Deliverable D6.5

Report on TDS 1

Identifier: NEXT-TELL-D6.5-KMRC-Report-TDS1_v06.doc
Deliverable number: D6.5
Author(s) and company: Gabriele Cierniak, Carmen Biel, Friedrich Hesse (KMRC)
Eva Hillemann (TUG)
Cecillie Hansen, Barbara Wasson (UniRes)
Jade Hunter (IOE)
Klaus Hammermüller (TALK)
Peter Reimann (MTO)
Internal reviewers: Eva Hillemann (TUG)
Work package / task: WP6
Document status: Final
Confidentiality: Public
Version 2013-09-09

© NEXT-TELL consortium: all rights reserved
D6.5
Report on TDS 1

History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Reason of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2013-04</td>
<td>KMRC: setting up</td>
</tr>
<tr>
<td>2</td>
<td>2013-06-01 to 2012-07-01</td>
<td>Negotiation of structure with project partners</td>
</tr>
<tr>
<td>3</td>
<td>2012-07-01 to 2012-08-27</td>
<td>Individual contributions of project partners</td>
</tr>
<tr>
<td>4</td>
<td>2013-09-03</td>
<td>Version for internal review for TUG</td>
</tr>
<tr>
<td>5</td>
<td>2013-09-06</td>
<td>Final Version</td>
</tr>
<tr>
<td>6</td>
<td>2013-09-09</td>
<td>Final layout – submitted to EC</td>
</tr>
</tbody>
</table>

Impressum

Full project title: Next Generation Teaching, Education and Learning for Life
Grant Agreement No: 285114
Workpackage Leader: Gabriele Cierniak, JRS
Project Co-ordinator: Harald Mayer, JRS
Scientific Project Leader: Peter Reimann, MTO

Acknowledgement: The research leading to these results has received funding from the European Union’s Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 258114.

Disclaimer: This document does not represent the opinion of the European Community, and the European Community is not responsible for any use that might be made of its content.
This document contains material, which is the copyright of certain NEXT-TELL consortium parties, and may not be reproduced or copied without permission. All NEXT-TELL consortium parties have agreed to full publication of this document. The commercial use of any information contained in this document may require a license from the proprietor of that information.
Neither the NEXT-TELL consortium as a whole, nor a certain party of the NEXT-TELL consortium warrant that the information contained in this document is capable of use, nor that use of the information is free from risk, and does not accept any liability for loss or damage suffered by any person using this information.
# Table of Contents

1 Executive Summary ........................................................................................................ 1

2 Introduction ..................................................................................................................... 2
  2.1 Purpose of this Document ......................................................................................... 2
  2.2 Scope of this Document ........................................................................................... 2
  2.3 Status of this Document ........................................................................................... 2
  2.4 Related Documents .................................................................................................. 2

3 Informal and Non-Formal Ways of Professional Teacher Development .......................... 3
  3.1 Informal Professional Development and a Participative Development 2.0 ............... 3
    3.1.1 A Participative Community in Social Media ...................................................... 4
    3.1.2 A Participative Community and its Face-to-Face Meetings ............................... 5
    3.1.3 A Participative Community and its Reflective Development ............................ 5
    3.1.4 Considerations for Technological Developments ............................................. 6
  3.2 Informal Individual Professional Development and Student Feedback ................... 7
    3.2.1 Student Feedback as part of Assessment for Learning and of Relevant Students’ Data 7
    3.2.2 An Example of Student Feedback Practice ....................................................... 8
    3.2.3 Considerations for Technological Developments ............................................. 11
  3.3 Developing Non-Formal TISL approaches within Schools ....................................... 12
    3.3.1 Current TISL Project ......................................................................................... 12
    3.3.2 Future TISL Projects ......................................................................................... 12

4 Developing Formative e-Assessment at Schools: Seven Case Studies ............................. 14
  4.1 Austria: Technological Support of Individualized Teaching & Learning Practices in Different Learning Contexts ........................................................................... 14
    4.1.1 Comparing the Influence of Different Automatized Feedback-Types in a Game-based Learning Tool ................................................................. 14
    4.1.2 Monitoring Students’ Learning Activities by Tablet-based Software in the “Open Classroom” ............................................................... 19
  4.2 Germany: Adopting new Feedback Practices with NEXT-TELL’s Open Learner Model .......................................................... 20
    4.2.1 OLM as Digital Grade Book and Tool to Leverage Self-Reflection .................... 21
    4.2.2 OLM as Tool to Leverage Peer-Feedback .......................................................... 30
  4.3 Norway: Chaining e-Assessment Tools to Detect and Dissolve Students’ Misconceptions .................................................................................... 37
    4.3.1 Overview ............................................................................................................ 37
    4.3.2 Starting with NEXT-TELL’s RGFA to Detect Students’ Misconceptions ........ 39
    4.3.3 Using OLMets to Identify Misconceptions ....................................................... 46
    4.3.4 Ending with NEXT-TELL’s Open Learner Model (OLM) ................................. 54
    4.3.5 Summarizing the RGFA-OLMets-OLM Method ................................................ 67
  4.4 Singapore: Developing ICT-enriched Instructions to Support Students’ Learning ........ 69
    4.4.1 Supporting Problem-based Learning with e-Assessment ................................ 69
    4.4.2 Critical Questioning and Thinking: The 6 Thinking Hats Method Adopted in Science Teaching ............................................................. 72
  4.5 Discussing the Case Studies ....................................................................................... 77

5 Presenting NEXT-TELL Tools ........................................................................................ 80
  5.1 Workshop Presentations ........................................................................................... 80
    5.1.1 Extended Teacher Workshop on “Virtual Worlds in the classroom” .................. 80
    5.1.2 Conference Workshop at an EduCamp ............................................................... 96
  5.2 Presentations for Individual Groups ......................................................................... 98
1 Executive Summary

The deliverable D6.5 presents the research conducted in project year 3. We start with an up-dated overview of aspects on informal teacher development in Germany as well as a summary on TISL research (chapter 3). We do so because one aim in NEXT-TELL is to support teachers in adopting ICT in the classroom in a bottom-up manner instead of waiting for top-down regulations only. This is why it is important to know how teacher-driven change is going on and to adapt NEXT-TELL support accordingly. Our main focus, however, is on studies about NEXT-TELL tools within different teaching contexts. This mainly teacher-led research is presented in chapter 4. In the subsequent chapter 5 we report on workshops and other meetings that provide insights into how teachers (and media pedagogues) responded to NEXT-TELL trainings and presentations. Subsequently, we analysed influences on ICT adoption into teaching. We end D6.5 with ideas about the interplay of the open learner model (OLM) and the evidence-centred activity and assessment design (ECAAD) planner based on competencies and a forecast to next research steps.

Following the purpose and scope of this report, chapter 3 provides an up-dated overview of practices in teacher development in Germany. We describe how teachers interested in ICT build an informal online community in order to learn from information shared online and in face-to-face conferences. Furthermore, we show which instruments teachers also use in order to reconsider their teaching practices exemplified with one teacher practicing student feedback. We think it is important to consider teachers’ (shared) development practices in ICT, when developing and introducing NEXT-TELL’s TISL approach – as summarized in the last section of the chapter – to a community of practice.

Chapter 4 provides the main research with regard to the adoption of NEXT-TELL e-assessment tools in classrooms. Several NEXT-TELL tools were developed and implemented into different teaching contexts. The developments and contexts varied from an individual game-based tool with different types of automatic feedback up to a tablet tool for student monitoring in an open classroom. Further tool developments like the repertory grid for formative assessment (RGFA) and the open learner model (OLM) were also used by teachers and their students. The OLM was implemented in most cases and provided first insights into how differently teachers implemented it and how differently students responded to it. Overall, the studies showed that although implementing and developing NEXT-TELL tools was challenging for teachers, they are interested in using them again or try another approach in their classrooms.

Subsequent to NEXT-TELL tools adoption in classrooms we provide insights into how teachers responded to presentations to and trainings in NEXT-TELL tools. Whereas a hands-on workshop in “virtual worlds in the classroom” showed how teachers are interested in NEXT-TELL topics and how they evaluated TUG’s ProNIFA tool based on cbKST, other meetings showed why teachers were sceptical towards the NEXT-TELL tool OLM and why they did not want to use it.

In Chapter 6 we analysed the factors which might be relevant for adopting ICT or NEXT-TELL tools in teachers’ classrooms or not. Whereas personality seems to have less influence with regard to ICT adoption in general, the perceived usefulness of a tool seems to be more relevant concerning NETX-TELL developments like the OLM. If teachers thought that the tools support them in assessment practices they are interested in, they used the tool even though they knew that it is still under development. However, if teachers and students could not see how the OLM might support their teaching and their learning routines but rather perceived it as extra work, the OLM was rejected.

Finally, chapter 7 summarises the research conducted, discusses issues of the competence-based assessment approach for ECAAD and OLM, and presents next research.
2 Introduction

2.1 Purpose of this Document

D6.5 informs about the on-going Teacher-led Design Studies (TDS) of the third project year within NEXT-TELL. Moreover, it informs about reasons that influence whether teachers participate in NEXT-TELL or not. All information aims at supporting the development and adoption of NEXT-TELL’s e-assessment tools in classrooms.

2.2 Scope of this Document

The main information presented in D6.5 is about research on how NEXT-TELL’s e-assessment tools are adopted in classrooms. The adoption ranges in dependence of the tool used as well as of teachers’ ideas and ways of implementing it. In most cases teachers led the research by selecting the topics they are interested in NEXT-TELL and/or in a specific tool, even though they did not conduct TISL studies. NEXT-TELL partners accompanied the teachers with regard to tool developments and adaptions as well as data gathering (e.g., questionnaire or interviews).

We provide further results on factors (not) influencing ICT adoption in classrooms. Moreover, we start with a description of how (German) teachers interested in ICT build an online-community to learn about ICT and teaching within their personal learning environment.

This deliverable does not provide a step-by-step manual about how to adopt NEXT-TELL tools in teaching. Neither does it provide the TISL method that supports teachers in a detailed way how to investigate the influence of their teaching practices on students’ learning.

2.3 Status of this Document

This is the final version of Deliverable D6.5.

2.4 Related Documents

Before reading this document it is recommended to be familiar with the abbreviations used in the NEXT-TELL deliverables. Therefore, we recommend to first have a look in the glossary section at the end of this document.

For a comprehensive understanding we recommend the following public deliverables which present former steps within the project:

- D4.: Student Model Tools R1
- D5.1: TISL (Teachers’ Inquiry into Students’ Learning), SPICE (Strategic Planning with ICTs in Education)
- D6.2: Report on RDS 1

We also recommend four deliverables with a focus on technological and methodological details:

- D2.6: ECAAD Tools R3 (restricted) for cbKST-based 1x1 Ninja tool and tablet-based application LIP (TALK)
- D3.6: Activity Capturing Tools R3 (restricted) for OLM competence analyser over time and assessment engine
- D4.5: Methods and Specifications for the Student Model V3
- D5.5 and D5.6: Methods and Specification for TISL Components V3 as well as TISL Components R3
3 Informal and Non-Formal Ways of Professional Teacher Development

NEXT-TELL aims at enhancing teaching and learning practices by supporting teachers in adopting ICT in classrooms in general and NEXT-TELL's e-assessment tools specifically. In order to provide useful support it is important to know what teachers already do to improve their teaching practices as well as to adopt ICT in their classrooms. This chapter provides an up-date in how German teachers practice teacher-driven professional development and it considers ways to support these practices in relation with NEXT-TELL.

In NEXT-TELL, WP5 focuses on developing methods and tools to support a more structured way of gathering and evaluating students’ data in order to adapt or improve teaching with ICT (see D5.1 to D5.6). Whereas developing a structured method of Teachers’ Inquiry into students’ learning (TISL) that is conducted by a group of teachers will be called a non-formal way of teacher development in the following, more unstructured ways of teachers’ practices for professional development will be called informal ways of teacher development. Both ways are regarded as teacher-driven practices because in both ways teachers are the main actors and drivers with the aim to change and improve their teaching practices without formal certification.

TISL as conceptualized in NEXT-TELL is considered as a type of action research that also includes experience sharing among teachers. The results on Teachers’ Inquiry into Students’ Learning (TISL) reported in D6.2 which were based on in-depths interviews with a hand full of teachers in the following countries Austria, England, Germany, and Norway respectively, however, showed that the interviewed teachers in Austria and Germany reported not to communicate a lot about their teaching practices neither face-to-face nor via social media whereas the interviewed teachers in Norway communicate much more with each other and use for example Twitter to share their knowledge. Hence, Norwegian teachers seemed to engage more in informal development activities than teachers from the other countries stated. As NEXT-TELL research is not designed to collect representative data as is done for example in such large-scale research projects like PISA, we rather report kinds of snapshots which represent single puzzle pieces of the whole educational picture in the participating countries in NEXT-TELL. In addition to the results presented in D6.2 this chapter provides further information on how a group of teachers in Germany practice (i) collaborative as well as (ii) individual activities for informal professional development. Finally, we summarize the ongoing work of WP5. All activities reported seem to be important to be considered for TISL developments in different countries concerning NEXT-TELL’s idea of promoting educational change in a bottom-up (teacher-driven) rather than a top-down (government-driven) manner. Suggestions for specific technological developments are also provided.

3.1 Informal Professional Development and a Participative Community 2.0

During the last three years, we have seen that the use of digital media for teaching and learning is not as widespread as was assumed in the DoW. Nevertheless, there are teachers interested in and using digital media across the countries. In Germany (like in Austria, England, and Norway) some of these teachers share their opinions and practices in Twitter thereby building an active community 2.0 about teaching and learning with digital media. As these communities are especially interested in teaching and learning with digital media, they might be one potential source of future bottom-up or teacher-driven change in Europe. Such a German community will be described more thoroughly in the next sections. The impressions have been collected by KMRC over about one year duration (April 2012 up to now) in actively joining the micro-blogging system Twitter as a “researcher interested in knowledge acquisition and application in relation with digital media (web 2.0)”. The information exchange in Twitter showed that the community is not only made up of active teachers but also of student teachers and others who share their experiences, opinions, and information they find important and interesting online as well as offline in face-to-face meetings. Moreover, the communication within the community shows that there are reflections that might drive further professional development practices within the community.
3.1.1 A Participative Community in Social Media

Within the social media provider Twitter, there is a German speaking community of teachers and others of about several hundreds up to several thousands who share information and opinions on ICT at school. The numbers are rough estimations based on follower-numbers in Twitter. The tweeting community exists not only of (student) teachers but also of media pedagogues, researchers in media pedagogy, professors teaching with ICT, persons in teacher development, tool providers like Itslearning, and journalists. It seems that more and more schools are also entering Twitter but so far with rather less contributions compared to individual teachers. So far, there does not seem to be conversations going on between school tweets and students and/or parents. As Twitter is an open provider in which anybody can follow anybody as long as persons have open profiles and do not block each other, it is theoretically possible that persons from all school stakeholder groups are part of the community. However, besides the groups represented in this community there are possible groups not well represented or not linked within the community very much. According to twitter profiles there are not many principals within the community. Furthermore, there are only a few students in this Twitter community. This is not astonishing as Twitter is regarded as the “Facebook for adults” and students are using Twitter not very much in general. Furthermore, it seems that there is no organized parents’ representations account although this stakeholder group is a topic in teachers’ tweets. Of course, parents may have individual accounts in Twitter but it seems that they do not largely participate in the network of teachers and media pedagogues in their role of parents’ representatives. Only one parents’ representative has been identified so far (but the whole community is not known). Hence, one may assume that there is no close exchange between the stakeholder groups schools, teachers, and parents with respect to teaching and learning with digital media via Twitter. Another Twitter profile was found which tried to offer news and information around digital media to and from parents supported by a blog. To summarize, one can distinguish at least twelve sub-groups within this Twitter community and three stakeholder groups not largely represented. Table 1 provides an overview of the different person groups building a self-established online community or network about teaching, learning, and living with digital media in Germany.

<table>
<thead>
<tr>
<th>Groups within the Community</th>
<th>Groups not well represented within the Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Teachers</td>
<td>• School leaders</td>
</tr>
<tr>
<td>• Student teachers</td>
<td>• Students</td>
</tr>
<tr>
<td>• Teacher development</td>
<td>• Parents or Parents’ Representatives</td>
</tr>
<tr>
<td>• Platforms providing teaching materials</td>
<td></td>
</tr>
<tr>
<td>• Software platforms</td>
<td></td>
</tr>
<tr>
<td>• School book publishers</td>
<td></td>
</tr>
<tr>
<td>• Consultants for (e-)learning</td>
<td></td>
</tr>
<tr>
<td>• Researchers in media pedagogy</td>
<td></td>
</tr>
<tr>
<td>• Professors teaching with ICT (open research)</td>
<td></td>
</tr>
<tr>
<td>• Journalists</td>
<td></td>
</tr>
<tr>
<td>• EduCamps Organization (see section 3.1.2)</td>
<td></td>
</tr>
<tr>
<td>• Schools</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Groups within a Twitter community according to Twitter profiles

Many of the teachers participating in Twitter have been writing their own blog, sometimes for more than several years. Some of these teachers might be called the visible pioneers in ICT for teaching and learning in Germany. They wrote more than 10 or 20 thousand tweets and are followed by up to 2000 persons in Twitter. Writing their own blogs shows that these teachers want to share their individual perspective on which topics they are ever interested in. They often emphasize that it is their personal view and that they are not blogging or tweeting in their official role as a teacher. Besides blogging and twittering, there is a tendency towards
Google+ (rather than Facebook). Teachers are reporting about their experiences or projects with iPads and
digital media (e.g., Geogebra), about their lives as student teachers or about their teaching practices in general
without digital media. Hence, the topics in Twitter are divers. They reach from links to own blog contributions
to contributions from English sites for teaching with ICT like for example [www.edudemic.com],
[www.techlearning.com], or [www.educatorstechnology], or latest education relevant articles from German
online-newspapers. During project year 3, community members tweeted about game-based learning, bring
your own device (BYOD), educational resources (OER), creative commons (CC), massive open online-courses
(MOOCs), and their self-organized OER conferences and/or MOOCs. They shared how a teacher’s personal
(online) learning environment (PLE) might look like, provided suggestions concerning which apps they use to
organize themselves or teach digitally or provided supportive words for student teachers or starting teachers.
Besides these educational topics, they discussed about actual political topics like NSA, PRISM, and data privacy
especially after PRISM but also after the official recommendation of the Education Ministry in Baden-
Württemberg (as well as Bavaria) which more or less prohibits the use of social media for teaching. They
tweeted where they were (partially using Foursquare) or communicated sometimes about more personal
interests running a network of “friends”. They communicated in a respectful and social manner (e.g., wishing
each other good holidays or good start of new school year across different German states). However, they
neither shared detailed lesson plans (a project issue related to ECAAD) nor organized themselves in bigger
inquiry groups (a project issue related to TISL). In addition to their online communication they organize
themselves in face-to-face meetings which is described next.

3.1.2 A Participative Community and its Face-to-Face Meetings

Besides the more or less daily online-communication in Twitter, teachers and media pedagogues across
Germany interested in ICT also organize themselves in face-to-face meetings like for example so called
EduCamps. An EduCamp is a special form of a BarCamp which is a free (un)conference organized in a special
way. Usually, EduCamps take place at a weekend and comprise about 100-200 participants in Germany. In
Germany, EduCamps have been taken place twice a year since 2008 ([http://de.wikipedia.org/wiki/EduCamp],
August, 2013). The general topic of an EduCamp is teaching and learning 2.0 and the general requirement for
participants is to actively contribute to the conference by suggesting sessions and actively participating in
sessions in a convenient atmosphere. Hence, teachers (interested in and) using ICT in teaching come together
to share their experiences and to learn from each other. The specific sessions of an EduCamp are determined at
the introduction session by the participants. The introduction session usually starts with a round in which
participants introduce themselves with three words (according to the hashtag-style in Twitter). Afterwards,
participants can suggest topics they want to discuss or work on. If a big enough group of participants is also
interested in a topic suggested, the session is included in the conference scheme. The pre-organization of an
EduCamp is supported via social media by an interactive website and via Twitter (e.g., EduCamp account and
hashtags to e.g., pre-collect topics, do fundraising, and let people interested in the EduCamp communicate in
advance, during the meeting, and afterwards). Overall, it can be said that EduCamps are attended by teachers
and pedagogues highly interested in ICT, however, not necessarily practicing teaching with ICT. Moreover, one
can assume that as EduCamps are advertised online, probably almost only teachers using Twitter know about
these EduCamps. Hence, EduCamps might be attended mainly by sub-groups of persons participating in the
larger Twitter community described above, although not only.

3.1.3 A Participative Community and its Reflective Development

The following descriptions of online discussions will show that the community described above is not fixed but
rather interested in its further development. During the organization of the first EduCamp in 2013 a tweet was
sent with the respective EduCamp hashtag in Twitter. One of the community members had written a post in its
blog ([http://www.amsellen.com]) and linked to it in Twitter. The blogger asked the community members to
reflect whether they are focused too much on themselves, concentrate too much on ICT and therefore
overlook good (combinations of digital and) analogue teaching or whether they have moved too far away from
“the other non-digital teachers”. The blog contribution had 20 (positive) comments, was 19 times shared via
Twitter, 25 times liked in Facebook, and 9 times in Google+ (August, 2013). The blog contribution as well as the
reactions to it show that first, some community members reflect about their actions by considering themselves
as persons very familiar with digital tools and second, that this experienced community is “open” because two

© NEXT-TELL consortium: all rights reserved
comments were made by persons who described themselves as non-community members – one experienced and one rather inexperienced in digital media.

A week later, a follow-up blog contribution was posted which summarized the comments and stated that the tendencies of some community members to separate themselves from teachers not using digital media because they are tired of “tilting at windmills” can be understood but that this behaviour might include the danger of becoming enclosed. This concern of becoming (or staying) an enclosed or exclusive group hints to the existing gap between teachers using ICT and the majority of teachers not using ICT at school.

A teacher in teacher development commented that she did not see this danger of encapsulation because of new members attending the EduCamps but rather asked “... How do we get beyond the gut-reflection-experience-exchange? (Recently, a colleague called this “organized superficiality”.) I’m more and more dissatisfied that we are satisfied with just collecting experiential knowledge. I would like a mixture of input which stands on more grounded feet which we then can again share in an organized way. ...” (blog comment on http://www.amsellen.com, April, 2013). No further online discussion followed this contribution.

The community descriptions show that teachers in this self-organized community in Germany practice bottom-up change within their range of possibilities. The fact that the community consists of persons with different backgrounds (not just teachers but also e.g. media pedagogues etc.) shows that moving forward with ICT in the educational context needs a variety of supporters. One can further assume that the community is in motion because members are reflecting about its further development as well as how teaching and learning with digital media might be developed within the community. Despite this change-supportive attitude, the critical voices also show that there is no structured teacher practice of inquiring students’ learning (see also D6.2). In a discussion on Twitter with the starting tweet on action research it became clear that teachers’ limited time resources (see D6.2) is seen as an inhibiting factor in this community. Ideas how participative teachers with interest and experiences in ICT might be supported in practicing TISL via technology in the community is discussed next.

3.1.4 Considerations for Technological Developments

Teachers of the participative community 2.0 are interested in how to best implement ICT in teachings and therefore share their practices either in their blogs, via Twitter or in face-to-face meetings. This sharing of instructional practices and experiences, however, is not done in such a way that a bigger picture of which practices work best under which conditions can be derived. As the community works in a self-organized way and teachers participate in their free-time the first step in direction of action research and teachers’ inquiry into students learning needs to be very easy.

So far, minutes provided by session participants are collected and shared within the EduCamp platform. Hence, a first step might just be an accessible online-place where the contributions of EduCamp participants who present how they use ICT with their students upload their presentations or materials they provide for the conference. This would demand not much additional time from the teacher but his/her willingness to share the work publicly (e.g., maybe including a CC licence). It would need, however, a server or online space where these materials are saved or linked to. A wiki-platform might be a kind of portal to access the contributions. However, these developments go beyond NEXT-TELL. Whether the information provided by teachers at the conference might be brought into NEXT-TELL’s TISL system might be another possibility to be considered further. A second step might be to create a template in order to describe the important meta-information of the contributions (e.g., ICT, grade level, teaching aim, pedagogical approach etc.) that is connected with it and can be used as filter. Here, the TISL method developed in WPS might provide support with regard to important factors and steps to be considered. A good mix between qualitative as well as quantitative information and its categorizations would be needed. Integrating information of students’ learning would need to be in accordance with data privacy issues. Further developments might be that teachers provide information about some of their characteristics (e.g., profiles with age etc. that is anonymously connected with data base). Developing technology in this way would not start with planning teachers’ inquiry (which might be suggested by a TISL planner) but rather would exploit what is already done. This might offer the possibility to benefit and learn from classroom practices in which the teacher does not necessarily need to set-up groups for comparison. In further steps, more information might be integrated by including information from, for example, forms provided to students to give feedback about the classes to the teacher (see next section).
3.2 Informal Individual Professional Development and Student Feedback

Besides the afore-described informal professional development within a community 2.0 specifically concerned with teaching and learning with digital media, some teachers in Germany use student feedback as a source to get to know more about their general (analogue) classroom teaching with the aim to change their teaching practices if necessary and possible. Before we report about a teacher’s way of practicing student feedback in order to derive ideas for further technological developments in NEXT-TELL, we summarize student feedback and its meaning within NEXT-TELL.

3.2.1 Student Feedback as part of Assessment for Learning and of Relevant Students’ Data

In NEXT-TELL, we are interested in supporting formative e-assessment based on the combination of the technological developments of open learner models [Bull, 2007] as well as the conceptual state-of-the-art feedback model of assessment for learning [Black, 1998; 2009; Hattie, 2007]. According to the rather broad definition of assessment for learning by Black et al. [2004] one might subsume student feedback practices under the term assessment for learning if the aim of the student feedback is not teacher tenure or promotion [cf. Rowley, 2003] but improvement of teaching practices in order to improve student learning:

“Assessment for learning is any assessment for which the first priority in its design and practice is to serve the purpose of promoting students’ learning. It thus differs from assessment designed primarily to serve the purpose of accountability, or of ranking, or of certifying competence. An assessment activity can help learning if it provides information that teachers and their student can use as feedback in assessing themselves and one another and in modifying the teaching and learning activities in which they are engaged. Such assessment becomes “formative assessment” when the evidence is actually used to adapt the teaching work to meet learning needs.” [Black et al., 2004, p. 10].

The main difference to traditional assessment at school is that the focus is on teacher’s practices evaluated by students rather than on students’ practices assessed by the teacher. The main difference to assessment for learning seems to be that student feedback is mainly collected at the end of a teaching period, and thus, it seems to be rather summative. Nevertheless, the purpose for teachers who collect student feedback is to gain information about different aspects in their teaching practices that are considered to be important for students’ learning.

There are different ways of collecting student feedback for teachers (e.g., conversations with students in class, creating a questionnaire for their students). Besides the teachers’ own techniques there are developments to create standard questionnaires [Rowley, 2003]. In Germany, for example, there are professional research programs [e.g., Helmke, 2011] which provide questionnaires for teachers in order to collect feedback on their teachings by colleagues and students (e.g., project partner MTO was asked by one school leader whether his teachers might use this questionnaire system with OLM). The feedback information serves as a means to reflect on their teaching practices for further professional development. Such research programmes as well as initiatives by official school departments of the Educational Ministry (BW) will probably increase teachers’ habits of collecting student feedback in the future.

Within NEXT-TELL, we developed a student questionnaire based on Crawford’s [2008] concept of cognitive density in project year 2 (see D6.4). This questionnaire was developed with the aim to gain insights into students’ learning according to the cognitive density concept. Although the questionnaire might be used by teachers for collecting student feedback in the future, we did not ask teachers to do so in year 3 because of several reasons. Rather, we decided to collect more information on how teachers practice student feedback. The main reason for a closer look on these teacher practices was that when presenting the NEXT-TELL OLM to teachers or school leaders in Germany we were asked whether the OLM can also be used to collect student feedback to support teachers in adapting their teachings. Hence, there are several reasons why student feedback is interesting within NEXT-TELL: First, student feedback seems to become more and more important for informal teacher development. Second, it can also be seen as an important part in assessment for learning practices. Third, we see student feedback as an additional source of student data besides students’ grades or competency measures (e.g., gathered in OLM) that might be considered in TISL practices. In order to get a closer insight of how teachers practice student feedback on their own, we interviewed a teacher who has collected student feedback for several years Whether and how student feedback might be collected
technologically in the NEXT-TELL OLM (as assumed by some teachers and school leaders in Germany) or better in a separate TISL tool (which might be more in line with suggestions in the DoW) is an issue which needs to be discussed further.

3.2.2 An Example of Student Feedback Practice

The following information is based on an interview of KMRC with a female teacher for mathematics, sports, and a drumming course in a German grammar school (38 years, 6 years of teaching experience, in school year 2012/13 she taught about 90 students in 4 classes). The interview was introduced to be about assessment and feedback what the teacher immediately (and throughout the whole interview) associated with student feedback. She reported that she collects student feedback via self-created questionnaires at the end of a school year.

The development and structure of student feedback questionnaires

The teacher reported that when she decided to collect student feedback it first took her a while before she created a questionnaire for herself (see Table 2). She thought several times that she lacks time to create a good one but one day she decided that it is okay to not have the whole range of important questions but to have at least some questions and that it is okay if the questionnaire looks not professional. After this decision of performing a “low-cost” step to student feedback, she sat down and wrote down what was important for her in that year. She decided to make just a line as a quantitative rating scale which was not time intensive for her and according to her also easier for her students to fill out because they would not need to think about whether it is “a three or a four” in a rating scale with check boxes.

<table>
<thead>
<tr>
<th>Former questionnaire (hand-written)</th>
<th>Recent questionnaire (computer-created)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The lessons were... not interesting/interesting.</td>
<td>- * I did... not like/liked attending the lessons</td>
</tr>
<tr>
<td>- The explanations were... unclear/clear</td>
<td>- * I understood the explanations... hardly/well</td>
</tr>
<tr>
<td>- Board writing... not readable/readable</td>
<td>- * I could ask questions... not true/true</td>
</tr>
<tr>
<td>- Language... difficult/easy to understand</td>
<td>- Questions were addressed... not true/true</td>
</tr>
<tr>
<td>- Teacher... unfriendly/friendly</td>
<td>- The board writing was... bad/good</td>
</tr>
<tr>
<td>- * I learned... not much/much</td>
<td>- The work with the BA was... bad/good</td>
</tr>
<tr>
<td>- * I prefer working in AA (than in class</td>
<td>-</td>
</tr>
</tbody>
</table>

© NEXT-TELL consortium: all rights reserved
## Table 2: Teacher-generated questionnaires for student feedback

<table>
<thead>
<tr>
<th>Former questionnaire (hand-written)</th>
<th>Recent questionnaire (computer-created)</th>
</tr>
</thead>
<tbody>
<tr>
<td>* I felt supervised... bad/good</td>
<td>discussion)... not true/true</td>
</tr>
<tr>
<td>The lessons were fun... no/yes</td>
<td>The teacher was... unfair/fair</td>
</tr>
<tr>
<td>The work with the dice was... not good/good</td>
<td>The atmosphere was... inconvenient/convenient</td>
</tr>
<tr>
<td>Other (open field)</td>
<td>* For the tests I prepared... badly/well</td>
</tr>
<tr>
<td></td>
<td>Homework should be controlled... more strictly/is o.k.</td>
</tr>
<tr>
<td></td>
<td>Other (open field)</td>
</tr>
</tbody>
</table>

Her questionnaires consist of about eight to twelve questions with a rating line with labels at the extremes. Additionally, it is important for the teacher that there is free space for open comments at the end of the questionnaire. The teacher asks her students to write down whatever they liked or did not like in order to be informed about topics she might not be aware of. It is also very important for her to find out whether her students feel good or frustrated with her. This is most important for her because in her opinion she does not need to start teaching when the students do not like the atmosphere. The other important information she wants to get is whether there is a kind of structural defect within her lessons that she would recognize if many students would not e.g., understand her explanations. She also asks for feedback on ambivalent topics that she is not truly sure of how to handle best like controlling homework. On the one hand, she reported that especially older students wanted to be treated like adults. This would imply for her not to control homework. On the other hand, not all students behave like adults and do their homework regularly. Hence, she seeks to find a good balance between freedom and “force of luck” because she knows sometimes better than the students that they need practicing regularly.

Students are free to write their names on the questionnaire or not. Many of the students did not write their names on it, suggesting that they want to stay anonymous.

One can see that the recent questionnaire consists of more items formulated in the first-person perspective than in the former one. This might be a hint that the teacher has developed a sense of question formulating which concentrates more on students’ subjective experience than on a kind of seemingly objective judgements of her practices. This interpretation is in line with the teacher’s opinion stated very early in the interview.

> Well, there are people who say “A student cannot assess. How should students assess teaching?” I think, of course, a student can assess and if I ask a student “Do you like attending my class?” he can give an answer. (...) Well, I don’t ask – no idea – don’t ask things like “Is it (the lesson) structured properly?” or so, because I think that is something they cannot assess.”

### Analysis and documentation of student feedback

When the teacher gets the questionnaires back from her students she reads through the questionnaires and looks (not analyses) whether the ratings of the students are located on the right side of the rating lines (left means not okay – right means okay). If marks are on the left side she has a closer look on them. If the majority of the marks are on the right side everything is fine. When asking her what the mark on the left side on the 2nd item on the recent questionnaire (“I understood the explanations hardly/well”) meant for her she hesitated shortly, not being sure what it meant and being somewhat tensed (for a short moment). Did it really mean that her explanations were not good enough? As the formulation of the item says that the student did not understand the information, it does not necessarily mean that her explanations were difficult to understand per se but rather that this special student found them sometimes difficult. This interpretation of the interaction of what she provides and how the students react seemed to be reliving for her. Hence, items in student feedback questionnaires might be best formulated in first-person perspective (compare formulations of 2nd items of former and recent questionnaire). As a next step she had a look on the other questionnaires. As the other students rated this item much better she concluded that she does not need to change her way to explain
maths. As we were talking about student feedback she did not consider whether this specific student would need some extra help because (s)he had seemed to have difficulties in understanding the explanations. The teacher made clear that she does not use any spreadsheet-system (e.g., Excel) to analyse the data, nor does she want to visualise the data in, for example, pie charts. She was not interested in documenting and tracking the feedback data over the years, emphasizing that she does not make any study out of these data. From students’ answers to the open question she is often informed about things she did not realize or care too much during teaching (e.g., too few breaks in the drumming course, or too less time spent with discussions about topics not subject-related but nevertheless important for her students – feedback in open field). When the feedback is discussed with the students and everything is clarified she throws away the paper-based questionnaires. However, she keeps the questionnaires with very kind or cute feedback. One reason for not analysing the data quantitatively (if it would be more numerical) is that putting the data into a spreadsheet would cost too much time. The more important reason, however, seemed to be related with her attitude towards statistics. At the end of the interview (after showing the NEXT-TELL OLM) she said that doing statistics, was not the job of teachers and that teacher time filled with doing statistics would be the wrong investment of teacher resources.

Affective-motivational issues

For the teacher student feedback is important. Nevertheless, it is sometimes also a challenge for her to deal with negative feedback formulated in a harsh way. She said that she had to learn to deal with such negative feedback. Now, she has got the rule that if harsh negative feedback was given, she would not react immediately but that she would wait at least for a day. If she gets especially positive feedback, she keeps it and does not throw it away (see above). We assume that any technology developed for feedback practices needs to consider such positive and negative emotional reactions.

Although the teacher is very motivated and interested in asking for student feedback she mentioned a concern. She worries that being too open for student feedback in adapting one’s teaching might tempt students into a passive “couch potato” state in which they forget that they are also accountable for their learning success and that they also contribute to the atmosphere. This concern made her think about a way to prevent this state in her students. Her idea was to include a column into her questionnaire where students can write down what they may contribute in order to improve what they do not like.

Colleagues and sharing practices

Being aware of rather few opportunities for teachers to communicate about their practices (see D6.2) we also asked whether she knows if her colleagues practice student feedback. She only knew about one colleague who had already practiced it regularly and more often than her throughout the school year. Another one might start practicing it because by coincidence that colleague saw her creating her recent questionnaire and asked whether she might get it. The teacher sent her questionnaire to her colleague via e-mail. After thinking for a while she said that if she would like to know whether more of her colleagues practice it or not, it would be best to ask the students otherwise it would need too much time and effort to get an answer. This seemingly unimportant information shows that teachers share their practices but that there are only few occasions to do so and if so it is only within in a small circle (but compare with teachers of the online community).

Oral feedback practices

Besides the practices based on questionnaires described above, the teacher also reported about experiences in oral feedback practices. She asked her students to give feedback by providing one sentence what they liked and one sentence what they would change. After the first students gave feedback in this way, however, the other students stop to provide specific topics and instead say “Everything was good”, “Instruction was good and I would change this and that”. Hence, she has to remind them to keep the structure. She said that this was effortful for students, however, otherwise feedback is too general and vague and does not help her very much.

Asking students what they liked in teaching within student feedback can be seen as analogue to providing students with information about their strengths or what they did well in teacher assessment. Stating students’ strengths is one characteristic of providing formative feedback to students [see Hattie, 2007]. Hence, besides the issues that need improvement or change, “strengths” are important information that also teachers...
practicing student feedback want to get to be assured (and motivated) where they are on their way in teaching. Concerning assessment for learning and e-assessment developments in WP2 and WP4, student feedback might be seen as one possibility to enhance teacher feedback to students based on own experiences from student feedback for the inter-dependent processes of teaching and learning. This was also one feedback we got from a teacher in teacher development in Germany (Landesinstitut für Lehrerbildung und Schulentwicklung, Hamburg) who also asked for student feedback when presenting NEXT-TELL’s OLM.

3.2.3 Considerations for Technological Developments

Student feedback developments can be considered as part of assessment for learning but also informal or non-formal teacher development related to teachers’ inquiry into students’ learning. Besides the ICT-based developments of NEXT-TELL, current researcher-driven developments in student feedback also provide some analytical support via Excel-sheets [Helmke, 2011]. Hence, it seems to be as a matter of course to consider technological developments for student feedback. Based on the information provided in the interview the following suggestions were derived concerning technological developments as well as contents of items:

Technological considerations

First, one needs to consider how students might provide quantitative feedback to questions. There are several possibilities concerning the rating format (e.g., via a continuous slider, star-rating as in NEXT-TELL OLM v2, or a traffic-light system as suggested in some literature [Black, 2004]). The influence of these formats needs to be further explored from perspective of reliability issues but also from perspective of students’ preferences. One option might be to include the possibility to select between different rating formats and thereby increase the personalization of the tool. The quantitative meaning of differently coarse-grained scales from different students for one questionnaire would be a challenge. Moreover, the visualisation formats of students’ rating data would also need to be considered.

Second, next to quantitative rating scales it seems to be necessary that the feedback tool contains open text fields (cs. NEXT-TELL OLM). According to the teacher interviewed, two fields seem to be especially important. One field is needed for free feedback independent on the questions provided. This field might be further divided into positive and negative aspects of teachings. The second field was the idea of including a space for students where they are asked to write down what or how they can contribute to improve aspects that they do not like. These free text fields might allow students to add icons or smilies to individualize their feedback. In order to analyse and summarize written feedback word clouds might be used. In general, the original written comments might be collected at one place instead of being the “appendix” of each questionnaire. One might need to further investigate how teachers would like such collections and aggregations compared to individual feedback sheets.

Third, for constructing student feedback questionnaires two types of question generating possibilities should be considered. First, a repository of several categories with pre-formulated questions seems to be one supporting factor because this would save time for teachers or at least reduce the entrance level because they would not need to start from scratch. Second, the inclusion of self-generated questions should also be possible to allow teachers asking what they want to know from their students in order to change their teachings.

Fourth, it seems also important to allow for emotion-based reactions with the feedback. Functions like favouring or liking specific contributions vs. disliking (react later) contributions in a personal account might be important to deal with emotions raised by feedback.

Finally, in order to use the student feedback for general or community-wide comparison (see above) with respect to ICT implementations in the classroom an option to share the quantitative data in anonymous ways would be useful. The possibility to upload or import these data into NEXT-TELL’s TISL technology might be an offer to teachers who want to share and willing to also provide further information like descriptions/characteristics of the instruction or specific lesson.

Considerations concerning contents of student feedback

The above-mentioned repository of questions would need to be developed. This repository should be organized because as it has become clear there are many interesting questions to be asked and teacher-driven
questionnaires do not necessarily overlap with teachers’ interests. Hence, the development of a categorization system would be needed that supports users in selecting questions. Possible categories might be classroom management or orchestration, individual-collaborative practices, social atmosphere, communication, metacognitive aspects and more.

3.3 Developing Non-Formal TISL approaches within Schools

In contrast to the informal practices described above which are not initiated, organized nor monitored by school development or school leading groups within one school, the following overview within NEXT-TELL’s TISL research (WP5) is an example of a rather non-formal school approach to professional (school) development concerning ICT use at school.

3.3.1 Current TISL Project

IOE conducted a TISL study with Thomas Deacon Academy, a school with pre-existing participation in the project. The TISL study focused on the evaluation of Google Forms as a formative assessment method for ‘Futures’, an annual Year 8 STEM project. This focus was chosen by the lead teacher (Teacher A) of the project. Drawing upon previous TISL findings, Teacher A was interested in exploring and evaluating the use of Google Forms to track and share student learning data with teaching colleagues. Due to the large scale of the project (with involvement of over 50 staff and over 300 students) Teacher A outlined a need for simple and time-efficient formative assessment, which could be accessed by the number of teachers responsible for each group. Google Forms was identified as a useful tool as it allowed for assessment data to be accessed from, and linked to the school VLE. Benefits relating to accessibility for students and staff were also envisaged by Teacher A.

Teacher A collected students’ formative assessment data using Google Forms in weekly learning diary tasks. Data was transferred to a spreadsheet, which teachers across the study could access for assessment and analysis. Teacher A obtained qualitative data relating to students’ use of Google Forms by including evaluative questions within the learning diaries and, as the inquiry is still underway, intends to use a survey to obtain qualitative feedback from teachers on the use of Google Forms as part of the TISL process.

The NEXT-TELL research perspective of the study focused on the TISL process throughout the project, notably on the ways in which it allowed for teacher inquiry and teacher collaboration. It also focused on the influence of the inquiry on changes to teaching practice. IOE data collection focused on the use of qualitative interviews to understand the way in which the Futures project had changed as a result of previous TISL findings, as well as exploring the extent of teacher inquiry, and teacher collaboration across the project. Lesson observations were implemented to understand the impact of context by identifying the resources which teachers use, and exploring the relationship between these resources as part of the Ecology of Resources framework.

As this study took place in July 2013, data analysis is not yet complete and will be reported in future deliverable (e.g., D5.7 in March 2014).

3.3.2 Future TISL Projects

IOE has invested substantial efforts to recruit new schools for participation, alongside maintaining effective partnerships with existing participants. An additional academy school has agreed to participate in using the TISL method in the 2013/2014 academic year. It is likely that this inquiry will be focused on the use of tracking formative assessment in online homework using Moodle.

A school aiming to implement a whole-school iPad strategy in September 2013 has also agreed to participate in TISL research. The TISL process will be applied to what has initially been identified as an evaluative inquiry of the impact of changes to the school ICT strategy, with a focus on the introduction of iPads across the school.

Besides these further developments of non-formal TISL practices in English schools as well as Norwegian schools (see TISL heart within D5.5), the described informal approaches in Germany need to be further reflected and set into relation with the research on specific non-formal TISL practices within specific schools and their specific questions. Practices developed within this non-formal TISL development approaches might be used as practical input for the informal development practices within Germany. Furthermore, practices like
informal student feedback might be considered within non-formal TISL approaches. Finally, the question needs to be considered whether and how teacher trainings and certification within WP5 and WP7 might be aligned with or kept separated from TISL approaches.
4 Developing Formative e-Assessment at Schools: Seven Case Studies

One of NEXT-TELL’s aims is developing e-assessment in order to support students’ learning by providing feedback and adapting instruction and learning to individual students. As learning takes place in different environments technological developments need not only be considered from perspective of data that should be processed and provided but also from perspective of the context in which the technology should be implemented. The following studies are conducted in a variety of learning contexts reaching from game-based tools for individual practices over blended learning scenarios as well as traditional classrooms to so called open classrooms. Depending on the learning environment feedback practices – a core technique to improve learning – differ and thus also need to be considered within technological developments.

The studies were conducted in different countries. As in the years before studies were run in NEXT-TELL project partner countries Austria, Germany, and Norway. New is the cooperation with non-European schools in Singapore. Overview on their practices is also provided. The sections are structured according to the countries.

4.1 Austria: Technological Support of Individualized Teaching & Learning Practices in Different Learning Contexts

The following two studies concentrate on individualized learning situations and how to present feedback in such situations. In section 1, TUG focused on feedback in an adaptive game-based tool for individual practice in multiplication tasks. In section 2, TALK worked on developing and adopting a tablet software for open classrooms in which students have much freedom to chose the learning materials on their own. The tools developed in these studies are described more thoroughly in D2.6 “ECCAD Tools R3”.

4.1.1 Comparing the Influence of Different Automatized Feedback-Types in a Game-based Learning Tool

In close cooperation with a practice primary school of the University of Teacher Education Styria, TUG developed – in the context of WP2 – an online multiplication-practicing tool, the 1x1 Ninja, for the primary school level.

The 1x1 Ninja tool (Figure ) helps kids to practice and stabilize basic skills in multiplication (times tables from 2x to 10x) in a fun and playful way. Multiplication tasks are generated randomly and adaptively (CbKST-based) by the system whereby each multiplicand is presented for its entire multiplication table. In order to motivate children, 1x1 Ninja incorporates a scoring and levelling feature. After solving a specific task, the scoring appears. This score depends on the difficulty of the task and is the basis for achieving various levels.

![Figure 1: Start screen (left) and main multiplication screen (right) of the 1x1 Ninja](image)

The main feature of the tool is the feedback mechanism: Feedback provided to the student depends on the setting and is available in the following modes: i) no feedback, ii) visual correct/incorrect feedback, iii) visual
and auditory feedback, and iv) visual and auditory feedback and a CbKST-based formative feedback. A detailed description of this multiplication-practicing tool can be found in D2.6.

The main aim of the present study was two-fold:

- to investigate whether children actually learn from playing 1x1 Ninja in general;
- to investigate the effect of different feedback methods provided by the 1x1 Ninja on learning.

Methodology and Data Collection

Participants and Procedure

58 students from the practical primary school of the University of Teacher Education Styria (Praxisvolksschule der Pädagogischen Hochschule Steiermark) took part in this study about differences in different feedback methods. The sample consisted of two classes of school children aged about 8-10 years.

Students were asked to accomplish a total of five five-minute sessions of multiplication tasks during school time within a period of two weeks. Students’ interaction with the tool were automatically logged by the tool and served as basis for answering research questions mentioned earlier.

Experimental Design

For our experiment we used a mixed design including three independent variables. Firstly, the type of feedback provided to students is varied (between-subjects variable). Secondly, the experiment was conducted in two different classes (between-subjects variable). Thirdly, there are five measuring points (within-subjects variable). Table 3 illustrates the experimental design, the number of subjects, and the number of subjects (in brackets) that were used for further analyses. The dependent variable is the value of learning performance (relative frequency of correctly solved problems). An overview of the experimental design used for this study is presented in Table 3.

<table>
<thead>
<tr>
<th>Group</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td>Feedback 1 (no feedback)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>4 (4)</td>
<td>6 (4)</td>
<td>5 (4)</td>
<td>6 (4)</td>
<td>7 (4)</td>
</tr>
<tr>
<td>Class 2</td>
<td>5 (3)</td>
<td>4 (3)</td>
<td>6 (3)</td>
<td>3 (3)</td>
<td>3 (3)</td>
</tr>
<tr>
<td>All</td>
<td>9 (7)</td>
<td>10 (7)</td>
<td>11 (7)</td>
<td>9 (7)</td>
<td>10 (7)</td>
</tr>
<tr>
<td>Feedback 2 (visual feedback)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>6 (2)</td>
<td>6 (2)</td>
<td>4 (2)</td>
<td>4 (2)</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Class 2</td>
<td>4 (4)</td>
<td>4 (4)</td>
<td>5 (4)</td>
<td>6 (4)</td>
<td>9 (4)</td>
</tr>
<tr>
<td>All</td>
<td>10 (6)</td>
<td>10 (6)</td>
<td>9 (6)</td>
<td>10 (6)</td>
<td>11 (6)</td>
</tr>
<tr>
<td>Feedback 3 (visual &amp; auditory feedback)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>6 (4)</td>
<td>7 (4)</td>
<td>4 (4)</td>
<td>8 (4)</td>
<td>6 (4)</td>
</tr>
<tr>
<td>Class 2</td>
<td>5 (3)</td>
<td>9 (3)</td>
<td>7 (3)</td>
<td>9 (3)</td>
<td>3 (3)</td>
</tr>
<tr>
<td>All</td>
<td>11 (7)</td>
<td>16 (7)</td>
<td>11 (7)</td>
<td>17 (7)</td>
<td>9 (7)</td>
</tr>
<tr>
<td>Feedback 4 (visual, auditory, &amp; CbKST-based feedback)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>5 (2)</td>
<td>5 (2)</td>
<td>7 (2)</td>
<td>2 (2)</td>
<td>6 (2)</td>
</tr>
<tr>
<td>Class 2</td>
<td>5 (1)</td>
<td>4 (1)</td>
<td>2 (1)</td>
<td>1 (1)</td>
<td>6 (1)</td>
</tr>
<tr>
<td>All</td>
<td>10 (3)</td>
<td>9 (3)</td>
<td>9 (3)</td>
<td>3 (3)</td>
<td>12 (3)</td>
</tr>
<tr>
<td>Overall</td>
<td>40 (23)</td>
<td>45 (23)</td>
<td>40 (23)</td>
<td>39 (23)</td>
<td>42 (23)</td>
</tr>
</tbody>
</table>

Table 3: Experimental Design

1 Please note, that for statistical comparisons between the five measuring points only those students, for which values were available from all measuring points, could be taken into account.
Results

Descriptive Statistics

The following section provides a summary of results addressing descriptive data.

In session 1, 2, and 3, students worked on nearly 24 tasks (M=23.88, SD=10.07 for session 1; M=24.4, SD=9.14 for session 2; M=24.45, SD=10.10 for session 3). With regard to session 4 and session 5, students completed on average 26 (M=26.00, SD=9.00) and 25 tasks (M=25.07, SD=10.36). A detailed overview of the quantity of completed tasks separately for each feedback group is illustrated in Figure 2.

![Figure 2: Quantity of completed tasks separately for each session and each feedback group](image)

Table 4: Overview of descriptive statistics for time duration in all five sessions

<table>
<thead>
<tr>
<th></th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>293.55</td>
<td>292.71</td>
<td>300</td>
<td>300</td>
<td>288.38</td>
<td>294.79</td>
</tr>
<tr>
<td>SD</td>
<td>21.08</td>
<td>27.96</td>
<td>0.00</td>
<td>0.00</td>
<td>37.65</td>
<td>23.58</td>
</tr>
<tr>
<td>Minimum</td>
<td>198</td>
<td>168</td>
<td>300</td>
<td>300</td>
<td>107</td>
<td>107</td>
</tr>
<tr>
<td>Maximum</td>
<td>300</td>
<td>300</td>
<td>300</td>
<td>300</td>
<td>300</td>
<td>300</td>
</tr>
</tbody>
</table>

After completing each session, students were asked to point out on a five-point-rating scale (ranging from 1 “strongly dislike” to 5 “strongly like”) whether they like using Ninja or not. The likeability of the tool was judged with 3.96 (SD=1.11; Median=4), which indicates a good result. Half of the users scored the tool with an average 4.00 or better, on a rating scale from 1-5. This means that students like learning with this tool.

Learning Performance and its relation to different types of feedback

A main aim of this study was to investigate whether students can benefit from playing and working with the Ninja-Tool. Additionally, on a more detailed level, the effect of different feedback types on learning performance was inquired.
In a first step, relative frequencies of correctly solved problems were calculated in order to make results of different pupils in different sessions comparable. Descriptive statistics are summarized in Table 5. Overall, it became clear, that learning performance increase over the different sessions regardless of presented type of feedback.

<table>
<thead>
<tr>
<th>Feedback</th>
<th>Class</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (no feedback)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>0.70 (0.10)</td>
<td>0.70 (0.11)</td>
<td>0.71 (0.07)</td>
<td>0.76 (0.11)</td>
<td>0.84 (0.05)</td>
</tr>
<tr>
<td></td>
<td>N=4</td>
<td>N=6</td>
<td>N=5</td>
<td>N=6</td>
<td>N=7</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.68 (0.07)</td>
<td>0.78 (0.12)</td>
<td>0.74 (0.44)</td>
<td>0.76 (0.13)</td>
<td>0.76 (0.09)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=5</td>
<td>N=4</td>
<td>N=6</td>
<td>N=3</td>
<td>N=3</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>0.69 (0.08)</td>
<td>0.74 (0.11)</td>
<td>0.72 (0.05)</td>
<td>0.76 (0.11)</td>
<td>0.82 (0.07)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=9</td>
<td>N=10</td>
<td>N=11</td>
<td>N=9</td>
<td>N=10</td>
<td></td>
</tr>
<tr>
<td>2 (visual feedback)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.69 (0.08)</td>
<td>0.70 (0.04)</td>
<td>0.72 (0.15)</td>
<td>0.78 (0.05)</td>
<td>0.77 (0.07)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=6</td>
<td>N=6</td>
<td>N=4</td>
<td>N=4</td>
<td>N=2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.67 (0.07)</td>
<td>0.66 (0.10)</td>
<td>0.74 (0.06)</td>
<td>0.80 (0.09)</td>
<td>0.79 (0.08)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=4</td>
<td>N=5</td>
<td>N=6</td>
<td>N=6</td>
<td>N=9</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>0.69 (0.08)</td>
<td>0.68 (0.07)</td>
<td>0.73 (0.10)</td>
<td>0.79 (0.07)</td>
<td>0.78 (0.08)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=10</td>
<td>N=10</td>
<td>N=9</td>
<td>N=10</td>
<td>N=11</td>
<td></td>
</tr>
<tr>
<td>3 (visual &amp; auditive feedback)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.75 (0.08)</td>
<td>0.72 (0.12)</td>
<td>0.76 (0.08)</td>
<td>0.81 (0.11)</td>
<td>0.75 (0.09)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=6</td>
<td>N=7</td>
<td>N=4</td>
<td>N=8</td>
<td>N=6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.76 (0.08)</td>
<td>0.72 (0.18)</td>
<td>0.79 (0.08)</td>
<td>0.84 (0.07)</td>
<td>0.88 (0.10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=5</td>
<td>N=9</td>
<td>N=7</td>
<td>N=9</td>
<td>N=3</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>0.75 (0.08)</td>
<td>0.72 (0.15)</td>
<td>0.78 (0.08)</td>
<td>0.82 (0.09)</td>
<td>0.79 (0.11)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=11</td>
<td>N=16</td>
<td>N=11</td>
<td>N=17</td>
<td>N=9</td>
<td></td>
</tr>
<tr>
<td>4 (visual, auditive, &amp; CbKST-based feedback)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.71 (0.14)</td>
<td>0.81 (0.07)</td>
<td>0.85 (0.10)</td>
<td>0.86 (0.04)</td>
<td>0.91 (0.40)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=5</td>
<td>N=5</td>
<td>N=7</td>
<td>N=2</td>
<td>N=6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.71 (0.24)</td>
<td>0.90 (0.07)</td>
<td>0.86 (0.13)</td>
<td>0.92 (0.90)</td>
<td>0.90 (0.05)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=5</td>
<td>N=4</td>
<td>N=2</td>
<td>N=1</td>
<td>N=6</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>0.71 (0.19)</td>
<td>0.85 (0.08)</td>
<td>0.86 (0.10)</td>
<td>0.88 (0.04)</td>
<td>0.90 (0.04)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=10</td>
<td>N=9</td>
<td>N=9</td>
<td>N=3</td>
<td>N=12</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>All</td>
<td>0.71</td>
<td>0.74</td>
<td>0.77</td>
<td>0.80</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.11)</td>
<td>(0.13)</td>
<td>(0.09)</td>
<td>(0.09)</td>
<td>(0.09)</td>
</tr>
<tr>
<td></td>
<td>N=40</td>
<td>N=45</td>
<td>N=40</td>
<td>N=39</td>
<td>N=42</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Relative frequencies of correctly solved problems for each session separately for each feedback type

To investigate whether pupils can benefit from working with the tool, the relative amount of correctly solved problems in session 1 and session 5 has been compared and analyzed in more detail. Results are illustrated in Figure 3a. The average score of session 1 is 0.71 (SD=0.11) and that of session 5 is 0.83 (SD=0.09). The difference between those two sessions is statistically significant (T=-5.138, df=80, p=0.000). When considering the results for the different feedback groups separately, it can be seen that all mean values are lower in session 1 compared to mean values obtained in session 5. Regarding feedback group 1, the mean value is 0.69 (SD=0.08) for session 1 and 0.82 (SD=0.07) for session 5. Concerning the second feedback group a similar picture reveals with M=0.69 (SD=0.08) for session 1 and M=0.78 (SD=0.08) for session 5. Learning performance for feedback group 3 is 0.75 (SD=0.08) in session 1 and 0.79 (SD=0.11) in session 5. For feedback group 4 the highest increase in learning performance could be identified with M=0.71 (SD=0.19) in session 1 and M=0.90 (SD=0.04) in session 5. For feedback groups 1, 2, and 4, these increases in learning performance are also statistically significant (group 1: T=-3.646, df=17, p=0.002; group 2: T=-2.978, df=19, p=0.008; group 4: T=-3.422, df=20, p=0.003). Regarding group 3, however, a tendency for better learning performance could be identified.
In order to find out more about differences between different types of feedback, classes, and measurement points, a repeated-measures analysis of variance was calculated. Analysis revealed a main effect of measuring point with F(2.76)=5.308, p=0.005, that was not qualified by type of feedback (F(8.18)=0.510, p=0.845) and class (F(2.73)=0.886, p=0.448). There was also a main effect of type of feedback with F(3)=7.00 (p=0.04). These results are also illustrated in Figure 3b. Post hoc analyses using Tamhane’s T2 (because variances are unequal) indicated that the average value of learning performance was significantly higher in the feedback 4 condition (M=0.86, SD=0.06) than were those in the feedback 1 condition (M=0.74, SD=0.09; p=0.013) and in the feedback 2 condition (M=0.74, SD=0.08; p=0.025). All other comparisons were non-significant.

Summary

Recent literature postulate the efficacy of providing feedback to improve learning performance and outcome [e.g., Alvero et al., 2001; Bangert-Drowns et al., 1991; Vollmeyer & Rheinberg, 2005]. The current investigation sought to answer the question whether the type of feedback delivered is related to subsequent student performance. Bangert-Drowns et al. [1991] stated based on a meta-analyses they conducted that the type of feedback is strongly related to effect size: “When feedback merely indicated that the response was correct or
incorrect; it resulted in a lower effect than when the feedback in some way informed the learner of the correct answer” (p.232). Results of the study presented in this section support this assumption.

Overall, results of this experimental study indicate that children can benefit from using and playing with the Ninja-Tool as they can acquire knowledge regardless of the type of feedback delivered. In all four feedback conditions positive effects could be suggested. That is, improvement was observed on subsequent attempts regardless of the feedback type received which consequently suggest possible practice effects due to playing the game. However, significant differences could be identified in the learning process and outcome for individuals who received CbKST-based formative feedback relative to the other feedback groups (i.e., no feedback, visual correct/incorrect feedback).

In general, it seems that providing some form of feedback is better than no feedback at all and students benefit more from receiving elaborated CbKST-based formative feedback relative to standard or regular feedback. This type of feedback can have a significant impact on learning performance as it allows for providing every student with immediate, individualized and elaborated feedback regarding their performance. Additionally to this, playing with the Ninja-Tool itself seems to improve students’ learning performance. Thus, in any case, students benefit from playing the game or working with this tool.

4.1.2 Monitoring Students’ Learning Activities by Tablet-based Software in the “Open Classroom”

We have seen in the study above that automatized e-assessment based on cbKST supports learning in a very specific and limited individual learning environment. However, if the learning environment does not consist of a specific technological learning tool as for instance “1-to-1 Ninja” or “Sonic Divider” but consists of hands-on materials in an open classroom in which students are rather free in choosing when they want to learn, with whom, and with which materials, how can technology support teaching and learning practices in such an environment? In order to support teaching and learning in open classrooms, project partner TALK developed a tablet software (see D2.6 for further tool descriptions) in close collaboration with two teachers working according to the Montessori pedagogy. The work is summarized based on the report of one of the teachers [see also Vaněček, 2013].

Teacher Profiles

Two female teachers collaborated with TALK. They work together in teaching across classes in primary school level according to Montessori pedagogy. According to this pedagogy “free learning phases” are an important element in learning. Documenting and monitoring students’ activities is another important element within this pedagogical approach. The reporting teacher has about 20 years of teaching experience. They teach in mixed groups of students from grade level 1 and 3.

Formulating Aims

The aim of this study is twofold. On student level, students’ autonomy in learning should increase. This means, students’ awareness in their own learning strengths, their self-reflection and the understanding what is learned for which purpose should increase. In order to reach these aims, students should participate more in documenting their own learning. Moreover, students should be introduced into digital media. On the teacher level, teachers’ competence to provide individualized learning should be elaborated. The software developed should first support teachers’ documenting because documenting takes a long time. Moreover, it should also support them in decision-making with regard to learning suggestions and instructions for each student.

Procedure

Configuring competencies. As first step teachers implemented the competencies and standards into the materials’ catalogue. A table was created to link materials, standards, and competencies.

Using spreadsheets. TALK started with developing a spreadsheet that teachers could use on the tablet in order to keep the process easy at the beginning and to find out what is needed.

Analysing learning materials. The materials were analysed according to averaged time they used in relation to competencies and learning goals.
Using version 1. The teachers used the first version of the tool (with drag and drop functions) to test the usability. The teachers use the software on a daily basis, thereby enabling the possibility for TALK to modify the software according to teachers’ requirements.

Visualizing data. Options for data visualizations were implemented to allow a quick overview and support teachers’ decisions. The software visualizes for example students’ outcomes with the materials or sociograms (who worked with whom).

Including students’ self-assessments. This feature is still in development. An output should be created which can be included in students’ portfolio.

Reflection Phase
First, it was not too easy to use the tablet and teachers need to familiarize with the software. Though, they got familiarized rather quickly.

Concerning the aims for 1st grade students teachers said that they have just started to work on these aims. Maybe some students had higher awareness and participated according to the information. In grade level 3 students showed increased reflection with better quality than before. It was very motivating for the teachers to see how interested the students were in how the teachers documented their learning. Moreover, students’ questions on that process made teachers reflect on aspects that they already took for granted, resulting in new perspectives for the teachers. Notably, students’ questions and comment were only there because the software enabled for the first time to visualize students learning activities at the end of the day. Hence, only with the software students could immediately be included into reflection processes. With regard to teachers level they felt very successful. In the yearly meeting on students’ open learning goals they decided to work more on making students’ strengths visible.

Both teachers felt very much supported by the tablet with the software developed. However, as soon as the internet connection did not work, the system could not be used and they had to return to the paper-based approach. When software was not working, they needed TALK to fix or explain it. Although teachers appreciated working with TALK very much, the teachers were aware that they depend on the TALK’s technological expertise because in many (severe) cases they could not help themselves fixing technological issues.

Side effects from this project are that the teachers got new and interesting perspectives from TALK representing a different disciplinary. Furthermore, teachers got insights into coding. Furthermore, their familiarity with digital media increased. The teachers find all points very enriching. They found it sad that unfortunately other teachers interested in the project could often not arrange a class visit because of time issues.

Next steps
The teachers are very convinced by the project, and thus, they want to help TALK to present the software to more teachers in order to find out how other teachers respond to the approach and use it. From a technological point of view an integration between the tablet software and OLM might be developed.

4.2 Germany: Adopting new Feedback Practices with NEXT-TELL’s Open Learner Model

The main aim of the following research is to find out how NEXT-TELL’s tools – in both cases NEXT-TELL’s competence-based OLM – is adopted by teachers for their real classroom practices as well as how NEXT-TELL’s OLM needs to be adapted in order to be adopted by teachers for their (developing) teaching routines because we see NEXT-TELL’s tool development as a bi-directional, recurring process. In order to find out how OLM might be adopted, it was important for us to provide the OLM with all its functionalities but without detailed instruction what a teacher should do in class. Hence, NEXT-TELL did not prescribe any pedagogy, although we are aware that feedback practices based on principles of assessment for learning [Black, 1998; 2004; 2009] are state-of-the-art feedback principles. Rather, the teachers were asked to work with the OLM in such ways that
were pedagogically most reasonable as well as realistically doable for them. The actual practices with regard to OLM were discussed with the researchers and further elaborated if needed. This implies that teachers adopted the OLM based on their interests, pedagogical and technological reasoning, as well as their natural way to interact with their students in their day-to-day school environment. This research should help to find out so called “Dos and Don’ts” for teachers but also for ICT developers.

As written in D6.2, German teachers are not yet very familiarized with assessment for learning [Black, 2004; 2009]. Although the individual principles of assessment for learning seem to be more and more familiar to younger teachers, there is still not much experience among German teachers in how to practice assessment and feedback in such a way that it supports students’ self-regulated and collaborative learning. The next sections need to be read with this background in mind. These sections focus on how inexperienced teachers in assessment for learning adopt OLM technology into their teaching and assessment practices. The research shows how differently the same tool was implemented into teaching practices according to teachers’ (and assuming students’) preferences of aspects related to assessment for learning.

According to the focus on teacher-led research partners KMRC and MTO supported teachers in their interests in working with the OLM. Teacher 1 (from a grammar school in Northern Germany) was accompanied by KMRC. This teacher was especially interested in students’ self-assessment to raise students’ reflection skills and thereby improve their learning practices and improve in overall subject competencies. Teacher 1 would like to find out how to best support his students in becoming self-reflected and self-regulated learners what should support students in learning. Teacher 2 (from a grammar school in Southern Germany) was accompanied by MTO (with procedure, interview questions, and questionnaires provided by KMRC). This teacher was especially interested in peer-feedback to make students think and help each other, and thereby to also improve students learning outcomes. Although both teachers had different intentions with the OLM, they both regarded OLM as a digital enhancement of their current assessment and feedback practices which they wanted to improve.

4.2.1 OLM as Digital Grade Book and Tool to Leverage Self-Reflection

Teacher Profile

The teacher (male, 35 years, 6 years teaching experience, subjects: Geography and History in English) is familiar with digital tools and uses for example a LMS, a Smart board, and had already introduced his older students’ in how to write a blog (students who want can link their blog with their profile in the LMS). He allows his students to use smart phones in his lessons in order to check or find information in the web not known by students in class but necessary to solve tasks as long as the use of the smart phone is not private and does not disturb other students. Concerning principles of assessment for learning, the teacher offers to provide self-assessments on a sheet of paper on which he also notes the oral grades of the students and which he uses to communicate feedback. The teacher is interested to collaborate with the researchers in NEXT-TELL because he (1) finds the topic “feedback” very interesting, (2) is interested in digital tools for teaching and learning, and (3) sees the collaboration as a chance to benefit from the project’s insights.

Introduction phase: Teacher’s first Opinions about OLM

At the beginning of March 2013 we introduced the teacher to the NEXT-TELL OLM according to the following procedure:

1. Discussing about assessment and feedback practices, partly about planning
2. OLM introduction
   
   Teacher account
   a. Brief intro based on home screen and visualisations
   b. Configure competencies
   c. Configure groups and students
   d. Configure subjects, units, and activities
   e. Assign competencies and groups to activities
   f. Add evidence
g. Visualisations at OLM Browser
   *Student account*

h. Home screen

i. Notifications

j. Visualisations at OLM Browser

k. Add Evidence

l. Visualisations at OLM Browser

   *Teacher account*

m. Home screen

n. Notifications

o. Visualisations at OLM Browser

p. Evidence and Guidance

3. Ideas for OLM implementation

As in conversations before (first contacts took place in June 2012) the teacher was very interested in the tool because he thinks that the OLM has the potential to support his assessment practices and to leverage feedback and students’ self-reflection. He had no difficulties in understanding the overall functioning of the OLM and saw the potential to use the OLM as a digital improvement for his assessment practices. He gives his students oral grades in a regular manner plus the written exams. He wanted to digitalize his procedure plus allowing students’ to self-assess on OLM, an option they could already do on paper if they wanted to but it was not used so much by students. In using the OLM in this way it would not be too much extra work and his students and he would get a visual overview of the competence development and see how they work with it. His plan was to implement the OLM as soon as he would have time to familiarize with it and to bring his teaching structure into the OLM. He wanted to use the OLM continuously whenever he grades students orally and their written exams. He enabled the self-assessment in all activities in OLM so that students could assess themselves.

At the introduction session we also asked him whether he would be interested in a digital planning tool (ECAAD). In general, the teacher would be interested in a digital planning tool, however, as he works at the moment with a digital white board (DWB) and an associated planning programme which includes the generation of slides for the lessons, he was not further interested.

In contrast to other teachers, this teacher liked that the OLM is in English language. As he teaches Geography and History in English (in a bilingual profile approach), he found it rather perfect because it is difficult for students to use English, if the surrounding is full of German language. During presenting the OLM the teacher liked the ideas to use the OLM as his digital grade book and make students assess themselves (self-assessment) best. Peer-assessment might be interesting one day but he was strictly against peer model viewing. Allowing students to see each other’s competencies would not be a good idea in his opinion.

In order to work with the teacher in a way that was acceptable for him with respect to time resources and his interest in trying out the OLM on his own first, we agreed that we visit him in class if possible and contact him regularly, whereas he should contact us whenever he needed support.

**Configurations in OLM and New Assessment Transparency in the Classroom**

KMRC kept in close communication contact with the teacher in order to provide support wherever possible. **Competencies:** About one month after the presentation (beginning of April), the teacher sent a first list of competencies that was based on an official assessment scheme for the Abitur exams (including the grading levels) – provided by the online-education server Berlin-Brandenburg – to the researchers in order to help him getting the competencies into the OLM. The list of competencies did not fit immediately into the OLM. Although the three main competencies seemed to be clear, the single sub-competencies seemed to be too vague and maybe also to rely to other more methodological competencies. Therefore, the researchers decided to discuss with the teacher what is meant by the sub-competencies. In two sessions with each of about two hours, the teacher and the researchers discussed about the meanings of each competence the teacher wanted
to put into the OLM. The researchers created an account for the teacher and put in the overall competence structure that consisted of three hierarchical main competencies (see figure 4).

Formulating the sub-competencies in such a way that they could be understood easily by students, however, needed time. According to assessment for learning sharing the success criteria (or as here competence levels) with students is one important principle [Black, 2004; 2009]. Subsequent to the first session with the researchers the teacher discussed with his students in class the meaning of the competencies. So far, the teacher had never explained the competence scheme that he uses for the Abitur exam to his students explicitly. As the students had difficulties in understanding his first descriptions, the teacher generated two posters with three main competencies and several sub-competencies for Geography and History (see figure 7). He formulated each sub-competence as question asking for the answer that is expected by the students (e.g., What is the problem? What geographical knowledge can be applied? What criteria can be used to assess the problem?). The competence posters were pinned to a board in the classroom so that they remained visible to students at all times. During the second online meeting with the researchers it was discussed how to put the sub-competencies into OLM. The result of this discussion was that the teacher formulated “I-can-statements” (in relation to rubrics) as answers to the questions on the posters as sub-competencies. With this idea in mind it was rather easy for the teacher to finalize the configuration of the competencies in OLM (see Figure 9).

Hence, if students self-assess their competencies assigned to an activity in OLM, they read for example, “I can identify the geographical problem” left to the 10-star rating scale. During two researchers’ classroom observations when introducing the students to OLM (see below), it was observed that students looked at the posters during task assignments. In class 2, students also asked or discussed with the teacher, when they did not understand for example why one answer was referred to a sub-competence, whereas another answer that seemed to be the same for them was referred to another sub-competence. Detecting the differences between the sub-competencies was difficult for the students. Overall, the teacher and the students referred actively to the posters during the lessons observed.

When asking a student (during a short break) whether she thought that the poster made a difference she told that they had never talked about these competence levels before and that she was not aware that what they were doing could be related to these competencies. She further told that they would actually do nothing differently than before, because the same questions were there before. However, she had the feeling that their answers were not that fluently anymore because they would now answer more specifically to the smaller sub-competence questions and not any longer to the overall broad questions.

© NEXT-TELL consortium: all rights reserved
Groups: During configuring his classes in the OLM, he assigned some students into the wrong group. Only with the help of BHAM it was possible to solve this issue which was then dissolved by BHAM in general. The teacher also complained about picking his students from a long list of students registered in the OLM. Meanwhile, this issue has been solved by BHAM.

Activities: Throughout the next weeks the teacher put in the activities according to his lessons into the configuration category “My teaching”. As there were only three levels in “My teaching” the teacher felt limited. In order to get to the activities he needed to skip for example the names of the subjects and the overall units.
within the subjects. Whereas “Global Cities” is a subject in the OLM, it is in fact a topic within a sub-unit of the subject Geography. The same holds true for “Modernizing the World” which is in fact a topic in a sub-unit of the subject History. Figure 10 shows a screenshot of his teaching configurations.

In a reflection session, the teacher said that he could manage the OLM’s configuration (but first steps were made by researchers). However, it took him a while to have enough time to sit in front of the tool and dive deeper into it to familiarize with it. As he is used to learn new tools on his own, it was possible for him to understand the OLM some weeks after the presentation session on his own. Nevertheless, he suggested online help (e.g., help search) in an easy to understand way like a list of so called FAQ like for example “Do you want to configure a class?” and then a short 3- or 5-step explanation should be provided but not more. Whenever teachers less experienced with technology should use the OLM he urgently recommended to provide such help functions (this issue needs to be further considered in WP7).

**Teacher’s OLM Use**

The teacher had configured two classes (with overall 26 out of 37 students registered in OLM, two subjects in OLM, as well as seven activities in which he could assess students and students do self-assessments). Table 6 provides a quantitative overview of the entries into OLM within about one month duration of active OLM use. The overview shows that the teacher provided input about once a week to several students (for about one month of duration). He did so at home in the afternoons or evenings. Students, however, did not use the OLM themselves (except two students each testing once). Some of them did rate themselves during a class session that the teacher organized after experiencing that his students did not use the OLM on their own at home as expected by him.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher sessions</td>
<td>6</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Teacher ratings</td>
<td>40</td>
<td>55</td>
<td>95</td>
</tr>
<tr>
<td>Teacher feedback</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Class sessions</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Class: Self-ratings</td>
<td>14</td>
<td>44</td>
<td>58</td>
</tr>
</tbody>
</table>
Stakeholder | Class 1 | Class 2 | Overall |
--- | --- | --- | --- |
Class: Self-feedback | 0 | 3 (1 student) | 3 |
Home sessions | 0 | 2 | 2 |
Home: Self-ratings | 0 | 4 (2 students) | 4 |
Home: Self-feedback | 0 | 2 (1 student) | 2 |

Table 6: Overview of the numbers of OLM entries made by the teacher and students

Add Evidence: It can be said that despite all these entries, an elaborative use of the OLM according to assessment for learning principles (though this was not demanded) was not made by him. The teacher did not provide any verbal feedback with regards to students’ strengths and/or guidance suggestions. In later reflection interviews on the usefulness of the OLM feedback the teacher realized that he provided quantitative feedback only, although he might have also provided qualitative verbal feedback. However, the idea to provide verbal feedback to each student seemed not very attractive for him because of lacking time resources. He suggested a kind of repository store with pre-written comments from where he might select the comments and where he can find suggestions for further tasks to provide in the guidance field. The idea to start establishing such a repository was not seen possible for him or only with extra resources. Figure 11 shows a screenshot of the “Add Evidence” in the teacher OLM perspective.

Evidence and Guidance: Moreover, the teacher was not aware of the “Evidence and Guidance” category. This implied that he was not aware where to find verbal feedback information provided by his students but as written above did also not expect verbal feedback. When he clicked to the “Evidence and Guidance” information, however, he did not find it really helpful because it was difficult for him to get an overview over this long list of entries and first wondering what the different colours should mean. He then tried to find deviations between his ratings and students’ self-assessment ratings, however, it was not possible for him to
make such comparisons in this format. As a radar plot will be included in OLM version 3 (see D4.6) this issue was not further discussed.

![Figure 12: Screenshot of teacher’s “Evidence and Guidance”](image)

**Notifications:** What he more or less complained about was that he was not informed automatically via e-mail when a student had registered (to include him/her in his groups) or when students had provided any ratings and/or feedback. During the reflection meeting he realized that there were three notifications in the system from one student from the last school year (he did not use the OLM during the summer break) which he had not read because this student provided the input three days after the teacher’s last entries. Since then, the teacher had not logged into the OLM. He was rather astonished because this student provided verbal feedback on his strengths and difficulties. The teacher wanted to read these comments on his own after the reflection meeting.

**Introducing Students to OLM**

At the mid of April 2013, the teacher introduced the students of both classes to the OLM in his normal class room without computers (see Figures 5 above), some days before the researchers’ visit to the class. He wanted to introduce the OLM to his students on his own. First, he summarized the NEXT-TELL project. Subsequently, he logged into the teacher OLM and showed them the OLM browser with the visualisations at the DWB. He explained the advantages that the OLM has according to his opinion with an emphasis on transparency in assessment and the possibility to self-assess. Then he gave the necessary log-in information to his students and asked the students to register and log-in once (at home) so that he could assign them into his groups.

During the researchers class visit, the teacher talked again about the OLM. The teachers’ OLM browser was again projected on the DWB. He further explained that the competence questions on the posters are directly related to the competence rating formulations in the OLM (I-can statements). He explained that they first should try to understand this relation. Next step would be to think how well they were in the competencies. Then he asked them again to register and log in (the URL was written down on the chalkboard) at home because his classes do normally take place in his classroom without computers. The students who would log in would get ratings from him and only they could self-assess. Concerning the OLM Browser, he focused on the table visualization and explained the relations between the official German grading system (15 points), the table’s five categories from very weak to very strong, and the 10-star rating scale. He explained that the five categories are rather rough measures compared to the German 15-points system in the examination classes of Grammar schools. Furthermore, he emphasized that the categories would show the tendency only, that is, the OLM category “very strong” would refer to 13, 14, and 15 points, and “strong” would refer to 10, 11, and 12 points of the 15-points grading system. Hence, the OLM would not show the exact grade. The teacher told his students that “If you are in the category strong, it will be my final decision for your grades whether you get 10,
11 or 12 points. I keep the joker with me”. The teacher did not explain the possibilities of written feedback concerning students’ strengths and guidance nor did he mention anything about the depreciation factor. After about five to ten minutes, the teacher explained the register process again and asked the students to register when they are at home but made clear that it would be voluntarily assuming that his students would register because no one protested. As the teacher also used a LMS where he organized the learning materials of both classes, he assumed that using a www tool is not that demanding for his students.

Students’ Reactions and OLM Use

The following information is based on the teacher’s reports in the reflection sessions. There was no possibility provided to interview the students directly or to provide the questionnaires used with the other German teacher (see below).

Registering: It took about one month from the day of the teacher’s first introduction of the OLM until his decision to go to the computer room with his classes in order to log further students into the OLM and show them how to use the OLM. The teacher had realized that so far only a few students had logged into the OLM but he wanted to provide feedback to all his students. Whereas in class 2 almost each student was registered, about a third of the students in class 1 refused to register. This result seemed to be a kind of group dynamic process because at first only one student did not want to register but after some weeks more students refused to participate, partly also because their parents did not allow them to participate. The students’ main argument was their concern related to data privacy. They feared that in several years employers would google their names and then found their OLM entries in the www. Based on these concerns students suggested to use pseudonyms. However, the teacher is against pseudonyms. He wants to be sure to whom he provides feedback and does not want to have extra work by learning pseudonyms.

OLM use: During the OLM session in the computer classroom the teacher asked his students to self-assess with regard to the topic of the written exam about “Hafencity”. The students had several difficulties related and not directly related with the OLM. It was just rather difficult for the students to assess themselves. Some students even called the teacher and asked him to tell them how good they were. The teacher had not expected that the students would have such difficulties with assessing themselves. Moreover, it was also difficult for students to use the 10-star rating scale in the OLM because they did not know how it should be related to grades that are based on a 15-points system in Germany. Many students did not know how to deal with this difference. For others the rating scale was just too detailed and the teacher suggested them to first imagine only three levels “low, medium, high” and then to think how well they would estimate their competence showed in relation to the topic of the test. In the next step they might think about transferring their assessment to the 10-star rating scale.

As reported in the table above, students did not use the OLM on their own at home as expected by the teacher. Many students said that they did not find the ratings helpful, if they would not get any advice by the teacher. They did not think that the OLM might be very useful at all. They also criticized that they should once try it in a lesson. This did not make any sense to them because the tool as such is not about any subject relevant content. Overall, the atmosphere was rather tensed during the lesson in the computer room with class 1 but not with class 2. The teacher was enthusiastic about using the OLM and did not expect his students to reject it. The teacher decided to skip the OLM for the rest of the school year, but used it once for oral grades in another activity (Los Angeles Analysis). The teacher’s first enthusiasm in using the OLM decreased a lot.

Meanwhile the next school year has started. So far, the students have not asked for the OLM – a sign the teacher has waited for in order to be assured whether to move on with the OLM or not.

Parents’ Reactions

Some parents did not allow his/her child to register. The teacher mentioned several objections: First, the parents had learned without technology and according to them, this demonstrates that ICT is not necessary. Second, as the students do not have immediate internet access at school as long as the teacher does not book the PC room (extra room organisation), he asked his students to also use the OLM at home and think at home about their learning and self-assessments. However, some parents did not like this kind of homework because the students are at school until about 4 or 5 pm, and thus, should not be bothered with extra work that is not
even necessary for the Abitur exam. Another sensitive point would be the rules (and fights) existing at home concerning registering into online-tools (e.g., facebook).

Reflecting first Implementation Practices

Based on the teacher’s reportings we summarized that his students seemed to be rather passive and expected all learning success to depend on him. This made the teacher think about his procedure. According to the teacher the introduction of the OLM to his students needs to be improved. Looking back, he thinks that he had just put the OLM on top of the students without getting their understanding and motivation to use it. He said that in his perfect school world students (aged 16 to 17) who attend his lessons are self-reflected and self-regulated learners like it is written in the ministerial school plan documents at this class level. However, he expected too much of the students. He should not have expected that they developed an interest on their own in their learning just because he thought the OLM could support them. He better should lead them step-by-step to a self-reflecting mode, continuously motivating them and providing feedback loops. Such practices would need more communication with his students. However, he feels stressed when doing too much communication because whenever he goes into communication with his students it costs time and they do not progress in subject content.

Moreover, he had introduced the OLM as a preparation for them to (1) see where they are in learning and self-reflect and (2) to write better tests grades. This was probably not attractive to the students, rather the opposite because grades are always an instrument of power. Hence, although he liked the idea to use the OLM for his normal grading practices and let students participate by self-assessments, it seemed to be unattractive and of little help for the students.

Furthermore, he said that from students’ perspective asking them to use OLM was maybe just like a kind of advertisement in the on-going stream of information flushed over them day by day, and thus, they did not pay much attention to it. Each teacher has his/her own practices, and hence, students need to switch to another teacher’s special practices every one or two hours at school. The OLM needs to be understood in the school’s whole assessment context. If (almost) no other teacher asks students to self-reflect why should they do it with him and online and at home? Hence, he should have invested more time to introduce the OLM to students and let them understand what they might do with the tool and how they might benefit from it. For the teacher the OLM is rather self-explaining but not so for his students. He has learned that self-reflection is not an easy task for his students and also not common practice. Some students even seem to not want to think about their learning. The teacher described some of his students to be strongly opinionated but not necessarily strongly reflected. According to his experiences the OLM seemed to disturb the common learning procedure of his students (teacher assigns tasks – student practices – teacher assesses whether it is correct or not). Hence, he reasoned that introducing self-reflection practices like self-assessment needed to be done more slowly. Issues like admitting freely that one has difficulties in a subject might not be easy in an achievement context like school is.

Next Steps: From Teacher-centred to Learner-centred OLM Use

An important aspect for the teacher to work further with the OLM is to have enough trustful boundaries with his students. Because of some students’ critiques concerning his use of a LMS he had started the new school year with stricken trust in his students and a change in his teaching practices (reduced use of LMS, increased step-by-step prescriptions during lessons). To proceed with the OLM, however, he needs first the students’ trust that he instructs in a way that supports them, but second also equally important is his trust into his students to test something new without being prosecuted. As there were several students who did not like to use the OLM in class 1 he decided to test further work with class 2 in which all students were allowed to register and where the atmosphere concerning OLM was not that tensed.

Whereas the first idea was to use the OLM as a tool that supports mainly the existing assessment practices digitally, the next idea is to use the OLM for new feedback practices which are more in line with the principles of assessment for learning. The first aim is to increase students’ understanding and motivation of new feedback practices that should help them in preparing themselves for the Abitur exam. As the Abitur exam is a goal students want to reach as best as possible, the teacher assumes that this might cause more intrinsic motivation
in his students to reflect about their learning and become more self-regulated than before. This would be a step from focusing more on short-term goals (tests) to a long-term goal (Abitur exam).

However, the most crucial difference will be that he won’t use the OLM for grades any longer. He said that grades are an instrument of power, and thus, never allows students and teachers to be relaxed about them. Thus, we set to find procedures using the OLM in a more relaxed way monitoring the preparation for the Abitur exam but without direct links to grades. This approach might become possible because he could change the History lessons in his classes with tutorial lessons in Geography. Moreover, the emphasis will be set on students’ self-assessment as a kind of checklist system that allows students to check, document, and monitor how far they are in their Abitur preparations (not his grades for oral or written performances). The teacher might also introduce peer-feedback but is not yet sure about it. According to the experiences with his students he assumes that they will not agree in peer-feedback. They did not want their peers to see their grades. Furthermore, when trying peer-feedback several times for group work, the teacher was not satisfied because the students rated themselves immediately all the same. It seemed to him that they do not want to get into conflict with their peers and this was why they did not differentiate among each other. Hearing that other teachers might have good experiences with peer-feedback was somewhat surprising for the teacher but made him also more open to maybe try again. We will work further on this issue and find out whether peer-assessment is acceptable for his students or not and if so in which ways.

4.2.2 OLM as Tool to Leverage Peer-Feedback

In contrast to the teacher above, the following case study with OLM is about a teacher who is especially interested in peer-feedback practices.

Teacher Profile

The teacher (male, 30 years, 5 years teaching experience, subjects: Economics, Politics, History, and Biology) is familiar with digital tools and already wrote a blog with his students in Economics. Concerning principles of assessment for learning the teacher already used peer-feedback several times and is most interested to leverage peer-feedback in his classroom practices.

Introduction phase: Teacher’s first opinions about OLM

MTO met with the teacher and presented the OLM according to the training materials provided by BHAM. While requesting a close technological guidance on using the OLM, he wished to retain independence concerning contents and final set-up. He mentioned that access to pre-formulated examples could be beneficial - especially from colleagues. The teacher’s primary interest in the OLM is to provide students with a platform to peer-review and comment on their own work and results.

Configurations in OLM

For his first use in an economics course, the teacher configured four rather broad main competencies, which are based on a concept he was introduced to in Biology, but which seemed to fit to all subjects for him in general, into the OLM:

- Kommunikationskompetenz (communicative competence)
- Sachwissen (expertise/knowledge of the field)
- Interpretation/Deutung und Reflexion (interpretation and reflection)
- Methodenkompetenz (methodological competence, e.g., creating a graphical representation, text writing (see figure 13))

It is interesting to see that the teacher did not create a main competence called “methodological competence” with sub-competencies but rather created two separate main competencies namely “creating graphical representations” and “writing text”. Although he needed time to figure out how the OLM functions and recommended to provide training materials in German language, it took him only about 1-2 hours to put his competencies into the OLM.
Introducing Students to OLM

The teacher wanted to introduce his students to the OLM by himself. At the beginning of July 2013, he did so to two of his classes at the beginning of a lesson in which he asked his students to create a mind or a concept map (students were free to choose) using several terms from the field of economic policy (which instruments can be used to decrease unemployment?). He had booked the computer room for this lesson.

He told his students that OLM is a tool to do self- and peer-feedback. He said that the important function is that they can provide support or suggestions to each other via the OLM. As he would like to use it next school year with them, he wanted to test it in this and the next lesson.

Then, he asked his students to register and log into the OLM. He allowed his students nicknames but only if he could identify them. When all students were once logged into OLM, they draw the mind or concept map, meanwhile he set-up the group in OLM and did the assignment of competencies and groups to the activity. Subsequent to creating the maps, students should provide self-ratings in the OLM and subsequently peer-feedback (ratings and verbal feedback). The teacher mentioned again that they should provide guidance to their peers. Students rated themselves in the OLM, however, it was not possible to provide peer-feedback because of technological issues related with the CAS system (as suggested later on by project partners BHAM and JRS). Thus, the teacher asked students to rate their peers directly on the sheets of paper and also to provide feedback on the papers. At the end of the lesson the teacher collected the papers with the mind and concept maps in order to rate them in the OLM at home and to show his students their OLM up-dated with his ratings in the following week.

Teacher’s OLM Use

At the afternoon, the teachers inspected the students’ mind and concept maps. As not all students had put their name on the paper, he could not rate all maps in OLM because in the OLM it is not possible to rate an artefact without being assigned to a student. At the beginning, the teacher provided all three possible feedback options namely star-ratings, strengths, and guidance in the OLM. However, he gradually reduced the verbal
feedback. He first stopped to comment students’ strengths. After a while, he also stopped to provide written
guidance. However, he rated each map numerically on the 10-star rating scale.

For the teacher, providing guidance was the most effortful process. As the feedback should not be general but
tailored to the students’ work, it took some time. Rating students was much quicker and could be done by just
mouse-clicking. Hence, after some maps the teacher reduced his written feedback, although it had been
important for him to stress in class that the students should provide written feedback and guidance.

Looking at the maps with the peer-feedback showed, however, that many students did not provide (much)
written feedback and guidance. They had also focused on ratings, sometimes even providing the average of the
summed sub-competence ratings (maybe as kind of imitation of OLM).

Students’ OLM use and Reactions

The students registered and logged into the OLM during the lesson in the computer room. Many of them used
nicknames but the teacher could recognize all of them. They were enthusiastic to try the OLM and rated
themselves in OLM but because of the technological issue they could not do peer-feedback.

One week later, when MTO visited the teacher and both classes, they went in the computer room again.
Students were asked to fill out an online-questionnaire about the OLM use (provided by KMRC), and then to
have a look at teacher’s ratings in the OLM.

Some students did both tasks in parallel. As the peer-ratings were written on paper (the teacher had handed
the sheets of paper with the mind and concept maps out again), the students realized that the teacher’s ratings
were much lower than their self- or peer-ratings. Despite some students’ asking why there were such big
differences in ratings, there was no much discussion about this issue. As there was not much time for
discussion the teacher just answered shortly to the students asking for the differences (observations by MTO).

The following figures summarize students’ answers to a questionnaire provided by KMRC in order to gather
more specific information with regard to OLM functions. The questions could be rated on a 6-point Likert-type
scale (highly disagree, disagree, rather disagree, rather agree, agree, highly agree) or the students could chose
the option “no information”, if they thought they had too little experience with the OLM to already provide an
answer. The three disagreement and the three agreement rating options of the rating scale were summarized
respectively and thereby dichotomized into disagree and agree to provide a quick overview of students’
answers in the following. Thus, the answers were coded either no information, disagree, or agree.
Furthermore, there were open text fields for free comments. It needs to be considered that these students
used OLM only once during a lesson for self-ratings, while providing peer-feedback was not possible at that
time. Hence, the data are preliminary results.

Computer Use: We asked students to rate their knowledge in computers. Eleven out of 28 students (41%) rated
their computer knowledge as “rather high”. Eleven students (41%) rated their computer knowledge as “high”
and one student (3.5%) as “very high”. Moreover, three students (3.5%) rated it as “rather low” and one
student as “low”. With regard to the technologies they own, 26 students (93%) answered to have a laptop and
23 students (82%) to have a smartphone.

With regard to www use, social networks like Facebook where used daily by most of the students (82%) or at
least several times per week (11%). Only two students answered that they had never used social networks.
Communication providers like WhatsApp and Skype were on place 2 for daily use (64%), and video providers
like Youtube or Vimeo at place 3 (57%). Eighty-two percentages answered to never use micro blogging tools
like Twitter.

Usefulness of feedback types: Turning to OLM and feedback, we asked students how much they liked to be
informed about their competence levels via (1) oral feedback only, (2) written feedback on paper, and (3) OLM.
While about 90% of the students agreed to like getting competence feedback via OLM, only 17% agreed to like
getting competence feedback only orally. Figure 14 visualizes the results.

These results clearly demonstrate that the majority of these students would like to get feedback via OLM. One
student wrote:

“It’s cool! (German: isch scho cool!)”.
Usefulness of visualization types: Students were asked more precisely how helpful they found the different visualization types in OLM. They had to rate statements like “I find the visualization type (Skill Meter, Table, Smilies, Word Cloud, and Competency Treemap) in the Browser’s category “groups” helpful to see in which subjects I reached which competence level”. Two further questions followed which concentrated on categories “competencies” and “activities”. Figures 15 and 16 show two competence visualizations in the OLM.

In each of the three questions students (about 60-70%) rated the skill meter to be most helpful (see figure 17). The table and smiles visualizations followed (about 30%). The word cloud and the competency treemap were rated to be at least helpful (10-20%). It needs to be recognized, however, that most of the students (up to 70%) chose to not provide any information due to lack of experiences with the OLM in the latter visualization types.
Further Preferences of Visualization types: Concerning visualizations we also asked students which information they would like to see depicted. We asked for (1) current competence level in subjects, (2) difference between current competence level and competence level they want to reach, (3) difference between teacher’s ratings and self-ratings, (4) comparison with their peers, (5) the development of their competencies, (6) the overview of the knowledge in subjects, and (7) the difference between their peer’s ratings and their own self-ratings. More than 90% of the students are interested in seeing their current competence level depicted. This is exactly what OLM is doing. However, the results show that students are further interested in more complex visualizations because about 90% were interested in seeing how far they are currently away from the competence level they would like to reach. Such information would be important for self-regulated learning. Furthermore, about 85% of the students were interested in directly being informed about the difference between their self-ratings and teacher’s ratings. This result might not be astonishing in these two classes because students realized that the teacher’s ratings in OLM differed a lot from their own ratings and the peer-ratings on paper. However, they were not so much interested (only 40%) in how much their peer’s ratings differ from their self-ratings, maybe because their self-ratings and peer-ratings were very similar for this task. The aspect of visualizing different person’s ratings is addressed in OLM version 3 (see D4.6) via radar plots. Although it might cause a competitive learning atmosphere, 80% of students were interested in how good they are compared to their peers. Finally, about 70% were also interested in seeing their competence development visualized and knowledge overview. The latter might be topics for further developments of the OLM. Figure 18 depicts the results described.
**OLM functionalities:** We further asked about how easy it is to use OLM in general and its filter that enables to depict specific information only in the visualizations. Furthermore, we asked different functionalities: (1) using OLM is easy, (2) using the filter is easy, (3) evidence and guidance is useful for changing ratings, (4) it is clear how the competence levels are calculated (algorithm), (5) notifications are important, (6) discussion option is important. Only about 25% of the students agreed that using the OLM tool was easy (first time users). Difficulties started for students for example already with the long URL of the OLM-homepage (also observed by MTO during the class visit). One student wrote:

"The internet address could be much easier. Furthermore, the website is rather unclear and difficult to understand. -> Usability should be increased! [Die Internetadresse könnte echt einfacher sein. Ebenso ist die Internetseite sehr unübersichtlich und schwer zu verstehen. -> Benutzerfreundlichkeit sollte stark verbessert werden!]."

Only 7% found the filtering function of OLM easy. However, about 70% did not provide an answer to that question suggesting that students could not try it a lot during the session. The same was true for the function of evidence and guidance. In the open comment fields, some students wrote that they would even not know where the evidence and guidance site would be in the OLM. The “Guidance and Evidence” site provides the information of all feedback provided to a student. It can be described as a time-line repository of the ratings and written feedback provided for (or by) an OLM user. Only about 30% of the students thought that they understood how the competencies are calculated in the OLM. Despite their inexperience in OLM, 40-60% of the students agreed that notifications (deletable information of ratings and written feedback), and discussion options (referenced to competencies) are important in OLM. Figure 19 provides an overview of students’ ratings concerning these six topics.

![Figure 19: Percentages of students rating OLM use and other OLM functionalities](image)

**OLM's influences:** Besides these technological functionalities, we were also interested in how OLM influenced the students while using it. As OLM is intended to increase students’ reflection processes we asked whether they (1) thought about what they already could do and what not (strengths and weaknesses) and (2) thought about what they would like to do better. Besides these cognitive variables we also asked (3) whether a tool like OLM would stress them. Figure 20 depicts students’ agreement ratings to these questions. For this one session the students had in OLM about 30% of them agreed that during using the OLM they thought about their strengths and weaknesses as well as about what they would like to learn next. Fortunately, a tool like the OLM would not stress most of the students. However, it needs to be mentioned that about 16% (4 out of 28 students) agreed that a tool like OLM would cause some stress and performance pressure on them. These answers showed that there will probably always be students who react very sensitively with regard to issues of performance motivation. Such students should not be overseen in first steps, in order to prevent negative...
consequences of OLM use. So far, however, it is too early to speculate about negative or positive consequences of OLM concerning achievement motivation and stress.

![Diagram](image)

**Figure 20: Percentages of students rating OLM’s influences**

**Data privacy:** Finally, we also asked how much students agreed with the fact that OLM stores their data in the WWW. About 40% of the students agreed to be concerned that their data are stored in the so called cloud. One of the students, for example, even wrote

“I don’t like that all these data about me are in the www now and can be seen by others!! I can visualize them myself at home [German: Ich finde es nicht gut, dass diese ganzen Daten über mich nun sogar im Internet stehen und von anderen eingesehen werden können!! Die kann ich mir auch zu Hause selbst visualisieren].”

However, 20% more (see Figure 21) found it rather practical that they can access their data from everywhere they would be. With all the political discussions going on in daily media (e.g., whistle-blowers and Prism) and strict data privacy regulations at schools, NEXT-TELL needs to consider data privacy issues in next steps more thoroughly.

![Diagram](image)

**Figure 21: Percentages of students rating OLM and WWW**

The best summary of students’ impression of the OLM might be the comment of one student who wrote at the end of the questionnaire:

“Good idea, but not yet developed maturely enough [Gute Idee, aber noch lange nicht ausgereift]”. 
The comments of students who used the OLM once show that the OLM development is on a good way, although it has not yet reached a level of easy and straightforward usability. Concerning students’ ratings of OLM in the questionnaire, project partners MTO, KMRC, UniRes, and BHAM will further discuss how these results influence OLM developments as well as OLM implementations or student trainings.

Reflecting first Implementation Phase

Concerning the use of OLM, the teacher would also like to offer course content and tasks directly to students, to highlight the link between their work and associated competencies. The teacher was also keen on using OLMlets to provide automated data to the OLM. In line with the point above, he stated that he would like to link the OLM with additional materials and instructions as already used in the classroom. For example, add a source on analysis in economy or history courses, to relate to the competencies defined. This suggests a perception of achievable integration into his existing teaching.

Concerning the big differences between teacher ratings and self- as well as peer-feedback the teacher stayed relaxed because he had expected that students would rate themselves better as they were, because students would often rate themselves good when they would do something for the first time. As he explained the specific meanings of the criteria subsequent to their first self- and peer-assessments (e.g., using different colours), the next time, the students should do better and a learning progression should be visible. He assumes that next time the differences between teacher’s and students’ ratings should be much smaller.

No further information was given so far concerning students’ arguments that their peers rated their mind or concepts maps well and much better than the teacher did. However, MTO as observer in class realized that there seemed to be some changes going on. Suddenly, students had their peers’ ratings as argument for better grades. Such possibilities might change the perspective or even teacher’s arguments for his/her grading (e.g., You are not doing the task for me but for others who need to understand it).

Next Steps: Inquiring the Influences of Peer-Feedback Types

As the teacher had little time to use the OLM in the last school year, he wants to further use the OLM in the next school year (2013/14) to find out how to benefit best from peer-feedback. According to the teacher peer-feedback is (only or) much more helpful, if peer-feedback is provided voluntarily but not if students are asked to do so. In order to find out whether his assumption is true, he wants to split his students into 2 groups (voluntary peer-feedback vs. obligatory peer-feedback). This is a question which might be directly supported by TISL practices developed so far in WP5.

4.3 Norway: Chaining e-Assessment Tools to Detect and Dissolve Students’ Misconceptions

This research in Norway was based on former work in project year 2, where teachers experienced in assessment for learning had set up a science unit on Energy for the Future (cf D6.4), but only with limited use of technology. The aim of this on-going research was to increase the use of NEXT-TELL e-Assessment technology within this unit. During this TDS the researchers tried to be involved as little as possible, but technical difficulties with the tools and conceptual challenges related to the tools resulted in our involvement being more than planned. Thus we can refer to this trial as a partial TDS. After an overview of the trial, the section is divided according to the three tools with which the two teachers experimented: RGFA, OLMlets (non-NEXT-TELL tool), and OLM.

4.3.1 Overview

The Spring-2013-trial conducted at Nordahl Grieg Upper Secondary School in Norway was a teacher-led study in the sense of what was being taught, how it was taught, and why it was taught. The teachers themselves also chose which NT-tools to use, and how to use them, although the researchers supported the process, both by giving advice and by facilitating the tool use (including giving feedback to tool developers on problems that needed to be fixed for the tools to be used).
From a NEXT-TELL perspective we investigated how teachers use a combination of the NEXT-TELL tools. In the trial these comprise RGFA, OLMlets, and the Open Learner Model (OLM), which together provide teachers with a state-of-the-art student achievement overview that can be useful for improving teaching, with a particular focus on formative assessment and student learning. The research data collected during the trial includes field notes, observations, pictures, assessment results, a questionnaire about the OLM for teachers and students, teachers-tool-reflecting-tasks, and interviews.

From a teacher perspective they were introducing a new method, and we (teachers and researchers) were interested in whether this method increased motivation for their students, if they received information that was useful, and if the students got a better overview of their competencies.

The trial started in March 2013. While there is still data analysis remaining (e.g., the teachers-tool-reflecting-tasks and interview has not been analysed), this section reports on an analysis of the assessment methodology related to the use of three tools, RGFA tool, the OLMlets and the OLM, and the integration of their data. First a short description of the role of the NEXT-TELL tools in the trial is given, followed by a description of the use tools and some issues of use in the classroom, and concluding with how these tools functions together as an assessment method.

Two STEM teachers conducted the trial with approximately 50 students from three different classes engaged in a science unit on Energy for the Future. From previous findings (see D 2.4 and D6.4) we know that our teachers start planning by looking at the competence goals that are relevant for the unit, as specified in the national curriculum. These goals are not only goals for students’ learning, but are also a guide for teachers and students on what should be taught. In order to know when students have reached these goals, the students are assessed in different ways. Student data from the different assessment situations provides information on whether the students have reached the goals, indicates where the teacher should focus their future teaching, or whether the teacher needs to adjust the teaching in order to give students new possibilities to reach the goal, that is, the student data is used formatively (see D5.5). During this trial a selection of Next-Tell tools are enhancing this process.

At the beginning the Energy for the Future unit (for more detailed information on this unit as a STEM subject see D2.4 and D6.4), the teachers used the RGFA tool in order to gain an overview of student’s knowledge and misconceptions of concepts related to the theme. They then analysed the student’s answers identifying a number of misconceptions, which are then used in a formative way to create questions for the OLMlets tool. When the students use the OLMlets, the OLM is updated automatically. During the unit the students had to carry out a project on solar traps (solar thermal collectors) and give an oral presentation on this to the class. This presentation was then assessed both by teachers and peers, using a rubric (on paper) prepared by the teachers. Having done this, the students entered OLM in order to do a self- and peer assessment, updating the students’ learner model. The procedure was the following:

Teachers prepared the RGFA task by finding terms related to the unit the Energy for the Future.

Teachers prepared triads of the terms.

Students carried out the RGFA task.

Teachers looked at the results of the RGFA in order to find misconceptions.

Misconceptions were used in order to form questions in the OLMlets.

- Teachers entered the questions in the OLMlets tool, creating a quiz.
- Students did the OLMlets quiz.
- Students looked at their results in the OLMlets tool.
- Teachers looked at students’ results in the OLMlets tool.
- Student prepared their solar trap experiment.
- Students presented their solar trap experiment for their peers.
- Students assessed their peers' experiment and the presentation using a rubric on paper.
- Teachers assessed their students’ experiments and the presentation using a rubric on paper.
- Students do a peer evaluation on their work on the experiment in the OLM.
- Students do a self-evaluation on their work on the experiment in the OLM.
- Teachers looked at students’ self- and peer assessment and the learner models in the OLM tool.

4.3.2 Starting with NEXT-TELL’s RGFA to Detect Students’ Misconceptions

We introduced the idea of using the RGFA (information about the tool itself can be found in D4.6.) and OLMlets tools to the teachers. After being introduced to the OLMlets tool the teachers immediately saw the benefit of the tool for the students, and were interested in using this tool after the RGFA during the Energy of the Future unit. The idea was met with enthusiasm. The teachers had a plan for how to work on the unit with test, assignments, and presentations, and re-planned this to fit in the use of the tools. This section describes their use of the RGFA tool to gain an overview of student’s current knowledge and misconceptions, and then use the misconceptions as a basis for a quiz in the OLMlets tool.

The exercise

The teachers decided that the focus of the RGFA activity was to gain an overview of the student’s understanding of solar energy and its relationship to heat pumps, solar cells, and solar traps. They identified 15 elements related to these concepts and created 7 triads. Originally they identified 27 terms, but our suggestion was that 27 items was probably too many as each item had to be ranked against the similarity and different constructs (they even had items that were not going to be used in a triad and would only show up in the ranking list). The final 15 terms were:

- Electrons
- Silicon
- Solar cells
- Circular current
- Alternating Current (AC)
- Heat Pumps
- Evaporation
- Rechargeable batteries
- Condensation
- Valve
- Copper pipes
- Heat
- Pressure
- Solar thermal collector (solar trap)
- Alkaline batteries

Figure 22 shows the introduction to the RGFA exercise and the list of 15 elements. Note that the figure shows the directions in English and the list of elements in Norwegian (this was, and is, an on-going issue); in the trial the students had a Norwegian interface, however.
The teachers collaborated and discussed in length the items, how the terms should fit together into triads, and whether they should be presented as a term, picture, or video (they particularly liked the idea of using pictures). They carefully composed the seven triads as follows:

1. Electrons - Silicon (picture) - AC
2. Solar cells (picture) - Circular flow - Rechargeable batteries
3. Solar cells (picture) - Heat pumps (picture) - Silicon (picture)
4. Condensation - Pressure - Alkaline batteries
5. Evaporation (picture) - Valve (picture) - Solar cells (picture)
6. Heat - Circular flow - Copper pipe
7. Solar traps - Heat - AC (picture)

Figure 23 shows the first triad, again with the English interface (note the headings and triad elements are in Norwegian).
Using the RGFA in the Classroom

In the classroom the teachers asked us to introduce the project and tell in general about the role of the tool to the students. The teachers then took control, and managed and explained the exercise for the students. When the students experienced any problems the teachers were active in finding solutions, however, as the time dragged out we also participated in giving help when needed. The issues were both technical and conceptual. For instance, the students experienced some problems such as an extremely slow network, but also in getting extra information on what the purpose of the task was, and understanding the concept of the triads.

The RGFA may resemble a quiz, since they are given three different choices to select between, but it the reflection (or reason) for selection that is in focus, see figure 24, and not the selection itself. This idea of focusing on how elements differ or are like, instead of focusing on correct or wrong answers, was a new way for the students’ problem solving, and resulted in many questions. One teacher was intrigued how, after sitting down with a student and helping them through a couple of triads, a light went on and the student said, “I got it!” It was also interesting how some students really concentrated on a triad and wrote a long detailed explanation even after having been told that they only needed to write a phrase. The next section addresses a number of issues with the RGFA use in the classroom.
Technical issues with RGFA

There were several technical problems with the tool, which were reported to the developers (see D4.5 for a list), and they worked on fixing these, most of which were fixed in time for the classroom use. After several attempts to use the tool over several days, the teachers ran out of time to prepare the exercise, and we had to help with the preparation. Even though there were many frustrations with the tool, the teachers remained enthusiastic!

During the trial researchers needed to adapt to teachers’ school life, their availability, and trying to smooth over the technical issues. There were a lot of challenges, however, as the teachers stayed positive because of their long teaching experience, and confidence on what and how to teach being expressed in their relaxed personality (we take the stress on us), the trial could go on. Despite the challenges the teachers saw the value of the tools and continued.
Issues experienced in the classroom

In addition to the issues that arose while creating/preparing the RGFA activity, the students experienced some issues when doing the activity in the classroom. These are summarised briefly below.

Practical issues

- When the teachers sent the link to the students via Outlook, the student could not click on the link and have it open directly (as they do with other links they have sent). This created confusion and extra work for the teachers and the students.
- With 50 students using the RGFA at the same time, it appeared that the RGFA was rather slow. It is not clear if this was related to the RGFA server or the capacity at the school, but as a high-density technology school this should not be the case.
- We discovered that if the students do not rank one or more items (this is easy to miss with a long list) and they click “save” they do not get a message telling that they need to rank all items, it just appears as if the system is taking a long time. It took us awhile to discover this, but in the meantime led to some frustration over having to wait.
- If the students were kicked out of RGFA, which happened to a few, they had to do start at the beginning and do all triads over again. One of the girls reporting this was working on triad 5 when she was kicked out and she had to start again at number 1; this was very de-motivating for her.
- Two students experienced that the “next” button led them to the triad they just had been answering, and that they had to do a triad three and four times before they were moved to a new triad.
- One of the students found the task so tiresome that he decided to log out.
- Finally, the teachers found that using the RGFA was like a learning activity and it did take some time. It was originally thought it would take 30 minutes, but took almost one and a half hours, thus they thought that one solution would be to give the RGFA as homework instead of as a classroom activity.

Conceptual issues

- Although it might have been difficult to select an element that was different, and to give a reason why the two remaining elements were like, the students managed to do this. What they found more difficult, however, was ranking the other elements against the “different” or “alike” explanations. The main problem was in understanding how to rank elements that do not seem to have anything to do with either the “different” or “alike” reasons. One of the questions from the students was “how do I rank elements that don’t fit into my reasoning?” This element could be ranked “3” as it is equally between the “different” explanation and the “like” explanation, however, this is not obvious. Eventually the teachers explained this to the students, but they still found it difficult.
- Our suggestion is that this need to be made clearer and perhaps there should be a possibility to choose “no relevance”. The teachers themselves wondered how they would distinguish between the students thinking that the element was in between the two explanations and when they thought that the element really had “no relevance” to the others. They felt that this was an important distinction. This needs to be thought through, but one idea might be that when an element is placed in the middle they can check a “no relevance” box beside the element name, and yet another idea would be to give a “no relevance” option along side the “(1)”, “2”, “3”, “4”, and “(5)” options in the ranking menu. Either way, if ticked as “3” or “not relevant”, the students would have to explain their choice.

The analytics

The day after the classroom trial the teacher logged into RGFA to look at the analytics. What they found most interesting was the triad responses, and in particular the reasons why they had selected out one element form the other two (see figure 25).
The teachers used these responses to identify misconceptions, see figure 26, for examples of misconceptions (in Norwegian) that the teachers have identified for triads 1 and 2. For the triad 1 electrons – silicon – AC, they identified the misconceptions: “solar traps, heat pumps, and solar cells are made of a thin layer of silicon”, “there are electrons in silicon that are in solar traps, solar cells and heat pumps”, “electrons and AC have the same energy balance”, “electrons are a type of power”, “silicon does not have anything to do with a closed circuit”, etc.

For the triad 2, solar cells – circular circuit - rechargeable batteries, the teachers identified misconceptions: “solar cells and circular circuits are natural solar energy”, “circular circuit is a type of power”, “solar cells do not have anything to do with a power circuit”, “circular current is electric power generated by magnetism”, etc. The interesting thing is that “circular current” is not a real concept (in Norwegian “sirkelstrøm” sounds really nice and evident), but was made up by one of the teachers who wanted to catch if the students recognised that it was not a real concept.
Figure 26: Example misconceptions identified in the triad responses

The other analytical visualisations see figure 27, are also interesting, but our first impression is that the teacher’s appeared to be less interested (but we have had little time to ask about this as they are focused on misconceptions at this point). For example, the time taken to answer each triad is informative, but it is generally high for the first triads, which might be explained that they are trying to figure out how to do the exercise (this might be combated by the student’s carrying out a training exercise first). The word cloud of responses, while of interest, could be made even more interesting as an informative analytical tool if non-informative words such as “inn” (in), “og” (and) “fordi” (because) have to be taken out, as well as the element words.
The misconceptions that teachers have identified in the RGFA student data, were to be used for the next formative assessment situation, being the OLMlets.

4.3.3 Using OLMlets to Identify Misconceptions

After being introduced to the OLMlets tool (the OLMlets tool is not a NEXT-TELL tool but provided by partner BHAM as external tool which provides data to the OLM), the teachers immediately saw the benefit of the tool for the students, and were interested in using it. Using the misconceptions identified from the RGFA analytics, the teachers developed an OLMlets quiz. This section describes the teacher’s work with OLMlets.

Introduction to the tool use

In order for the teachers to be able to use and prepare their classes for using OLMlets, we held an OLMlets workshop. As a start of the training, the teachers acted as students themselves, and took an OLMlets quiz that had been developed by the researchers, as part of training for teachers/students to understand the functionality of OLMlets. To make it light, the content of the questions were chosen based on a topic that most people have a relation to—dogs (see figure 28).

Based on this hands-on try-out, the teachers were able to understand the concept of feedback on misconceptions.

The exercise – preparation before using OLMlets

The teachers had focus on the student’s understanding of solar energy and its relationship to heat pumps, solar cells, and solar traps. The RGFA task had made the teachers aware of different misconceptions that the students had related to these topics. In the OLMlets, the teachers created multiple-choice questions for the students, linked to the competencies for the unit, with the answer choices one of “right answer”, “wrong
answer”, “misconception”. The misconceptions would be linked to a description of the misconception. This means that the students get feedback as to whether their answer to a question is correct, wrong, or if it is suspected that they hold a certain misconception. With respect to formative assessment, the feedback on misconceptions points the students in a direction of where they need further effort. In that sense the tool is not only a summative assessment tool, but also a formative assessment tool, and gets to the heart of formative assessment: to help the student move towards the goal, feed forwarding, not only looking on what has been done. In addition to the misconceptions found in the RGFA, the questions in the OLMlets are tied to competencies as specified in the OLM, and thus as students answer the OLMlets quiz, the OLM is updating its beliefs about the students’ competencies. This, however, is all that is automated so far.

At present it is not possible to make an overview of questions, competencies and misconceptions, which would link the RGFA and the OLMlets. The different steps of 1) finding misconception, 2) developing related questions, 3) tying the questions answers to misconceptions, all has to be done by hand, with pen and pencil or in a word processing tool at the teachers’ computers. This process does require some planning that could in the future be supported technology, with an integration of the tools.

After developing their questions and answer set, based on their findings in the RGFA analytics, the teachers entered the questions in the OLMlets tool, see figure 29. In the present version of the OLMlets, the misconceptions would have to be reformulated. The OLMlets automatically starts the sentence with “You may believe...” and the teachers would then have to put in the ending of the sentence, such as “soltrappene er laget av titan”, resulting in a mixture of English and Norwegian, see the second and third questions in figure 29.

During question answering the students do not get feedback about whether they answered correct or wrong, however, after the quiz is finished they can access the learning analytics. Students can view a visualisation of the progress, e.g. a bar that shows green, red or a grey colour based on the answers. In addition, they can see if their answer to each of the questions was correct, or not, or if they had a misconception. If the student has answered in such a way that the answer is tied to a misconception, the feedback on the analytics would be, “You might believe that...”. The following 11 misconceptions were used in three different quizzes developed in OLMlets for the Energy of the Future unit:

**Course topic a1: solar cells. (Science)**

1. You may believe that solar traps and heat pumps make electrical power.
2. You may believe that circular power is a type of power.
3. You may believe that solar traps are made of silicon.
4. You may believe that solar traps and heat pumps have silicon with free electrons.
5. You may believe that solar cells are a source of power and that they do not receive energy from the sun.

**Course topic a2: solar traps. (Science)**

1. You may believe that a solar trap collects particles into its water system.
2. You may believe that a solar trap makes electrical power.
3. You may believe that a solar trap saves solar energy in chargeable batteries.

**Course topic b1: explain how heat pumps function. (Science)**

1. You may believe that the copper tubes in the heat pumps transmit electrical power.
2. You may believe that heat pumps make electric power.
3. You may believe that condensation makes electricity.

**Developing the exercise – using OLMlets to develop a quiz**

When ready to develop the OLMlets quiz, the teachers begin in the OLM defining an OLMlets activity and choosing which competencies are to be addressed in the activity. This ties the OLMlets quiz to the competencies already identified in the OLM and enables an automatic updating of the OLM as the students take a quiz. In our case, from earlier work, the competencies already existed in the OLM so the teachers only had to set up an OLMlets activity in the OLM and tie the relevant competencies to this (if the competencies have not been previously defined then they would have to be first defined in the OLM before the OLM activity is set up). The authoring of a quiz in OLMlets takes place through the Course Admin screen, where an activity identified in the OLM is brought into the OLMlets (referred to as a course) and the related competencies (referred to as topics).

The course in OLMlets, see figure 30, was imported via the OLMlets activity defined in the OLM, and comprises ten competencies (called topics in the OLMlets, see figure 30), related to the first, second and the forth competence goals in the Energy for the Future (cf D6.4).
The list of Course Topics based on competencies imported from the OLM, see figure 30, were:

A: carry out experiments with solar cells and solar traps, and explain the main principles for how these function

D: describe the principles and areas of use of some common rechargeable and non-rechargeable batteries and fuel cells

\[ \begin{align*}
    a1: & \text{ solar cells} \\
    a2: & \text{ solar traps} \\
    b1: & \text{ explain how heat pumps function} \\
    b2: & \text{ explain in which contexts heat pumps are used} \\
    d1: & \text{ describe the principles of some common rechargeable batteries} \\
    d2: & \text{ describe the use of some common rechargeable batteries} \\
    d3: & \text{ describe the principles of some common non-rechargeable batteries} \\
    d4: & \text{ describe the use of some common non-rechargeable batteries} 
\end{align*} \]

The teachers planned to make OLMlets related to all ten competencies, but as this was their first time using the OLMlets, they did not realise that each of them would be one quiz, and this was very time consuming, so in this field trial, they only developed three of them. If a student clicked on a topic for which there were no questions, they received “No Questions Found” message. This was not ideal, however, the experience taught us that making one OLMlets activity related to several competencies is not a good idea.

The following are examples of questions (Q#) and possible answers (A) for three of the topics.

**Examples from Course topic a1: solar cells. (Science)**

Q1: solar cells have the same properties as solar traps and heat pumps.
A: no (correct)
A: yes (You may believe that solar traps and heat pumps make electrical power)
A: unsure
Q2: solar cells make power.
   A: yes (correct)
   A: no (incorrect)
   A: unsure

Examples from Course topic a2: solar traps. (Science)
Q1: solar traps collect positive charged particles.
   A: no (correct)
   A: yes (You may believe that a solar trap collects particles into its water system.)
   A: unsure
Q2: a solar trap makes AC
   A: no (correct)
   A: yes (You may believe that a solar trap makes electrical power.)
   A: unsure

Examples from Course topic b1: explain how heat pumps function. (Science)
Q1: in heat pumps the condensation and pressure makes the electric power.
   A: no (correct)
   A: yes (incorrect)
   A: unsure
Q2: the copper tubes in a heat pump lead electrical power.
   A: yes (You may believe that the copper tubes in the heat pumps lead electrical power)
   A: yes (correct)
   A: unsure

The teacher also chooses whether to let the students answer the questions, one and up till five times. When the students have answered all the questions in one of the topics they are presented with, "You have now answered all questions on this topic. If you choose to proceed you will be presented with questions you have seen before. If you do not wish to do this, choose another topic.". Thus, the students are able to look at their learning model, and if they wish take the quiz once more.

Using OLMlets
As there had been so much time wasted on the technical problems with the NEXT-TELL tools there was no classroom time left for using OLMlets during classroom time. Thus, OLMlets was not used in the classroom, which was the original plan, but was used by the students on the day in which there were group presentations of their solar trap projects. The groups were divided into three sessions, where each group would present their project, which were assessed on rubric forms by both the teacher and by the other students (i.e., peer assessment). As the rest of the student groups were left to work on their own, we decided to take the waiting groups, one at a time, to a small group room and have them try the OLMlets tool.
To use the OLMlets tool, the students first choose a course, and in this case they could choose either the training course on dogs, or the OLMlets course (NOTE: the title here was misleading but was a result of the teachers giving the OLMlets activity in the OLM the title OLMlets; they should have named it something like “Energy of the Future quiz”). The session began with the students doing the Dog course (see above) to familiarise themselves with the tool and the analytics. Then they used the OLMlets course, which was related to their Energy of the Future unit. After they had answered the quiz they could look at the visualisations of
their results. The feedback, see figure 31, does not tell the student the correct answer (if they have answered incorrectly), as it aims at helping students to identify what they most need to work on further. The idea is that the quizzes can be used over and over again by the student, in order to see how they are progressing with the material, and if they still have misconceptions after having worked with the unit material.

![Figure 31: Feedback on their quiz results in the OLMlets](image)

**Using the teaching analytics in OLMlets**

OLMlets provides some teaching analytics for the teachers so they can follow the progress of the students. Figure 32 shows the summary presented to the teacher for the Solar cell topic (similar statistics were given for the other topics).

![Figure 32: OLMlets Solar cells statistics show the results from the solar cells course](image)

There were 52 student users assigned to the group for taking the OLMlets courses; this group was put together in the OLM tool (how this was done will be described later in the section on the OLM). The OLMlets statistics, see figure 32, showed that only 20 student took the Solar cell course, 17 students took the Solar trap course, while only 15 students took the heat pump course. The statistics also show that students have done only one of the questions in each of the courses. Part of the explanation for this is that the teachers (and eventually the researchers) had a difficult time in assigning students to the OLMlets, due to technical difficulties. This meant
that some of the students could not log onto the OLMlets. As this was not a classroom activity, the students were pretty much left on their own to do the course, in between doing their group presentation, so it was somewhat unorganised (due to time constraints as mentioned above). Furthermore, when they did get to log in, there was time wasted in finding which topics in a course actually had questions (recall the teachers had chosen too many competencies and only created quizzes for 3 of the 10).

Despite the low number of participating students, the teachers found the results very interesting and helpful. The list of misconceptions that the students held, see figure 26, provides valuable input into their next lesson on this subject. The results in the figure told the teacher that most of the students had understood the topic well, but that there were aspects that should be explained further. For example, that there were student’s that believed that there existed a concept such as circular power, was a surprise. Also the role silicon plays in solar cells, traps and heat pumps was an issue which needed further focus. The results also showed that the students where more confident about the competence of solar cells compared to solar traps and heat pumps.

Technical issues with OLMlets

As mentioned before, time became short for this unit. One of the challenges when teaching natural science (at least in Norway and most likely in other countries) is the amount of material that a teacher has to cover in each unit, given few classroom hours. This means the teachers have to go quickly, instead of letting the students learn less, more thoroughly. Then, when they participate in a research trial like ours, we add extra work on top of that. The little time available is quite crucial in a research project like this, and if the technology is not working, or there is just a minor problem, the time will be eaten up by bug fixing, leaving little time for tool use. This results in little time for actual data collection on the usefulness of a tool like this in the school, which is “integrated into the learning activity” and not just in testing the tools.

We experienced both conceptual challenges (that took time to think through, time we did not have at our disposal) and technical problems (that both frustrated teachers and students, as well as us, and stole time that we never recovered, shortening our access to classroom time).

Developing the OLMlet quizzes was not difficult for the teachers once they had prepared the questions and the answers and misconceptions on paper. These need to be ready to put in to the OLMlets tool, since the tool is not a place to design the test in itself (i.e., it is not really an authoring tool). Also the misconceptions, identified through the RGFA exercise, cannot be imported from the RGFA tool as they need to be identified by the teachers and massaged into answers for questions. This is a conceptual challenge for the teacher. They have to make up a question and an answer that will capture the misconception that the students might have – this in itself was a new way for the teachers to think about questions. They found it intriguing, however, it took a lot of time that we had not planned for.

During the OLMlets session with the students we again were at the disposition of the teachers, and during this stage we also met technical difficulties, as some of the students in the class were not able to log into the OLMlets tool. This was related to the awkward nature of having to have the students create an account and log into CAS, and then OLM (logging out immediately), so that the teacher could see their name in a list in OLM, and then assign them to OLMlets. If the students had forgotten to log into the OLM (which many of them did as this was done outside of class on their own time), then the teacher did not see them in the list and could not assign them to the OLMlets activity. In addition, their names sometimes appeared twice in the list and the teacher was not sure which was the correct one to include in the group. In summary, the clumsy procedure was:

1. Students sign up for an account in CAS.
2. Students sign in to CAS.
3. Students sign in to OLM.
4. Students log out of OLM.
5. Teachers log in to CAS.
6. Teachers log in to OLM.
7. Teachers assign the student to their group.
8. Teachers update the group going to take the OLMlets.
9. Then students could sign into OLMlets.

As one can imagine, this resulted in much wasted time, and frustration especially as this was discovered the evening before the OLMlets session and we were trying to solve it during the group presentations of their projects. Once more we were blessed with having teachers on top of the situation, whatever unexpected that was happening.

**Issues experienced in the classroom**

In addition to the issues that arose while creating the OLMlets activity, the students experienced some issues when doing the activity in the classroom. These are summarised briefly below.

It was immediately clear that it was difficult to understand how to start the quiz. To start the quiz the student had to press the button, but it was not clear for the students. This may have been the reason for the low participation rate in the OLMlets. The students were sitting in many different rooms when they were doing the OLMlets, and the teachers (nor the researchers) were able to help them all.

The researchers were only able to observe some students doing the OLMlets. We observed how quickly they understood the OLMlets when they had been guided to enter the quiz. The reason for this may be that the quiz looks like other online quizzes/tests. The main problem came when they were finished. If the teachers had made it available for them to take the OLMlets several times, they would just start over again on a question they already had answered. This was confusing for them, and they would ask when the quiz would stop and why it seemed like they were doing the quiz over and over again. The researchers guided the students in this issue, and explained to them that they were able to stop whenever they wished. We also explained that there was a reason for being able to take the quiz over again, perhaps at a later time after they had worked with the material for which they had identified misconceptions or wrong answers. We explained that this was a method of formative assessment. Since they are able to take the quiz, look at their answers, and see that some of their answers may have been misconceptions; they should know where to focus their efforts. From our earlier work on developing the Norwegian national test for English (BITE-IT project), we know that students should be able to know how many questions they have to answer; such awareness has turned out to be very important. When taking a paper quiz/test we know that students look at the number of questions when they are handed a test and pace themselves accordingly. Even on-line surveys generally let you know that you are answering question 6 of 10 (6/10, for example).

Another issue was to understand that they had to take all the courses. Also finding back to the different courses was difficult. The OLMlets is not part of the NEXT-TELL tool package, and thus is not a tool that was student-ready-to-use for 16 years old students. The students had to do the following steps:

1. Enter the OLMlets.
2. Find the course containing questions (first the dog course, then the OLMlets course).
3. Understand how to start the course.
4. Understand when to stop, in order to check feedback.
5. Finding feedback.
6. Finding the next courses.

When finishing the questions in course students were able to enter the visualisation of their results. This was not something they did on their own, but something that we had to guide them to. The group of students being observed by the researchers found the visualisations very interesting. Looking at the misconceptions they held, made them want to take the quiz once more. We had them do so, so that they would see that the feedback visualisation bar was updated.

**Practical issues**

In addition to technical issues, also practical issues where detected:

- When the teachers were making the OLMlets quiz they needed to make a quiz for all the competencies, referred to as topics, which had been assigned to the activity in the OLM. It was not possible to delete them and the students had to click all the topics in order to find the out which ones had quizzes (only 3 of the 10 topics had quizzes).
- The teachers were not able to find and assign all their students to the OLMlets. The reason for this was that the students had not signed into OLM, though they had made a user account.
- Some of the students were not able to enter the test, though they had made a user account. The reason for this was that they had not signed into OLM.
- The students had problem with understanding how to start the courses. Entering the course, they found a text, and a small "Q". It was not clear that this was how to start the quiz.
- The students did not understand that they could get feedback and visualization of their progress.

Conceptual issues
Taking a course (e.g., the dog course) in order to let the students understand the concept, before the course on Solar cells, solar traps and heat pumps was very important. Carrying out this course first made the students able to concentrate on the unit course (OLMlets), and learn and reflect on the theme, rather than having to solve user issues such as understanding what to do next and how to “read” the tool.

The OLMlets analytics
After the students had done the OLMlets courses the teachers entered to look at the results. What they found most interesting was the overall information about all the students, but also looking at single students was of interest. The visualisation gave quick information about the students. Sitting together the teachers could discuss the findings and decide what to emphasis when teaching the subject further. The teachers stressed how such visual information about the class and single students was very time saving, being a quick way of getting information as to where students had misconceptions regarding the topic, and where to focus further teaching and activities.

As there was not much time left in the unit, and the students had already had their lessons on the topic, this showed that the OLMlets should be a part of the teaching as soon as possible, in fact as soon at they have been introduced for the topic. The quick quiz, with quick information, makes it easier for the teachers, as well as the students themselves, to know where to focus for further work on the topic. The plan is to use the OLMlets from the beginning of the unit and as homework.

This means that RGFA should be ready for the first lesson, and the OLMlets should be ready for the second lesson. Again, the main problem is that this does take time to process the information coming out of the RGFA analytics and preparing the OLMlets. Although the teachers have a head start for next year (they can reuse the RGFA elements and tuplets and the OLMlets quizzes that exist) we should try to find ways of streamlining this process—and at least have the tools functioning technically! This is worth effort as they stress this as very useful.

The experience from the RGFA showed that the best suggestion would be to focus on just a few, but important elements within each of the competence goals. Too many terms in the RGFA, as done in this trial is too thorough, and perhaps tiresome. The RGFA should then just be a trigger for new misconceptions that the teachers can then work into the OLMlets. This means that both tools would need to allow teachers to edit exiting quizzes, something that is not possible at the moment of writing (and as OLMlets is not a Next-Tell tool, will not happen in the project timeframe).

4.3.4 Ending with NEXT-TELL’s Open Learner Model (OLM)
Having worked with the RGFA and the OLMlets, the students were ready to look at the Open Learner Model, the OLM tool. Since the students were doing an experiment in the Energy for the Future unit, they also had to present their experiment. In the experiment the student had to heat up a bottle of water using a solar trap. The students were divided into groups when conducting the experiment. While the groups presented their project results, the students were each assessed by their peers, and by both teachers. A paper rubric was used for the peer and teacher assessments.
Exercise with a Norwegian Rubric (assessment sheet)

Rubrics assessments are not directly, but conceptually, part of the OLM. Since a rubric system was not available when conducting the trial, we thought that we could enter the paper rubrics that were used into the OLM through the forms. This proved difficult. Still it is important to describe the assessment activity, as it will inform a future NEXT-TELL tool.

In the rubric exercise the students had to write down their names, the name of the assessed group, and their comments regarding what was good, what could be better, participation of the group members, and the grades, see figure 33. Looking at the feedback in the rubrics, we see that the feedback is not very to the point, and most of the groups have received a very good grade.

<table>
<thead>
<tr>
<th>What is good</th>
<th>What could be better</th>
<th>Participation of the group members</th>
<th>Assessment grades</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good overview, understand the topic.</td>
<td></td>
<td></td>
<td>5+</td>
</tr>
<tr>
<td>Speaks loudly, Nice with film.</td>
<td></td>
<td></td>
<td>5-</td>
</tr>
<tr>
<td>Speaks loud and clear. Some without manuscript. Good facts.</td>
<td>All on the group should contribute. This was showing. (Girls name) has been working really hard. (I can confirm this) Others should contribute more.</td>
<td>Girls name: 5/6 The rest 4-5</td>
<td>5/4</td>
</tr>
<tr>
<td>Good facts, good presentation, Speaks loud and clear</td>
<td>More interesting facts.</td>
<td>It looks like all have contributed about the same.</td>
<td>5/4</td>
</tr>
<tr>
<td>Knew all by heart.</td>
<td>Some details should be made simpler.</td>
<td>Good participation.</td>
<td>5</td>
</tr>
<tr>
<td>Great content.</td>
<td>Some unclear statements.</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Everything was very good, and they were really good to explain.</td>
<td>Everybody should have been talking as much as the others.</td>
<td></td>
<td>5+</td>
</tr>
<tr>
<td>Good facts.</td>
<td>Everybody should have been talking as much as the others.</td>
<td></td>
<td>5-</td>
</tr>
<tr>
<td>Talking loud and clear.</td>
<td>Should have been more serious.</td>
<td></td>
<td>4+</td>
</tr>
<tr>
<td>Everyone was talking as much as the others, and with out manuscript.</td>
<td>Should talk louder.</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>All of them were talking. Good explanations. Copyous.</td>
<td>Could talk louder.</td>
<td></td>
<td>4+</td>
</tr>
</tbody>
</table>

Figure 33: Snapshot of the Norwegian Rubric: Assessment sheet with a peer assessment

Rubrics like these are used in a variety of formats in Norwegian classrooms, and a search of the Internet turns up many different templates/examples in use. Google docs are often used for the peer assessment. When we asked our teacher why the rubrics were not done using on a computer, they explained that they felt this made the students look at the computers, instead of the presenters. Using pen and paper forced them to look at the presentations, instead of hiding behind the computer. We wonder if using a tablet might be acceptable and be a good solution to get data quicker into the teachers’ files, since now the teachers had to scan the sheets in order to store such rubric assessments.

Looking at the peer assessment sheets in order to see how these rubrics could fit into the OLM tool as it is now, turned out to be difficult. As the OLM is organised around to competencies and activities that link these competencies, we suggested that skills related to presentation would have to be added to the OLM competence set.
In summary, the reasons for the difficulties in getting these rubrics into the OLM format include:

- The first question that was raised was what kinds of competencies are being assessed? It is both the format, being the presentation, and the content being the solar trap, focusing on what was good, what could be better, the participation in the groups, and grades. So how are these elements transformed into competencies? First they are related to one competence that was already in the OLM: solar traps. But it was also related to competencies that are not one of the competence goals in the natural science curricula, though being a very important 21st century skill elements: presentation and collaboration. After identifying the competence, and adding the competence in the OLM, we could then tie the competence to an activity. Since peer-and self-assessment activities are activities that can be done directly in OLM, we could transfer the information from the rubrics to the peer assessment forms in OLM. Still, the format in OLM with stars and competencies, made it difficult to transform the students feedback in the existing format (see figure 34).

![Figure 34: OLM’s peer assessment](image)

- Looking at the peer-assessment interface (figure 34) you will see the title Competency. Under this, you see the competency “Work effort” (arbeidsinnsats), though what the students were to assess was what was good, what could be better, the participation in the groups, and grades. These wordings do not fit in as competencies, and can therefore not be added to the list of competencies. Hence, the original Norwegian rubric could not be translated into the OLM.

In addition to the students, the teachers also filled out the rubrics. The teachers quickly noted relevant comments, during the different presentations, often about individual students as well. Thus, although the groups that had been doing the experiment and presentation together, the teachers would still distinguish between the different students in the group, sometimes giving them different marks on their work. Thus,

- There was also a problem that on paper a “group” could be assessed and in the OLM one has to assess a single student – this would be cumbersome if this had to repeated for each student. Thus, it would be desirable to have a way of entering the assessment for several students on one screen (we have made such a suggestion in our design suggestions for a rubrics tool).
As with the students’ Norwegian rubrics, we were not able to put the feedback/feedforward, as it is, into the OLM.

Using the OLM when planning assessment

When planning and making the quiz in the OLMlets (see above), the teachers had to enter the OLM. To understand what, how, and why the teachers were to use OLM, the teachers participated in a workshop. The workshop had the following goals:

Get to know the Open Learner Model tool by:

1. Understanding the use of OLM, and what to put into OLM: competencies, activities, and students.
2. Understanding how the OLM functions; its features and its functionality (how to add competencies and activities)
3. Understanding the reason why the OLM requires what it does, and the information that teachers and students can get from using the tool

In the following text these different goals will be described in order to show how they were introduced, the teachers trained for using the OLM.

Task 1 and 2. The use of OLM, and understanding how the OLM functions

The first task for the teachers was to learn to:

- Define competence goals
- Define activities
- Assign students

This lead to an immediate discussion about:

- Where was the most meaningful place to start?
- How should one start when to enter data in the OLM?

Starting with the activities could be one solution, but after some discussion, staring with the competencies seemed to be the best thing to do, since this is how the teachers work (see D2.4). Also if they started by filling in the activities, they would need to stop and add competencies as they are needed to complete the activity definition.

Thus the teachers decided to add the six competencies addressed in the Energy for the Future into OLM. These are:

The aims for the education are that the pupil shall be able to

- carry out experiments with solar cells and solar traps and explain the main principles for how these function
- explain how heat pumps function, and in which contexts heat pumps are used
- explain what redox reactions are, carry out experiments with combustion, galvanic elements and electrolysis and elaborate on the results
- describe the principles and areas of use of some common rechargeable and non-rechargeable batteries and fuel cells
- elaborate on different uses of biomass as an energy source
- elaborate on hydrogen as an energy carrier

<table>
<thead>
<tr>
<th>Student names</th>
<th>Marshmallows, short wave radiation. Satellite dish in aluminium. Foil front. Snow. Why the start time. Marshmallows in focus. Max 102.3 C</th>
<th>Sources (-) Rain (-)</th>
<th>4</th>
</tr>
</thead>
</table>

Table 7: Teacher’s assessment in Norwegian rubrics
Looking at the national competencies it turned out that the teachers found it problematic to put the competencies as listed into OLM. The reason for this is because the competencies listed are really combination of activities and knowledge building: carry out experiments and explain, describe or elaborate principles and functions. This understanding of competencies as a combination of skills and knowledge, and also attitudes is not unusual. Still, the teachers became confused as to whether to place the skills, described as an activity (in the curricula), as: 1. a competence or, 2. an activity. The teachers are used to think about competence, but not necessary dividing them into skills or knowledge. What turns out even more difficult for them is the notion of activity being separated from competence, since doing something is also a competence. Furthermore, one researcher opened a discussion as to whether the skills should be divorced from the content (e.g., have the competence “explain” and not “explain sun traps”, and rather have “sun traps” as a sub-competence). This was too much for the teachers at this point (although it came up again when the competencies collaboration and presentation were relevant).

In the end the teachers identified the following competencies for the Energy of the Future unit:

1. to experiment with solar cells
2. to experiment with solar traps
3. to explain the main principles of how solar cells function
4. to explain the main principles of how solar traps function
5. to explain how heat pumps function
6. to explain in which contexts heat pumps are used
7. to explain what redox reactions are
8. to experiment with combustion
9. to experiment with galvanic elements
10. to experiment with electrolysis
11. to elaborate on the results of experiment with combustion
12. to elaborate on the results of experiment with galvanic elements
13. to elaborate on the results of experiment with electrolysis
14. to describe the principles of some common rechargeable batteries
15. to describe the principles of some non-rechargeable batteries
16. to describe the principles of fuel cells
17. to describe the use of some common rechargeable batteries
18. to describe the use of some common non-rechargeable batteries
19. to describe the use of fuel cells
20. to elaborate on different uses of biomass as an energy source
21. elaborate on hydrogen as an energy carrier

How to arrange these 21 competencies was the next discussion.

The national curricula competencies that are put into OLM where divided into sub-competencies. Though the first list was taken directly from the original competence list. The teachers now did their own reformulation of the sub-competencies in the following way:

A. carry out experiments with solar cells and solar traps and explain the main principles for how these function
   a1. solar cells
   a2. solar traps

B. explain how heat pumps function, and in which contexts heat pumps are used
   b1. explain how heat pumps function
   b2. to explain in which contexts heat pumps are used

C. explain what redox reactions are, carry out experiments with combustion, galvanic elements and electrolysis and elaborate on the results
   c1. explain what redox reactions are
   c2. explain what redox combustion are
   c3. explain how galvanic elements function
   c4. explain what happens in electrolysis

D. describe the principles and areas of use of some common rechargeable and non-rechargeable batteries and fuel cells
   d1. describe how some common rechargeable batteries function
   d2. describe the use of some rechargeable batteries
   d3. describe how non-rechargeable batteries function
   d4. describe the use of non-rechargeable batteries
   d5. describe how fuel cells function
   d6. describe the use of fuel cells

E. elaborate on different uses of biomass as an energy source
F. elaborate on hydrogen as an energy carrier

Making the national curricula competencies into sub competencies is still not a common way of thinking for the Norwegian teachers. In Norway it is most common to split competencies into assessment criteria according to Characteristics of achievement. The teachers themselves define these assessment criteria, since the idea is to make these criteria as local as possible for the students. For instance, according to the regulations of the Education Act, students should know what is being emphasized in the assessment. An important principle of formative assessment is to make it understandable for the student what is expected that they learn. If it is clear, it can be easier to adjust own learning. Such characteristics can contribute to assessing being perceived as fairer. Characteristics of achievement with descriptions of competencies at various levels may be most appropriate to use, though criteria may not be suited in all situations. Still, white paper 31 (2007-2008) from the Norwegian government states that the curriculum does not provide enough guidance for schools and teachers to plan and conduct optimal training towards the competencies, or to assess students’ level of achievement. Therefore, The Directorate of Education has developed a tutorial to support the local assessment efforts and the national focus on assessment, and the teacher can find guidelines with examples to use or further develop. Still, because the examples in the manuals are local examples of characteristics, the achievement levels differ, and may not show the situation in that area (http://www.udir.no/Vurdering-for-
Our teachers were used to working with criteria and level of achievement, therefore splitting competencies into sub-competencies was somewhat confusing for them.

Looking at the tree of competencies (figure 36) at this point, it now shows additional sub-competencies added sub-competencies a2 and c1:

A. carry out experiments with solar cells and solar traps and explain the main principles for how these function
   a1. solar cells
   a2. solar traps
      • Uses simple analogy (e.g. Solar in the face) to explain that light waves get materials, molecules and electrons to oscillate.
      • Explains how to determine the efficiency (effectiveness) of a solar trap.
      • Are able to describe different types of solar traps.
      • Compare the behaviour, and the effect of different solar traps.

B. explain what redox reactions are, carry out experiments with combustion, galvanic elements and electrolysis and elaborate on the results
   c1. explain what redox reactions are
      • Combustion of magnesium.

When the teachers finally managed to decide on which competencies to use, they had to formulate the unit and its activities in their teaching, via the My Teaching screen in the OLM (see figure 37). First a new subject is identified, in our case Energy for the Future. Then they discovered that they had to add a unit to the subject, so after some discussion the teachers found out that what they have done, would not be correct. They should rather add the subject Natural Science and then add the unit Energy for the Future, under this subject. Having done so they are able to add activities to the unit. You can see their struggle in figure 37, as there are two subjects (energy for framtiden AND naturfag) still listed. The one they continued with, however, is:
- Subject -> Natural Science
  - Unit -> Energy for the Future

This way of thinking suits their practice. This practice of planning the activities, based on the competence goals, found in the units of their teaching subject is forced its through by the way of how the documents that describes the national curricula is formulated, but in the OLM they start with the Subject as in figure 37.

- Natural Curricula
  - Subject -> Natural Science
    - Unit -> Energy for the Future
      - Competences (knowledge and skills - activities)

The national curricula as a document, and therefore also a tool for the teachers to use in order to plan their teaching and what is going to be assessed, is forming their practice. A tool such as the OLM, where such a practise as formulating competencies and activities tied to subjects and units will be best integrated if it suits these steps, rather than having the teachers to replan their curricula document to have it fit the tool.

Once the teachers understand how to define the competencies in the OLM, adding activities was easier. The teacher’s had already had a discussion about the different activities while deciding how to add the competencies from the national curricula into the OLM. The activities they decided to add, see figure 37, were:

- A1: experiments with solar cells
- A2: experiments with solar traps
- A3: experiments with combustion
- A4: experiments with galvanic elements
- A5: experiments with electrolysis

In addition to the list of experiments found in the national curricula, the teachers also planned other activities, such as a:

- peer-assessment
- self-assessment
- OLMlets (The OLMlets activity as described earlier)

After defining the activities, the teachers still had to tie the relevant competencies to be assessed in the different activities, see figure 38.
Figure 38 shows how the teachers add competencies to their activities. In the activity, *experiments with solar cells*, the teachers have added the competence *solar cells*. They find this by clicking through the tree of competencies that they themselves have added to OLM. Still, this illustrates yet another problem. The competence should have been formulated as a “can do” competence (as the CEFR does for English as a foreign language) so that they make sense when read in another circumstance. For example, the skill meter in the OLM (see D4.3) shows how a student progresses towards a goal, the competence *solar cells*, does not imply what is known about solar cells.

In contrast to defining activities, and how this fits the practice of dividing the subject into units, and the units into activities, there are still issues on how fit the idea of assessment criteria and the Characteristics of achievement levels in the OLM. This does not only manifest itself when the teachers are discussing how to add competencies, but also when tying these competencies to the activities.

After adding competencies to the activities, they also had to tie students, as members in a group, to the activities. First the teachers had to make student groups by adding a group, and then adding students to the group. In order not to pollute the data, the teachers made one group with their real students (Nordahl Grieg ST1), and one group for the researchers (Bentes test gruppe). One of the main problems with adding students was that ALL students that signed up for a CAS account and logged into the OLM, end up in a student list containing *all students* who had signed up for an account. This was a long list that included student and researchers from England, Germany, Denmark and Norway. This is a LONG list for teachers to browse and find their own students. It would be much better if to group the list by class (or school), thus saving precious time for the teachers. This became an issue in the project with discussions about functionality, user interface, and ethics. This issue will be solved within a short time.

In summary, the trial showed that adding activities was not difficult, but the teachers struggled when having to add competencies. This is due to the notion of separating activities from competencies. Competencies are often defined as skills, knowledge and attitudes. The idea of separating what is known from what is done was difficult. This is addressed in a later section.
Task 3. Understanding the reason why the OLM requires what it does, and the information that teachers and students can get from using the tool

Teachers would like to understand why they should do something. Why should teachers do this extra work of defining competencies and tying them to activities? They already know the competencies to teach, and they already know the activities to do. So the big question is, why define them in a tool, when they are already in a book, and the assessment is already documented. In Norwegian schools the idea of formatative assessment is formulated in the Regulations of the Education Act. All students have the right to be assessed. This section addresses these issues, particular to the Norwegian situation.

The purpose of assessment is to promote learning and to determine the competence of the student. Still, what is being assessed must be known and accessible to the students, and information should be given continuously and systematically. Assessments shall provide each student with information about their competence with respect to the competence aims in the curriculum, in order to guide the student on how s/he can improve the competence in the subject. The national curricula are oriented towards what students should be able to master, with goals for student competence. Competence goals are placed within the context of school-level and overarching key areas that collectively describe what the subject is all about. As mentioned, the curricula need to be tailored locally, therefore it is stressed as important that the curricula is competency-based and not content-based. As the curricula do not describe learning content and working methods at various grades, as previously (L97 and R94), it is necessary that the teacher select content, activities, and practices that develop students’ skills. It is stressed that by doing so, it will become visible for students what they need to master, in order to develop their skills.

This means that teachers sometimes have to work with content, competencies, and achievement criteria. Choosing what content to teach, will then have to be based both on students' prior knowledge and bring students closer to the target competencies (http://www.udir.no/Lareplaner/Veiledninger-til-LK06/Naturfag/Naturfag/Artikler-niva-1/Kunnskapsoffret-og-vurdering/).

To further explain how the teachers work, we illustrate this with a rubric that has been developed for Science in Norway. Figure 39 shows a fine-tuned competence grid that includes the assessment criteria and its Characteristics of achievement used by our teachers.

![Figure 39: Assessment Criteria for Natural Science](image-url)
The right side of figure 39 shows some of the assessment criteria for Science in General. The first column lists the goals and the next three columns list the achievement levels with their criteria. In the figure there are three general goals (reading down column 1): 1) Theory, models, and terms. 2) Communication, and 3) Practise, experiments. Reading across a row one can find the assessment criteria for achieving Low, Medium, or Exceptional competence. This is easier to illustrate with a particular local competence from the Energy for the Future unit as specified by our teachers.

The assessment criteria table used by the teachers, see figure 39, shows what teachers use in order to assess their students. This is an important tool for them to nuance the different elements in the assessment situation. Looking at the first table (on the left) shows the activity in the Energy for the Future (Energi for fremtiden) unit that is being assessed, and the achievement criteria. The first column identifies the competence goal being assessed, Gjør rede for hvordan solfanere viker (Explain how sun traps work). The next three columns describe how to recognise achievement levels Low (Lav), Medium (Nokså god), High (Meget god and framragende)

For each competence level criteria to be met are listed. For example under Nokså good kompetanse (Middle) the criteria is “can describe different types of sun traps”, while under Meget god (Very good and Exceptional) the criteria is “Compares how it works and the effect of different sun traps” and “Describe how one can decide the effectiveness of a sun trap”. In this way the students are aware of how much they need to understand and be able to describe or explain to reach each level of achievement.

This illustrates how the Norwegian regulations, as described before, are being used in practise in schools. Since this practice is both in actual use, and according to rules and regulations, we think that we can develop such rubrics in a standalone tool or in an OLM form that can feed information directly into the OLM.

Looking at the OLM it is clear that the OLM putting in competencies are possible, though not an easy task given how the OLM is functioning at the moment. Also the focus of dividing the competencies into local criteria is also not a just-to-fill-in-task for the teachers. It will be interesting how easy this will be for the next unit the teachers are planning for the upcoming trial in fall 2013, now that they have experience.

There are still other issues in the curriculum that the OLM will be supporting. The curriculum focuses on individual-based assessment. This means that the assessment of individual students should not be class-related. What should be considered is the quality of the individual student’s results / performance against competency goals of the curricula at the time the assessment is given. As students will, in varying degrees, achieve the stated competency goals, this is where the OLM is perfect.

If the OLM could be more suited for Norwegian curricula plans, which is extremely specific about Norwegian teacher’s practises, the OLM would be of great help for doing the individual-based assessment. Other relevant issues in Norwegian assessment regulations would be on-the-go-assessment (underveisvurdering) and feedforward for formative assessment. This on-the-go-assessment is continuous and never finished, as is the OLM models, and should say something about where the student are at a given time and should also point out what the student should do in order to go where s/he should be. According to Norwegian regulations, marks can be given from 8th grade. The given mark should be related to what is expected from the student at the time the mark is given. Throughout the students’ education, all students, as part of the continuous assessment, get half-year-assessment that should both show the competence of the student in relation to the competence goals in the curriculum when the assessment is given, and guide on how the student can improve their competence in the subject for the final one-year-assessment. The OLM, as is, would be perfect for supporting this:

<table>
<thead>
<tr>
<th>Competence goals</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview of assessment activities</td>
<td>✓</td>
</tr>
<tr>
<td>Assessment criteria</td>
<td></td>
</tr>
<tr>
<td>Characteristics of achievement levels.</td>
<td></td>
</tr>
<tr>
<td>Individual-based assessment</td>
<td>✓</td>
</tr>
<tr>
<td>Formative assessment -&gt; Feed forward</td>
<td></td>
</tr>
</tbody>
</table>

© NEXT-TELL consortium: all rights reserved
Examples of formative assessment activities given by the authorities, which in the future could be supported by an OLM:

- dialogue with students in class
- student conferences
- feedback/forward on presentations, performances, tests, exercises, laboratory work, assignments, projects etc.
- portfolios documenting process and development
- logs
- plans with learning goals and activities
- self- and peer-assessment
- parent meetings
- half-year assessment

(retrieved from: http://www.udir.no/Lareplaner/Veiledninger-til-LK06/Naturfag/Naturfag/Artikler-niva-1/Kunnskapsofsett-og-vurdering/)

With these requirements placed on them, and knowing that teachers’ practices should contain elements of formative assessment and feed forward, the idea of how OLM could be of help was not difficult to see for our teachers. There are, however, elements that are regulated by national curriculum that could be better supported in the future.

The Self- and Peer-Assessment

Although the students had done a peer-assessment activity on paper during the Energy for the Future, entering this assessment directly into the OLM would be preferable, as it would feed into the student models.

As shown in Figure 40 the teachers’ assessments were tied to the students’ skills and knowledge about Solar traps. If this assessment situation could have been done directly on iPads/PC, it would also have fed directly into the OLM. We tried to do so using the existing forms in the OLM, but it was not possible as, for example, the elements of what was good, could be better and the degree of participation, did not fit the structure of the editable form. Thus, one suggestion to consider is to build a flexible rubric entry form in the OLM. Another approach would be to build a standalone rubric tool that fed its data through an API to the OLM. This is an issue currently under discussion in the project.

The teachers had prepared the following questions for the self-assessment:

- How did the group function?
- Describe the performance of the group members: Was the work equally divided?
- Describe your work.

These questions did not fit into the OLM form structure either. As a question would need to be tied to a competence, it was not clear how to do so. The questions actually address “collaboration”, a transversal skill, which at this point had not been defined. Thus, we added “collaboration” to the competence list and added two sub-competencies:

a) My work effort (arbeidsinnsats?) (see figure 40 where they rate their effort and comment).

b) My peers work effort (arbeidsinnsats?) (see figure 41 where they rate their peer’s effort and comment).
Using the OLM in the classroom

After a short introduction to OLM the students were told to log into OLM, and do the peer- and self-assessments. As there was not much time to both train the students and to help them understand the use of OLM, the tool was not used in a good way and the data has not been analysed. We decided that the session should rather be looked upon as a training session. Its use would really only be interesting if they had used the tool throughout the unit, and not only as a short activity in the last class session. Next year the teachers make sure that the students get enough time to learn and understand the tool. To fully use the tool the students would need time to investigate it, and understand their model. During the next school year, the OLM will be used to track competence development within the units Energy for the Future and Nutrition and Health.

Technical issues with OLM

There were no critical technical issues regarding the use of OLM. The main issue was if students had been assigned to the OLM before the session started, since teachers would not be able to assign them to OLMlets if they had not been logged in on beforehand (see section under OLMlets tool and also below).
Practical issues

- The teachers were not able to assign their students to the OLM themselves, resulting in some students that had not made an account in CAS, and/or had not logged into the OLM after making the account, not being able to use the OLMlets and/or OLM. This created confusion and extra work for the teachers and the students.

Conceptual issues

- Every assessment situation has to be tied to a competence. Some competencies, such as collaboration are not a subject-oriented competence, but rather a transversal competence, and it is confusing how to tie such competencies to a subject. For example, one teacher asked “How do I get the self- and peer assessment tied to natural science?”.
- Using peer and self-assessment is a new way of assessing for most of the students. They need practice to assess peers.
- Do stars fit into a formative assessment method? What do peers understand from this?
- The OLM does not fit the Norwegian assessment system with its local assessment criteria and characteristics of achievement levels.

The analytics

The teachers had little time to look at the OLM results, but quickly viewed single students (it was interesting as they searched for students that they were curious about and had expectations about), and the results of the whole group. As a conclusion, the results showed interesting findings both to confirm student’s knowledge, but also making it concrete as to where the whole class is missing out on knowledge.

4.3.5 Summarizing the RGFA-OLMlets-OLM Method

Based on the experience from the Norwegian teachers’ use of RGFA, OLMlets, and the OLM as a formative assessment method, we preliminarily suggest the following:

Training exercise RGFA

1. Teachers use training exercise
2. Develop the exercise (teacher(s))
3. Select competence goal(s) to investigate
4. Identify an overall theme for the exercise
5. Think about what aspects of this theme should be investigated
6. Identify elements related to the theme
7. Decide if the elements should be represented as a term, picture, or video
8. Develop the triads

Classroom activity

8. Students create a user name and password in CAS
9. Students use training exercise (link from teacher)
10. Students carry out the exercise (link from teacher)

Teacher analysis

11. Use the analytics to get an overview of the exercise
12. Use the triad responses to identify the reasons given for “different” and “like”
13. Detect and sort students misconceptions

Formative use of results

14. Teach towards the findings, helping student develop their understanding
15. Use the misconceptions as the basis for the questions in the OLMlets tool

Training exercise OLMlets

1. Teachers use training exercise
   Develop the exercise (teacher(s))
   2. Define competence goals in OLM
   3. Assign students to student group
   4. Define subject, unit and activity
   5. Tie activity to competencies (each competence becomes a course)
   6. Make questions
   7. Tie questions to misconceptions
   8. Develop OLMlets

Classroom activity

9. Students use training exercise (sign in to OLMlets)
10. Students carry out the exercise (sign in to OLMlets)

Teacher analysis

11. Use the analytics to get an overview of the exercise
12. Use the responses to identify single students and group of students having misconceptions

Formative use of results

13. Teach towards the findings, helping student develop their understanding

Training exercise OLM

1. Teachers use OLM to define competencies and activities

Classroom activity

2. Students log into OLM
3. Students use OLM to identify competence
4. Students carry out self- and peer-assessment

Teacher analysis

5. Use the analytics to get an overview of competencies
6. Detect and sort students competencies

Formative use of results

7. Teach towards the findings, helping student develop their understanding
8. Use the competencies as the basis for further teaching

There are issues as described in this report that should have been part of the method, but as the technology did not enable this (e.g., rubrics, defining local assessment criteria and characteristics of achievement level), these were not yet included in the method.

The first step, teachers doing the training exercise, is very important. The teachers had the training materials for describing how to use the tool, but this was by far not enough. So, after the RGFA trial we created a training exercise about dogs. The teachers tested this and were in agreement that the best would be for teachers to first do the training exercise before using the training materials/documentation to develop an exercise. This was also an issue with the OLMlets. This is very important because one needs to have a good understanding of where one is headed when developing a tool for use by students. The training exercise should also be used for students. We have communicated this to WP7 Training.

Regarding the tools, RGFA, OLMlets and OLM, we need to investigate the time element around the use of the tools and whether or not the teachers find a benefit in using the tools, as there is a fine line between the time
they have available and the benefit in investing time in using the tools. For example, if exercises and the information can be reused or shared and edited (which it cannot be at the moment) then it would increase its benefit and attractiveness.

In summary, the use of the tools in this combination was very interesting and rewarding. We should note that in addition to the exercises being a new way of thinking for the students, the idea of a tool that gives teachers the ability to find misconceptions in students’ understanding was also a new way of approaching the competence goals for the teachers. Their and our first impressions, despite the technical issues, have been positive and we are all excited about the use the tools in a new unit, for the coming trial in fall 2013. Furthermore, the school leadership would like these teachers to share their method with other teachers, both STEM and other subject teachers, in the future.

4.4 Singapore: Developing ICT-enriched Instructions to Support Students’ Learning

The next two sections provide an overview of NEXT-TELL’s work in two ICT-enriched schools in the non-European education system of Singapore.

Jurong Secondary School (http://www.jurongsec.moe.edu.sg/) is a public high school and Hwa Chong Institute (HCI, http://www.hwachong.edu.sg/) is a large private high school and college both are located in Singapore. JSS and HCI are among Singapore’s “Future Schools”, selected by the Ministry of Education to participate in innovation of ICT use in schools. The following sections describe the research with teachers interested in enhancing students’ learning with specific instructional methods (e.g., problem based learning, PBL) and use of ICT which should support the respective learning processes.

4.4.1 Supporting Problem-based Learning with e-Assessment

NEXT-TELL is cooperating with the head teacher in science of the Jurong Secondary School, and the Ministry of Education, to trial advanced learning technologies for fostering 21C learning. The subject matter focus is biology, the research focus is on problem based learning and the role of question development in the PBL process. The study will be conducted during August, initially involving one class (about 30 students), taught by the head teacher. The PBL model currently in use at JSS has these main steps:

- Step 1: Meeting the Problem
- Step 2: Problem Analysis
- Step 3: Discovery & Reporting
- Step 4: Problem Resolution
- Step 5: Integration & Evaluation

Steps 1 and 2 are conducted in the classroom, moderated by the teacher. The outcome of the problem analysis (Step 2) is captured as a Google Spreadsheet (see figure 42):
Step 3 is usually done in form of homework (e.g., involving web searches). Each team presents its solution in class after 5-7 days of working on it (Step 3 and 4) and there is an expectation that students compare their solutions across teams (Step 5), perhaps coming to an integrated solution that builds on ideas from multiple teams.

Research Topics

From a science education point of view, the quality of students’ questions (“learning issues”) generated during Step 2 is a key concern. There is clear evidence that the quality of questions affects the quality and extent of students’ learning. While it is to some extent understood what to look for in the questions (question quality criteria), it is less well understood how to facilitate the (collaborative) question generation process, that is the problem analysis. The teacher is interested to find out more about how to facilitate these processes and therefore puts the research question:

“Can systematic methods for question and idea generation, such as brainstorming methods, be taught to students, realized in teamwork, and do they contribute to raising the question quality?”

In cooperation with NEXT-TELL, this question is made more specific by (1) introducing the NEXT-TELL repertory grid software, RGFA (see D4.6), to engage students in reflecting and improving upon their questions, and (2) by the use of the NEXT-TELL OLM to involve students in self- and peer-assessment of the PBL competencies, including questioning skills. The technology-enhanced scenario is displayed in Figure 43.
RGFA is used in the following manner: On a weekly basis, students create individual and team based questions. These questions are intended to guide the individual research during the rest of the week, conducted online and in the library. Once the students have suggested their questions on the group level and represented them in a Google Spreadsheet, the teacher creates a repertory grid exercise for each group, with the questions from the spreadsheet as well as questions the teacher herself made up (these can be “good” but also “bad” questions). Students then work through the repertory grid exercise individually and/or in a group, and revise their questions in the spreadsheet where they see fit.

The OLM is used as a means to engage students in reflection of the overall PBL process. Figure 44 shows the competencies as suggested by the head teacher. These competencies were planned to be updated once or twice a week, in self-assessment mode and by way of peer-assessment. Data gathering is still going on when writing this report.
The PBL related questions—students’ learning—are researched by the teachers in cooperation with a researcher from the Ministry of Education. NEXT-TELL conducts research on the use of its tools by way of log file analysis, questionnaires, and interviews with the teachers. Questions pertain to usability of and pedagogical value created by RGFA and OLM. Technological data and experiences will be investigated.

4.4.2 Critical Questioning and Thinking: The 6 Thinking Hats Method Adopted in Science Teaching

NEXT-TELL is cooperating with three science teachers in the high school of the Hwa Chong Institute. The teachers are conducting a multi-week science project with their students, involving on-line work, classroom activities, and laboratory experiments. The group size is 4-5 students. NEXT-TELL is used in three of these groups. The study is being conducted in July and August 2013. The study at HCI is a cooperation between HCI, Singapore’s Ministry of Education, and NEXT-TELL.

NEXT-TELL technology is used to realize the workflow as depicted in Figure 45. HCI makes use of our integration of Moodle and Mahara and the NEXT-TELL OLM.
Teachers’ Research Question and Hypotheses

The main research question the teachers want to investigate is the application of De Bono’s [1990] creative thinking framework to the problem-based learning pedagogy that undergirds HCI’s approach to science education. Their research question is about the “role of questioning in science projects”. They assume that learning or experimenting with thinking hats (generating questions from different perspectives) promotes questioning and thinking in science projects.

Study-Design and Topics of Interest

Two groups of students should participate. Group 1 consists of eight students in sec level 2 and group 2 consists of six students in sec level 1. It should be investigated how:

- Development of students’ thinking routine: Are students able to use a variety of thinking hats (divergent thinking) in order to develop a regular sequence of thinking hats used
- Degree of collaboration within a group: Are students able to sustain a discussion in a single thread (depth of thinking) and develop a network of interactions (breath of thinking)
- How ICT can help to mediate richer discussions and assessment for learning by studying the evolution of the first two topics over time.

The 6 Thinking Hats and Questioning in Science

Edward De Bono’s six thinking hats are used to create a set of possible questioning “skills”.

- **Information:** (White Hat)
  - Clarifying questions: “who, what, where and when” questions. They can be answered quickly and easily
- **Discernment:** (Black Hat)
  - Questions to probe mistakes about experimental results or procedures
- **Creativity:** (Green Hat)
Questions to probe assumptions and rationale of experiment
- Scientifically productive questions that will take learning further and deepen knowledge
- Questions to improve the experimental results or procedures

- **Management of Thinking (Blue Hat)**
  - Questions to discuss how the online meeting will be conducted
  - Questions to develop the goals and objectives

- **Negative Emotions: (Red Hat)**
  - Questions to seek negative emotions (intuitive or instinctive gut reactions)

- **Optimistic Response (Yellow Hat)**
  - Questions to identify benefits and seek harmony

### Instruction Procedure of the “Thinking Hats” in Science

<table>
<thead>
<tr>
<th>No</th>
<th>Step</th>
<th>Timing*</th>
<th>Tech</th>
<th>Comments</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Teacher poses a <strong>trigger question</strong> before every session (lab/consultation)</td>
<td>Mon</td>
<td>Moodle</td>
<td>Teacher poses a <strong>trigger question</strong> before every session (lab/consultation)</td>
<td>Teacher poses a <strong>trigger question</strong> before every session (lab/consultation)</td>
</tr>
<tr>
<td>2</td>
<td>Students will generate questions using Edward De Bono’s six thinking hats to ask questions.</td>
<td>Day -2 to -1</td>
<td>Moodle</td>
<td>One of the members will play the discussion moderator (or the leader) in that case wearing the blue thinking hat</td>
<td>Students will generate questions using Edward De Bono’s six thinking hats to ask questions.</td>
</tr>
</tbody>
</table>

**Suggested Thinking Protocol:**
The meeting may start with everyone assuming the Blue hat to discuss how the meeting will be conducted and to develop the goals and objectives.
The discussion may move to Red hat thinking in order to collect opinions and reactions to the problem.
Next, the discussion may move to the (Yellow then) Green hat in order to generate ideas and possible solutions.
Lastly, the discussion may move between White hat thinking as part of developing information and Black hat thinking to develop criticisms of the solution set.
### Report on TDS 1

<table>
<thead>
<tr>
<th>No</th>
<th>Step</th>
<th>Timing*</th>
<th>Tech</th>
<th>Comments</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Students will do peer critique of the questions until they come to a consensus on what to do for the next lab session which will address the trigger question.</td>
<td>Day -2 to -1</td>
<td>Moodle, OLM</td>
<td>These questions will be registered on the MAHARA.</td>
<td>Students will do peer critique of the questions until they come to a consensus on what to do for the next lab session which will address the trigger question.</td>
</tr>
<tr>
<td>4</td>
<td>Teacher will provide feedback on their plan.</td>
<td>Day -1 Morning</td>
<td>Moodle, OLM</td>
<td></td>
<td>Teacher will provide feedback on their plan.</td>
</tr>
<tr>
<td>5</td>
<td>Students rectify and finalise their plan.</td>
<td>Remaining of Day -1</td>
<td>Moodle, OLM</td>
<td></td>
<td>Students rectify and finalise their plan.</td>
</tr>
<tr>
<td>6</td>
<td>Students perform research session in lab</td>
<td>Day 0 (duration of research)</td>
<td>Google doc</td>
<td>Students use Google doc to provide real time log: 1000h “1.0 kg of red cabbage is chopped.”</td>
<td>Students perform research session in lab</td>
</tr>
<tr>
<td>7</td>
<td>Students update the MAHARA with their findings.</td>
<td>Day +1</td>
<td>MAHARA</td>
<td>In short, a report</td>
<td>Students update the MAHARA with their findings.</td>
</tr>
</tbody>
</table>

In short, a report on TDS 1 is presented, outlining the steps and timing for each phase of the project. The table includes details on the timing, technology used, and specific comments for each step. For instance, students will perform a research session in the lab, with a duration of 1000 hours, and update their findings in the MAHARA system.
The following Table 9 lists the competencies considered so far and possibilities concerning e-assessment.

<table>
<thead>
<tr>
<th>Competency</th>
<th>Elaboration</th>
<th>Possible measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulating range/variety of question in addressing trigger question</td>
<td>Questions posed by students are able to provide them a rounded view of the project/experiment.</td>
<td>Number of different types of hats used</td>
</tr>
<tr>
<td>Consistency in thinking protocol</td>
<td>Six hats used in the advised specific sequence (BRYGWB), and the sequence is regularly repeated.</td>
<td>Number of complete sequences in the entire discussion thread.</td>
</tr>
<tr>
<td>Depth of collaboration</td>
<td>Students continuously comment on a single thread, like a rally in a badminton singles match</td>
<td>Volume of questioning and responses per thread</td>
</tr>
<tr>
<td>Breadth of collaboration</td>
<td>Students comment on each other’s threads, like rallies in a badminton doubles match</td>
<td>Collaboration Pattern is achieved:</td>
</tr>
<tr>
<td></td>
<td>(A) Questions and responses were made independently and only once per student.</td>
<td>(A) if interactions are from single student to other students.</td>
</tr>
<tr>
<td></td>
<td>(B) an intricate web-like pattern.</td>
<td>(B) other interaction types</td>
</tr>
<tr>
<td></td>
<td>- For three person group: maximum 6 interaction types</td>
<td>We want to achieve more (B) patterns</td>
</tr>
<tr>
<td></td>
<td>AB, BA, AC, CA, BC, CB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- For four person group: maximum 10 interaction types</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB, BA, AC, CA, AD, DA, BC, CB, CD, DC,</td>
<td></td>
</tr>
</tbody>
</table>

Table 9: Overview of competencies and data types for measurement
Moreover, a rubric for human assessment was developed in order to rate students by teachers and/or peers. Table 10 shows the rubric developed so far.

<table>
<thead>
<tr>
<th>Competency</th>
<th>Possible measurement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulating <strong>range/variety</strong> of question in addressing trigger question</td>
<td>Number of different types of hats used</td>
<td>One to Two types of thinking hats are used.</td>
<td>Three types of thinking hats are used.</td>
<td>Four types of thinking hats are used.</td>
<td>Four or more types of thinking hats are used.</td>
</tr>
<tr>
<td>Consistency in thinking protocol</td>
<td>Any recognisable patterns in questions (use of coloured hats) during a single discussion. e.g. &quot;BRGBRGBRG&quot;</td>
<td>More than 20% of the discussions followed the suggested thinking protocol</td>
<td>More than 40% of the discussions followed the suggested thinking protocol</td>
<td>More than 60% of the discussions followed the suggested thinking protocol</td>
<td>More than 80% of the discussions followed the suggested thinking protocol</td>
</tr>
<tr>
<td>Depth of collaboration</td>
<td>Volume of questioning and responses per thread</td>
<td>Measure the increase in the responses over time.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breadth of collaboration</td>
<td>Collaboration Pattern achieved: Type A: if interactions are single student to others. (B) other interaction types (intricate web like pattern)</td>
<td>All interactions are Type A.</td>
<td>More than 40% of the interactions are Type B.</td>
<td>More than 60% of the interactions are Type B.</td>
<td>More than 80% of the interactions are Type B.</td>
</tr>
</tbody>
</table>

Table 10: Overview of the rubric for the “thinking hats” instruction

The study was still running at the date of report writing. Technological data and experiences will be investigated.

4.5 Discussing the Case Studies

The studies above show which broad spectrum of teaching and learning environments formative e-assessment (aiming at assessment for learning) needs to but also can approach in order to support students’ learning. The studies above also show, however, that developing and adopting competence-based formative e-assessment in teaching-learning-interactions is not done from one day to the next. Rather, they show that there are a lot of issues that need to be considered. The main points are mainly discussed with regard to NEXT-TELL’s OLM because this was the tool used in most of the studies.
Whereas the first points focus on new assessment practices, the latter points focus more on new assessment instruments. Both issues seem to be related to teaching routines that would need to be changed in the one or the other way.

- Teachers as well as learners need not only to be familiarized with technology but partly also with new feedback practices that e-assessment tools like NEXT-TELL’s OLM offers like for example self- and peer-assessment. This was shown in the studies in German classrooms. Both teachers were rather inexperienced with practicing principles of assessment for learning. Although they saw OLM as a good chance to implement types of feedback practices they think are important for learning, it was shown that even if technology offers such possibilities, it is not guaranteed that students recognize and welcome the new practices (teacher 1). Moreover, students might start questioning teacher’s assessment style, if peer-assessment differs from the former. Such processes might be very beneficial for learning, however, they might also challenge teachers not used to deal with such feedback.

- Another finding from the studies was that teachers as well as students inexperienced with practices in assessment for learning tended to provide more numerical data in OLM than verbal feedback. With regard to OLM’s main task of visualizing competencies it seems obvious to do so. One of the teachers even explicitly related the ratings in OLM with grading. It was, however, not so clear for which purpose the other teachers used or would use the numerical ratings in OLM. Some students also criticized that OLM’s visualization would not be helpful without comments. In contrast to this focus on numerical feedback with teachers inexperienced in assessment for learning, Black et al. [2004] even recommend not to use grades within assessment for learning because it reduces students’ task involvement. A recent study from Harks et al. [2013] showed that feedback on grades was less successful than processes-oriented feedback according to Hattie [2007]. Thus, from the perspective of assessment for learning it seems to be questionable whether OLM’s numerical feedback is really helpful or maybe even not or the opposite (cf. the critiques in a workshop about OLM in section 5.1.2). However, as former research on that issue hardly concentrated on competencies but on grades in general, it is not yet clear which influence the competence-based feedback of OLM might have on students’ learning, especially if OLM is introduced and trained as a tool for reflection and further decision-making.

- To sum up, these results show that not only teachers but also students need time and training for working with the OLM. However, as described in the Norwegian studies, the same holds true for the RGFA and OLMlets which are not always totally self-explaining. Though the OLM is more complex than RGFA (and OLMlets), we think that each assessment tool was not thoroughly understood after using it once without detailed instructions or without more experience. However, being with the teachers and knowing their time schedules, this also shows how difficult it is to integrate extra tool training into teachings. Normally, no time is planned for tool trainings. Hence, teachers keep the time invested in a tool introduction rather short. However, short introductions might cause negative consequences for further use, if students do not understand the purpose of the tool or still find it difficult to use after short introductions. As the OLM has been a tool in the German classrooms described above for feedback practices that are not common practice and without direct, obvious link to learning activities for many students, the upcoming task for NEXT-TELL and teachers will be to create practices and ways that invite students really in, namely in such a way that students feel that the OLM is supporting them in their learning.

- For the open classroom in Austria the teachers felt to be supported a lot by the tablet software with regard to documenting and decision-making. Here, the software offered support for daily time-consuming practices instead of introducing new practices. Although it is yet too early to diagnose because the young students had not used the software so far on their own. The first steps, however, in which teachers shared results with their students and listened to students’ comments look very promising. For these teachers it was clear, that they just have started the processes that lead students to more reflection and aware decision-making.

- Although the studies in Germany showed that teachers inexperienced in practicing assessment for learning might face more challenges concerning student-teacher-interactions than configuration, the OLM-step in the Norwegian study showed that teachers experienced in assessment for learning face challenges with regard to transferring their non-technological assessments into the OLM. With regard
to the assessment in the Energy unit, teachers seemed to want transferring their assessment sheet 1:1 into OLM but not being successful in doing so. As the OLM has been designed for competence-based feedback Norwegian teachers were challenged because so far they had practiced assessment for learning but not necessarily with this special focus on competence assessment. Hence, the technology seemed to interfere with or not support their practices and/or instruments used for assessment and feedback easily. These challenges were not observed so far, in Germany. Here, the participating teachers did not need to adapt an already existing assessment instrument but did set-up the competence-based assessment in OLM from the scratch of their new practices. One of these teachers worked even more on the issue of increasing assessment transparency for his students, rather than to struggle with configuring competencies in the OLM. Hence, which challenges teachers faced in working with the OLM seemed to depend more on their former routines than on the OLM per se.
5 Presenting NEXT-TELL Tools

During project year 3, partners conducted not only studies within schools (see chapter 4) but also presented NEXT-TELL and selected NEXT-TELL tools to teachers to find out how teachers react to the project developments, even though or because they might not want to use NEXT-TELL developments. Whereas TUG and TALK invited teachers for extended 2-days workshops on immersive learning environments like OpenSim, KMRC used different types of meetings to find out what teachers like or dislike about NEXT-TELL’s ECAAD and OLM. Workshop presentations are described first, before small group or individual meetings with teachers are described.

5.1 Workshop Presentations

First, a conference workshop with focus on NEXT-TELL’s OLM is presented. As it was a public workshop within a conference no special data collection instruments like questionnaires or audio recordings were used. Second, two joint workshop of TALK and TUG with a focus on OpenSim and ProNIFA were conducted within a frame of teacher training. Here, project partners could collect also specific research data via questionnaires.

5.1.1 Extended Teacher Workshop on “Virtual Worlds in the classroom”

A workshop entitled “Virtual Worlds in the Classroom” [Virtuelle Welten im Unterricht] has been carried out with two groups of interested Austrian teachers one from January 25 to 26, 2013 in Bad Waltersdorf, the other from May 28 to 29, 2013 in Gabelhofen.

The objective of this teacher workshop was twofold: (i) The primary aim of the workshop was on the one hand to highlight the potential of virtual worlds and environments and their application in the international school context by presenting potential application scenarios and on the other, as a consequence, to initiate an intensive discussion about their implementation and usage in Austrian classrooms. Thus, besides disseminating NEXT-TELL and its fundamental ideas on a general level, there was a strong focus on spreading NEXT-TELL’s methods, concepts and tools that were developed for especially supporting teaching and learning in virtual worlds and environments. (ii) The workshop also served the collection of teachers’ experiences on both the methodological and technological approach and the practical application in the context of ProNIFA.

The workshop description as well as the workshops materials can be found on the corresponding workshop homepage http://css-kmi.tugraz.at/NTWS2013 (in German language).
Disseminating the NEXT-TELL approach and its application

The first part of the workshop was characterized by giving a short overview of the fundamental ideas and foundations of the NEXT-TELL project. In particular, this was realized by giving a presentation about the current situation that is characterized by a need for a conceptual change in the educational system in order to being able to tackle the challenges of the 21\textsuperscript{st} century. With this mind, the NEXT-TELL project, its goals and capacities with a specific focus on virtual worlds, was presented in more detail.

Training in-depth: OpenSIM

The second and main part of the workshop focused on virtual worlds and virtual environments and how they can be used in the classroom. In general, the workshop followed the procedure that is described in more detail in the context of D7.3 “Training Materials for Release 2” and its respective Moodle Learning course. In the following section only an overview of the relevant parts is provided (see Table 11).

| Introduction                                                                 | • Basics: Understanding of how the system works and how virtual worlds can be used in general;  |
|                                                                             | • Explanation of the pedagogical value and possibilities that virtual worlds offer |  |
| Life as Avatar                                                             | • Learning Avatar’s basic skills (Hands-On) |  |
| Putting on your student’s shoes                                           | • Solving the Granny quest in OpenSim (Hands-on) |  |
| Analyzing students’ activities                                            | • Presentation of the tool ProNIFA that allows for automatically analyzing log files created in OpenSim while using it. |  |
| Learning scenario design                                                    | • Gathering ideas on how to create own learning scenarios |  |

Table 11. OpenSIM training material

- First of all, teachers got an introduction to the 3D environment OpenSIM and functionality in order to get a basic understanding on the one hand of how the system works (technically) and on the other of what can be done with virtual worlds in general.
- Teachers were asked to try out the virtual environment on their own. Initially, teachers use it in order to learn and to deeper skills that make their avatar a fully accepted member of the virtual community. After getting familiar with the avatar, teachers tried out one specific quest, the Granny-Quest, where teachers had the possibility to fully immerse themselves into their student’s shoes.
- The first half-day of the workshop was conducted with a dinner.
- On the second day of the workshop, teachers were presented with the ProNIFA tool and functionality and how it is used to assist the formative assessment process. For the demonstration of the (semi-) automatic analysis and reporting/visualizing functionality of ProNIFA, the reports from the log-data gathered during the first part of the workshop (where teachers solved the Granny-Quest) were used.
- Subsequently, there was an open discussion session where participants had the opportunity to exchange their views about virtual learning environments, OpenSIM, and ProNIFA and comment on specific positive or critical aspects, and issues for further improvement. Additionally participants were asked to fill in a questionnaire.

Research Purpose

The purpose of research carried out in connection with teacher workshops was to take the opportunity to additionally gather (i) general information on teachers’ attitudes towards the use of ICT, (ii) with respect to ProNIFA: general feedback on usability aspects from users that is only based on their impression of the tool without direct interaction and handling it, (iii) with respect to SecondLife/OpenSIM: in-depth feedback on user acceptance aspects based on their experiences with the virtual environment and (iv) teachers’ personality.
The main aim of the research carried out in connection with teacher workshops was to investigate the impact of and relationship between teacher personality traits, their educational beliefs and their acceptance and use of educational technologies. The resulting research questions are as follows:

- **General:**
  1. What is the level of ICT use for educational purposes by teachers?
  2. What are teachers’ attitude towards the use of ICT for educational purposes?

- **Usability and User Acceptance:**
  3. How usable is the ProNIFA tool – does ProNIFA allow teachers to effectively, efficiently, and satisfactorily accomplish their tasks for educational purposes?
  4. Do teachers consider Second Life/OpenSIM acceptable and intend to use it for educational purposes?

- **Personality:**
  5. Is there a relationship between teachers’ personality, their educational believes (i.e., attitude towards the use of ICT) and their acceptance and use of educational technologies?

**User Trials and Participants**

**First teacher workshop: Bad Waltersdorf-Trial**

The first teacher workshop on 'Virtual worlds in the classroom' has been carried out by TUG on 25th and 26th January 2013 in Bad Waltersdorf, Austria. Overall, 22 teachers took part in this workshop.

**Second teacher workshop: Gabelhofen-Trial**

The second workshop with teachers took place on 28th to 29th May 2012 at Gabelhofen, Austria. The workshop involved a group of in sum 27 interested teachers.

**Method**

**Procedure**

- The project NEXT-TELL and subsequently the virtual environment Second Life/OpenSIM was explained to the workshop participants.
- All teachers had the possibility to use OpenSIM on their own.
- After working with the virtual environment and after getting an overview and explanation of the ProNIFA tool, participants were asked to fill in a questionnaire (in German language).
- Subsequently, participants took part in a group discussion.
- Approximately three weeks after the workshop, a follow-up online questionnaire (in German language) was distributed to participants (only to participants attending the first workshop).

**Instruments/Questionnaires**

To collect data, two different questionnaires were employed. The first questionnaire used in the first teacher workshop (i.e., Bad Waltersdorf-Trial I) covers questions on the following aspects: (i) demography and background, (ii) use of ICT in the classroom, (iii) usability of ProNIFA and its visualisations. For the second workshop (Gabelhofen-Trial), a modified and revised questionnaire was used to collect data whereby the following topics have been identified to be of interest: (i) demography and background, (ii) use of ICT in the classroom, (iii) user acceptance of Second Life, and (iv) personality traits. This modified questionnaire was also distributed, as a follow-up questionnaire - to the participants of the first workshop (Bad Waltersdorf-Trial II).
Bad Waltersdorf-Trial I

With respect to demography and background questions on gender, age, teaching experience, age groups of children, and on taught subjects were posed. The use of ICT in the classroom was measured on the one hand by general items on internet and computer usage behavior and on the other by general statements focusing on perceived experiences in using ICT in the classroom. With respect to ProNIFA, the System Usability Scale (SUS, [Brooke, 1996] was used for a general usability assessment. For a subjective assessment of visualizations provided by ProNIFA, questions on relevant aspects of usability (i.e., suitability for the task and self-descriptiveness) were used in order to gather first user feedback. The questionnaire was concluded by an open comments section for qualitative feedback, where respondents had the possibility to make general remarks on ProNIFA and the visualizations provided by the tool.

The collection of questions and their association with the different aspects is listed in the table below. Please note that the original questionnaire was in German language, in the following table only a translation of the questions is given.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Question</th>
<th>Answer options/format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demography/Background</td>
<td>DG1. Gender</td>
<td>- male - female</td>
</tr>
<tr>
<td></td>
<td>DG2. Age</td>
<td>Number entry</td>
</tr>
<tr>
<td></td>
<td>DG3. Teaching experience</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DG4. Age group of children</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DG5. Taught subjects</td>
<td>Free text entry</td>
</tr>
<tr>
<td>Use of ICT in the classroom</td>
<td>UoM1. How often do you use the internet at home?</td>
<td>- never - one time a month - one time a week - several times a week - daily</td>
</tr>
<tr>
<td></td>
<td>UoM2. How often do you use the internet for your lesson preparation?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UoM3. How often do you use the computer in the classroom (with your students)?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UoM4. How often do you use the internet in the classroom (with your students)?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UoM5. The implementation of new media in the classroom increases students’ motivation.</td>
<td>5-point rating scale from “strongly disagree” to “strongly agree”</td>
</tr>
<tr>
<td></td>
<td>UoM6. The implementation of new media increases the variety of methods used in the classroom.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UoM7. The usage of new media in the classroom supports the implementation of different didactic concepts.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UoM8. New media supplement teaching in a useful way.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UoM9. The implementation of new media in the classroom entails extra work regarding lesson preparation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UoM10. The implementation of new media in the classroom entails extra work regarding lesson follow-up.</td>
<td></td>
</tr>
<tr>
<td>Aspect</td>
<td>Question</td>
<td>Answer options/format</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>UoM11. The usage of new media facilitate individual learning support.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UoM12. The usage of new media facilitate both cross-class and inter-school learning.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UoM13. The usage of new media facilitate team work between teachers.</td>
<td></td>
</tr>
<tr>
<td>ProNIFA: Usability</td>
<td>SUS1. I think that I would like to use this system frequently.</td>
<td>5-point rating scale from &quot;strongly disagree&quot; to &quot;strongly agree&quot;</td>
</tr>
<tr>
<td></td>
<td>SUS2. I found the system unnecessarily complex.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUS3. I thought the system was easy to use.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUS4. I think that I would need support of a technical person to be able to use this system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUS5. I found the various functions in this system well integrated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUS6. I thought there was too much inconsistency in this system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUS7. I would imagine that most people would learn to use this system very quickly.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUS8. I found the system very cumbersome to use.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUS9. I felt very confident using the system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUS10. I needed to learn a lot of things before I could get going with the system.</td>
<td></td>
</tr>
<tr>
<td>ProNIFA: quality of visualization</td>
<td>SD1. The visualization of the individual learner provided by ProNIFA is easy to understand.</td>
<td>5-point rating scale from &quot;strongly disagree&quot; to &quot;strongly agree&quot;</td>
</tr>
<tr>
<td></td>
<td>SD2. The visualization of a group of learners provided by ProNIFA is easy to understand.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST1. I find the visualisation of the individual learners provided by ProNIFA suitable for the assessment process.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ST2. I find the visualization of a group of learners provided by ProNIFA suitable for getting an overview of the learning process.</td>
<td></td>
</tr>
</tbody>
</table>

**Table 12: Translation of questionnaire items I**

**Bad Waltersdorf-Trial II and Gabelhofen-Trial**

With respect to *demography and background* relevant questions as used in the first teacher workshop were used. These included questions on gender, age, teaching experience, age groups of children, taught subjects. Additionally, questions on the experience with and use of computers were posed. For a high-level assessment of teachers’ attitudes towards *new media* six items were included in the questionnaire. Teachers’ *acceptance behaviour towards Second Life* was captured by subscales on the main user acceptance aspects according to the technology acceptance model [Davis, 1986], i.e. perceived ease of use, perceived usefulness, and behaviour. With regard to *personality*, the BFI-K was used.
The whole collection of questions is listed in the table below. Please note that the original questionnaire was in German language, in the following table only a translation of the questions is given.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Question</th>
<th>Answer option/format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demography/Background</td>
<td>DG1. Gender</td>
<td>- male</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- female</td>
</tr>
<tr>
<td></td>
<td>DG2. Age</td>
<td>Number entry</td>
</tr>
<tr>
<td></td>
<td>DG3. Teaching experience</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DG4. Age group of children</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DG5. Taught subjects</td>
<td>Free text entry</td>
</tr>
<tr>
<td></td>
<td>DG6. How would you estimate your knowledge in handling computers, in general?</td>
<td>- Far above average</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Above average</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Average</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Below average</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Far below average</td>
</tr>
<tr>
<td></td>
<td>DG7. How many years of experience do you have in using a computer?</td>
<td>Number entry</td>
</tr>
<tr>
<td>New media in the classroom</td>
<td>NM1. How is your attitude towards the usage of new technology in the classroom, in general?</td>
<td>- Positive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Rather positive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Neutral</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Rather negative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Negative</td>
</tr>
<tr>
<td></td>
<td>NM2. Students learn faster when using new technologies.</td>
<td>5-point rating scale from “strongly disagree” to “strongly agree”</td>
</tr>
<tr>
<td></td>
<td>NM3. The implementation of new technologies facilitates individual learning support.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NM4. The implementation of new technologies increases students’ motivation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NM5. The implementation of new technologies increase students’ concentration.</td>
<td></td>
</tr>
<tr>
<td>Second Life in the classroom</td>
<td>PEOU1. My interaction with Second Life is clear and understandable.</td>
<td></td>
</tr>
<tr>
<td>User Acceptance (Perceived Ease of Use)</td>
<td>PEOU2. Interaction with Second Life does not require a lot of my mental effort.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEOU3. I find Second Life to be easy to use.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEOU4. I find it easy to get Second Life to do what I want it to do.</td>
<td></td>
</tr>
</tbody>
</table>
### Table 13: Translation of questionnaire items II

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Question</th>
<th>Answer option/format</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Usefulness</strong></td>
<td>PU2. Using Second Life in my job increases my productivity.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PU4. I find Second Life to be useful in my job.</td>
<td></td>
</tr>
<tr>
<td><strong>User Acceptance</strong> (Intention to Use)</td>
<td>ItU1. Assuming I have access to Second Life, I intent to use it.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ItU2. Given that I have access to the system, I predict that I would use it.</td>
<td></td>
</tr>
<tr>
<td><strong>Personality</strong></td>
<td>I see myself as someone who...</td>
<td></td>
</tr>
<tr>
<td><strong>Extraversion</strong></td>
<td>E1...is reserved.</td>
<td>5-point rating scale from &quot;strongly disagree&quot; to &quot;strongly agree&quot;</td>
</tr>
<tr>
<td></td>
<td>E2...generates a lot of enthusiasm.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E3...tends to be quit.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E4...is outgoing, sociable.</td>
<td></td>
</tr>
<tr>
<td><strong>Neuroticism</strong></td>
<td>N1...is depressed, blue.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N2...is relaxed, handles stress well.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N3...worries a lot.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N4...gets nervous easily.</td>
<td></td>
</tr>
<tr>
<td><strong>Conscientiousness</strong></td>
<td>C1...does things efficiently.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C2...tends to be lazy.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C3...does a thorough job.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C4...makes plans and follows through with them.</td>
<td></td>
</tr>
<tr>
<td><strong>Agreeableness</strong></td>
<td>A1...tends to find fault with others.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A2...is generally trusting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A3...can be cold and aloof.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A4...is sometimes rude to others.</td>
<td></td>
</tr>
<tr>
<td><strong>Openness</strong></td>
<td>O1...is curious about many different things.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>O2...is ingenious, a deep thinker.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>O3...has an active imagination.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>O4...values artistic, aesthetic experiences</td>
<td></td>
</tr>
<tr>
<td></td>
<td>O5...has a few artistic interests.</td>
<td></td>
</tr>
</tbody>
</table>

**Results from Bad Waltersdorf-Trial I**

On the last day of the workshop, participants were asked to fill out a paper-pencil questionnaire which was completed by 17 persons (10 female, 7 male). Respondents were on average 42 years old (M = 42.24, SD = 11.23), with a range from 25 to 57 years. Their average teaching experience was nearly 17 years (M = 16.79, SD
= 12.26) ranging from 0.5 to 35 years. Most of the teachers teach either economic subjects such as business administration or STEM subjects. 3 teachers teach languages and also 3 teachers were teaching in a primary school where most of the subjects were presented by a single teacher. The participating educators principally cover all age groups of children depending on the type of school ranging from age level 6 to 10 (3 teachers), 10 to 14 (3 teachers), 10 to 18/19 (2 teachers), 15 to 18/19 (8 teachers). One teacher indicated to teach adults from the age of 19 or above.

The use of ICT in the classroom

Internet usage: Most of the participants (15 teachers, 88.2%) indicated to use internet on a daily basis, the rest, 2 persons (11.8%) regularly (several times per week). They use the internet primarily for dealing with emails or for the preparation of their lessons to acquire further knowledge in their subject matter or to download material for classroom use. When explicitly asking for internet usage for their lesson preparation, 8 persons (47.1%) indicated to use it daily, 9 persons (52.9%) several times a week. Thereby, not necessarily the preparation of a concrete teaching lesson is in the foreground, but also gathering of ideas and information on a certain teaching topic.

Computer and Internet usage in the classroom: In class, 12 teachers use computers regularly, either on a daily basis (7 teachers, 41.2%) or at least several times per week (5 teachers, 29.4%). For a detailed overview please see Figure 47.

Teachers’ Perceptions of the application of ICT in teaching: The second part of the survey focused on the perceived experiences in using ICT in the classroom. The five-point rating scale for each of the items ranges from 1 “strongly disagree” to 5 “strongly agree”.

Overall, teachers stated that they strongly agreed with all items concerning their perception of the application of ICT in teaching. Having a closer look at the single items (see for an overview Figure 48 and Figure 49), the highest score results for the second item with a mean score of 4.59 (SD=0.87). 88.3 % of the participants answered that they agree or strongly agree with the statement that using ICT increase the diversity of methods to be used in the classroom. This is in line with the result obtained for item 4 also identifying a high level of agreement with M=4.47 (SD=0.72). 88.3 % of the participants indicated that they find that the use of ICT enhance and complement existing classroom practice. The statement “Using ICT in the classroom enhance students’ motivation” was judged with M=4.41 (SD=0.71). 88.2% of the participants (completely) agree that using ICT in the classroom can increase pupils’ motivation in learning. Additionally, 14 teachers (82.3%) agreed
with the item that applying ICT in the classroom supports individual learning with \( M=4.00 \) (SD=0.79). The lowest score with \( M=3.12 \) (SD=1.27) could be identified for the last item “Using ICT encourages teachers’ team work”. 41.2% of the respondents teachers answered that they strongly disagree or disagree with that statement which indicates that they do not recognize the potential benefit using ICT could bring to them concerning team work quality.

Figure 48: Mean scores and standard deviations on individual items assessing teachers’ perceptions of the application of ICT

![Figure 48](image)

Figure 49: Results (percentages) for individual items assessing teachers’ perceptions of the application of ICT

ProNIFA and its application

**Usability:** Using the SUS-scale as part of the questionnaire allows for assessing the general usability for ProNIFA. The resulting general usability score has a possible score range between 0 and 100 with higher values indicating a better result and therefore a better usability. From responses an overall usability score of on average 46.32 (SD = 10.79), which argues for moderate to low usability. An analysis of individual item score contributions was done to gather further information on particularly positive or critical aspects. Each resulted score has a possible range from 0 to 4 whereby higher values indicate a better usability in each case. An
overview of the usability scores of each item is presented in Table 14 and Figure 50. As can be seen, all individual item scores are located near by 2, the center point of the scale (please note that the figure depicts the score contributions of each item to the overall usability score; this means that for all items higher values indicate better results, i.e. negatively poled items have been recoded).

The lowest score with $M=1.06$ (SD=1.20) could be identified for the item “I needed to learn a lot of things before I could get going with this system”. A similar picture emerges when looking at Item 4 querying whether the assistance of a technical person would be needed in order to be able to use the system that was also rated rather low with $M=1.24$ (SD=1.03). Both results indicate that explanation as well as further technical support seems to be needed for users in order to properly use the system. The best results, with mean score slightly around 2.20 could be found for the complexity and (in)consistency of the system, meaning that the tool ProNIFA is neither perceives as highly complex nor as highly inconsistent. For detailed results on each of the items please refer to Table 14 and Figure 50.

<table>
<thead>
<tr>
<th>Usability Items</th>
<th>Mean (SD)</th>
<th>Min-Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think that I would like this system frequently.</td>
<td>1.76 (0.90)</td>
<td>0.00-3.00</td>
</tr>
<tr>
<td>I found the system unnecessarily complex.</td>
<td>2.18 (1.01)</td>
<td>0.00-4.00</td>
</tr>
<tr>
<td>I thought the system was easy to use.</td>
<td>1.88 (1.11)</td>
<td>0.00-3.00</td>
</tr>
<tr>
<td>I think that I would need the support of a technical person to be able to use this system.</td>
<td>1.24 (1.03)</td>
<td>0.00-3.00</td>
</tr>
<tr>
<td>I found the various functions in this system were well integrated.</td>
<td>2.12 (0.60)</td>
<td>1.00-3.00</td>
</tr>
<tr>
<td>I thought there was too much inconsistency in this system.</td>
<td>2.18 (0.53)</td>
<td>1.00-3.00</td>
</tr>
<tr>
<td>I would imagine that most people would learn to use this system very quickly.</td>
<td>2.12 (0.93)</td>
<td>0.00-3.00</td>
</tr>
<tr>
<td>I found the system very cumbersome to use.</td>
<td>2.00 (0.00)</td>
<td>2.00</td>
</tr>
<tr>
<td>I felt very confident using the system.</td>
<td>2.00 (0.00)</td>
<td>2.00</td>
</tr>
<tr>
<td>I needed to learn a lot of things before I could get going with this system.</td>
<td>1.06 (1.20)</td>
<td>0.00-4.00</td>
</tr>
</tbody>
</table>

Table 14: Descriptive statistics for the individual usability items

Figure 50: Mean scores and standard deviations on individual usability items
Visualizations in ProNIFA: In order to gather first user feedback on the visualizations provided by ProNIFA, questions on relevant aspects of usability, i.e., suitability and self-descriptiveness have been included in the survey. Teachers were asked to answer 4 items by indicating their level of agreement on a 5-point rating scale with the end poles strongly disagree (=1) and strongly agree (=5). With respect to the perceived usability of the visualizations, a mean score of 4.00 (SD=0.82) was identified for the individual learner’s visualization, and a mean score of 3.78 (SD=0.95) for the visualizations of the group of learners. Analyzing individual item scores (see Figure 51), it can be seen that the visualizations were rated both as easy to use with M=4.00 (SD=0.82). Teachers felt both visualization types were suitable for their assessment process with M=3.81 (SD=0.98) and M=3.75 (SD=0.93).

![Figure 51: Overview of the results for individual items on the usability of visualisations](image)

Qualitative Results: In addition to the standard questionnaire and closed questions posed in the survey, a collection of open questions has been included in order to collect qualitative data from teachers on their opinion about ProNIFA. Overall, participants saw the high potential of application in the classroom – applicability and significance were acknowledged. The automatic analysis and reporting (containing different tables and statistics) was also appreciated. Nevertheless, in general, ProNIFA was perceived as being complicated to use. They would need support on how to use the tool in order to be able to appropriately work with the tool. Thus, it would be desirable to provide training sessions on the system in order to increase in users’ knowledge of and familiarity with the tool.

Results from Bad Waltersdorf-Trial II

Approximately three weeks after the workshop, a follow-up questionnaire was distributed to all participants. In sum, 15 teachers (9 female, 6 male) completed this online survey. In this case, their average age was 47 years (M=46.60, SD=11.27) and their average teaching experience nearly 18 years (M=17.90, SD=11.88) ranging from 1 to 34 years. In this respect again, all age groups of children were covered (age level 6 to 10: 2 teachers; 10 to 14: 1 teacher; 10 to 18/19: 6 teachers; >19: 1 teacher).

Computer literacy can be assumed to be high for this cohort – 10 teachers indicated their knowledge of computers and computer applications in general, as “high”, one person had “very high”. The average experience is over 23 years (M=23.27, SD=7.89) ranging from 10 to 36 years. 11 teachers stated to regularly attend training courses relating to the application and use of new media in teaching.

The use of ICT in the classroom

Teachers’ Perceptions of the application of ICT in teaching: On average, 80% of teachers have a positive image of the use of new media in educational settings and appreciate ICT as a viable educational tool. A similar picture emerges when looking at the single items that assess teachers’ overall attitude towards ICT usage with
4 statements using a 5-point Likert-scale from ‘strongly disagree’ to ‘strongly agree’ (with higher values indicating a better result). The highest score results for the statement “Using ICT in the classroom enhances student’s motivation with M=4.07 (SD=0.88). 80% (12 teachers) of the participants (completely) agree with this statement. The statement that the usage of ICT supports individual learning was rated with M=3.73 (SD=1.22) which means that 60% (9 teachers) agree with this statement. 4 teachers (26.7%) find that ICT enables students to learn faster. For this item a mean score of 3.20 (SD=0.86) resulted. The lowest score with M=2.60 (SD=1.24) could be identified for the last item “Using ICT enhances students’ concentration”. 40% of the responding teachers answered that they strongly disagree or disagree with that statement.

Teachers’ acceptance behaviour towards Second Life

Table 15 provides an overview of results on user acceptance aspects perceived ease of use, perceived usefulness, and behaviour intention to use. Also in this case the possible score range is 1 to 5, with higher values indicating better results.

<table>
<thead>
<tr>
<th></th>
<th>Perceived Use</th>
<th>Ease of Use</th>
<th>Perceived Usefulness</th>
<th>Behaviour Intention</th>
<th>User Acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.53</td>
<td>2.53</td>
<td>3.23</td>
<td>2.77</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>2.50</td>
<td>2.50</td>
<td>3.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>0.52</td>
<td>0.83</td>
<td>0.92</td>
<td>0.57</td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>1.25</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>3.25</td>
<td>4.00</td>
<td>4.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 15: Overview of results for user acceptance aspects

The resulting scores indicate: user acceptance outcomes are rather at a medium level with mean scores between 2.53 and 3.23. The overall user acceptance score is M=2.77 (SD=0.57). In more detail, the aspects ease of use and usefulness yielded the lowest score with 2.53 (SD=0.52 for ease of use, and SD=0.83 for usefulness). Even better was the result for behavior intention with a mean score of 3.23 (SD=0.92), which indicates that teachers are intending and willing to actually use SecondLife in their teaching. However, resulting scores on actual usage behavior are rather low with M=1.60 (SD=0.66) which means that teachers do actually not regularly use Second life for their teaching. Consequently, it would be desirable to provide training materials or training sessions in order to make the benefit of SecondLife for teaching and learning visible.

Teachers’ personality

Table 16 gives an overview of the results for all five personality traits. Overall mean scores for all personality aspects – except for neuroticism where the lowest score could be identified with 2.05 (SD=0.69) – are fairly high ranging from 3.68 to 4.30. The highest score could be determined for conscientiousness with M=4.30 (SD=0.61), followed by openness with M=4.29 (SD=0.62). Therefore, teachers can be described as being highly open to new experiences, conscientious, agreeable and extrovert.

<table>
<thead>
<tr>
<th></th>
<th>Extraversion</th>
<th>Neuroticism</th>
<th>Conscientiousness</th>
<th>Agreeableness</th>
<th>Openness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.68</td>
<td>2.05</td>
<td>4.30</td>
<td>3.78</td>
<td>4.29</td>
</tr>
<tr>
<td>Median</td>
<td>3.75</td>
<td>2.25</td>
<td>4.25</td>
<td>4.00</td>
<td>4.40</td>
</tr>
<tr>
<td>SD</td>
<td>0.72</td>
<td>0.69</td>
<td>0.61</td>
<td>0.62</td>
<td>0.62</td>
</tr>
<tr>
<td>Minimum</td>
<td>2.25</td>
<td>1.00</td>
<td>2.75</td>
<td>2.75</td>
<td>3.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>4.50</td>
<td>3.00</td>
<td>5.00</td>
<td>4.50</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Table 16: Overview of the results for the five personality traits
In a further step, the relationship between teacher personality traits, their educational beliefs (i.e., ICT attitude) and their acceptance of educational technologies was investigated. Using Spearman’s correlation index, correlations among the different user acceptance and personality traits scores were calculated. The detailed results are presented in the following Table 17.

Regarding the overall aspect of user acceptance, weak and statistically not significant relationships with r values between with all five personality traits could be identified. A moderate negative correlation was received by agreeableness with r=−.50. Openness and user acceptance weakly correlated with r=−.35. When having a closer look at the individual subscales of user acceptance, a moderate relationship between agreeableness and perceived usefulness with r=−.50 and agreeableness and intention to use with r=−.59 (p=0.03) could be identified. For the score describing teachers’ attitude towards ICT no correlations could be identified in relation to the different personality traits.

<table>
<thead>
<tr>
<th>Variable</th>
<th>ATT</th>
<th>UA</th>
<th>PEOU</th>
<th>PU</th>
<th>BI</th>
<th>E</th>
<th>N</th>
<th>C</th>
<th>A</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATT</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UA</td>
<td>0.32</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEOU</td>
<td>0.27</td>
<td>0.46</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PU</td>
<td>0.34</td>
<td>0.80*</td>
<td>0.06</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>0.13</td>
<td>0.88*</td>
<td>0.24</td>
<td>0.56*</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>0.26</td>
<td>0.10</td>
<td>0.24</td>
<td>0.03</td>
<td>0.04</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>-0.22</td>
<td>0.05</td>
<td>0.29</td>
<td>-0.22</td>
<td>0.12</td>
<td>-0.13</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>-0.16</td>
<td>-0.14</td>
<td>-0.17</td>
<td>0.11</td>
<td>-0.26</td>
<td>0.27</td>
<td>-0.59</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>0.25</td>
<td>-0.50</td>
<td>0.19</td>
<td>-0.50</td>
<td>-0.59*</td>
<td>0.37</td>
<td>-0.05</td>
<td>0.31</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>0.15</td>
<td>-0.35</td>
<td>0.42</td>
<td>-0.17</td>
<td>-0.25</td>
<td>0.39</td>
<td>-0.27</td>
<td>0.45</td>
<td>0.23</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table 17: Correlation of personality traits variables with attitude and user acceptance with its subscales

Note: Dependent Variables: Attitude and User Acceptance with its subscales (i.e., perceived ease of use, perceived usefulness, behavioral intention

ATT=Attitude; UA=User Acceptance; PEOU=Perceived Ease of Use; PU=Perceived Usefulness; BI=Behavioral Intention; E=Extraversion; N=Neuroticism; C=Conscientiousness; A=Agreeableness; O=Openness

Results from Gabelhofen-Trial

From the teacher workshop conducted at Gabelhofen in total 22 participants completed the questionnaire. Gender distribution was 12 (54.5%) female and 9 (40.90%)(with one missing). The average age of the participating teachers was years 45.43 (SD=8.39; Median=46.00) with a range from 28 to 57 years. Their average teaching experience was nearly 17 years (M=17.23; SD=10.64) ranging from 2 to 34 years. Most of the teachers (40.90%; 9 teachers) teaches in classes that comprise the age level 10 to 18/19, 6 teachers (27.3%) in classes comprising the age level 14-18/19. 3 teachers (13.6%) are working as instructors in an educational university (age level >18), 2 teachers (9.1%) in a grammar school (age level 10-14), and one teacher (4.5%) teaches in a primary school (age level 6-10).

With respect to experience with computers, in general, Table 18 gives an overview of the participants’ estimation of their own knowledge of handling computers and computer applications, in general. Computer literacy can be assumed to be moderate for this cohort. 19 teachers indicated their knowledge of computers as average or higher.

<table>
<thead>
<tr>
<th>Knowledge of computers</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Far above average</td>
<td>4</td>
<td>18.2</td>
</tr>
<tr>
<td>Above average</td>
<td>7</td>
<td>31.8</td>
</tr>
</tbody>
</table>
The use of ICT in the classroom

On average, teachers’ perception of the application of ICT in the educational context is positive: 95.5% of teachers stated that they have a positive image of the use of new media in educational settings. This is also reflected in the overall attitude score which is $M=3.49$ ($SD=0.63$). Having a closer look at the 4 statements assessing teachers’ overall attitude towards ICT usage, this result could be confirmed. For the assessment, a five-point rating scale was used (ranging from 1 ‘strongly disagree’ to 5 ‘strongly agree’) whereby higher values indicate a better result. The highest score result for the statement that ICT enhances students’ motivation with $M=3.77$ ($SD=0.81$), 63% of teachers (14 persons) agree with this statement, followed by the statement that the usage of ICT supports individual learning was rated with $M=3.64$ ($SD=1.00$) which means that 54.50% (12 teachers) agree with this statement. 9 teachers (40.90%) find that ICT enables students to learn faster. For this item a mean score of 3.55 ($SD=0.74$) resulted. The lowest score with $M=3.00$ ($SD=0.82$) could be identified for the item “Using ICT enhances students’ concentration”. 27.30 % of the responding teachers (6 teachers) answered that they strongly disagree or disagree with that statement. Half of the teachers (11 teachers; 50%) reported uncertainty on this statement. The overall score on teachers’ attitude is $M=3.49$ ($SD=0.63$).

Teachers’ acceptance behaviour towards Second Life

Actual usage of a system is largely influenced by a range of different aspects of user acceptance. In the questionnaire following main aspects have been explored: i) perceived ease of use, ii) perceived usefulness, and iii) behaviour intention. These aspects have been derived from the literature and are based on research work on the Technology Acceptance Model [cf. Davis, 1989].

Table 19 shows an overview of the mean scores for each of the subscales as well for the general aspect of user acceptance. Each aspect has been assessed by several items – for each aspect mean scores has been calculated. The overall score of user acceptance has been calculated by averaging the subscales. The possible score range is 1-5, with higher values indicating a better result.

Overall user acceptance was rated with 2.53 ($SD=0.72$) which is located near the centre point of the scale and is assumed as satisfactorily result. Perceived ease of use was judged with 2.69 ($SD=0.75$) which also indicates a satisfactorily result. This means that teachers think that Second Life is fairly easy to use. Perceived usefulness was rated with 2.12 ($SD=0.96$). This rather poor result indicates that teachers do not really see the benefit Second Life may provide to them and their work. With respect to a better understanding of these benefits, more extensive support to teachers should be provided (in the form of training materials/workshops). Behaviour intention was judged slightly better with $M=2.61$ ($SD=0.69$) which is a satisfactorily good result meaning that teachers can imaging to use the environment in the future. Consequently, results indicate that there is potential room for further improvement, in particular with respect to a better understanding of benefits provided by Second Life – training sessions on the system with a corresponding increase in users’ knowledge of the system and familiarity with the system may also improve user acceptance aspects.

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Below average</th>
<th>Far below average</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>Mean Knowledge</td>
<td>36.4</td>
<td>9.1</td>
<td>4.5</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 18: Overview of responses on teachers’ estimated knowledge in handling computers and computer applications
Table 19. Mean scores of the main user acceptance variables: perceived ease of use, perceived usefulness, and behavioural intention

<table>
<thead>
<tr>
<th></th>
<th>Perceived Ease of Use (n=21)</th>
<th>Perceived Usefulness (n=15)</th>
<th>Behaviour Intention (n=18)</th>
<th>User Acceptance (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.69</td>
<td>2.12</td>
<td>2.61</td>
<td>2.53</td>
</tr>
<tr>
<td>Median</td>
<td>2.75</td>
<td>1.25</td>
<td>2.75</td>
<td>2.58</td>
</tr>
<tr>
<td>SD</td>
<td>0.75</td>
<td>0.96</td>
<td>0.96</td>
<td>0.72</td>
</tr>
<tr>
<td>Minimum</td>
<td>1.50</td>
<td>1.00</td>
<td>1.00</td>
<td>1.33</td>
</tr>
<tr>
<td>Maximum</td>
<td>4.25</td>
<td>3.50</td>
<td>4.00</td>
<td>3.58</td>
</tr>
</tbody>
</table>

Teachers’ personality

Table 20 show mean scores on all five personality traits (i.e., extraversion, neuroticism, consciousness, agreeableness, and openness). For the aspects extraversion, conscientiousness, and agreeableness nearly the same mean scores resulted (ranging from 2.21 to 2.60). However, mean values for neuroticism with M=3.21 (SD=0.35) and for openness with M=3.46 (SD=0.49) are higher.

Table 20: Overview of the results for the five personality traits

The following Table 21 presents the correlation coefficients among the variables attitude towards ICT, user acceptance (with its main aspects perceived ease of use, perceived usefulness, and behavioral intention), and personality traits (i.e., extraversion, neuroticism, conscientiousness, agreeableness, and openness). Overall, correlations with r values ranging from -.22 to .54 could be identified between personality traits and attitude and user acceptance aspects. A moderate relationship between teachers’ attitude towards ICT and both personality traits extraversion (r=.44) and agreeableness (r=.54) could be identified.

<table>
<thead>
<tr>
<th>Variable</th>
<th>ATT</th>
<th>UA</th>
<th>PEOU</th>
<th>PU</th>
<th>BI</th>
<th>E</th>
<th>N</th>
<th>C</th>
<th>A</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATT</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UA</td>
<td>0.03</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEOU</td>
<td>-0.32</td>
<td>0.69*</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PU</td>
<td>0.10</td>
<td>0.92*</td>
<td>0.49</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>0.34</td>
<td>0.90*</td>
<td>0.27</td>
<td>0.82*</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>0.40</td>
<td>0.23</td>
<td>-0.17</td>
<td>0.22</td>
<td>0.39</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>0.02</td>
<td>0.17</td>
<td>0.29</td>
<td>0.16</td>
<td>0.06</td>
<td>-0.18</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>-0.19</td>
<td>-0.07</td>
<td>0.19</td>
<td>0.00</td>
<td>-0.14</td>
<td>0.10</td>
<td>-0.47*</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Summary of Outcomes of both teacher workshops

This section contrasts and summarises the results obtained from teachers in the context of both workshops at Waltersdorf (i.e., first workshop) and Gabelhofen (i.e., second workshop).

With respect to the knowledge of computers both workshop-studies have involved people with appropriate experience and knowledge level. Teachers also reported to have a medium to high level of ICT use for educational purposes. From the data collected via the online as well as paper-pencil survey it can be deducted that the majority of teachers perceive ICT to offer advantages to classroom learning for instance by supporting individual learning, increasing students’ motivation, or enabling a faster learning. When explicitly asking them whether ICT supports students’ concentration and attendance, most of the teachers are either undecided or not consented to this statement.

User acceptance of SecondLife can be assumed to be medium to good concerning all three aspects (i.e., perceived ease of use, perceived usefulness, and behavioural intention). Nevertheless, there seems to be a potential in better educating teachers with respect to understanding the potential relevance and usefulness of using SecondLife for educational purposes.

With respect to ProNIFA, usability was rated rather low. Although teachers saw its high potential for educational purposes, ProNIFA was perceived as being too complicated to use. Teachers need support on how to use the tool in order to be able to approximately work with the tool. Thus, it would be desirable to provide training sessions on the system (itself as well as for example in the context of SecondLife) in order to increase users’ knowledge of and familiarity with the tool. This has already been and will be realized in the context of WP7 where specific training materials were developed and made available online as Moodle course (for further information, please refer to D7.3 Training materials for Release 2). In addition to that, in the context of WP5, TUG is working on a teacher certification and training package aiming at supporting teachers in effectively using and applying (NEXT-TELL related) ICT in their classroom (for an overview, please refer to D5.6 TISL Components R3).

Regarding the different visualisations provided by ProNIFA, this overall investigation provided medium to good usability. Teachers found visualisation easy to understand and suitable for their work. Nevertheless, a fine grained analyses would be desirable in order to arrive at any conclusion for further improvements. A study that additionally investigates not only usability aspects but also teachers’ comprehension and understanding of different visualisations, is already planned and will be conducted at the beginning of the upcoming semester. The underlying methodology as well as results will be described and reported in the next WP6 Deliverable (i.e., D6.6 Report on TDS II).

Concerning personality traits, a distinct picture for the two groups of teacher results: in the first workshop trial (Bad Waltersdorf-Trial) teachers had higher scores in extraversion, agreeableness, conscientiousness, and openness, and a low score on neuroticism. Contrary to teachers of the second workshop who have high scores in neuroticism and openness and rather medium scores on the other personality traits. According to researchers at the University of Davis, the excellence of teaching is associated with high extraversion, high agreeableness, high conscientiousness, and high openness, but low neuroticism.

The trait openness to experience is a trait that distinguish people who are more imaginative from those who are down-to-earth. People who are scored higher in this trait tend to be more creative, more likely to open to new and different ideas. Contrary to people scoring lower, they tend to be more closed off, meaning that they are generally more analytical and resistant to change. In education,
teachers with high value in openness make constant connections between course topics and ideas in other courses and disciplines as well as outside the classroom. Neuroticism is the tendency to experience negative emotions. Especially in stressful situations, people with a high neuroticism value tend to be highly reactive than lowly neurotic people. Additionally they tend to interpret ordinary situations as threatening or minor situations as too difficult or as impossible. When presenting them with a difficult or new situation that they don’t know how to figure out, they just break down rather than being able to handle the situation. In the classroom, highly neurotic teachers tend to be inflexible and defensive by avoiding new situations. Best teachers are relaxed, easy-going, not-defensive, and flexible.

Extraversion can be described by pronounced engagement with the world. Highly extravert people tend to be enthusiastic, action-oriented, and loving excitement. Introverts tend to be quiet and not very involved in the social world. In the educational context, extravert teachers tend to initiate and maintain communication at every possible opportunity, stimulate active interaction during the lecture, and display involvement in extracurricular activities on behalf of the students. People having high score in the train agreeableness can be described as being compassionate and cooperative with others. Disagreeable people place self-interest above all else and are not very interested in others’ well-being. They are sceptical of people’s motives which often make them unfriendly or uncooperative. In the educational context, teachers with high score in agreeableness show high commitment and interest in their teaching and concerning their students. Conscientiousness is characterized by keywords such as self-discipline, dutifully, or aim for achievement. People scored high in this trait have a preference for planned rather than spontaneous behaviour. They can be described as being responsible and reliable and sometimes they become compulsive perfectionists and workaholics. Teachers with high value in conscientiousness can be described as being good-prepared to the course as they extensively plan and rehearse for each lecture, and being careful and methodical in the preparation of examination materials.

Answering the question whether there is any relationship between teachers’ personality, their educational believes (i.e., attitude towards the use of ICT) and their acceptance and use of educational technologies, only for agreeableness moderated correlations could be identified. Teachers with high values in agreeableness intend to use a system more likely and find it easier to use than others. Furthermore, results revealed that agreeable teachers express more positive attitudes towards the application of ICT whereas teachers who are less agreeable. In a next step, this model explaining the intention to use technology among school teachers with its relation to personality factors should be tested and scientifically validated (by applying the SEM – structural equation modelling – technique). This could be realized with two different teacher groups, in-teachers and pre-service teachers, in order to inform policy makers and teacher educators for planning and curriculum development purposes. Finally, comparative studies across countries could be conducted in order to identify the culture-invariant variables influencing teachers’ intention to use technology.

5.1.2 Conference Workshop at an EduCamp

In Germany, many teachers who use or aim at using digital media in teaching organize themselves in online platforms (see chapter 3.1) but also meet regularly in face-to-face BarCamps like for instance EduCamps that focus on teaching and learning with digital media. In order to present NEXT-TELL (or better parts of NEXT-TELL, OLM) to teachers interested in digital media, we suggested a workshop at the EduCamp in Hamburg (12-14 April, 2013). KMRC submitted a workshop contribution to the conference online (see: http://educamp.mixxt.de/networks/forum/thread.268335) with a short video introducing the OLM. The workshop was then accepted at the beginning session at the conference. About 18 participants attended the workshop (teachers and teachers in teacher development as well as media pedagogues). We present the three main issues that were discussed by the workshop participants: (1) Competencies, (2) quantitative vs. qualitative feedback, and (3) students’ learning goals.

1. Competencies

One of the first issues that was discussed by participants was the measurement of competencies. Workshop participants were rather critical towards the concept of competencies and where questioning what competencies should mean at all. They discussed whether competencies where just another "fancy
term” in order to describe what they had done all the years before. Participants agreed with each other that competencies are difficult to measure, that no one actually knows what they are, and that they did not like the concept too much.

One teacher told us after the workshop that when he entered the room and saw “competencies” visualized at the DWB he thought that he would get now THE solution to dealing with competencies. However, after the workshop, he was still not sure how to measure and deal with competencies.

Competencies are defined formally within the German educational research community as „kontextspezifische Leistungsdispositionen, die sich funktional auf Situationen und Anforderungen in bestimmten Domänen beziehen (Englisch: (Competencies are) context-specific performance dispositions that are related in a functional way to situations and demands in specific domains)” [Klieme, 2006, p. 4].

The research community has developed several domain-specific competence instruments but such developments are not yet validated or implemented at schools and it stays questionable whether they should be implemented and how at school. So far, schools and individual teachers need to develop their own competence concept in order to measure competencies. Many teachers have developed some resistance or antipathy against the concept of competencies because they are asked to teach and measure competencies, however, it remains rather unclear for them how it differs from what and how they have assessed over the last years.

2. Quantitative vs. Qualitative Feedback

Besides discussing “competencies” the workshop participants were interested in the measurement and feedback options within the OLM. Although OLM provides not only quantitative but also a qualitative (strengths and guidance) feedback options, the participants focused on the quantitative 10-star rating scale and the quantitative output visualizations in general. Many participants seemed to be reform-oriented and they criticized the quantitative rating and visualizing system. Students would have been measured enough by the system so far, and the OLM seemed to promote this measurement approach even more. With regard to the assumed influence of the competence visualizations on students’ (self-) reflection processes the participants remained rather sceptical. One participant was part of a research project (LASSI) which also developed visualizations and he was almost the only one who supported the visualization approach. Although participants criticized the quantitative rating approach, they did not welcome the qualitative feedback options “strengths” and “guidance” too much. It seemed to be an unknown approach to them to divide strengths and guidance or to provide them such explicitly. Furthermore, some participants said that the most important part for teachers would be missing between “strengths” and “guidance”. The most important part was seen in finding out what it is that students struggle with. This needs to be done by the teacher before the step of providing “guidance”. However, the participants did not see how the OLM might support them in finding out what students struggle with. Furthermore, they asked where the “guidance” might come from.

3. Students’ Learning Goals

Another big discussion option was about who decides and determines students’ learning goals. As the OLM was presented to support students in self-reflection and in the long term also in self-regulated learning, participants wondered how that should be done, if the teacher configures the competencies and assigns them to his/her students. They asked whether students could also configure competencies and activities on their own. According to the participants providing students the options to define their own learning goals (in which way ever) would be a “must”, if the OLM should support students in becoming self-organized 21st century learners.

To summarize, it can be said that the workshop participants stayed somewhat sceptical towards the OLM. They questioned whether the OLM would really improve students’ self-reflection and at this stage of development they did not regard it as a tool supporting self-regulated learning because there were no options for students to act on their own but only to re-act whatever the teacher fed into the OLM or allowed. Moreover, they had severe resentments against the quantitative rating and visualizing approach. The teachers among them did not like to use it in their classrooms at this point of development.
5.2 Presentations for Individual Groups

KMRC presented the OLM to further teachers besides the workshop reported above. In case one we got the occasion to present NEXT-TELL to a teacher in teacher education and school development who is also very known in the German online community presented in chapter 3.1. In occasion 2, we presented the NEXT-TELL OLM to a small group of teachers, and in the third occasion a teacher accepted to offer her time for an in-depth interview and the OLM presentation. We were not interested in providing some training in assessment for learning but aimed at finding out how teachers respond to the OLM when it was presented as a tool that is developed in order to support teachers and students in feedback practices for teaching and learning.

5.2.1 Case 1: Presenting ECAAD and OLM in a Teacher Education and School Development Context

In order to find out what are important aspects for teachers with regard to NEXT-TELL developments KMRC met with a teacher in teacher education and school development (Landesinstitut für Lehrerbildung und Schulentwicklung, Hamburg) who is a well-known member within the online community interested in teaching and learning with digital media, who taught about 25 years herself at school, and who is experienced in EC projects. She is specialized in project-based learning with blogs. We prepared three flyers, one presenting NEXT-TELL as a whole, one for the ECAAD tool and the third for the OLM tool which were used as elaboration to explain NEXT-TELL (see figure 52). The meeting took place in March 2013.

![Figure 52: Flyer for NEXT-TELL overview (left), for ECAAD (middle), and for OLM (right)](image)

For the former teacher it was important to find positive as well as challenging aspects within NEXT-TELL from the perspective of teachers as well as students. Her main points are listed in Table 22.

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Teachers</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>positive</td>
<td>Support of new demands like exchange and collaboration among teachers as suggested by ECAAD and TISL.</td>
<td>Being informed about own learning.</td>
</tr>
<tr>
<td></td>
<td>Supporting the demand for adaptive teaching (individual learning) by OLM</td>
<td>Being supported in planning own learning.</td>
</tr>
</tbody>
</table>
Table 22: Positive and challenging aspects within NEXT-TELL from perspective of teacher educator

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Teachers</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supporting the exchange with parents via OLM or better parents can inform themselves via OLM (considering that not all parents are that interested in child’s learning)</td>
<td>Exchange and support by friends/peers in learning.</td>
<td></td>
</tr>
<tr>
<td>Approach seems to overburden teachers because they need to learn new methods and new technologies. OLM might be interesting but ECAAD seems to be too much at odds with current practices.</td>
<td>The whole online data collection approach (e.g., OpenSIM) has a touch of “Big Brother is watching you”. OLM might be misused as “instrument of power” by teachers (even unintentionally). Missing opportunity in OLM for students feedback to teachers (cf. Finnish school system).</td>
<td></td>
</tr>
<tr>
<td>Teachers might feel stressed because tools might be used to check them. Teachers feel already overburdened by documentation.</td>
<td>Approach might take “recreation zones” away from students. Students need places at school (or online) where they are not observed by teachers.</td>
<td></td>
</tr>
<tr>
<td>Technologies ask for even more communication. Teachers feel already overburdened by communication.</td>
<td>OLM might be a “door opener” for cybermobbing, if students can see peers’ models and provide feedback.</td>
<td></td>
</tr>
</tbody>
</table>

5.2.2 Case 2: Presenting OLM to a Group of Teachers

One of the principals attending the SPICE workshop parallel to the plenary Meeting in September 2012 in Tuebingen, was further interested in NEXT-TELL, especially in OLM. KMRC had several appointments with the principal (sometimes with the school librarian and another teacher) and we provided a hand-out for the principal and his teachers (see figure 53).
The principal and especially the librarian were very interested in OLM, however, the principal did not want to introduce it as a “must-use” tool to his teachers. As he had introduced another “must-use” tool before (and the last years the programmes changed rather often), and many of his teachers did not like it, he did not want to put further technological demands on his teachers. Rather, he selected some teachers he thought who might be interested in and allowed a meeting with them. After organizing the meeting with the teachers suggested, we presented the OLM to three teachers and the person responsible for media (who installed three operation systems – Windows, Linux and Mac OS – on all school computers). However, we could not discuss with them their feedback practices extensively. In general, the teachers raised more concerns against OLM than interests in it. They mentioned the following concerns:

- **Basics:** Concerning basic requirements the principle stated during clarifying which kind of technology we would need to present the OLM that if the tool would not run on tablets (e.g., iPads) we did not need to present the tool to any of his teachers. Concerning the OLM itself the teachers did not like that the tool was in English language only. They doubted whether their students or colleagues would be able to handle the English. They saw the English language as a first obstacle that should be changed.

- **Configuration:** Assigning students to teachers’ groups: First, teachers did not like that they had to pick the students from a long list (OLM v2). The teachers wished that the assignment of students should be somehow done automatically based on existing students lists. The media responsible, however, saw that one pool of all students (of course, only of their school) as background might make it easier concerning the progressions of students from one year to the other over their school life. Second, privacy issues were raised concerning the open list with students. This issue of open student assignment has meanwhile been solved by BHAM.

- **Colleagues and school-wide up-take:** The teachers could not imagine that their colleagues were willing and able to use the OLM in the version presented (version 2). This was an important issue for the whole group which was brought up during the whole conversation several times. Although we made clear that not all teachers need to use the OLM but rather these teachers who were interested in feedback practices, it was important for these teachers to think ahead and consider a whole school adoption. They stated that they did not see the purpose in trying out again another tool that is not yet fully developed and will not even be compulsory. Moreover, they mentioned the grading tool they must use and which is considered to also develop competence tracking but is not yet there. They compared the NEXT-TELL OLM automatically with this grading tool they must use and which many of their colleagues did not like (showing their inner protest by posting a sign saying “Imagine, it is *tool name* and nobody goes there!”).

- **Formal certification requirements:** The teachers’ comparison with the grading tool made them interested in whether the NEXT-TELL OLM can also be used for printing students’ certifications at the end of the school year. As the OLM is not considered to be used for official documents within NEXT-TELL, the teachers could again not imagine why it should be used across the school. As doing the formal grading documents is an important task for them which they associated with the overall feedback output, their interest in the OLM stayed limited.

- **Individual reasons to not use the OLM:** In addition to the rather general reasons stated above, the teachers also mentioned individual reasons why they could not imagine to use the OLM at the moment, although they saw some potential. One of the teachers was in his first year after his teacher examinations. He said that he is so busy with preparing and managing his basic teaching that he did not want to try out extra practices and technology. Another one told that she already had two language tools in use with her 5-6 grade students in German courses. She said that she did not want to introduce any additional digital tool to these young students. Two tools would be demanding enough for the students. Besides that she mentioned that these tools already collect data how well the students solved the tasks and also visualises the results. Hence, she did not really see additional benefits in OLM for her teaching practices (just additional work in using it). Whereas the first teacher rejected OLM because of protecting him from being overstrained, the latter teacher rejected the OLM because of protecting her students from being overstrained by digital tools.
5.2.3 Case 3: Individual In-Depth Interview on Feedback and OLM Presentation

KMRC conducted an in-depth interview on feedback with a female teacher in mathematics, sports, and a drumming course in a grammar school (38 years, 6 years teaching experience, no ICT is used in teachings) and presented the OLM afterwards. The results for both parts are summarized below.

Feedback Practices

According to the teacher, feedback practices are related especially to student feedback (see chapter 3.2.2). When asked how she provides feedback to students she told that she writes some comments next to a grade under a written test, depending on the student and the quality of the test. For example, she writes “You are able to do more. Participate more during the lessons.” In general, she approaches the students who are falling back and goes for a personal conversation with them. She said that students do normally not approach her, especially not these students who show bad performances. However, some weeks ago there was one student who was asking for a better oral grade. She first thought this would not be possible at all but then she realized that because most students of the class are lagging behind she does not provide more difficult tasks, and thereby preventing good students to show that they might do better. Hence, she planned to provide tasks of varying difficulty next school year in order to give students the chance to show how good they might be.

When asked how transparent her assessment system is for students she hesitated a bit and then answered: “Mmmm…I would think it is medium transparent, because I … don’t know … for example, I don’t know at the moment, did I explain it to my students so clearly? I think it should be clear. It is not just about quantity (of participation) but also about quality”.

When asked whether she also practices self- and/or peer assessment she denied but found it rather interesting. The interviewer suggested some ideas how for example peer-feedback might be included in her teachings. The teacher asked whether she could write down the interviewer’s suggestions and said: “Yes, it is … I mean, it is not that you have never heard of it, but you have forgotten and not … eerm, you did not follow it (explanation: follow means here “practicing in the classroom what was recommended verbally”).”

Later in the interview she said: “(…) one thing is theory, of such things which were discussed at a pedagogical day or where ever. Eeerm, and the other thing is, how to really put it into practice.”

To summarize, the teacher was in general very interested in the feedback topic, especially with regard to student feedback (see chapter 3.2.2). With regard to her feedback practices she is similar to the German teachers interviewed in year 1 (see D6.2). She does not practice principles of assessment for learning in an elaborated way. For example, her assessment explanations and feedback comments seem to be rather general, although she cares about her students and wants to support them. Furthermore, she does not practice self- and peer-assessment that is regarded as one important principle within assessment for learning [Black, 2004]. Interestingly, she mentioned the gap between theoretical input in formal teacher development at so called pedagogical days and the practices or implementation in her classroom.

Opinion about OLM

After the interview, the OLM was presented step by step to the teacher. We summarize crucial comments made by the teacher as well as her opinion on the OLM and the teaching practices she thought would be needed if she would use the OLM in her classes (T = teacher and I = interviewer).  

Competencies: When showing where to configure OLM competencies the teacher immediately commented:  

T: “Competencies. Comp… that’s meanwhile a term with such a negative connotation. Competence training, competencies, learning competencies…and that’s so much…doesn’t matter.”

This comment shows the resistance that emerges in some or even many teachers when the topic is about competencies (cf. workshop at EduCamp above).  

Discussion: As response to a short hint to the discussion option in OLM the teacher asked:
T: “With whom do I have to discuss?”
I: “Theoretically, you have the option to discuss with your students…”
T: “NO! … Surely not and especially not about competencies.”

The teacher made clear that discussing with students about grades and especially about competencies is not a good idea.

Add Evidence: During explaining the feedback options ratings, strengths, and guidance provided in OLM the teacher added in a cynical voice the following comment about the guidance text box:

T: “It’s not allowed to say weaknesses. GUIDANCE!”

Here, the teacher thought that the OLM might be “politically correct” but also that it is not the whole truth. As this teacher was not familiar with assessment for learning she might have misunderstood the point of the guidance text box. It remained unclear whether she got it with the explanations provided during presenting the OLM.

After about 20 minutes of presenting the OLM, the teacher came to the following conclusion:

T: “Erm…I won’t use it… I think, yes, I can say that very clearly. Because it is something I need to do at the computer and I do not like this. I want to reduce the time I’m sitting in front of a computer. Point 1. Point 2: It seems to be a huge amount of work at the moment and I question its effectiveness.”

Later on she told about her principal:

T: “He once came with such something to us … with such something exactly … feedback sheets and smileys to rate for each exam for each student what (s)he can do and what not. I just thought (in a cynical tone): Super! You do that just once and then you don’t do it again. I do not think that he is practicing that any longer.”

Although the teacher suggested that we might visit her principal after the summer break, she feared that he would be interested in OLM and he would ask the Mathematics teachers again to do such feedback practices she does not want to do. For the teacher it was very clear that providing feedback to students the way the OLM suggests would cost too much time. Moreover, providing feedback to an exam would also be rather useless. Students would want to move on, do the next topic. Students would not look at the feedback on an exam or care about it. Hence, providing feedback about an exam would not be very useful but a waste of time. If she realizes that a student has severe problems in an exam she writes a comment and thinks about what to do and asks the student whether (s)he has already learned it and if not what to do. But to do that, she does not need the OLM.

As assessment for learning does not concentrate on summative feedback but wants to promote learning we asked her how one might use the OLM in order to benefit from it. The teacher started to talk and then came to the idea that if she would practice the feedback she would need to say:

T: “Okay, the next four weeks we do this feedback and work on … more or less in stations with specific tasks and I do as many stations as I have topics … for example five. I would create five stations and for each station I would provide materials for its topic … and then each student could go to that station where (s)he has the lowest smiley and then move on. (…) Yes, this would be great.”

The teacher told that she does not practice station work very often. Sometimes at the end of a year, but this year there would have been no time. She needed to progress in content and this seems to be at odds with doing station work although she was not quite sure about that. However, she does not like to work with stations, if she starts a new topic. Moreover, she could imagine doing station work in Mathematics with her students in grade 6 but she could not imagine doing station work with her students in grade 12 who prepare for the Abitur exam.

She also asked us whether we could provide her with materials for station work, for example online tasks in Mathematics, so that results can be fed automatically into OLM. Anything else would be too time consuming.

According to the interview, one can assume that the teacher has two main reasons why not to use the OLM. First, she does not want to use technology. Second, even though her principal once shared with her and some of her colleagues how he wanted to provide more formative feedback, she has not yet even tried it because she thinks that it is much too time demanding and not effective enough. Even when she understood that the
OLM can be used formatively, and she found formative feedback positive, she could not imagine changing her feedback or her teaching routines that she thinks would need to be changed if using the OLM.
6 Analysing the Adoption of ICT and NEXT-TELL Tools in Teaching from Perspectives of Personality and Perceived Usefulness

We saw in project years 1 and 2 that there are still many teachers who are not yet used to teach with ICT in their classrooms. Nevertheless, there are teachers who use ICT or are eager to use it and join online communities to learn more about the topic. This made TUG ask whether adoption of ICT in the classroom might depend on special personality traits. This question goes beyond the Technology Acceptance Model (TAM) [Davis, 1989; Vankatesh, 2000] that focuses especially on users’ perceived usefulness of ICT and perceived ease of use to determine whether ICT is used in organisations or not. According to the literature one can assume that these two factors hold true for teachers at schools and probably also for their students. In the following we first describe a study on how teachers’ personality might influence ICT adoption in classrooms. Subsequently, we interpret the results of our school studies reported in chapter 4 from the perspective of the TAM.

6.1 The Usage of New Technologies in the 21st century classroom: A Question of Teachers’ Personality?

The implementation of new technologies in educational systems has significant effects on teachers and pupils such as enhancing the cooperation with colleagues, increasing the motivation, enabling more student-centered teaching and learning, and also developing new skills and abilities necessary in the changing society of today. Although several schooling initiatives and international support programs exist, the current level of ICT-implementation remains rather restricted. Research shows that the success of educational technology use in the educational setting largely depends on the attitude of educators, who eventually determine how to use technologies in the classroom. The aspect of user acceptance of technologies, in general, has been intensively researched and a variety of different models have been developed for modelling and understanding the underlying processes and influencing factors. The most prominent model explaining computer usage behaviour is the Technology Acceptance Model that postulates that two particular forces, perceived usefulness and perceived ease of use, are crucial for computer acceptance behaviour. More recently, dedicated research work has been accomplished on personality factors (i.e., extraversion, neuroticism, conscientiousness, agreeableness, openness to experience) that affect the acceptance and intention to use new technologies. However, especially in the field of education, the effects of personality traits have seldom been examined.

Given the importance of teachers’ capabilities in and willingness to use information and communication technology in the classroom, the study presented in the following sections investigates the impact of and relationship between teacher personality traits, their educational beliefs and their acceptance and use of educational technologies. Before describing the study in more detail, an overview of the relevant state of the art is given with regard to research in personality as well as user acceptance.

6.1.1 Personality and the Five-Factor Model

Personality can be described as a dynamic and organized set of traits that determine people’s attitudes, beliefs, cognitions, and behaviors [Ryckmann, 2004]. Because traits play such a ubiquitous role in human cognition and behavior, it is beyond all doubt, that personality play an important part when investigating the persons’ behaviors in utilizing information and communication technologies. In psychology, the domain of personality can be described by five constructs [Digman, 1990] which are often referred to as the big five. Although several different labels have been used to describe these five personality factors, representative labels are (i) extraversion, (ii) neuroticism, (iii) conscientiousness, (iv) agreeableness, and (v) openness to experience.
Extraversion represents sociability, being gregarious, cheerfulness, and optimism. “Extraverts are more sociable, and active but are also described as being more active and impulsive, less dysphoric, and as less introspective and self-preoccupied than introverts” [Watson & Clark, 1997, p.769]. Neuroticism or emotional stability is associated with common traits including being anxious, depressed, angry, embarrassed, emotional, and worried. Highly neurotic people tend to have difficulty managing stress [Judge et al., 1999] and lack self-confidence and self-esteem [McCrae & Costa, 1991].

Conscientiousness can be described as the tendency to be self-disciplined, strong-willed, deliberate, trusty, organized, and resilient. People with a high value in conscientiousness actively plan, organize, and carry out tasks. It is also the trait that has been drawn upon as a main psychological resource in situations where achievements, especially in the context of work, learning, and education, play an important role [De Raad, 2000].

Agreeableness refers to a willingness to participate, conform, and cooperate with others. Agreeable persons are cooperative and forgiving as well as sympathetic and good-natured [Judge et al., 1999].

Openness to experience represents one’s curiosity, creativity, imagination and willingness to explore new ideas [Judge & Bono, 2000]. “Open individuals tend to devise novel ideas, hold conventional values and willingly question authority” [Costa & McCrae, 2000, p.325]. People who score high on the openness factor engage the world with a spirit that is eager and keenly interested [Beck, 1999].

These five personality traits can be categorized into following three personality types: overcontrolled, undercontrolled, and resilient [Block, 1995; Caspi, 1998]. Overcontrolled individuals are characterized by high neuroticism, low extraversion, and typically average score on the remaining factors. Undercontrolled individuals are characterized by low conscientiousness (sometimes accompanied by elevated neuroticism and low agreeableness). Resilient individuals are characterized by low neuroticism and above-average scores on all other factors.

6.1.2 Technology Acceptance and Personality

The introduction of a new technological system such as a learning system does not inherently translate into individuals actually using the system – independent of how technically sound it is [Hirschheim, 2007]. Oftentimes computer interaction systems are not used by people, even they may benefit from them [Nickerson, 1999]. This is why in the last decades many theoretical approaches have been devised aiming for a better understanding of this issue – and for deriving indications on how to prompt users to successfully adopt a new system. This relates to user acceptance, and one well-known theoretical model in this context is the Technology Acceptance Model (TAM) which was devised by Davis [1986]. The concept of User acceptance can be defined as the “...demonstrable willingness within a user group to employ information technology for the tasks it is designed to support” [Dillon & Morris, 1996, p.3]. TAM is specifically tailored for modelling user acceptance of information systems and explaining computer-usage behaviour. It postulates that two particular factors, perceived usefulness and perceived ease of use, are crucial for computer acceptance behaviour. Perceived usefulness is defined as “the degree to which a person believes that using a particular system would enhance his or her job performance” [Davis et al., 1989, p.320]. Perceived ease of use refers to “the degree to which a person believes that using a particular system would be free of effort” [Davis et al., 1989, p.320].

Perceived ease of use and perceived usefulness can be predicted through external variables such as personality whereby personality is hypothesized to lead to beliefs related to the behaviour [Ajzen & Fishbein, 1980].

Devaraj et al. [2008] investigated in their research the relationship between personality, technology usage and acceptance and online behaviour. Their findings revealed that people high in agreeableness and conscientiousness traits are more likely to perceive usefulness of new technology, while individuals high in neurotic traits are less likely to perceive the technology’s usefulness. Hudiburg et al. [1999] showed that neuroticism aggravates problems in using computers whereas extraversion alleviates them. Concerning internet usage behaviour, Hamburger and Ben-Artz [2000] found that extraversion and neuroticism has an impact. Katz [1992] suggests in his work that extrovert, stable, and though minded personalities were more receptive to the use of computers. Overall, research in personality gives evidence that personality does make a difference in a person’s willingness to use technology. However, especially in the field of education, the effects of personality traits have seldom been examined.
6.1.3 Method

Participants

In sum, 110 persons (79 female, 31 male) have completed the survey. Respondents were on average 44 years old (M = 43.65, SD = 10.91), with a range from 23 to 63 years. Their average teaching experience was nearly 17 years (M = 16.78, SD = 11.95) ranging from 1 to 40 years. Most of the teachers teach either economic subjects such as business administration or STEM subjects. 13 teachers teach languages and also 2 teachers were teaching in a primary school where most of the subjects were presented by a single teacher. The participating educators principally cover all age groups of children depending on the type of school ranging from age level 6 to 10 (2 teachers), 10 to 14 (11 teachers), 10 to 18 (68 teachers), 15 to 20 (25 teachers). One teacher indicated to teach adults from the age of 20 or above.

Material and Apparatus

An online survey was created and implemented covering the following aspects: (i) attitudes toward the usage of ICT, (ii) user acceptance, and (iii) personality traits. These aspects were preceded by a set of questions on demography.

The survey section on attitudes comprised five short items exploring teachers’ actual attitudes and opinions towards the usage of ICT. Subsequently, user acceptance and personality traits were considered. The use of standardized questionnaires provides the advantage of a sound assessment on a certain parameter, and the possibility to compare results even with other studies. For the general assessment of user acceptance, the subscales on the main user acceptance aspects (i.e., perceived ease of use, and behaviour intention) from the questionnaire based on Venkatesh and Davis [2000] were used. With respect to personality traits, the BFI-K [Rammstedt & John, 2005] was used in order to investigate the five personality traits extraversion, neuroticism, conscientiousness, agreeability, and openness.

6.1.4 Results

The use of ICT in the classroom

Computer and Internet Usage: Most of the participants (61 teachers, 55.5%) indicated to use computer on a daily basis, 46 persons (41.8%) regularly, and 3 persons (2.7%) one time per month. They use the computer primarily for dealing with emails or for the preparation of their lessons to acquire further knowledge in their subject matter or to download material for classroom use. Thereby, not necessarily the preparation of a concrete teaching lesson is in the foreground, but also gathering of ideas and information on a certain teaching topic. In class, 53 teachers (48.2%) use computers regularly, either on a daily basis (19 teachers, 17.3%) or at least several times per week (34 teachers, 30.9%). 30 teachers (27.3%) also use internet regularly in their classroom. For a detailed overview please see Figure 54.

Teachers’ Perceptions of the application of ICT in teaching: The survey also focused on the perceived experiences in using ICT in the classroom. Teachers’ overall attitude toward ICT was positive with an overall mean score of 4.18 (SD=0.78). Thus, 80.9% of the respondents (89 teachers) considered the application of ICT in teaching as a viable educational tool.

Teachers’ overall attitude towards ICT usage has been assessed with four statements asking for teachers’ attitude on a more detailed level, which have been combined to form one score (with score range 1-5). The resulting mean score is 2.99 (SD=0.76). This result argues for a moderate to good attitude towards the usage of ICT. Having a closer look at the individual contributions of the additional items (see for an overview Figure 2c), the highest score results for the statement “Using ICT in the classroom enhance students’ motivation” with M=3.64 (SD=0.99). 59.1% (65 teachers) of the participants (completely) agree that using ICT in the classroom can increase pupils’ motivation in learning. 48 teachers (43.6%) agreed with the item that applying ICT in the classroom supports individual learning with M=3.22 (SD=1.08). 28 teachers (25.4%) find that ICT enables students to learn faster. For this item a mean score of 2.95 (SD=0.88) resulted. The lowest score with M=2.39 (SD=0.90) could be identified for the last item ‘Using ICT enhances students’ concentration”. 57.3% of the responding teachers answered that they strongly disagree or disagree with that statement.
Teachers' acceptance towards e-learning systems and platforms: A range of different aspects of user acceptance influencing the behavioural intention and actual usage of a (virtual) learning environment have been explored in the questionnaire. This mainly includes the factors perceived ease of use, perceived usefulness, and behaviour intention. Participants only filled out this part of the questionnaire after indicating to regularly use some kind of virtual learning environment (e.g., learning management systems, Second Life, educational tools, etc.) in their teaching.

Overall, 43 teachers (39.1%) regularly use an e-learning system or e-learning platform in their teaching process. In particular, Moodle is used by 32 teachers (29.1%), other learning management systems by 11 teachers (10%). The following section reports on the results of Moodle. Each aspect has been assessed by one or several items – for each aspect mean scores has been calculated as well as an overall acceptance score resulting from these three subscales. The possible score range in each case is 1 to 5, with higher values indicating a better result.

The average acceptance score that could be determined for Moodle was 3.83 (SD=0.64) arguing for good user acceptance and participants' interest in using the system in the future. Having a look at the subscales, the derived mean score on ease of use is 3.90 (SD=0.70) that argues for a good ease of use. Perceived usefulness was rated with an average score of 3.72 (SD=0.65), thus indicating a medium to good result. A mean score of 3.86 (SD=1.00) resulted for behavioural intention.

Teachers' personality

The second part of the questionnaire contained questions on the ‘Big Five’ personality traits: extraversion, neuroticism, conscientiousness, agreeableness, and openness. Therefore, the BFI-K [Rammstedt & John, 2005] was applied, which consists of 21 items. Moreover, each trait is measured by 5-point Likert-scale items ranging from 1 “Strongly disagree” to 5 “Strongly agree”. For each subscales mean scores has been calculated. The possible score range in each case is 1-5, with higher values indicating a better result (i.e. negative poled items have been recoded).

Table 23 presents the mean, std. deviation, and minimum and maximum of scores for all five personality traits for teachers using Moodle, using any e-learning system as well as for the whole sample without taking into account their usage behavior. When having a closer look at the table, it is obvious that mean scores of both groups for all variables differ only very slightly. For the whole sample, the overall mean values for extraversion...
(M=3.58, SD=0.81), conscientiousness (M=3.93, SD=0.85), agreeableness (M=3.31, SD=0.66) are fairly high. The highest score could be determined for openness with M=4.09, SD=0.85. The lowest score could be identified for neuroticism with M=2.49 (SD=0.82). When having a closer look at the results of teachers, who are regularly working with Moodle, a similar picture reveals: in general, mean values for all subscales are fairly high (extraversion with M=3.34, SD=0.77; agreeableness with M=3.40, SD=0.59; and openness with M=3.87, SD=3.87), except for the subscale neuroticism with M=2.49 (SD=0.77). The highest mean score could be identified for conscientiousness (M=3.98, SD=0.86). Nearly the same results could be obtained for teachers who do not regularly use any e-learning system or environment. The highest score could be identified for openness with 4.14 (SD=0.79). Whereby the lowest score with M=2.52 (SD=0.82) is for the scale neuroticism. All mean values of the others traits are also fairly high (extraversion with M=3.65, SD=0.82; conscientiousness with M=3.89, SD=0.85; and agreeableness with M=3.27, SD=0.64).

<table>
<thead>
<tr>
<th>Trait</th>
<th>Moodle user (n=32)</th>
<th>No system is used (n=65)</th>
<th>All teacher (n=108)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Min-Max</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Extraversion</td>
<td>3.34 (.77)</td>
<td>2.00-5.00</td>
<td>3.65 (.82)</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>2.49 (.77)</td>
<td>1.50-4.50</td>
<td>2.52 (.82)</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>3.98 (.86)</td>
<td>1.50-5.00</td>
<td>3.89 (.85)</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>3.40 (.59)</td>
<td>2.25-4.75</td>
<td>3.27 (.64)</td>
</tr>
<tr>
<td>Openness</td>
<td>3.87 (1.01)</td>
<td>1.20-5.00</td>
<td>4.14 (.79)</td>
</tr>
</tbody>
</table>

Table 23: Descriptive Statistics of the five personality traits depending on different groups of teachers

From the interplay and combination of personality traits, three different personality types can be derived: overcontrolled, undercontrolled, and resilient (see above).

To derive personality types in this sample, hierarchical cluster analysis was calculated resulting in a 3-cluster solution. Figure 55 presents the personality types (using z scores for ease of interpretation) of the three groups obtained from the cluster analysis. The first group (undercontrolled) was characterized by low extraversion, low conscientiousness and average or above on the other factors. 19 teachers (17.3) can be added to this group. The second group (overcontrolled) was characterized by high neuroticism and low extraversion. 18 teachers (16.4) belong to the overcontrolled personality type. The third group (resilient) is characterized by low neuroticism and higher than average level on all other factors. The majority of teachers (71 persons, 64.5%) can be characterized as being resilient.
Teachers’ acceptance behaviour and its relation to personality traits

The third aim of this study was to investigate the relationship between teacher personality traits, their educational beliefs and their acceptance and use of educational technologies. To this end, as personality traits can be linked to aspects of ICT attitude and user acceptance (i.e., perceived ease of use, usefulness, behavioral intention, and overall user acceptance), Pearson correlation coefficient was utilized to calculate these relationships. The overall results are presented in Table 24.

Concerning the overall user acceptance score, a slightly moderate and negative correlation could be identified with neuroticism (r=-.273, n=42). Conscientiousness (r=.270, n=42) and openness (r=.278, n=42) received a positive correlation. When having a closer look at the subscales of user acceptance, a negative correlation between the scale perceived ease of use and neuroticism could be identified (r=-.325, n=42). Perceived usefulness is positive correlated with conscientiousness (r=.256, n=42) and agreeability (r=.274, n=42). For behavioral intention a positive correlation with openness (r=.274, n=42) could be shown.

For the score describing teachers’ attitude towards ICT no correlations could be identified in relation to the different personality traits.

Considering the derived personality traits (i.e., undercontrolled, overcontrolled, and resilient) no significant differences in terms of attitude towards ICT and acceptance behavior could be identified between those three groups. Nevertheless, there is a tendency that the personality type resilient has a positive impact on user acceptance. Persons described through this personality type are characterized as having low neuroticism and above average scores on all other factors. This suggestion is compatible with results obtained for the correlations between the single personality traits and user acceptance whereby user acceptance is negatively correlated with neuroticism and slightly positive correlated with the other factors.
D6.5
Report on TDS 1

Table 24: Correlation of personality traits variables with attitude and user acceptance with its subscales

<table>
<thead>
<tr>
<th>Variable</th>
<th>ATT</th>
<th>UA</th>
<th>PEOU</th>
<th>PU</th>
<th>BI</th>
<th>E</th>
<th>N</th>
<th>C</th>
<th>A</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATT</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N=110</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UA</td>
<td>.231</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N=42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEOU</td>
<td>.019</td>
<td>.781</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>N=42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PU</td>
<td>.487</td>
<td>.767</td>
<td>.484</td>
<td>1</td>
<td></td>
<td></td>
<td>N=42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>.121</td>
<td>.845</td>
<td>.435</td>
<td>.473</td>
<td>1</td>
<td></td>
<td>N=42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>.137</td>
<td>.088</td>
<td>-.015</td>
<td>.092</td>
<td>.124</td>
<td>1</td>
<td>N=108</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>-.106</td>
<td>-.273</td>
<td>-.325</td>
<td>-.202</td>
<td>-.150</td>
<td>-.321</td>
<td>1</td>
<td>N=108</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>.175</td>
<td>.270</td>
<td>.156</td>
<td>.256</td>
<td>.239</td>
<td>.314</td>
<td>-.261</td>
<td>1</td>
<td>N=108</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>.087</td>
<td>.123</td>
<td>-.096</td>
<td>.274</td>
<td>.137</td>
<td>.137</td>
<td>-.149</td>
<td>.146</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>-.081</td>
<td>.278</td>
<td>.160</td>
<td>.221</td>
<td>.274</td>
<td>.319</td>
<td>-.226</td>
<td>.290</td>
<td>.222</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Dependent Variables: Attitude and User Acceptance with its subscales (i.e., perceived ease of use, perceived usefulness, behavioral intention)
ATT=Attitude; UA=User Acceptance; PEOU=Perceived Ease of Use; PU=Perceived Usefulness; BI=Behavioral Intention; E=Extraversion; N=Neuroticism; C=Conscientiousness; A=Agreeability; O=openness

6.1.5 Discussion and Conclusions

The primary objective of this study was to examine the impact of and relationship between teacher personality traits, their educational beliefs and their acceptance and use of educational technologies. In general, teachers taking part in this study have a positive view towards computer technology usage in teaching and learning activities. There is a widespread awareness that ICT can be an effective tool in supporting teaching and learning. However, a closer look at the single items measuring their attitudes suggest the assumption that teachers do not really see the added value and benefit that use of ICT can bring for them. This potential lack of understanding and of recognizing the potential support could be determined by providing in-depth training in a wide range of computer technology skills to make full use of ICT in the teaching process. Given the importance of teachers’ capabilities in and willingness to use information and communication technology in the classroom, NEXT-TELL will increase assistance of teachers in terms of ICT support including the various tools for effective planning, assessing, and visualising students’ learning processes. Trainings and workshops are offered that promote the NEXT-TELL idea and the usage of related technologies. Teachers are introduced to novel and existing tools and the pedagogically sound integration in daily school practise is demonstrated.

Moreover, the results of the study revealed that the surveyed teachers had a good user acceptance towards learning management systems they regularly use in the classroom. All aspects (i.e. perceived ease of use, perceived usefulness, and behavioural intention) of user acceptance have been assessed quite good.
Regarding teachers’ personality traits, the results indicated that the surveyed teachers were high extrovert, agreeable, conscientious and open characteristics and a low neurotic. Therefore, most of the teachers can be characterized as having a resilient personality profile. The findings of the relationship between teachers’ personality traits and their acceptance behaviour showed that neuroticism has a slightly and moderate negative correlation with user acceptance. Furthermore, positive correlations with conscientiousness and openness could be identified in relation to user acceptance. Nevertheless, these correlations are not very high which implies that teachers’ personality profile does not play such an important role meaning that there should be no worries whether a teacher with any type of personality traits is probably in advantage for using the computer technology throughout his/her class practice.

6.2 Perceived Usefulness of NEXT-TELL Tools and their Ease of Use

The main factors in the TAM are perceived usefulness and ease of use of ICT. Within NEXT-TELL, we see also, although not measured via questionnaires, that these factors seem to be relevant. Whether teachers participate in NEXT-TELL or not seems to depend on these issues. However, not only teachers but also students need to be convinced by the usefulness of the tools.

6.2.1 TAM and Teachers

Teachers participating in NEXT-TELL see great potential in NEXT-TELL tools. Be it the teachers with the tablet tool developed by TALK for documenting what students are learning or the teachers in Germany and Norway using the OLM and/or RGFA. All these teachers think that NEXT-TELL developments are interesting and address crucial practices in learning, and hence, are useful for them and assumingly for their students. The usefulness can be seen in different aspects of a tool, as shown for example, when working with the OLM. Whereas one teacher found the option for self-assessment very useful in order to leverage students’ self-reflection, the other teacher saw peer-assessment as the most useful aspect in OLM. Concerning ease of use, the participating teachers are informed that NEXT-TELL tools are still under development and hence, they do not weigh this aspect too much but they give feedback to NEXT-TELL partners because also for them the aim is to have tools easy to use because otherwise they also do not want to keep on working with them in the future. The teacher workshop on ProNIFA showed that teachers realized the benefit of this tool, however, they also found it rather difficult to use in its current stage. Hence, one point in NEXT-TELL is developing and adapting the tools in such a way that they are easy to use.

Teachers who did not see the usefulness of NEXT-TELL tools did hesitate or did not want to participate. Many German teachers which were introduced to OLM (see chapter 5) where not really convinced that OLM is useful for them and all their other colleagues. Their questions gathered around how the OLM might support their work processes they have to do like creating graduate certifications. They also checked for very practical issues like printing etc. Or they criticized that important aspects of self-regulated learning are missing, and thus, perceived the tool as less useful. The in-depth interview with a German teacher also showed that this teacher did not see that the OLM was really helpful for her teaching. For example, she does not practice self- and peer-assessment, and hence, these were functions in OLM she did not recognize as very useful for her current teaching practices, rather the opposite. She had, however, the idea that her principal might be interested because he once wanted to provide more detailed feedback to his students in a way similar to features in the OLM, and thus, might perceive the OLM more useful for his teaching than the interviewed teacher did.

Thus, one can say that whether NEXT-TELL tools are perceived as useful tools depends a lot on teaching routines teachers already practice or aim at. However, not all NEXT-TELL tools are tools just for the teacher. The RGFA, CoNeTo, and the OLM, for example, are tools which also need to be used by students.

6.2.2 TAM, Students, and Context

One challenging point in NEXT-TELL tools like RGFA, CoNeTo, and OLM is the fact that these tools need to be used by different stakeholder groups. As stated above, not only teachers but also students need to use these tools. Hence, not only teachers but also students need to perceive these tools as useful. Of course, a teacher
can always ask his/her students to use a tool, however, we assume that tools like the OLM (more than RGFA) are most supportive, if students perceive them as useful and therefore use them voluntarily.

With regard to RGFA, we saw in chapter 4.3.2 that teachers found the tool useful especially after they have seen that they can detect their students’ misconceptions. Students on the other side first had difficulties because it was not the normal correct-incorrect rating they were used to. However, when they had understood the task, students were interested in thinking about the elements provided via the RGFA. Students might not have thought deeply about whether the RGFA is useful for them or not, however, they seemed to find the task interesting which might be considered as “useful” for students, whereas boring tasks might be perceived by students as less useful.

With regard to the OLM, we saw in chapter 4.2 that even though teachers perceive OLM as useful, students not necessarily do so. The students of one of the German teachers, for example, did not see how OLM might be useful for them. They could not imagine that seeing their competence level might be useful for them. They neither found self-assessment useful for them. Many of the students just found it to be difficult. Hence, many of these students rejected the OLM, although the teacher perceived it as useful. Notably, this teacher was the only one who introduced the usage of OLM to be voluntarily. The other teachers did not stress this option to their students. Hence, only within this freedom or room the teacher offered, the students could deny to use the tool because they might have just perceived it as “instrument of power” or as “risky because of data privacy issues”.

According to the teacher’s reflections we assume that linking the OLM with grades was not attractive for many of his students. As the teacher still perceives the OLM as useful he wants to try a new way to present the OLM to his students so that they also find it useful.

A critical issue in whether NEXT-TELL tools are adopted in teaching is not only whether the teachers perceive the tool as useful but also whether they succeed in making their students perceive the tool as useful. In contrast to ease of use, perceived usefulness of NEXT-TELL tools needs to be considered within a broader contextual range. The teacher referred to “assessment context” meaning that his students learn in an environment in which self-assessment and self-reflection is not practiced widely or routinely. He also described the OLM as disturbing students’ learning routines that made it even more difficult for them to see the benefits of the OLM. Many of them might just saw it as extra work without any benefit.

### 6.3 Summary

In summary, whether NEXT-TELL tools are adopted in teaching and learning seems to be less a matter of a specific personality trait but rather a matter of whether the teacher perceives the tool as useful. Teachers who do not perceive that a tool might be useful for them, do not want to use a tool. Whether teachers realize NEXT-TELL tools as useful seems to depend much on their (targeted) teaching routines. Notably, Perrotta [2013] showed that “teachers’ perceptions of the benefits of using technology are influenced more by institutional rather than individual characteristics” [p.314]. This result is interesting because according to the experiences in Germany, whether NEXT-TELL tools are adopted in teaching and learning is not just a question of teachers’ perceived usefulness but also of students’ (and even parents’) perceived usefulness, especially if the teachers provide room for students to decide about usefulness in first steps. If principals communicate a clear favour for ICT at their schools, students and parents might also be more open to try, and thus, support rather than stop teachers in adopting NEXT-TELL tools.
7 Discussion

The research conducted within NEXT-TELL’s project year 3 concentrated on e-assessment and feedback. Issues of TISL were also addressed but not yet analysed in detail. ECAAD will be considered in close relation with OLM. Before we provide an overview of our next steps, we summarize the results of year 3 and provide ideas with regard to configuring competencies in OLM and ECAAD.

7.1 Summary

This deliverable D6.5 provided an overview of the research conducted in project year 3. Further insights were collected with regard to professional teacher development (chapter 3), implementation of NEXT-TELL tools which was based on teacher-led research (chapter 4), responses to presentations of NEXT-TELL tools (chapter 5), and an evaluation of factors influencing the adoption of ICT in general and NEXT-TELL specifically (chapter 6).

Concerning professional development in chapter 3 we demonstrated that ICT knowledge is acquired and shared by teachers interested in this topic in informal ways via information exchange in Twitter. Moreover, we demonstrated that collecting student feedback is practiced by some teachers independent of digital media use. Both ways seem to be important and need to be considered further in relation with TISL development in Germany. In England and Norway TISL studies have been conducted in individual schools and key features of adopting the TISL method will be further investigated.

Moreover, several school studies were conducted in order to investigate the adoption and further development of the tools described in chapter 4. The adoption was mainly based on teachers’ interests and their considerations but not formally conducted as TISL studies (see D5.6). We showed how different the adoptions looked like by describing three case studies about the OLM. So far, we can say that OLM use for students was not easy. Furthermore, requirements with regard to the configuration issues in OLM showed how important it is to think about and develop the integration of a planning and configuration tool with the OLM. This issue is discussed more thoroughly below.

Chapter 5 presented how teachers responded to presentations and trainings of NEXT-TELL tools. Within an intensive training on immersive worlds in classrooms, teachers realized the potential of such worlds but trainings needs to be further developed. Presentations on ECAAD and OLM demonstrated which objections teachers and media pedagogues raised. Compared to teachers adopting the OLM (chapter 4) these teachers did not perceive the tools (especially OLM) to be very useful for their teaching routines. Rather, they thought that they would need to change their routines in the one or the other way. This difference was detailed in chapter 6. Here, it was also shown that a special personality profile according to the big five does not seem to determine whether teachers adopt ICT in teaching or not in general.

Overall, it can be said that NEXT-TELL’s e-assessment tools support teachers in different aspects of assessment for learning and that teachers liked to test the tools. We also showed, however, that it was not too easy for teachers to adopt NEXT-TELL’s tools into their classroom practices. This was partly true because of difficulties with using tools by teachers but also by students (e.g., RGFA or OLM and CAS). But it was also partly true because of old routines that would probably need to be changed (e.g., defining and assessing learning goals in a competence-based way) or because of the need for setting up new routines (e.g., practicing self-assessment).

7.2 Configuring Competencies: Providing Suggestions

Besides usability issues when working with NEXT-TELL’s e-assessment tools, it became obvious that a first step for using some tools (e.g., OLM) was to define and configure learning goals. Within NEXT-TELL “learning goals” are mainly defined in a competence-based manner. Whereas configuring sub-competencies was done in the 1x1-Ninja tool by researchers, the OLM demands the configuration of competencies from the user. The studies
demonstrated that configuring competencies was not always easy for teachers because of several reasons. Because competencies and their configuration were difficult topics within our research, we want to discuss them more thoroughly.

First, it needs to be emphasized that although teachers configured competencies in OLM, the configuration of competencies is not necessarily a step that needs to be done in the OLM. Rather, the configuration of competencies can be categorized as a step in lesson planning, and therefore, might be done in a planning tool like the ECAAD planner. However, it becomes clear at first sight that it does not make much sense to configure competencies as learning goals in a separate tool that is not connected with the OLM that shows students’ learning (or competence) progression, which in turn, should support further decision-making processes. The close connection between configuring competencies and showing students learning progression on competence levels needs to be solved technologically in a smooth way that does not burden teachers too much, otherwise the risk is high that they will not use such technologies. Figure 56 depicts the possibility of data flow between ECAAD and OLM by connecting both tools via a third component which offers a light way of competence configuration without detailed lesson planning. It remains open whether the assessment engine (see D3.6) can also provide such a light way of configuration.

![Figure 56: Possible approach of data flow when combining planning (ECAAD) and reflecting (OLM) in software architecture](image)

Despite this suggestion of putting the configuration issue out of the OLM, there are several possibilities to consider why it might be good or not good if the configuration is done in OLM:

- Good because teachers do not need to learn two different tools
- Good because the connection between what is assessed and how might be closer, and thus, helps the teacher to interpret the data
- Critical because configuration tasks in OLM might distract teachers from the core work of OLM – supporting reflection processes by visualizing competencies and qualitative feedback.

Another question is whether it is really necessary that the assessment should focus on competencies rather than on any other formulation of learning goals? As it seems to be difficult for teachers to clearly define, separate, and link competencies, contents, attitude, and activities should the OLM visualize something else than competencies? We think the study by TUG with the cbKST-based feedback in the 1x1-Ninja game showed that students who received competence-based feedback outperformed students who got superficial feedback on number of tasks solved correct or incorrect. This result is in line with recent research on competence-based feedback that also shows that competence-based feedback supports learning [Wollenschläger et al., 2011; 2012]. Hence, despite teachers’ difficulties to disentangle competencies, contents, and activities, it seems to be worthwhile to keep the competence-based approach...
within NEXT-TELL. BHAM’s solution to configure competencies, activities, and groups separately and to connect them via assignment seems to be a good technological approach that should be used even if the configuration might be done in a tool other than the OLM.

Finally, as teachers had difficulties defining competencies and each schools seems to develop their own competence lists, KMRC suggests a possibility for schools how to structure competencies in more detail (for example in ECAAD or in the new OLM configuration tool that accompanies OLM R3) in order to share a kind of common basis with regard to thinking processes. Concerning cognitive learning goals Bloom’s [1956] taxonomy or its revised version [Krathwohl, 2002] might be used as structure. The competencies in Geography configured by one of the German teachers already comprised several levels of Bloom’s taxonomy (see chapter 4.2). However, it remains unclear whether this structure would be helpful for teachers. Although Bloom’s taxonomy is well-known in the English-speaking educational ICT community with suggestions of categorizing on-line tools to different levels, it is less well known among (older) German teachers with less interest in ICT. The structuring or categorizing of competencies might be supported in ECAAD by providing the different levels or categories of the taxonomy (see Figure 57). If competencies are structured according to Bloom’s taxonomy, they might be visualised in OLM in concentric doughnuts (see Figure 58). Such visualizations might show whether students have already reached the lower levels of a broader competence or in a broader topic or subject before moving to higher levels.

![Figure 57: Possible categories visualized according to Bloom’s taxonomy (revised) for ECAAD to characterize learning activities and goals](image)

![Figure 58: Possible visualization of competence levels according to Bloom’s taxonomy as concentric doughnuts in OLM](image)

### 7.3 Next Steps: Upcoming School Studies

As already mentioned in presenting the school studies, most of these studies are ongoing research and further trials will be conducted. The teachers in Austria will develop TALK’s LIP tablet-based application (see D2.6) further within their classes. Moreover, they want to find colleagues who also try the tool to share experiences. TUG is also busy with planning new studies on ProNiFA’s visualisations. The teachers in Germany are already planning with KMRC and MTO their next implementation of OLM in their classrooms. Moreover, MTO
introduced NEXT-TELL to a school in Germany who wants to use the OLM in order to support the teachers in practicing adaptive teaching or individualized learning. A group of about six teachers is considered to use the OLM in grade 1 and grade 5. The Norwegian teachers are also highly interested to further work with the tools used so far and use them for another topic. Furthermore, we are waiting for more feedback from Singapore. Furthermore, as ICT in teaching is still so new and it is often unclear for teachers whether tools they use to support learning really do so, teachers are also interested in TISL (see teachers in England and Norway). Hence, research planned by IOE and UniRes will go on. In Germany, teachers who are thinking about the structure of PLEs might be interested in TISL but also schools who try to adopt the OLM with more teachers.

All the above-mentioned studies will have their focus on e-assessment and feedback or on ICT use in classrooms in general because these fields are of most interest to teachers. Although lesson planning with ECAAD was not in our focus in year 3, studies around the ECAAD tool are considered by KMRC. However, as lesson planning with the method of ECAAD seems to be a difficult issue for teachers, we need to think about different approaches than a narrow use of ECAAD by teachers who have limited time resources. So far, it seems that teachers who are organized digitally often use Evernote to organize their lessons. Evernote is in so far attractive to them because it not only allows them to add content and share with colleagues or even students if they want to but also because Evernote offers the possibility to take a photo of the (chalk)board and add it to their notes as documentation (not necessarily used for planning). According to online discussions teachers seem to find this feature very attractive. As the difference between a tool like Evernote and ECAAD seems to be rather big, the benefits of the ECAAD planner compared to other tools that are used to organize their teaching need to be investigated more closely. Nevertheless, a continuous planning feedback/annotation mechanism was developed for ECAAD which seems to be an interesting feature to consider in further studies (see D2.6).

Before further research is conducted project partners and teachers need to familiarize with the new releases of the tools (R 3).
8 References


http://www.unterrichtsdiagnostik.info/media/files/Broschuere_2.02_30.01.2011.pdf


9 Glossary

Terms used within the NEXT-TELL project, sorted alphabetically.

**BSCW** The document store used in NEXT-TELL used for storing internal documents

**Document store** see BSCW

**EuresTools** The reporting tool used in NEXT-TELL

**PM** Person month

**T** Task

**WP** Work package

**Partner Acronyms**

**JRS** JOANNEUM RESEARCH Forschungsgesellschaft mbH, AT

**UniRes** UNI RESEARCH AS, NO

**KMRC** Medien in der Bildung Stiftung, DE

**TUG** Technische Universität Graz, AT

**CBS** Copenhagen Business School, DM

**BHAM** University of Birmingham, UK

**IOE** Institute of Education, University of London, UK

**EXACT** eXact Learning Solutions SPA, IT

**TALK** Verein offenes Lernen, AT

**BOC-AT** BOC Asset Management GmbH, AT

**BOC-PL** BOC Information Technologies Consulting SP.Z.O.O., PL

**MTO** MTO Psychologische Forschung und Beratung GmbH, DE

**Abbreviations**

**BS** Baseline Study

**CAS** Central Authentication Service

**CbKST** Competence-based Knowledge Space Theory Training Course

**CBT** Computer Based Training

**DBR** Design-Based Research

**ECAAD** Evidence Centered Activity and Appraisal Design (builds on the ECD)

**ECD** Evidence Centered assessment Design (e.g. PADI project)

**EFL** 'English as a Foreign Language'; EFL refers to learning English in a non-English-speaking region, such as studying English in an Asian or Latin American nation. Typically, EFL is learned as part of a student's school curriculum or for career purposes if working for an international corporation.

**ENA** Epistemic Network Analysis

**ESL** English as a Second Language; refers to learning English in the target language environment

**HCI** Human Computer Interaction

**ICT** Information and Communication Technology

**IT** Information Technology

**LEPP** Longitudinal Evaluation of Performance in Psychology (2nd generation e-Portfolio)

**NEXT-TELL** Next Generation Teaching, Education and Learning for Life
OLM       Open Learner Model
PADI      The PADI project aims to provide a practical, theory-based approach to developing quality assessments of science inquiry by combining developments in cognitive psychology and research on science inquiry with advances in measurement theory and technology.
RA        Requirement Analysis
RDS       Researcher-led Design Study
SRI       Stanford Research Institute
STEM      The Science, Technology, Engineering, and Mathematics (STEM) fields are collectively considered core technological underpinnings of an advanced society, according to both the National Research Council and the National Science Foundation
TDS       Teacher-led Design Study
TEL       Technology Enhanced Learning
TESL      Teaching English as Second Language
TISL      Teachers Inquiry into Students Learning

Acknowledgement: The research leading to these results has received funding from the European Union’s Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 258114.