaces in combination with student-engaging assessment methods, and this supports mobile technology in becoming an indispensable part of day-to-day life in the workforce. The ever-expanding cellular network is a key driver for increasing ease and speed with which it is possible to access the Internet from virtually anywhere in the world.

Done-IT promotes European cooperation by covering two transversal sub-programs, and develops services and assessment methods within a partnership containing 2 national certification bodies, one dedicated VET provider, a research institute, and 3 universities. Due to the complementary expertise and skills, the project promotes European cooperation in order to solve joint European challenges. Furthermore, exploitation targets policy-level decision makers, thus demonstrating and promoting the added effect of European cooperation.

The quality and transparency of member states education and training system are based on evaluation and learning activities that promote joint, harmonized European guidelines for education within the material testing sector. It directly promotes quality, transparency and deployment within material testing with respect to European member states education and training systems, by using international guidelines that defines curricula and educational levels for VET as well as engineering education.

Done-It supports ICT as a catalyst for innovation and creativity in lifelong learning by introducing a pedagogical method that turns evaluation and assessment processes of tests and exams into an innovative learning process. Student creativity is fostered through immediate elaborative feedback which

- Addresses new inquiry and problem based learning approaches
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- Directly support learning-by-doing through experiments
- Promotes immediate application of knowledge to practice
- Introduces peer learning in groups by immediate application of test results

Furthermore, it is expected that PeLe has the potential to support groups at risk of dropping out of studies, and to stimulate them to participate more actively in education and training. This is due to the fact that mobile technology and mobile learning promote use of anonymous verification and/or elaboration processes. Examples of such groups are women who want to study engineering, or students in a class that who are afraid to raise their hands to answer questions. PeLe allows all students – including the risk groups above – to take part in assessment solutions that promote anonymous interaction and active participation through use of verification-and elaborative peer learning approaches.

The Education and Training initiative calls for modernization of the educational system as a means for European competitiveness, to be achieved through exchange of experiences within the member states. Done-IT contributes to these policies and goals by validating innovative evaluation and assessment solutions that pilot new ICT technology in a number of European countries, comparing the success in each, and developing good practice guidelines for teachers and policy makers.

Finally, one of the added values from this project will be the Green IT approach in which the use of a large number of PCs may be replaced by small devices that are already (soon) widespread and affordable. This requires less material consumption during the production process, resulting in less manufacturing costs, reduced carbon footprints, and promotes increased use of renewable energies. Two-way video (video conferences and Skype) has been used regularly between the team of developers every day during the development phase.

Figure 17. Two-way video meeting between Trondheim and Søderhamn in September 2011. Trond M. Thorseth from HiST and Per Bergegård from CFL participate.
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Figure 18. Two-way video meeting between HiST in Trondheim and MHiE in Budapest, September 2011.
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7. Evaluation methods

The PeLe services have been constructed by initiating a close collaboration between software developers, pedagogues, experienced teachers and groups of students from high school level and higher education. Teachers and students have been involved in the design from month 5 of the project. Video and Skype are used for collaboration and communication every day. The next sections describe an example of the evaluation and testing that has been carried out in order to develop the interfaces at the mobile devices.

Through the spring and autumn 2011, a total of 10 students (three girls and seven boys) from Sør-Trøndelag University College (HiST) have been involved in an initial technical testing of the student interface of the assessment system developed through the Done-IT project. The purpose of the testing has been to obtain feedback about the functionality and usability of the interface.

Arranging a total of 10 tests from May to November with students that take a real test has resulted in the development of PeLe. After each test the interfaces was improved before the next group used the services. We have during the trials tried to create a test context that resembles a real-life test in a classroom. These have proceeded as follows:

**Part 1: Technology testing:**

- Students have been given a test that they completed individually.
- They have answered the test using an iPod.
- They had 10 minutes to complete the test.
- They never knew in advance anything about new technological changes or developments in the PeLe services.
- The students were filmed during testing, using three different camera views: a group shot from a remote camera; shots of each student using small cameras, and a screen recording on the iPod of each student’s movements on the device.

**Part 2: Discussion**

After each test, a part of the research team set down with the students and talked about their first impressions, experiences and opinions in relation to the test they had been through. Based on four such tests, and the ensuing detailed discussions with the students, the following feedback has been received:

1. The importance of feeling secure in relation to use of technology

For students, the use of technology in an assessment situation represents something new and slightly frightening. They are used to answering on paper, as that is what
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they have done throughout their academic careers. Initially, they therefore felt a bit insecure about the technology, and the first test introduced considerable stress because of this. The uncertainty was rooted in fear of the iPod suddenly turning off, or breaking down, or that their responses would be lost.

The uncertainty and the stress were, however, proved short-lived. By the second test, they already felt significantly more comfortable about the technology. The students emphasized that the technology seemed less alien now that they had been through a test before, and they felt confident in how it worked, which also meant that they liked the interface a lot better.

**Lessons learnt from this:** when we enter a classroom with the assessment system, one of our primary focus areas should be making the students feel confident and comfortable with the technology. The system should be presented with a thorough introduction followed by a sample test, so that the students get used to the technology as soon as possible. The students emphasized that the various icons, with pictures and labels, should also be described on the test sheet. Additionally, we will develop a separate help icon on the interface, where students can find explanations about the functionality of the interface.

2. **Home page**

After students have logged on to the student interface with a username and password, they want to enter a “start page” with a start button. According to students, such a page will soften the start of the test.

**Our solution:** Following a logon, the students now enter a “start page” with a “start button”.

![Home page interface screenshot]
3. Home page - overview - submit

The students early on requested a “home page” containing a summary of which questions they have answered, and what they answered. This is a page students can go to during a test to get an overview of their responses. Feedback from students suggests that this page is particularly important in the submission phase of the test.

Our solution: We developed a “home page” (icon depicting a home), from which this information is available. Additionally, they can see which questions they have flagged (if any), and submit the test by clicking a button at the bottom of the page.

4. Submit

From the students’ point of view, there should be no uncertainty as to where and how they deliver the test. During the first test, few of the students understood how to submit, which increased their stress levels.

Our solution: A “submit bar”. When students have answered all the questions, a green "submit bar" will appear at the top of the interface, and at the same time the “home page icon” turns red. The students can then either press the green bar or on the home icon, as both choices link to the submission page. According to students, this was a very clear and good feature!

5. Use of colour and sharp contrasts

According to the students, the row of icons should have the same colour as the rest of the interface - to make it clear that they are part of the test page. The top navigation bar- i.e. a row of numbers indicating the numbering of the questions, should not change to green when the student responds, as green is often associated with correct answers.

Our solution: we chose to use a blue and red colour scheme. Red is used for the open questions, and blue for unanswered questions. According to students, this was a clear and distinct use of colour. Red indicates that something is wrong, which it is;
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as red indicates an unanswered question. One of the students was colour blind, but had no difficulty seeing the contrasts clearly.

6. “Trash can icon”
In the first tests, the interface had a “trash can icon” for deleting responses. After a total of three tests, the students saw this as a "scary" icon that none of them felt confident about using. They were afraid that it would delete the entire test. For the students, it felt natural to delete responses using the already existing "check-uncheck" function.

Our solution: We decided to remove the “trash can icon”. They can delete their responses using the “check, uncheck” mechanism, which is the “delete” method they prefer.

7. “Star icon” – “flag icon”
Initially, the interface had a “star icon” for marking questions. The students pointed out that they associate the star with favourites (when bookmarking web pages etc.). One of the students suggested changing the star icon into flag instead. Upon hearing this suggestion, all of the students liked the idea. To them, a flag icon brings no particular associations by default, so they may well associate it with "marking" or "flagging" something.

Our solution: We changed the icon from a star to a flag.

Pictures from point 5-7: