

Communication Tools in E-learning: Experiences in Academic Geomatics Education

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Key words: E-learning, Good Practice, Academic Geomatics Education, Learning Management System, Course Management System *moodle*, Communication

SUMMARY

At the University of Natural Resources and Applied Life Sciences, Vienna (BOKU), the Institute of Surveying, Remote Sensing and Land Information (IVFL) offers education in geomatics (surveying) for more than fifteen study programs on bachelor and master degree. Seven years ago e-learning was introduced at the institute to meet the challenges of the high number of lectures and the huge number of students. The paper investigates the possibilities of communication within an e-learning platform. Based on two lectures at IVFL with different characteristics it describes the practical realization of e-communication between teachers and students. An analysis of available communication tools within the course management system *moodle* is given, based on the experiences of two staff members of IVFL and of the head of the BOKU e-Learning Centre as well as based on the results of a survey amongst students. Conclusions concerning communication in e-learning-systems for providing academic education are outlined in the final part.

ZUSAMMENFASSUNG

Das Institut für Vermessung, Fernerkundung und Landinformation (IVFL) der Universität für Bodenkultur Wien (BOKU) bietet eine Geomatikausbildung in mehr als fünfzehn Bachelor- und Master-Studienprogrammen an. Vor sieben Jahre wurde e-Learning am Institut eingeführt, um die Anforderungen der hohen Anzahl von Lehrveranstaltungen und Studierenden bewältigen zu können. Der Artikel untersucht die Möglichkeiten der Kommunikation in einer e-Learning Plattform. Anhand zweier Lehrveranstaltungen mit sehr unterschiedlicher Charakteristik wird die praktische Realisierung der Kommunikation zwischen Lehrenden und Studierenden beschrieben. Eine Analyse der verfügbaren Kommunikations-Werkzeuge der e-Learning Plattform *moodle* wird vorgestellt, basierend auf den Erfahrungen von zwei BOKU-Lehrenden und dem Leiter des BOKU e-Learning-Zentrums sowie den Resultaten einer Meinungsumfrage von Studierenden. Abschließend werden Schlussfolgerungen betreffend der Kommunikation in e-Learning-Systemen zur Vermittlung akademischer Ausbildung präsentiert.

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1. INTRODUCTION

The University of Natural Resources and Applied Life Sciences, Vienna (BOKU) offers 9 Bachelor Programmes and 23 Master Programmes (7 International Master Programmes) on the topics of agriculture, forestry, environmental engineering, landscape architecture, landscape planning, food sciences, and biotechnology for approximately 6000 students (BOKU, 2008). 17 of all study programmes include a geomatics education (including surveying, remote sensing, and geoinformatics) that is provided by the Institute of Surveying, Remote Sensing and Land Information (IVFL). In sum, the institute handles 140 *semester hours* of lectures, exercises and practicals per year (one *semester hour* is equivalent to 45 minutes of teaching per week within a semester).

To cover the challenges of the enormous number of lectures and of the huge amount of students, teaching staff of IVFL applies advanced teaching methods and modern information communication technology (ICT) to provide an optimal knowledge transfer to the students. Four years ago the e-learning platform *moodle* (moodle, 2008) was introduced at BOKU and IVFL to support all educational tasks. The acceptance of e-learning at BOKU is growing, as documented by the significantly increased number of lectures, users and accesses to the *moodle* platform (Figure 1).

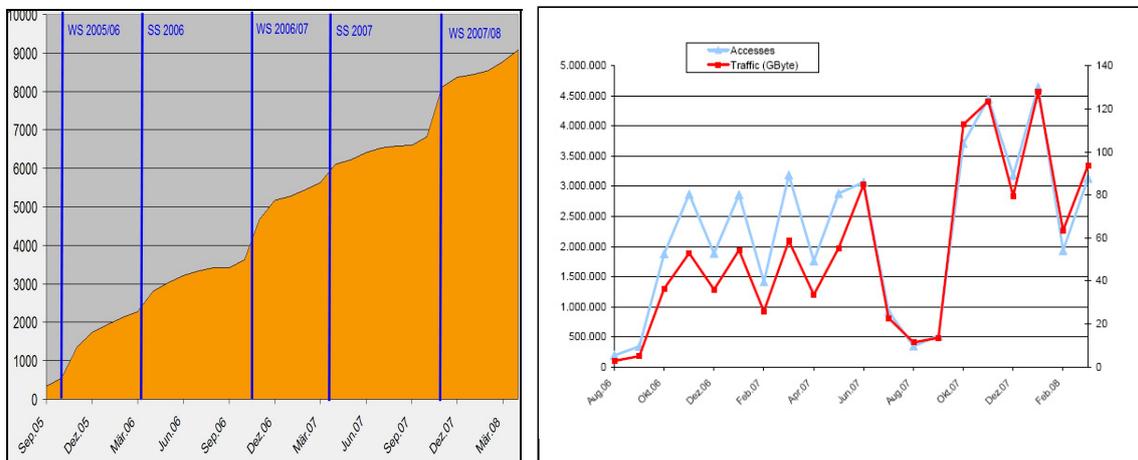


Figure 1: Growth of e-learning use at BOKU
(left - number of users, right - accesses and traffic)

An essential ingredient in the knowledge transfer between teachers and students is communication. Communication is defined as the *process that allows organisms to exchange information by several methods* (Wikipedia, 2008). Communication can be performed by

written means (text, graphic, animated graphic, etc.), auditory means (speaking, singing, etc.) or physical means (body language, gesture, sign language, touch, eye contact).

The three principal learning concepts are characterized by the kind of communication between teachers and students. *Conventional Teaching* (face-to-face teaching) requires the physical presence of teachers and students. *Distance learning* is based on a virtual communication by electronic media. Finally the *Blended learning* concepts describes the combination of traditional face-to-face and virtual communication.

Communication in knowledge transfer is a comprehensive issue. In academic education communication is not only restricted to teachers and students. Modern teaching and learning activities require also interactions with administrative and technical staff as well as with professionals of the public and private sector.

This paper is not able to cover all the aspects of communication in academic education. Therefore it is restricted to document the application and experiences of two BOKU-lecturers and the head of the BOKU e-Learning Centre with the communication tools provided by the e-learning platform *moodle*.

2. ASPECTS OF COMMUNICATION IN E-LEARNING

While in the early days of e-learning discussions were dominated by content, how to modularize and standardize it, the focus shifted towards online communication and collaboration over the last three to four years. The content still remains a constant factor in e-learning, but *Web 2.0* technologies, also called *social software*, were introduced into higher education (O'Reilly, 2006). The communicational part of e-learning can be characterized by different aspects.

Direction: The direction of the communication can be in one way (unidirectional), in two ways (bidirectional) or in many different ways at the same time (multidirectional). The unidirectional communication most often takes place when information is given by the teacher to the students like announcement boards for example. While there is no possibility for questions or feedback by the recipients, theoretically all have the same level of information at the same time. In bidirectional communication the communication takes place in both directions like chats, video conferences or online discussions between teachers and students (Kear, 2007).

Relation: As in real life a further differentiation can be made by the number of participants: one-to-one (1 : 1) communications like a private talk, one-to-many (1 : n), characteristic for a lecture, and many-to-many (n : m) as a discussion for example.

Response Time: Another aspect is the response time between the interactions by the participants. On the one hand synchronous communication such as a chat for example provides almost immediate reaction thus providing prompt feedback. The disadvantage is that the participants are on pressure since the others are waiting for their response. Discussion forums on the other hand with a time interval between the interactions are forms of asynchronous communication. This gives an opportunity for reflecting the other contributions and time before writing their own postings (E-teaching, 2008).

Content: The content of the communication in university e-learning settings itself can be dealing with course subject related, organisational, technical, or informal questions.

Media: The communication itself can be facilitated by different media such as text, illustrations, audio or video. These media can be combined like an illustrated comment in a blog or video conference with a whiteboard.

Number of Channels: Of special importance is the number of channels involved in the communication including verbal and nonverbal cues like the use of voice and facial expression in video conferences (Parks Floyd, 1996 in Yuzer et al., 2007).

Roles of the participants: When looking at the roles participants play within a virtual learning environment three main types can be distinguished: the *system administrator*, who can see and change everything but is usually not responsible for the courses and is therefore not covered in this paper, the *teacher*, who can modify everything in her or his course, and the *student*, who's rights to participate in activities and access learning materials are restricted. Modern course management systems such as *moodle* allow the creation of customized hybrid roles like upgraded student roles with teacher like rights for single activities or teachers with reading rights on the whole faculty level.

Level of activity: The engagement of the students can be *passive* or *active*. While the nature of passive engagement from a student's perspective is to perceive information, its active counterpart provides an environment for applying the information and getting feedback if the lesson was understood. When knowledge is actively built by the students themselves (constructivism) others learners can be passive at the same time in receiving this newly created information. In this case a communication flow takes place from active to passive participants.

Informal communication: Nevertheless informal learning plays an important role in the context of formal academic education. Parallel to formal framework provided by the university, students use a multitude of ICT tools ranging from chat and VoIP systems to discussion boards provided by the student union. Blending them in a pragmatic manner and often mixing work with private life, these forms of communication and collaborative team work are mostly invisible and therefore uncontrollable for the teachers. According to Csanyi et al. (2007, 2008) the speed of communication seems to be a crucial factor as students are not used to wait: if respond time between a student's question and answer is too long the need of communication itself will disappear together with the learning motivation.

3. VIRTUAL COMMUNICATION IN *moodle*

At BOKU the e-learning platform *moodle* was implemented in autumn 2005. Regarding the virtual communication the moodle system enables a broad spectrum of communication tools as outlined below (moodle, 2008). The challenge during the planning stage of a lecture is the choice of proper tools to facilitate the optimal knowledge and information transfer.

3.1 Tools of Communication in *moodle*

Choices: Choices enable the teacher to get a quick poll to a specific question. Students are able to make a choice out of multiple responses predefined by the teacher. This tool is mainly used for organizational purposes, e.g. assignments to groups or for scheduling appointment.

Resources: Resources are the kernel of an e-learning platform: they represent the content (knowledge) and information provided by the lecturers. Prepared files (manuscripts, papers, presentations, etc.) can be uploaded to the server and links to external web pages can be established. All the files and links can be labelled and described by the lecturer. Students get access to all resources.

Assignments: During course lecturers often specify tasks that students can elaborate at home. The results of this work (report, essay, calculation) have to be converted to a digital format and can be submitted in various standardized file-formats to the e-learning platform. The assignment tool also includes grading facilities.

Chats: Online (real-time synchronous) communication between teachers and students is facilitated by the chat-Tool. A chat room can be opened for discussing a specific topic, but it might also be used as virtual consultation hours of lecturers. Numerous features for managing and reviewing chat discussions are available on the *moodle*-platform.

Forums: Forums can be used in two different ways: News forums act as announcement platforms (blackboard). Discussion forums enable a knowledge transfer based on questions and answer(s) between all the actors. Normally forums are installed by the lecturer and all participants are allowed to add discussion topics. To accelerate the communication process, contributions in the forum also can be submitted per e-mail. An option of this module is the peer rating of each posting.

Lessons: Content can be delivered to students in a flexible way with the lesson-module. A lesson consists of a number of pages. The navigation can be done straight forward in a defined order or in a more complex way by predefined buttons. The acquired knowledge of the students can be checked by one or more questions at the end of each page. Depending on the answer the navigation to the next page can be controlled.

Quizzes: Quizzes are a very powerful tool in *moodle* for checking the knowledge of students (Mansberger et al. 2006). Teachers have various options to organise of tests, like the definition of a time limit or number of attempts allowed. Many kinds of question are available in this module, like single answer questions, multiple answer questions, true-false questions, embedded answers, matching, and numerical examples. The questions are kept in a categorised database. Using the grading facilities included in the test module the students will receive immediately the results.

Wikis: A wiki enables students to edit web pages collectively. Using this technology the contents of a document grow continuously. The text always can be proofed, corrected or extended by each of the wiki participants.

Grading: *moodle* includes a grading module implemented in many of the available communication tools. Lecturers have the possibility to predefine the maximum number of points for each of the tasks. The rating itself is done automatically (e.g. in the quiz module), by the lecturer (e.g. in the assignment module) or by a peer rating of the students (e.g. in the forum module).

The authors of the paper got experience with all the tools outlined above. But until yet there are still “white spots” in the full spectrum of communication tools available in the *moodle*-

platform, as the *Glossary*-module, the *Journal*-module, the *Workshop*-module and the *Survey*-module.

The *Glossary*-module allows participants to create and maintain a list of definitions, like a dictionary. Links from the whole course materials to all the entries can be created automatically.

The *Journal*-module enables a communication between the teacher and an individual student. Students have to reflect within a defined time to a specific topic. So this module can be used to trigger the activity of students.

The *Workshop*-module is a peer assessment activity that allows all participants to evaluate each other's projects.

The *Survey*-module can be used to get feedback about the learning environment. At BOKU the questionnaire is predefined.

3.2 Characteristics of Communication Tools in moodle

As documented in *Chapter 2* the communication tools in an e-learning system can be characterized by different aspects. Based on their own experiences the authors classified all the communication tools available on the *moodle* platform. The results of this analysis can be seen in *Figure 2*.

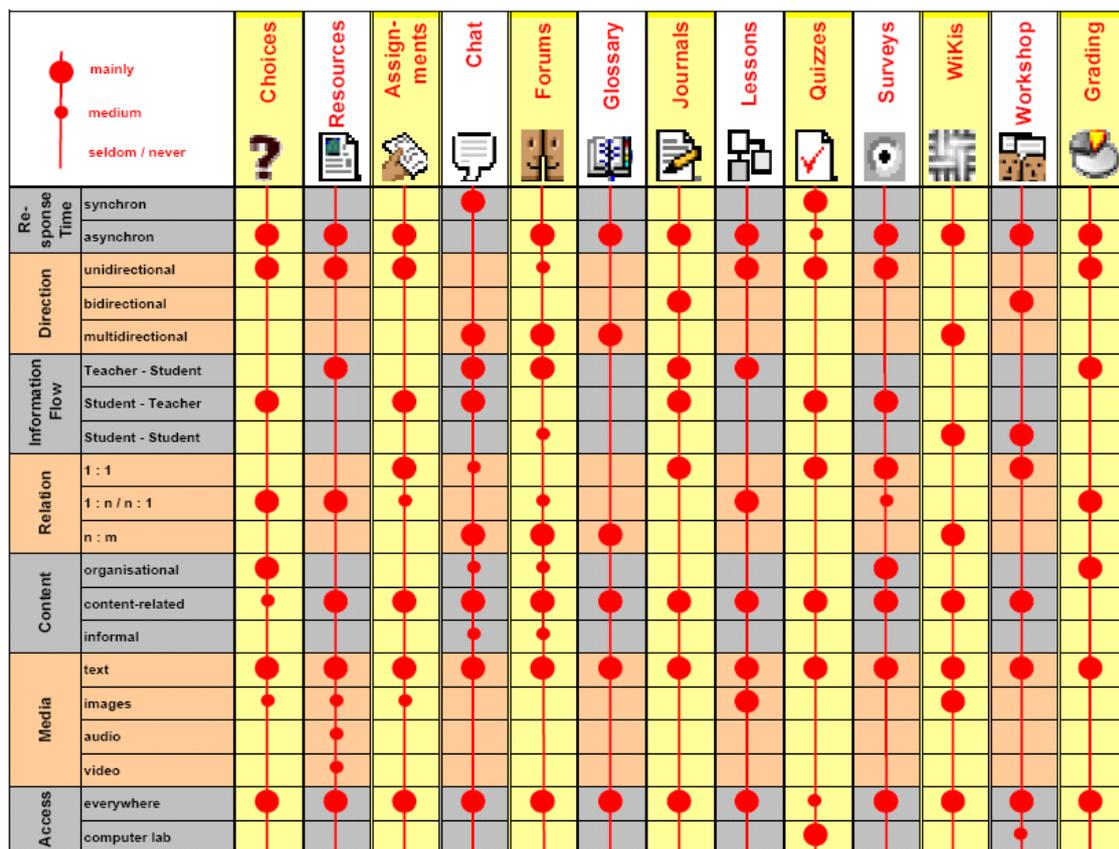


Figure 2: Characteristics of Communication Tools in moodle

For example the quiz-tool is a unidirectional tool, as the students have to provide evidence about their knowledge on the topic. The information flow is from the student to the teacher and as the test has to be done by each of the students individually, the relation of the information flow is (1 : 1). The content of communication is strongly content-related and the medium written text. Dependent if the quiz is used as an examination or – optional – used as a self-assessment quiz, the access has to be provided in a computer lab (controlled by the lecturer) or - in the case of the self assessment - the quiz can be carried out from everywhere.

3.3 Time-dependent Application of moodle-Communication Tools during a Lecture

Due to their characteristics the communication-modules can be applied for specific didactic tasks during the education process. At the begin of a lecture (or a phase of a lecture) normally a lot of organisational information has to be delivered to the students and from the professional education the first stage in a teaching process usually is the *knowledge transfer* from the lecturer to the student. As the information flow is mainly from the teachers to the students, all the communication tools with this specific characteristic (news forum, choices, resources, lessons) are primary in use during the first phase of a lecture (see *Figure 3*).

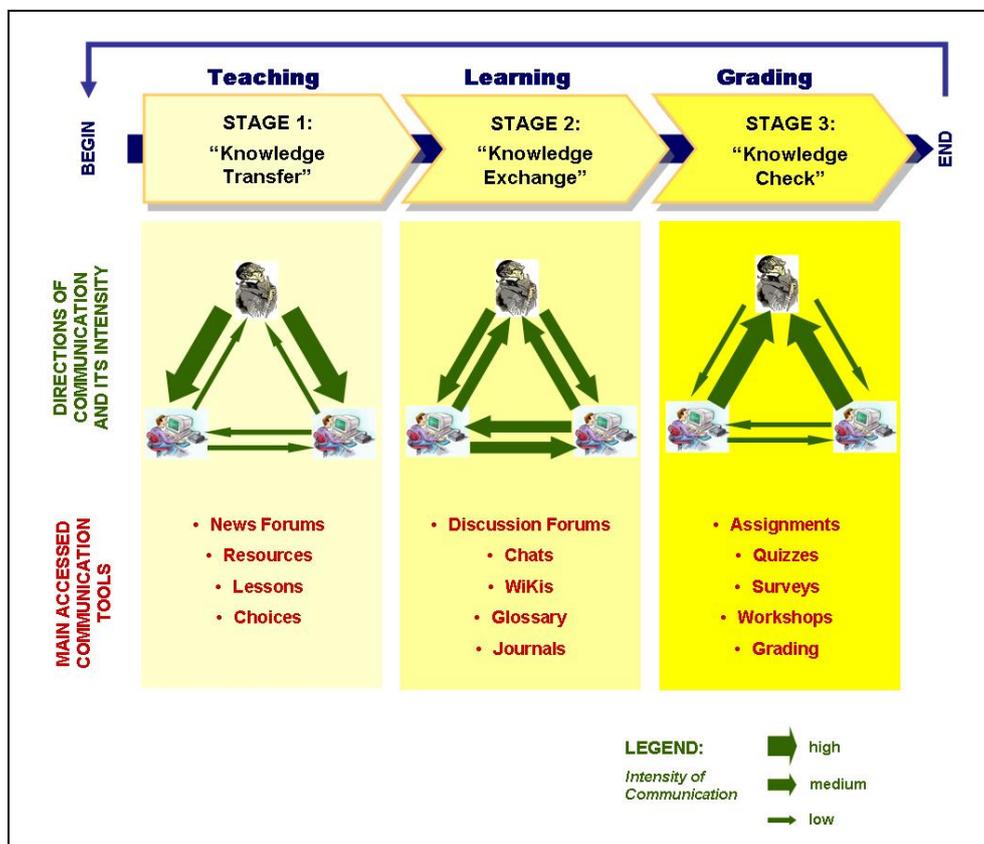


Figure 3: Access of moodle-tools during the different stages of a lecture (or phase of lecture)

In a next step the students have to acquire and to extend the knowledge. The *moodle*-platform provides several tools for *knowledge exchange* between teachers and students as well as

among students. Communication activities with multidirectional information flow and (n : m) relation are predestined to achieve an optimal information exchange between all participants (discussion forums, chats, wikis, glossary, journals).

During the final stage of a lecture normally the students have to be checked, evaluated and graded about their knowledge achieved. Assignments, quizzes, workshops and grading are proper activities for knowledge control, as these tools enable an information flow from individual students to the teacher (unidirectional, (1 : 1) relation). By using the survey-module teachers will get feedback from the students on the quality of the lecture and on their personal performance.

4. INVESTIGATION ON VIRTUAL COMMUNICATION IN ACADEMIC SURVEYING EDUCATION

4.1 Sources of Investigation

The analysis of the virtual communication is based on the experiences of two lecturers gained in two characteristic lectures of the surveying education at BOKU and from the head of the BOKU e-Learning Centre. Additionally the experiences of students with the e-learning platform *moodle* were scrutinized by a student survey and by personal interviews with students.

4.1.1 Lectures supported by e-learning at IVFL

The lecture *Applied Photogrammetry* (3 semester hours) gives the students a more comprehensive understanding of photogrammetric methods. Due to the limited instrumental equipment the compulsory-elective lecture is limited to 12 students. The lecture is designed in the *Blended Learning Concept* using the *moodle*-platform.

During the first stage a face-to-face lesson on specific topics of photogrammetry is given and photogrammetric software is trained to the students in the computer lab. An excursion to the photogrammetric lab of the Austrian Map Agency (BEV) is also part of *knowledge transfer*. All materials are provided in a digital format by the *resource*-module. Organisational information is communicated by the *news forum*.

In the second phase – the main part of the lecture – the students have to elaborate a photogrammetric project. This task has to be done as group work (*knowledge exchange*). The students have the possibility to select one out of several offered photogrammetric projects using the *choice*-activity in *moodle*. Manuals of the photogrammetric software are provided by the *resource*-module. The practical work is supervised in a mixed way: lecturer and tutors are supervising the students in the computer lab during predefined times. Additional questions of students are answered in a distance-learning component by the *chat*-tool and the *discussion forum*-activity.

Finally the students have to proof their knowledge at the end of the lecture (*knowledge control*). The grading was based on the quality of final photogrammetric project, on the content of the technical report (submitted by the *assignment*-tool) and by a final test (*quiz*-module).

The courses *Geoinformatics* aims to teach students the basic principles in the application of geographical information systems (GIS). In the winter term 2007/08 110 students were enrolled and in the summer term more than 250 students attended the course. It is divided into two parts, a lecture on theory (2/3 of the available 3 semester week hours) and a practical (1/3) where students are working with a GIS software. While the theoretical part is finished by a written exam, students have to work out a small project during the practical. After the upload of the results to the server (*assignment* tool), the projects are marked and a feedback is given by the teacher (using the *grading* function). Student can then modify their projects until the deadline.

The theoretical part is based on a face-to-face lecture and gives an overview of definitions and terms related to geographic information processing. In addition an e-book is offered to students summarizing all topics of the lecture as html pages or as a pdf-document. After students are taught in the principles of a GIS, the practical part of the lecture starts.

The big challenge for the practical part is the lack of appropriate infrastructure to teach a large number of students in software applications. The computer lab of the institute consists of 12 workstations and not more than 20 students can sit in a relatively small room. Instead of teaching six parallel groups it was decided to follow the distance learning concept for the practical. An e-learning course was prepared for that purpose and students are given a DVD with the software (ArcGIS - student edition). Step by step students will learn how to use the software and small exercises have to be solved. The software tools are explained by using screenshots, animated GIS and complex tasks are demonstrated with short video sequences. The amount of time for the practical is estimated with 15-20 hours. A survey has proven that this is realistic and most of the students succeed in completing the practical within that period.

For the communication between teachers and students *discussion forums* and *chats* are offered where problems can be solved. The e-learning course is supported by tutorials in the computer lab. During the opening hours students can work on the workstation under the guidance of a tutor.

4.1.2 Student Survey (Opinion Poll)

A survey was carried out to get feedback about the communication tools and the software used during the courses. The survey was based on a questionnaire that was designed on the e-learning platform. Students were given an anonymous login name. The survey was sent to all students of the courses described above. The return quote was about 25% taking into account those students who finished the course.

The first part of the questionnaire contained common questions as the number of semesters enrolled at the university, the study program, where e-learning is mainly used, etc. The second part focused on the software used during the selected course. It comprised questions on the usability and functionality of the software especially from a beginner's point of view. This is to see if the software is suitable in regard to the goals of the courses. The third part addressed the communication during the courses, e.g. tools used, quality of support by the teachers.

4.2 Lessons Learnt

This chapter summarises the main results of the survey and the conclusions as drawn by the teachers.

Students accept e-learning

The survey revealed the *moodle* is widely accepted by the students. 90% appreciated the integration of e-learning in the courses and for 41% the e-learning platform is a big relief for their daily study life (see *Figure 4*).

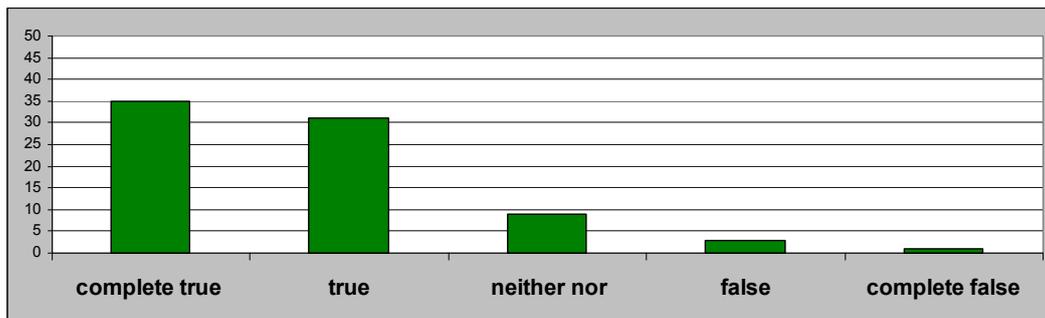


Figure 4: Question: BOKUlearn is a relief in my daily study life

Access to e-learning platform from private computers

91% of the students login to the e-learning platform at home, the rest at the computer labs at the university. 92% of the students already attended an e-learning based course at the BOKU. Only for 8% it was the first touch with *moodle*.

As stated in the previous chapters, various ways of communication between teachers and students exist. Especially during the process of learning (knowledge exchange) specific software tools communication is essential. Several questions were ask regarding the unidirectional way of communication (i.e. information is given from teachers to students).

Structure of courses is logical

87% of the students agreed that the structure of the courses followed a logical way. A well structured and clear work flow is essential for the training of software applications.

Videos and animations appreciated by students

For the explanation of software tools short videos and animated GIFs were used. The survey has shown that especially videos are appreciated by students (72%). Videos and animations are a perfect tool for demonstrating online the use of software functions.

Informal Communication essential for problem solving

In case of problems when learning the software, several possibilities were offered to students in order to get help. *Figure 5* shows the answers in regard to the communication tools used. Multiple answers were possible.

95 students answered to use online communication when looking for an answer while 110 students searched for help through a personal contact to either the teacher or colleagues.

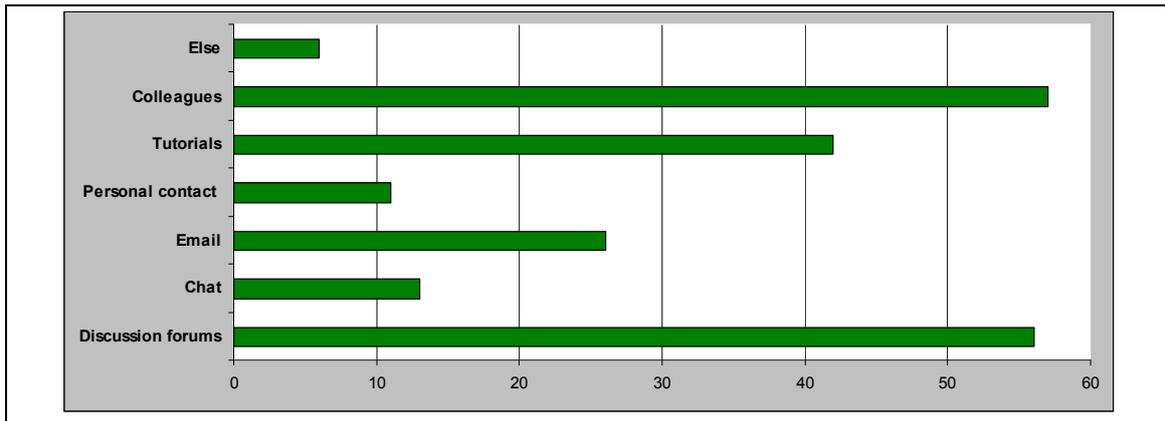


Figure 5: Question: What kind of communication tools did you use in case of problems?

The high number of answers for "colleagues" shows that especially informal learning (i.e. students help each other and work together) plays an important role when applying e-learning. Also the tutorials were often visited by student. These high responses reveal that a personal contact is often wanted by the students. At a separate question, 54% of the students confirmed that the tutorial were a good support for the practical work.

Response time for requests sufficient

Asynchronous communication with a time interval between interactions is somehow problematic when teaching software tools. There is a danger that students get frustrated when hanging with a problem. 83% confirmed that the answers given in the discussion forum or sent per email were given within a sufficient time range. A frequent online presence of the teacher is therefore necessary. Synchronous communication as a chat is more useful in that case although it was not used by the students that often. 84% of the students confirmed that they received the right answers.

Online Consulting hours accepted by students

Those students who used the chat where asked if the number of online consulting hours was sufficient (Figure 6). The majority of students was pleased by the online presence of the teacher. Online consulting hours are different to normal consulting hours as students are often using the e-learning platform at "non-office" hours.

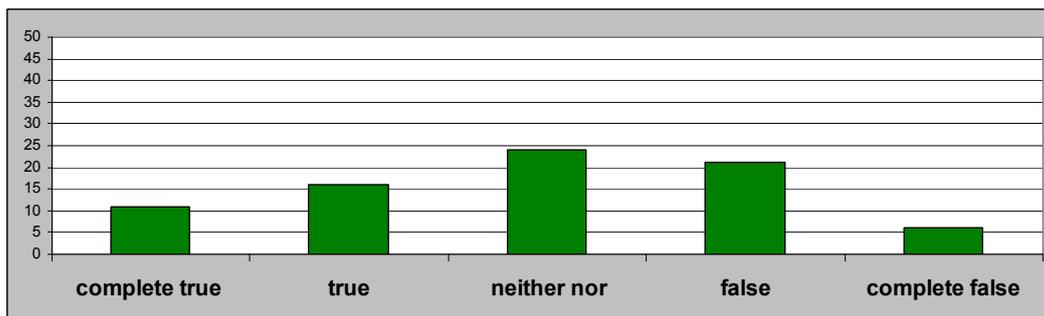


Figure 6: More face-to-face lecture units should be offered and the software tools and their applications should be demonstrated in the lecture hall.

Students are ambivalent about additional face-to-face units

The question about additional face-to-face units in the lecture hall revealed that not all students favour distance learning courses. As it could be seen from other answers, a personal contact is important to many students.

The survey also offered the possibility to students to give a written feedback for topics not covered during the survey. In addition some of the following points are based on personal talks with the teachers and reflect the experience made by the teachers during the courses.

E-learning requires flexibility in time for lectures

When analysing the time and the date of the postings within the discussion forums, it is obvious that students appreciate the flexibility in time. Many of the questions were raised at “non-office” hours (e.g. on the weekend, in the evening, etc.). In case of teaching software tools, this is problematic as students need answers to specific questions. Otherwise they will get frustrated. Teachers therefore have to try to take this flexibility into consideration and adapt as far as possible their working hours.

Benefit of e-communication increases with number of students

One of the goals for the application of e-learning is to save time for teachers. Especially organisational issues such as notices of changes or supply of students with new features can easily be handled with the help of E-communication.

The documentation of questions in a discussion forum or the generation of FAQ (frequently asked questions) help students when facing problems. Teachers are then not asked the same questions several times.

Questions posted on the e-learning platform are well-considered

In context with the above mentioned benefits of e-communications, teachers at IVFL experienced that questions posted online are in many cases well-considered. Students are posing a question more precisely than in a face-to-face lecture.

Acceptance of online exams

In the meantime online exams are widely applied at the IVFL in order to deal with the large number of students and to minimise the time for correcting. Online exams are accepted by students as the results are comprehensible, actual (students receive the result immediately after submission) and personalized. I.e. the students can only see their own results.

Students favour synchronous communication to asynchronous communication

The survey and written feedback pointed out that students still prefer synchronous communication, especially when learning software tools.

5. CONCLUSIONS

Within the last years the lecturers of the Institute of Surveying, Remote Sensing and Land Information gained a lot of experience in providing academic education by means of e-learning components. It was recognized that a well directed use of these modern teaching and

learning tools enables an improvement in the quality of knowledge transfer, knowledge exchange and knowledge control. In addition e-learning platforms enable an increased flexibility of time and place for teachers as well as for students.

This paper focuses on the communication part of e-learning platforms. Communication is analysed and classified by its characteristics. The proper use of specific communication tools during the different stages of a lecture is outlined. Lessons learnt in the virtual communication are documented, based on the experiences of lecturers and students.

Concerning the communication in academic education in general and virtual communication enabled by an e-learning system in particular the following conclusions can be outlined.

Communication is the information carrier in academic education

During a lecture different contents of information (e.g. organisational, professional) are transferred and exchanged between all players in academic education (e.g. lecturers, students, public authorities). Any information transfer between human beings is realised by communication. The lack of communication between lecturers and students is equivalent to an insufficient information transfer and successively to a poor education.

Characteristics of communication is varying during a lecture

Different stages of information transfer can be observed during a lecture. At the beginning of a lecture knowledge mainly is provided by the lecturer (*teaching period*). Teaching materials can be downloaded from the e-learning platform by the students, based on their personal requirements. In a second stage knowledge is exchanged between lecturers and students but also amongst students (*learning period*). Synchronous communication tools are favoured during this *learning period*. In the final phase the knowledge of the students has to be evaluated by the lecturers. The main direction of information transfer during the *assessment (examination) period* is from the individual student to the lecturer.

E-learning platforms provide proper tools for various kinds of communication

The characteristics of communication are manifold. Communication is differing by response times, contents and directions of transferred information, number of involved persons, etc. E-learning platform, such as *moodle*, provides a huge number of tools tailored to specific needs of communication.

The use of communication tools has to be planned

The use of e-learning platforms does not necessarily save time for lecturers. Especially the preparation of e-content is a very time-consuming process. The implementation of proper communication tools improves the quality of the knowledge transfer and enables more place and time flexibility. In addition lecturers can reduce their working hours for organisational and administrative activities by using adequate tools at the right time.

Virtual communication cannot completely substitute personal communication

The lecturers of the IVFL appreciate the implementation of the e-learning platform at the BOKU. E-learning is a relief when facing shortage of educational staff and infrastructure. The system provides a broad spectrum of possibilities in e-communication and the performance of the *moodle* platform at BOKU is reliable and stable. Nevertheless, face two face communication has to be the first choice for educational tasks.

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BIOGRAPHICAL NOTES

Reinfried MANSBERGER currently works as an Assistant Professor at the Institute of Surveying, Remote Sensing and Land Information at the University of Natural Resources and Applied Life Sciences, Vienna (BOKU Wien). In 1982 he obtained his Master's degree in surveying at the Vienna University of Technology. He obtained his PhD degree at the BOKU Wien. He is in the editorial board of Ashgate "Land Management Book Series" and involved in FIG as Austrian delegate of Commission 2. Reinfried Mansberger is an elected member of the European Faculty of Land Use and Development and Council Member of the Austrian Society of Surveying and Geoinformation. His research work is focusing on Land Use Planning, Land Information, Land Administration Systems, and Photogrammetry.

Claus Rainer MICHALEK is the head of the e-learning Centre at the University of Natural Resources and Applied Life Sciences, Vienna (BOKU Wien) since 2004. The centre coordinates and hosts all activities related to blended learning and online collaboration. Claus Rainer Michalek obtained his Masters' degree in Landscape Architecture and Planning at BOKU in 2003. His research work focuses on e-learning and blended learning in higher education.

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