

# **TUM: Junge Akademie**

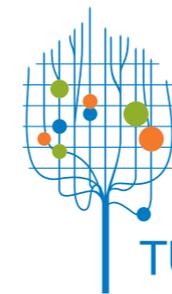
Project Reports 2014/2015



# TUM: Junge Akademie

Project Reports 2014/2015

Partner of



TUM Universitätsstiftung

## TUM: Junge Akademie 2015



This book presents the outcomes of the 2014/15 project groups. The evolution of these projects was again an exciting process. In the initial proposals, which were part of the individual applications for becoming a member of the TUM: Junge Akademie, ideas bubbled up frenetically – concrete, solid, visionary, fantastical, woodcut-like. Through a process of collaborative review and discussion, they gradually merged into focused topics for the project teams. Here creativity and enthusiasm, combined

with clearly and tightly described ideas, led to challenging projects with well-defined aims and tangible outcomes, requiring a well-structured project management and effective teamwork.

Under the theme of “Campus of the Future,” the TUM: Junge Akademie has encompassed an impressively wide range of issues, ideas and proposals. It includes the scientific overview of new electronic teaching formats facilitating motivational teaching (LectureLab); the development of communication structures that can negotiate the enormous diversity of a university with 50,000 staff and students (openTUM); a proposal for the use of an Internet cloud technology (TUMCloud) to optimize the exchange of information within TUM, ranging from specific research matters to finding the best way to communicate on specific topics; a campus radio (TUMradio) as a new “old” format to promote the TUM community;

and, finally (zusammen.sammeln) the development of a charitable donation system for TUM based on the concept of micro-crowdfunding. All projects show how ideas can have a valuable impact, if they are effectively developed, managed and implemented.

The project ideas presented here originated in the period during which Prof. Regine Keller was Director of the TUM: Junge Akademie. I thank her warmly for her support of the students and for the creation of an inspiring environment.

In this book, you can also read about the further development of the projects of previous years, about the projects in prospect for the coming year under the new theme of “Transformational Processes”, as well as about other activities unfolding at the TUM: Junge Akademie.

I would like to give my sincere thanks to all the mentors and tutors involved in the projects. Your generosity of time, expertise and friendly advice has been of enormous value to the project groups. Many thanks also to the Management Board, Herr Finger and Frau Hannecker for your invaluable and highly professional guidance.

Enjoy reading this book!

Yours,

Gerhard Müller  
Senior Vice President Academic and Student Affairs

## Dear members, friends and supporters of the TUM: Junge Akademie,



To develop visions and projects that can focus the campus of the future and lead to effective practical actions is an ambitious task whose successful realization is not always easy, even for an experienced university manager.

It is all the more exciting, then, to observe talented young people rethinking academic questions afresh from the perspective of interdisciplinary teams – developing hypotheses, testing them with

scientific methods, and generating convincing results.

The project teams of the TUM: Junge Akademie are able to engage with TUM in its entirety, as a large laboratory comprising not only students and doctoral candidates, but also, equally, professors and staff from different faculties, along with a large group of alumni of TUM. Every single individual can contribute and support the project teams in the work which they tackle with such great creativity and commitment.

The TUM: Junge Akademie thus supports and advances its most talented students at an early stage. Over 60% of these students have already decided on a career in science or are planning to undertake a Ph.D. in the future – and, of these latter, over 80% hope to be supervised by a professor within TUM. Our university opens many doors to facilitate this. Our dedicated professors offer their expertise and experience to provide relevant ideas, motivation and

inspiration, and they bring members into contact with their personal academic networks, thereby making themselves excellent role models as scientists – though perhaps even more as human beings!

This year, too, sees the TUM University Foundation standing side by side with the Academy as a supporting partner, thus expanding opportunities for individuals to develop their scientific competences and further encouraging the interdisciplinary exchange of ideas on issues of social and political relevance.

For 2016, the TUM: Junge Akademie has written into its agenda not only the implementation of new projects and the new initiative, “Transformational Processes”, but also ambitious aims for the development of its own organizational structure: In particular, the link with the MCTS will be consolidated and a further link will be created with the Hochschule für Politik, as these institutions provide significant support to the leading researchers of TUM in their investigation and elaboration of the complexities of how social and political structures interact with science and technology.

I wish all those involved in these endeavors perseverance, determination, fitness of thought and action, as well as enthusiasm, not only in the development of ideas but also in the celebration of their successes.

Cordially yours,

A handwritten signature in blue ink that reads "Wolfgang A. Herrmann". The signature is written in a cursive style.

Wolfgang Herrmann  
President

„Coming together is a beginning;  
 keeping together is progress;  
 working together is success.“

Henry Ford

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## Project Report **LectureLab**

### Team

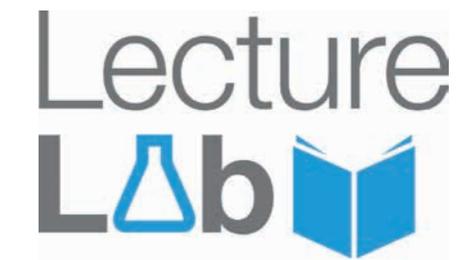
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## LectureLab

It is eight o'clock, Monday morning. The class starts in 15 minutes. 500 students and one professor who is supposed to teach them mathematics. This is a challenge, as there are 500 individuals and one cannot read their thoughts. Some of the students are finishing their coffee, many are yawning, rubbing their heads and quietly suffering under the prospect of differential equations.

It's hard to follow complicated algebra, sitting in a huge lecture hall surrounded by an anonymous crowd of fellow students, watching a tiny person in front of a large blackboard scribbling down random numbers or flipping through some complicated looking slides. It is very tempting to put off concentration for two more minutes and have a look at your favorite social network – just to see what happened on the weekend – to write messages and dwell in the smartphone distraction just a little longer.

It would be difficult to give a talk about any topic in front of such a huge indifferent mass of people. How would you feel expressing that a cure for cancer has finally been found, but everyone is more interested in their coffee? Is there a way to enhance conveying the fascination of mathematics to 500 students who are getting more confused and tired with every slide, filled to the last corner with complex formulas? In this technologically advanced world we live in, where communication around the globe is easier than ever before, there should be a possibility to interact better with 500 people. And it is possible – e-learning tools have been invented for that purpose. For example, questions can be asked to a crowd via a smartphone app in real time. A group of professors and students at TUM has started a pilot project to implement those tools.

“Well hello back everybody – please take out your smartphones.” The professor earns some skeptical looks. “I explicitly ask you to use your phone and go on the internet.” He has their attention now.

“I want to help you recap what we learned last week. I will ask you a question which you will see on the screen behind me. You can answer this question by following the link you see here. I will give you 30 seconds to answer this multiple choice question and afterwards a bar chart will show us how you answered.” One minute later the results show that, surprisingly, 300 students participated. “Okay... so there still seem to be some misunderstandings on the topic of differential equations. I will go into that again for a minute because it is important for you to understand.” The students are listening now and some even make some remarks in their lecture notes. At 9:30 the coffees are long finished and the lecture ends. This time the students stayed in the lecture hall until the very last minute. The professor smiles and packs his belongings.

Meanwhile from one student's point of view...

“To solve the differential equation you need to...”. The voice of the lecturer blurs in my head as I try to follow his explanations. My attention fades and my eyes wander across the lecture hall – 500 fellow students and we all try to tackle another semester of complicated studies.

The subject matter is difficult and even if I try to write down everything the lecturer writes on the blackboard I understand only half of it. But maybe it's just me and at this pace... come on... will anyone really fully grasp this complex matter in such a short time? I am sure that if I revise the lecture again at home with more time and the necessary composure I might be able to finally understand how to solve differential equations.

Well... my experience tells me this isn't going to happen. So I should ask questions now – here in the lecture. But no one really does that – right? Don't I seem stupid if I am the only one raising

my arm and asking the lecturer to repeat the last step? Moreover, maybe I even annoy him with my stupid question. He has a lot of teaching points to bring across this semester, he cannot always repeat the topic just because I am not able to understand. So I continue scribbling down the lecturer's remarks. I will figure it out eventually, the notes will help me with that and if everything else fails I can always ask Wikipedia – right? But then the lecturer wants us to use our smartphones and introduces us to e-learning tools. Unbelieving stares are the answer – also mine. But in the end everyone participates and tries out the new tools.

Now, with a new e-learning tool designed with both lecturers and students in mind, every time I have a question during the lecture I can type it into my smartphone and it will be sent to the lecturer. Every time we are scribbling down our notes and the lecturer pauses, he can look up the feed of questions on his phone or tablet. This way all of my urgent questions get answered during the lecture. I don't have to be afraid of asking because the tool works anonymously. When I encounter problems after the lecture going through my notes, I can put down my questions and ask them in the next lecture. Once the lecturer finds time and considers my question relevant he repeats and answers it for us all.

But it's not only me. My fellow students also regularly ask questions through this tool now and quite often I think – yes that is exactly what I was wondering for a while, but I couldn't really put it into a proper question. Sometimes we even surprise the lecturer and come up with a question he had never thought of. In these cases, he seems really excited about how well the tool works and encourages us to continue asking. I have the feeling that it also eases his work a little. He gets feedback on what topics are actually challenging for us – just by looking at the number of questions raised – and it seems to lower the number of students that come to him after the lecture with questions they didn't want to, or were

afraid, to ask during the lecture. It seems like a win-win situation and my learning experience has definitely improved.

Normally I used to go out of the lecture hall some minutes before the lecture ends to get a coffee before catching the bus, but now every minute of the lecture is more valuable than a coffee, so I stay till the end and so do the others. Impressed by the new possibilities we leave the lecture hall.

## Abstract

**LectureLab proposes an e-learning tool that improves professor-student communication during lectures, something which has been deteriorating in recent years as student numbers have increased rapidly.**

A number of e-learning tools have been analyzed in detail and categorized with respect to both technical and didactical features. Moreover, three lectures were examined by applying different e-learning tools and surveying students' and lecturers' perspectives before, during and after using the tools. The surveys were qualitatively analyzed and highlighted both positive and negative aspects of the tools, such as an enhanced interaction between the lecturer and the students, but also potential disappointment if the interaction did not lead to the desired changes and enhancements. Other critical points such as the potential of the tools to distract students appear to be less important, according to the survey results. All in all, e-learning tools seem to be a promising add-on in lectures where interaction between the lecturer and the students is not possible on a personal level.

## 1. Introduction

In recent years many countries have begun to see the need to advance towards a knowledge society and thus political directions have fostered access to third level education in their education systems. This has resulted in rising student numbers especially at university level. This in turn has led to lectures with large class sizes and a more complex learning environment with less communication between lecturer and student (Milliken & Barnes, 2002). Moreover, the rapid development of information and communication technology and the concurrent emergence of so called "digital natives" entering universities have posed a new challenge to higher education (Benett, Maton, & Kervin, 2008). For example, the fact that students nowadays cannot go long without checking their mobile devices keeps lecturers struggling to catch the student's attention and engage them into the lecture (Yu & Conway, 2012).

Nevertheless this development has positive and negative implications. Negative, as increasing student numbers make it nearly impossible for lecturers to give lectures with a clear interactive component following the classical way of teaching. Positive, as

new technologies and the students' adeptness in using them has evolved and given way to the use of e-learning tools. Those tools are able to enrich the lecture by enhancing student collaboration, improving interactivity and encouraging active participation (Cleveland-Innes, & Emes, 2005). According to Ruiz, Mintzer and Leipzig (2006), correct use of e-learning tools has the potential to lead to a shift in education, "where educators will no longer serve mainly as the distributors of content, but will become more involved as facilitators of learning and assessors of competency" (207).

To leverage the advantages of e-learning tools for both the lecturer and the students one needs to understand their correct use and application in a classroom setting. Hence the project team LectureLab attempted to clarify the following research questions:

- What e-learning tools are available and what functionalities do they offer?
- What functionalities add an actual benefit to the learning experience?
- How can the lecturer use those functionalities effectively?
- How do students and lecturers perceive the influence and effectiveness of e-learning tools on their learning experience?

## 2. Goals and methods

The goal of this project was to analyze the impact of e-learning tools on the student-lecturer interaction in the context of a pilot project at TUM. The goal is to make a contribution to an improved student-lecturer interaction during lectures. The following sections present the methodology used to achieve this goal.

### 2.1 Study design

The present pilot project is an intervention study following a pre-test-post-test design. As is characteristic for intervention studies there was no control group, but in three participating groups the use of e-learning tools was tested in an intervention approach. Pretest data was collected with the help of a quantitative questionnaire (paper&pencil) from the participating student groups. Post-test data was then collected with a similar questionnaire in the last lecture of the semester, after the last possible intervention of the selected e-learning tools.

### 2.2 Sample and pilot study procedure

As preparation for the intervention study we carried out extensive literature research as a first step in order to assemble a pool of convincing e-learning tools. Besides user-friendliness and functionality, the tools had to be for free and unlimited in terms of the number of users. We classified the suitable tools into three different sectors: "poll system", "mood barometer" and "question tools". In addition to the literature research we interviewed seven lecturers from TUM, who are already using e-learning tools in their lectures. Additionally we interviewed two didactic and teaching experts from the ProLehre institute at TUM. The aim of ProLehre is to improve teaching quality at TUM. On the whole, we had eight qualitative interviews in order to prepare the pilot study procedure.

In the expert interview with ProLehre we were advised to include only younger students in the pilot project. This derived from the assumption that younger students have been less strongly influenced by the atmosphere in lectures and therefore should be less biased about e-learning tools. As there are very few first-semester students in the summer term we decided to focus on second-semester students. With the help of the university calendar we created a list of lectures in summer term for second-semester students. We selected three lecturers from different disciplines and invited them to participate in our pilot project. Fortunately, Dr. Tobias Lasser (Chair for Computer Aided Medical Procedures & Augmented Reality), Dr. Christian Karpfinger (Research group Algebra) and Prof. Dr. Gerhard Müller (Chair for Structural Mechanics) agreed to participate in the pilot project.

Before the actual start of the summer term we talked with each of the three lecturers twice. The first meeting served to introduce them to the study, while in the second a suitable e-learning tool was chosen. Additionally, we organized one meeting during the semester and offered technical support for the first lectures as well as meetings during the semester if required. After the end of summer term we reviewed each lecture asking the lecturers about their experiences (e.g. frequency of use, benefits, challenges, technical aspects).

### 2.3 Measurement tool

For the expert interviews we created an interview scheme, which was applied to all of our interviews. The questions focus on experiences with e-learning tools, their benefits and disadvantages, and advice on how to use them.

As a pre-test in the target population we designed a quantitative questionnaire with 14 items. Nine items were rated on a 5-point Likert-Scale (1 = extremely; 5 = not at all), four were measured on a frequency rating scale and gender was also requested. The final pre-test sample included n=909 students from three fields of studies.

The post-test questionnaire included 28 items. In addition to the pre-test, the items focused on the lecture situation without e-learning tools, on technical aspects (e.g. technical problems), on the use of the tool in the lecture (e.g. frequency), on students' participation and on questions specific to the used e-learning tool. The majority of the items were rated on a 5-point Likert Scale. In the final post-test sample, n=552 students completed the questionnaire.

### 2.4 Analysis

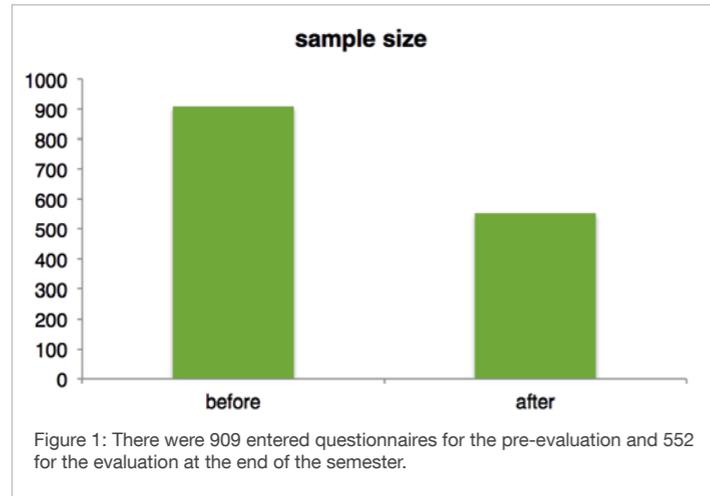
The questionnaires were prepared with the evaluation software EvaSys. Therefore, the questionnaires could be scanned and evaluated automatically. Beside the economy of time, the risk of input errors in the database is reduced by using this software.

Results from the qualitative interviews with the three lecturers from the pilot projects were used to create the individual profiles of e-learning tools from the different sectors. Suitable quotations were chosen for these profiles, which will be communicated online by the ProLehre institute.

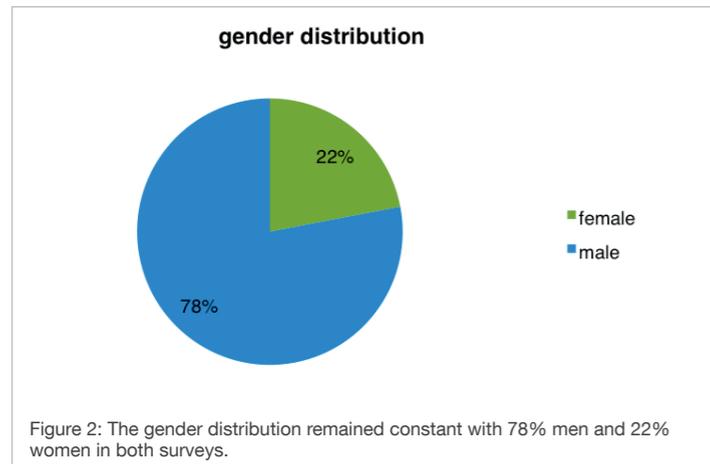
## 3. Results

Since not all of the collected data is relevant for the analysis, not all parts will be presented. No distinctions are made between the three different courses that are part of our project. Instead, the data sets are combined in order to obtain the largest sample size possible and lessen the impact of peculiarities of the single lectures.

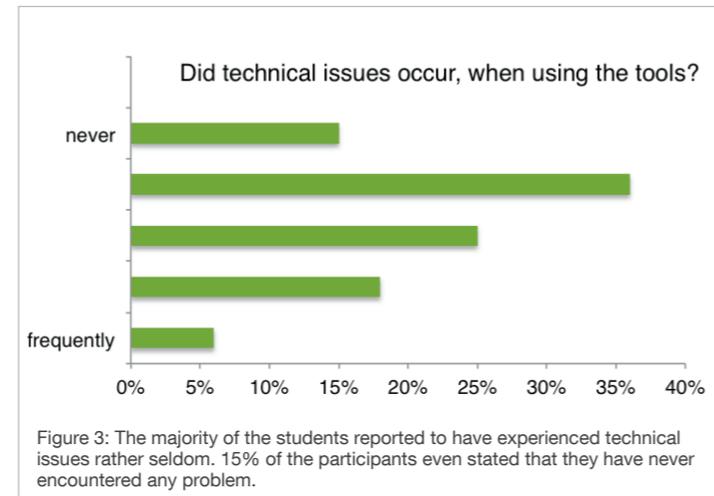
This results in 909 entered questionnaires for the pre-evaluation and 552 for the evaluation at the end of the semester. This remarkable decrease is mainly due to the falling attendance over the duration of the course.



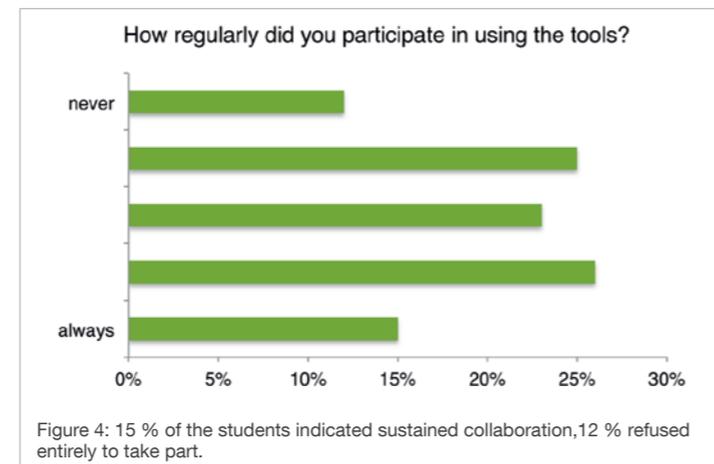
However, the gender distribution remained constant with 78 % men and 22 % women in both surveys (Figure 2).



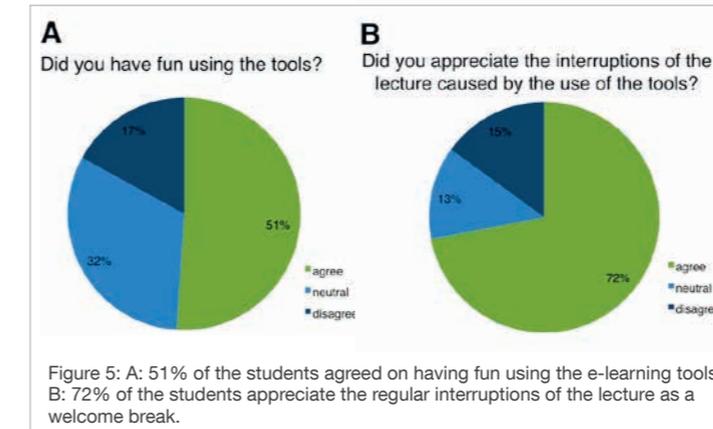
Although there have been several technical issues with the e-learning tools in use, the majority of the students reported that they seldom experienced these. Fifteen percent of the participants even stated that they have never encountered any problem (Figure 3).



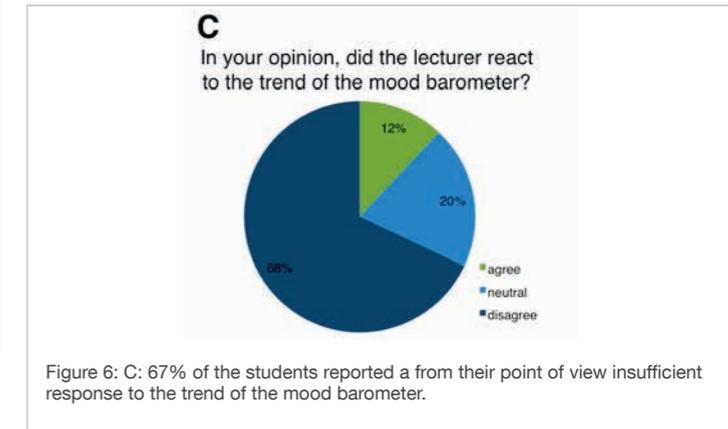
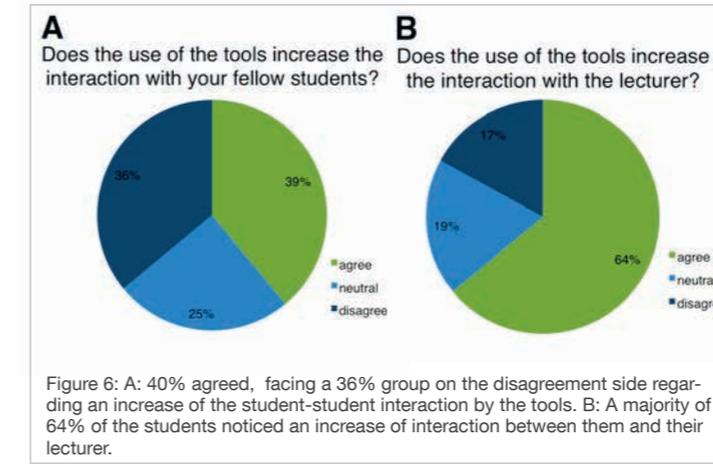
The participation of the students in the usage of the tools is quite symmetrically distributed between the two extremes of the scale, yielding 15 % who indicated sustained collaboration and 12 % who refused entirely to take part (Figure 4).



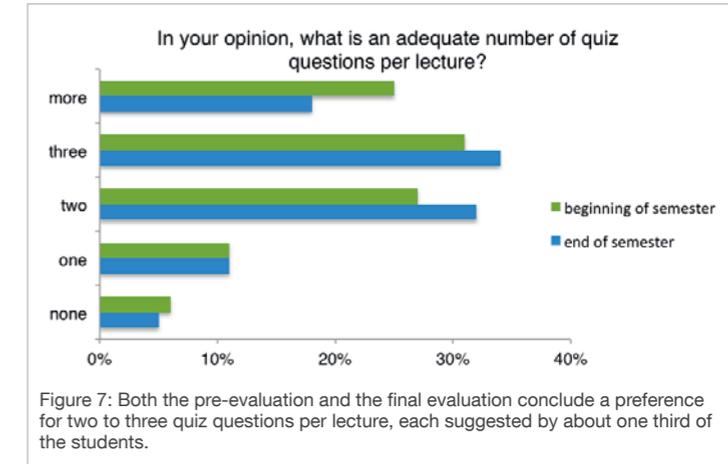
Fifty-one percent of the students agreed on having fun using the e-learning tools and 72 % appreciated the regular interruptions of the lecture.



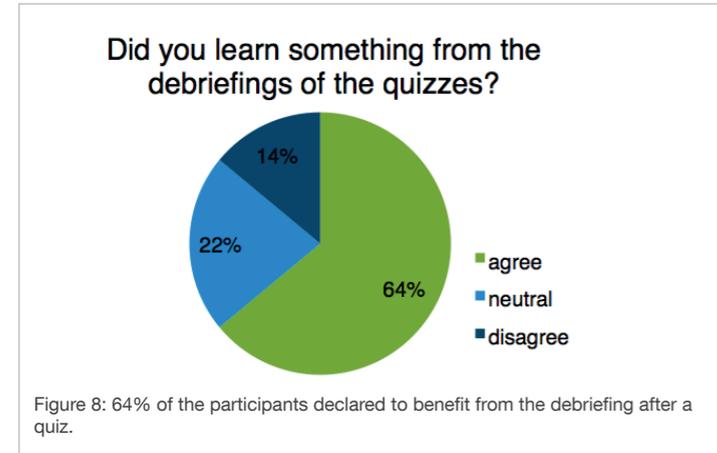
With 40 % on the agreement side facing a 36 % group on the disagreement side, opinions on whether the tools affect the interaction between the participants and their fellows are quite discordant, but a majority of 64 % of the students noticed an increase of interaction between them and their lecturer. However, 67 % reported that, from their point of view, there was an insufficient response to the trend of the mood barometer.



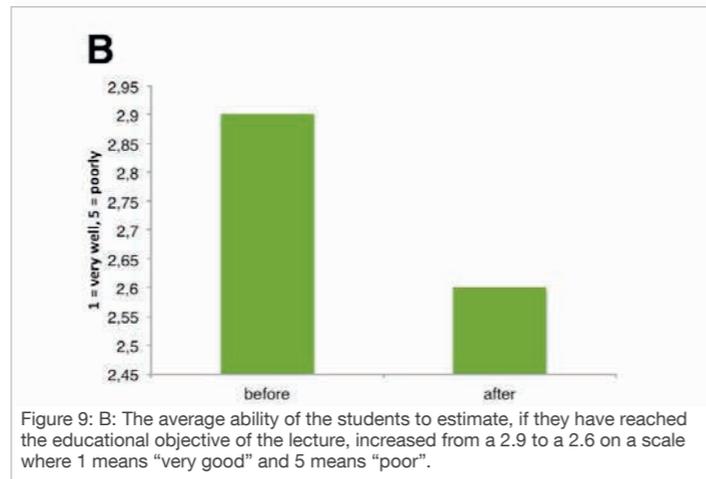
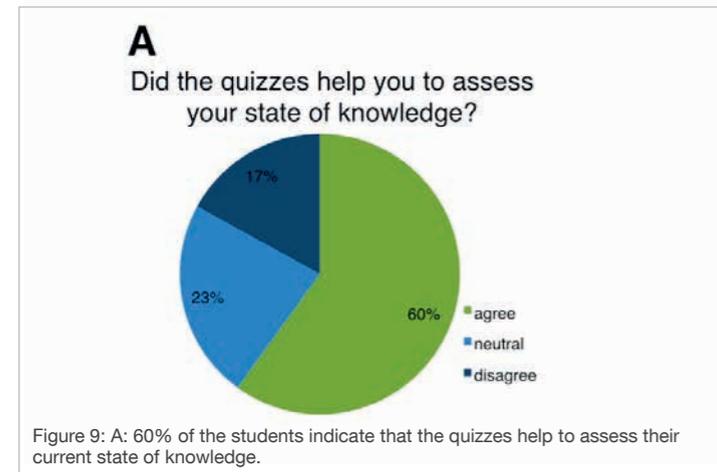
In both surveys, the students were asked to estimate the optimal number of quiz questions per lecture and both the pre-evaluation and the final evaluation concluded a preference for two to three questions, each suggested by about one third of the group (Figure 7).



Sixty-four percent of the participants declared a benefit from the debriefing after a quiz (Figure 8).



The quizzes also help the students assess their state of knowledge, as 60% indicate. The average ability of the students to estimate, if they have reached the educational objective of the lecture, increased from a 2.9 to a 2.6 on a scale where 1 means “very good” and 5 means “poor” (Figure 9).



The possibility to ask anonymous questions was only sparsely used by about one quarter of the participants, although half of the students declared an increased willingness to ask questions under these circumstances at the beginning of the semester. The most popular reason for not using the question feature is the lack of elaborate questions, whereas the dominant reason for doing so is the consolidated confidence due to anonymity (Figure 10).

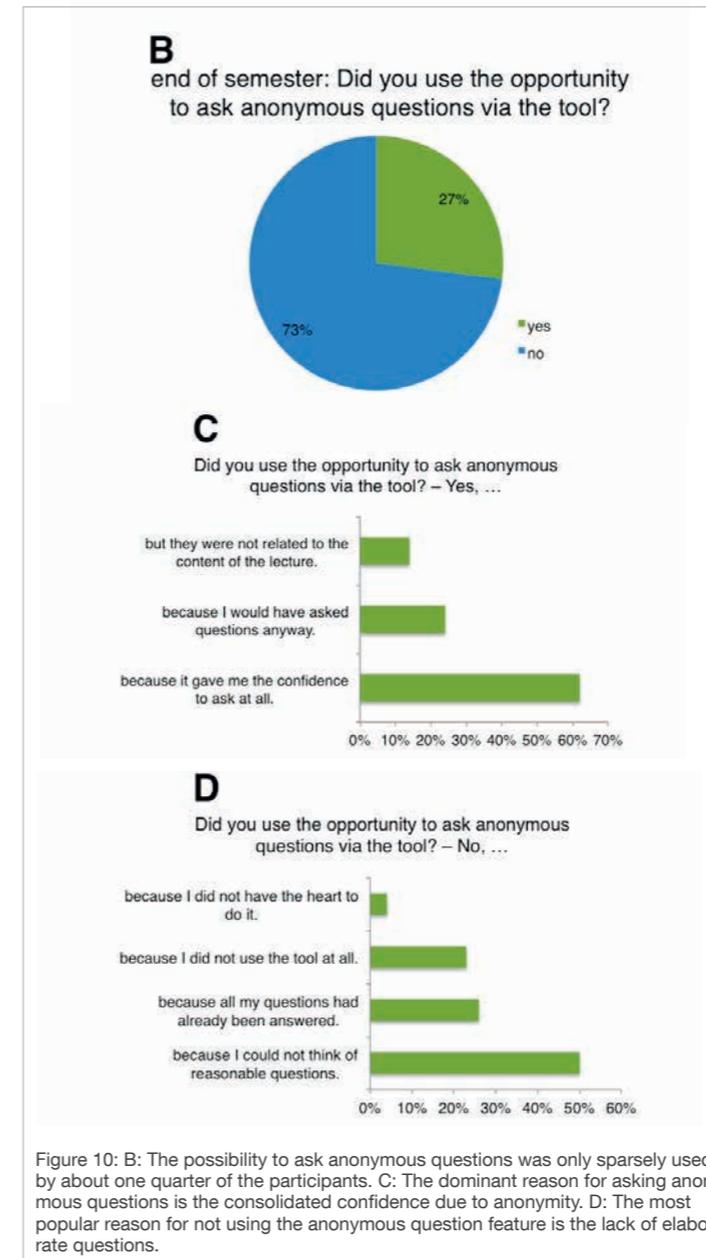
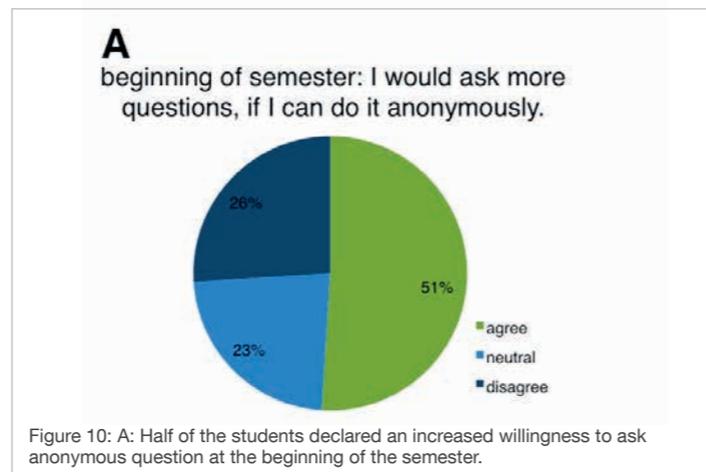


Figure 10: B: The possibility to ask anonymous questions was only sparsely used by about one quarter of the participants. C: The dominant reason for asking anonymous questions is the consolidated confidence due to anonymity. D: The most popular reason for not using the anonymous question feature is the lack of elaborate questions.

#### 4. Discussion

In the following, the results of the surveys, which have been conducted during the last months, shall be discussed. Before starting, the analysis shall be critically examined. First of all, the examination was limited to three lectures, which were all located in the natural-scientific field. Thus, the sample number was very limited and the results probably cannot be extended to other types of lectures, such as humanities ones. Another substantial limitation of the examination is the lack of a control group as the lectures could not be divided, with one part using e-learning tools and another part not using them.

Moreover, the questionnaires were invented by members of the LectureLab team and were not reviewed by experts. Therefore they were not validated and do not comply with the scientific quality criteria of objectivity, validity and reliability (Kirk, Miller 1985). Additionally, the selection of the lecturers, using the tool, was not randomized as they were chosen on the recommendation of teaching-experts from ProLehre, who had worked with these lecturers before. As not only the e-learning tools themselves but also how they are applied can alter their impact a lot, this biased selection of participating lecturers limits the examination. The results of this examination can therefore not be applied to every lecture and every type of lecturer. However, the number of participating students and their gender-distribution can be seen as representative for TUM and therefore the results of this examination may serve as an indicative trend.

By being invited at every lecture to answer questions about the last one or about general problems, the students deal with the learning matter very frequently. Therefore it is expected that students who participate in polls by e-learning tools during the lecture not only save the matter in their long-term memory more frequently (Lee, 1973), but are also much better in their self-assessment. They have to ask themselves very frequently if they know the learning matter and therefore it is no surprise that the majority of the students state that their self-assessment has been enhanced by the use of e-learning tools.

Additionally, the students stated that they could extend their knowledge by the use of the e-learning tools. This was also expected, as every encounter with a problem evokes thoughts around the present problem, establishing links between different aspects and thereby deepening the understanding.

To have an opportunity to ask questions anonymously seems to be not enough of an incentive actually to do so. The participation in the use of the tools in general was relatively limited. The majority of the students stated they would use the chance to ask questions via an e-learning tool but did not do so in the end. As the major reason they stated that they did not know how to formulate a good question. This clarifies a problem, which might be rooted in the fact that students nowadays are not instructed in how to ask questions as there is almost no space for it in normal lectures and even during high school. Maybe a workshop at the start would be a way out of this problem. In this workshop the students would learn how to phrase a question in a way that is precise and clear, as described in a study by Marbach-Ad and Sokolove (2000). A major point of such a workshop would also be that every student asks questions there and learns the value of doing so and that almost every question is worth while.

The possibility, of students being distracted by the tool cannot be ruled out, but it appears to be a relatively small problem. The majority of the students stated that the use of the tools during the lecture felt like a small rest for them. However this may be due to the fact that the flow of knowledge is paused in the periods where questions are asked. Even if these periods involve a much more intense engagement with the learning matter the students might experience this independent, active thinking as a rest, as to follow another person stating complex facts and to embed these facts into the network of already existing knowledge might appear more exhausting to them, a situation which is described in literature as very positive for the learning process (Rusbult, 1989). Thus, the fact that the students experience these periods as a rest does not inevitably mean that they get distracted.

Moreover, the students stated that using the e-learning tools is fun for them. A positive attitude to this method of teaching is absolutely necessary for its success, as otherwise they would simply reject it. Furthermore, the interaction between lecturer and student should take place in a positive atmosphere in order to establish a fruitful relationship.

An e-learning tool which has the potential to enhance but also to endanger this relationship is the mood-barometer. By letting the lecturer know if they can follow his/her thoughts the relationship between the students and the lecturer becomes less distant, a potentially positive fact. But the use of this tool by the students is linked to the expectation that the lecturer will refer and react to it, by altering the way of presenting or repeating the latest thoughts. Most of the students stated that the lecturer did not react to the information given by the tool. Therefore it has to be noted that the mood barometer tool, in particular, can also lead to student disappointment and can thereby harm the relationship between lecturer and the students. These concerns of course only apply to the mood-barometer tools and not for example to the poll-system tools.

Even though the students were reserved in asking questions via e-learning tools, they stated that the interaction between the lecturer and themselves was enhanced - thus the main aim of the project was achieved.

## 5. Outlook

All in all e-learning tools appear to enhance the learning experience during lectures for numerous students. As the present analysis is limited, more examinations employing a higher number of lectures and including comparable control groups have to be conducted to come to a final evaluation. However, this analysis shows that e-learning tools are a promising approach and should be employed in lectures. In order to further analyze their impact and allow more students the pleasure of facilitated interaction with the lec-

turer, the tested tools are offered to TUM-lecturers by the official department of didactics in lectures, named ProLehre. In close cooperation with the project team a brochure was established which interested lecturers can use to inform themselves further and get help in deciding which tool is best for their lectures.

Thus, ProLehre will carry on encouraging lecturers to use these tools and will provide tips and information arising from the present examination. Moreover, with the medienzentrum of TUM a clear decision-tree of the available e-learning tools was set up online, which enables lecturers to find the right tool for themselves within a few minutes, without engaging in a time-consuming research. Turning from student-lecturer interaction and coming to student-student interaction, another online tool was established by a project team of the center of digital technology and the management of TUM (CDTM).

Their tool feedbackme helps students to enhance their presenting skills by getting feedback from their fellow students. This tool might be combined with the e-learning tools, examined in this study to render the lectures at TUM even more attractive and effective for the students. This example shows that in the field of online-tools for lectures much is yet to come and the data of this study strongly implies that it is worth developing this trend in TUM lectures.

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# Project Report **openTUM**

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## Getting connected by openTUM

There was a young man called small Heinz  
His alma mater was TUM, not in the vicinity of Mainz.  
He came south from there five years ago  
and was welcomed with a big “Hello”.

One day he was struck by an issue,  
which was so hard that he cried into a tissue.

Someone told him to his face,  
You should visit openTUM’s new project database.  
He could solve his problem with a trick  
by contacting the database with only one click.

This way he got to know some new colleagues,  
-Not all of them were freaks-  
He said, “They are quite nice.  
I want to meet them twice.”

As often in the examination period, the days became long and the  
nights short. One night, it was already past 2 a.m. when Heinz  
dragged himself to his bed, unsure if he would pass the exam  
or even his studies. “What will be in twenty years? What will I  
become?” With these thoughts he fell asleep...

*Twenty years later, Heinz made a career and became a professor.  
He recognized with surprise that a main focus of his work was influ-  
enced by interdisciplinary discussions and teamwork with people  
from another field. Some older colleagues were really amazed by  
Heinz’s rhetorical and social skills.*

*Heinz found that these skills are not naturally given at all, but can be  
practiced and learned like scientific methods. He was really happy  
about having taken part in some interdisciplinary projects during  
his studies. He remembered the openTUM team and their interdis-  
ciplinary workshop as well as their database, which collected offers*

*of different faculties for students. He was also able to share these  
experiences with his students, who thus got motivated to contact  
students from other fields. They agreed that a focus on only one  
subject might provide a solid foundation, but people who want  
to be successful and fulfilled in life do need a broader horizon.  
Therefore, Heinz concluded that interdisciplinarity would never be  
a completed topic, as long as science exists.*

A streetcar drove by Heinz’s house waking him. But it took him only  
a minute to visit the world of dreams again...

*Twenty years later, Heinz obtained a responsible position as a  
manager in a company because of his rhetorical skills, his smart  
character and his social commitment. He earned a lot of money  
and remembered that he would never have been able to get into  
this position without his interdisciplinary soft skills. “I was so lucky,  
I practiced these skills during my studies”, he said to himself. He  
found himself in many situations where he had to convince people  
of the many benefits and advantages of his company. He was able  
to manage this since he knew the way of thinking of “foreign”  
people and how to work in an interdisciplinary team.*

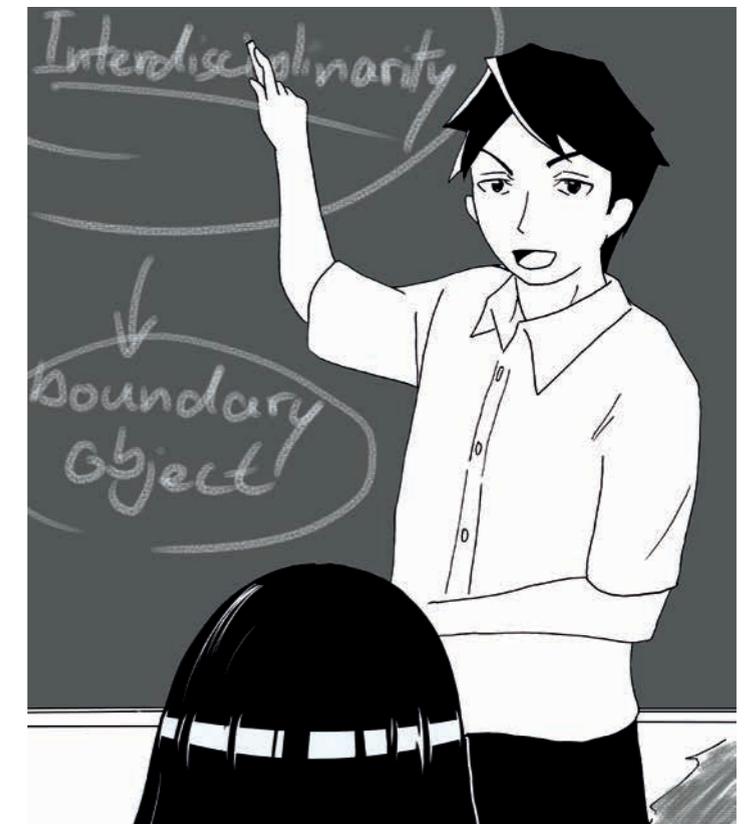
The crying baby of the neighbor woke Heinz, who cursed the thin  
walls of his apartment. He turned over to the other side of his bed  
and slowly drifted back to sleep...

*Twenty years later, Heinz was going on vacation with his family  
by car. “Dad, when will we arrive?” “I don’t wanna sit in this car  
any longer!” “Darling, please do not drive that fast!!!” A “normal”  
father would suffer a crisis and shout or just stop listening. But  
Heinz knew about communication strategies and was therefore  
able to solve the situation in a smart way: He found a reasonable  
compromise. The holidays were rescued! Heinz remembered that  
he had learned about the way of dealing with different opinions  
and characters during his studies by taking advantage of the help*



offered by openTUM. “Different people, different cultures...,” he  
thought with a smile.

Loud buzzing of Heinz’s alarm clock marked the end of the restless  
night. Stumbling towards the shower, he recapitulated the parts of  
his dreams he could remember and summarized them for himself:  
Regardless of whether one wants to make a career in academia or  
industry or if one becomes a parent, it is important to keep an open  
mind and to get connected with others.



## Abstract

**TUM students should have the possibility to gain experience of working in interdisciplinary groups in order to face the increasing interdependence of disciplines in science and industry.**

### 1. Background

Universities can make a contribution to solving the problems of modern society. In many cases, important social challenges and problems cannot be addressed in an uni-disciplinary way, which leads to the demand of an interdisciplinary approach in science. Topics like “climate change” or “cancer” require input from several dominant disciplines (e.g., medicine, geography, chemistry). A satisfying and general discussion about these issues can only be accomplished by teamwork between the different fields (Bergmann, Brohmann et al. 2005):

The term “interdisciplinarity” has to be distinguished from “multidisciplinarity” and “transdisciplinarity” (Bergmann, Brohmann et al. 2005):

- Transdisciplinarity: Participation of people from outside of the scientific context and consideration of their interests.
- Multidisciplinarity: Division of labor between different disciplines working independently from each other.
- Interdisciplinarity: Combining methods of different disciplines to solve a problem which cannot be assigned to a specific field of study.

“Interdisciplinarity requires disciplinary competence. An overlap of empty sets is empty as well. However, also the fascination by the common cause and the capacity for team work contribute to the success.”

*Prof. Wolfgang A. Herrmann, President*

At TUM, interdisciplinarity is realized in some courses of studies, for example in chemical engineering or energy efficient and sustainable construction, or some courses of the Carl von Linde Academy.

However, no systematic overview of courses and activities exists. Also, there is no general concept of teaching the key competences of interdisciplinarity like communication or project management. In order to promote the teaching of interdisciplinarity to students, it has to be considered that disciplinary knowledge represents the basis of effective interdisciplinary work:

“They [the disciplines] practice specific modes of working on tasks and different approaches to solve problems; in general they have therefore developed typical ways of thinking and acting.” (Rhein 2011)

The home field of study acts therefore as a stable reference and sets an identity in the social context of interdisciplinary working (H. Frehe 2015). The success of an interdisciplinary workshop is determined by how the members work together. Effective interdisciplinarity demands a clear definition of the topic as a so-called boundary object. Also, a structured organization by a responsible team leader is vital for success (Bergmann, Brohmann et al. 2005, H. Frehe 2015). The relationship between disciplines and boundary objects is illustrated in Figure 1.

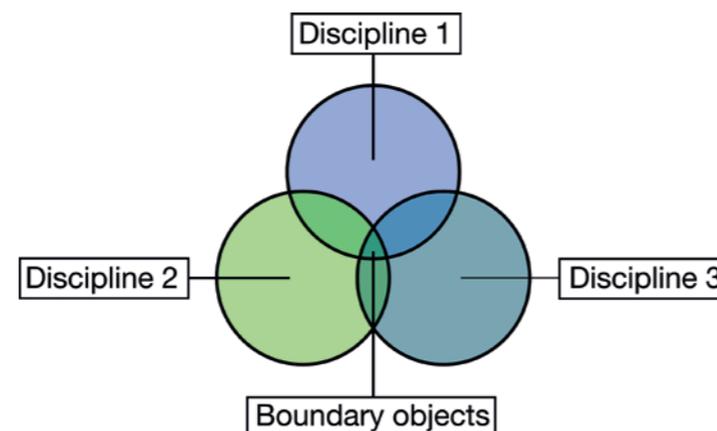


Fig. 1: Representation of three disciplines and their common boundary objects found in the intersections of the different fields.

In the context of teaching at universities, outcome-orientation is essential. This means that the mediated competences should be defined clearly in advance (H. Frehe 2015). During and after the project, the success has to be evaluated, concerning the solution of the given problem as well as whether the used strategies promoted the desired competences (Bergmann, Brohmann et al. 2005, H. Frehe 2015).

### 2. Goals and Methods

The two main goals of openTUM are to improve the connections among students and scientists at TUM, thus strengthening their network and the exchange of knowledge of different disciplines. We identified two different options to achieve our goals: Either supporting and improving an already existing interdisciplinary program or starting a new project.

“There exist things in the gaps between the domains, which we have not recognized yet, about which we do not know that they exist: potentials.”

*Prof. Gerhard Müller, Senior Vice President of Academic and Student Affairs*

At the beginning of the project year, we started a comprehensive analysis of the current situation at TUM. We mainly concentrated on existing and well-known interdisciplinary and multidisciplinary projects, trying to get a general overview and to find possible weak spots. We did not only focus on our university but extended our research to other universities like EuroTech universities with the idea of possibly starting a collaboration.

We started our analysis by conducting a survey among 176 students of eleven different departments of TUM. They were asked 15 questions about their experience, needs and wishes concerning inter- and multidisciplinary programs. The students also had the chance to give us their own opinions and to make suggestions about how such opportunities at TUM can be improved.

By conducting interviews with different experts affiliated to TUM, a deeper understanding of interdisciplinarity and its associated problems was obtained. The president of TUM, the director of MCTS (Munich Center for Technology in Society) and six other experts were

asked for their personal experience and advice concerning the teaching of interdisciplinarity. During the interviews, we asked a set of standardized questions in order to compare the answers of the interviewees.

“Interdisciplinarity, in my way of interpretation, are also always highly specialized affairs, specific for a question, as empirical as it, very exactly orchestrated and configured. Not the research of everyone with everyone on everything, but rather with specific people on specific problems.”

*Prof. Sabine Maasen, Director of MCTS*

After the status quo was evaluated by the interviews, the survey and our own research, we were able to define two final project goals: A central database and an interdisciplinary project module. The database should improve the overview of multidisciplinary programs and initiatives at TUM. Students can either search for a specific program or obtain information about existing events. The concept is realized via Moodle and it is planned to transform it into a website. The ongoing maintenance should be performed by another TUM institution (e.g., AStA).

Five members of openTUM attended the 9th IGSSE forum (International Graduate School of Science and Engineering) in order to observe PhD students from different fields in a series of workshops. We paid special attention to the aspects of scientific work, interdisciplinarity, project management, teamwork and communication.

The interdisciplinary project module, which was devised in cooperation with Prof. Sabine Maasen (MCTS) and Dr. Alfred Slanitz (Carl von Linde Academy), aims to advance the learning of interdisciplinary skills. The aim is to start a first run in summer semester 2016, after the administrative part is organized by the Carl von Linde Academy and the final collaborative partners are determined.

### 3. Outcome and Discussion

The survey showed that contact with students from other disciplines is important for over 60% of the participants. Personal interest was the most significant motivator for participation in events offered at TUM. All forms of options (sports, culture etc.) enjoy po-

pularity by at least half of the participants. The students have mainly participated in sport courses of the ZHS or language courses offered by Sprachenzentrum. The former shows that the integration into leisure time is important. In addition, the general conditions of the courses (adequate duration, no competing courses, convenient location etc.) are also important. About half of the students have been at university student parties, university fairs or at the “tu film”. However, it was evident that the full range of interdisciplinary courses available was not known.

“Nothing is as efficient and rewarding as the communication with another human being.”

*Prof. Michael Klimke, Managing Director of TUM Graduate School*

As only 176 students participated and gender and faculty distribution did not correspond with the overall university quota, the survey was not representative but gave a rough overview. In addition, simply convenient sampling was used, also diminishing validity.

Interviews with eight experts provided insights into interdisciplinary work, its characteristics and significance from diverse perspectives. In addition to conventional problems arising from team work, further challenges – e.g., different languages and habits of disciplines – are posed in interdisciplinary projects. However, disciplinary work can also be successful and provides the foundation for interdisciplinary success. As the interviewees were exceptionally consistent in their positive views, their answers may have been biased by the general approval of interdisciplinarity in the scientific community. Interdisciplinary work is not a solution to every problem.

„Interdisciplinarity is endeavor to bring together different disciplines, to exchange ideas and to aim at new goals. As long as there is science, interdisciplinarity will not be exhausted.“

*Prof. Bertold Hock, TUM Emeritus of Excellence*

For a better overview of interdisciplinary opportunities at TUM, a database was built. Over 30 entries have been collected via collaboration with other parties at TUM. A concept for a suitable website has been drafted. By working together with the Corporate Communication Center, it may be possible to build this website and make it available online.

By attending the 9th IGSSE forum as observing participants, we gained first-hand experience concerning interdisciplinarity and project management. While the benefit of this qualitative approach is the deep understanding one can gain, it is a challenge to treat collected data objectively because of the high personal involvement.

In order to exploit the full potential of an interdisciplinary team, project management workshops as well as a guiding hand are necessary. To create a more focused working atmosphere, the groups should be intentionally matched to assure a boundary object and thus interdisciplinarity. Also a group size of 8 to 10 students is advisable. The working efficiency could be enhanced by providing project management workshops with professional trainers.

The project module is planned for the summer semester of 2016. A timetable of the implementation has been prepared together with the MCTS. The main structure and content has been drafted and partner chairs have already been found.

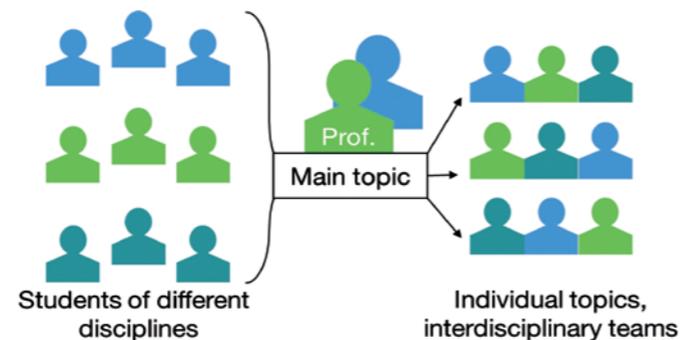


Fig. 2: Structure of the interdisciplinary project module: Students of different disciplines form interdisciplinary teams working on individual topics assigned by cooperation professors from different disciplines.

#### 4. Summary and Future Goals

An interdisciplinary project module for students was designed in cooperation with the MCTS. The basic design is illustrated in Figure 2.

At least two Professors from different fields develop a main topic and assign interdisciplinary problems. These are treated by teams composed of students from different disciplines. Because the members belong to different degree programs, they should be able to contribute their own special knowledge to solve the problem. The project module also features integrated courses about working in interdisciplinary groups and project management.

The interdisciplinary project module is going to be implemented into the teaching program of the Carl von Linde Academy. Its launch is planned for the summer semester of 2016. The course might be chosen as a module in several degree programs of different faculties.

The formation of a relevant network can be catalyzed through the already available but not fully exhausted range of multidisciplinary courses. A central database should improve the overview and visibility of such courses and therefore the network building. Information about 30 different multidisciplinary opportunities at TUM was collected successfully. It will be embedded in an existing TUM related website. The promotion of the database will lead to an increasing knowledge and use of these multidisciplinary opportunities.

„I think that the output of an interdisciplinary team doubles. You write a lot on a paper, but it gets really exciting if you exchange different ideas with other people.“

*Dipl.-Ing. Peter Finger, Managing Director of TUM: Junge Akademie*

As a result of increasing awareness, the database will be extended with additional or still missing entries. Our goal is the completion of the database to give students and employees an adequate overview over every multidisciplinary group and project. Maintenance and updating will be guaranteed by other TUM facilities.

We hope that our project will help all members of TUM to keep an open mind and will improve their cooperation with people from other disciplines.

“As a human being, you should look after your interests, also the ones outside of one’s subject area. Everyone is self-responsible to shape one’s life in an interesting way; professional and personal life should not be separated because there is only one life.“

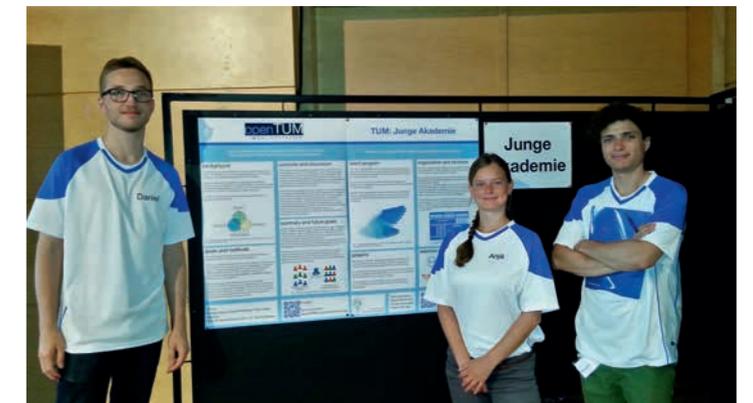
*Maestro Felix Mayer, artistic director of the TUM choir and orchestra*

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IGSSE forum



At the top: Teammeeting  
Below: Information exchange with MCTS/TUM



TUM Campus Run 2015



Annual Conference of the Academy



# Project Report **TUMcloud**

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## To the cloud and beyond

*“I’ve always been a connected person. Ever since I got my first computer I’ve used technology not just for work, but also to stay connected to those who matter most to me. In my opinion, the Internet is all about collaboration, about sharing, about being close to people even if in reality they are on the other side of the planet. It is fascinating to see how the pace of innovation seems to be ever increasing. Life is so much more convenient nowadays.”<sup>1</sup>*

The Internet has always been a place for great innovation. Over the years it has fueled the rocket-like rise of young startups, some even steeper crashes and the phoenix-like resurrection of a whole industry. Today, major parts of our everyday life heavily depend on the Internet. One of the latest trends stimulated by the world wide web is so-called “Cloud Computing”. Since giving a precise technical definition about what “the cloud” really is seems to be impossible, let us stick to what it means for most people: The cloud is a simple way to store and share data of all kind and to have it available no matter where you are and no matter what device you have with you.

A centralized system for data storage that is universally accessible through the Internet creates new opportunities for simple and convenient collaboration. On the other hand, there are reasonable concerns when it comes to uploading private data to “the cloud.” Apart from general fears about government mass surveillance there have been dramatic cases where unauthorized access to private or business-critical data has led to tremendously negative consequences for the owner. It is obvious that cloud technologies come with great potential, but also with risks that need to be dealt with adequately.

*“To be honest, when I first came to the university and started working with its IT systems, I felt a little bit disappointed. It’s not that I missed anything specific, but my overall impression wasn’t exactly what I had imagined IT at a leading technical university would be like. I have had experiences with the easy to use systems from some of the commercial market leaders. At TUM, to me it felt like they got most things right, but very little was perfect.”*

*“Many different solutions seemed to be available, but often they were hard to find and a great degree of fragmentation led to inconsistencies that made work feel inefficient. Furthermore, most systems just were not flexible enough to support true collaboration. In consequence, a lot of my colleagues decided to use commercial alternatives, including all disadvantages this implies in an academic context.”*

Universities are all about collaboration. Modern IT systems can drastically reduce the overhead that comes with working in a team - no matter how small or large it is. In consequence, they can help to better connect teams, increase their productivity and make collaborative work a much more pleasant experience for all involved parties. At TUM, a lot of effort is being spent on continuously introducing such innovative systems, on improving the overall user experience, unifying existing systems and promoting them amongst the members of the university. Nevertheless, there still is room for improvement towards a consistent IT infrastructure that really fosters collaboration.

Furthermore, IT is a rapidly changing field with new trends arising at an enormous rate. Trying to be at the forefront of innovation is a

great challenge. Impetus provided by somebody with an unbiased view can be beneficial to identify aspects that might need additional work.

*“It is important that decision makers really focus on innovation. To me, part of that is listening to the ideas and concerns of students. There are some great efforts especially among student initiatives. I discovered that they can really set up a lot of impressive things. It seems like in the end it is a lack of communication that prevents those efforts from being turned into something really great!”*

We started project TUMcloud because we are convinced that even a small group of students can have a great positive impact on the whole university by making contributions towards further improving university IT. The original idea was to create a simple, consistent and collaborative platform for data management at TUM. In more concrete terms this means that we wanted to create a system combining functionalities of Dropbox, Eduroam and Google Docs. Realizing that there already are several initiatives aiming into the same direction, we decided early on to expand the scope of our project. Over the course of the following months we started collecting suggestions and feedback from fellow students and university personnel, generated our own ideas and established connections to relevant institutions within the university.

In the beginning our focus was placed on comparatively minor, rather concrete pain points and on ways to overcome them, but over time we started to think in a much more visionary way about what we call the “digital academic workplace of the future”. We tried to work out the trends that will have the greatest impact in

the next years and subsequently started deriving actions and decisions that we think need to be discussed today in order to be well prepared for future developments.

Assuming that a group of nine students can radically change and innovate IT of a whole university would be presumptuous. We see ourselves in a very different position: First, we focused on listening to the people who are behind the core parts of university IT. We wanted to learn more about their specific tasks, services and ideas. Furthermore, we tried to better understand the different interests and concerns those people have. Afterwards, we worked on bringing our ideas to the agenda, to promote them and to explain what benefits they will generate for all members of the university.

By directly implementing some of these ideas in the form of software prototypes we demonstrated for example how system interfaces can be used to access information in a more convenient way, how two distinct systems can be connected for additional user benefit and how existing systems can be augmented to enable collaboration. Details about the results of our work can be found in the report on the following pages.

*“It’s been quite some years since I’ve last set foot on the university campus, but now that I am back all those memories came up again. Considering for example the remarkable innovations in IT, everything seems to be so much easier nowadays. Systems got so smart, it feels weird if they are not there anymore. I wish I could have used this new “digital workplace” back in my days. Being a student would have been so much easier.”*

<sup>1</sup> The statements in the paragraphs marked by quotation marks were compiled from interviews with students and alumni. In consequence in its entirety they do not reflect the opinion of a single person, but rather illustrate a common pattern among the individual statements.

## Abstract

**IT services have become an omnipresent factor in everyday student-life. The TUMcloud team set out to discover how new trends in IT can help to simplify common tasks, foster collaboration, and boost productivity.**

### 1. Background

In the light of strong competition between universities, partly triggered by intensified international mobility of students and the regular release and consultation of global university rankings, students are increasingly viewed as customers of services offered by the university. Therefore, the institution and especially the IT solutions it chooses to offer to students are evaluated with regard to the quality of service they manage to provide (Alt et al., 2010, pp. 186). ‚Student lifecycle‘ is one of the keywords mentioned in this context (Bick & Börgmann, 2009, pp. 109), indicating not only that the student is explicitly viewed and treated as a customer of the university he or she attends, but also signifying the necessity to divide a student’s interaction with the university into several phases, beginning with the orientation and decision for a certain field of study and university, followed by the core studies, graduation, and different stages as alumna or alumnus (Alt et al., 2010, pp. 186). All of these phases impose different requirements on the university’s IT systems.

**Students are increasingly viewed as customers of services offered by the university**

While the university’s IT infrastructure with the campus management system at its core should support all of the phases mentioned above, our role as current students enabled us to focus specifically on the demands this target group might have. Students often expect institutions of higher education to adopt some of the major technological trends from the consumer or entertainment sector. During early discussions within the project team innovative approaches towards collaboration within the student community and between students and lecturers as well as the convenience of gathering, editing, and storing university-related documents such as lecture notes, lecture videos, personal notes etc. in a consistent

way were tentatively identified as potential areas of improvement. According to Johnson et al. (2014) within the upcoming two years increasing pervasiveness of social media and integration of online, blended, and collaborative learning (pp. 9) will be major trends. This view is backed by Sharples et al. (2014), who identify massive open social learning (pp. 9) and the flipped classroom approach (pp. 15) as two major innovations in the area of education. Another field of development, that over the past few years has already found its way into private and corporate use (Gandhi et al., 2012) and possibly yields a lot of potential for applications in the academic context, are cloud storage services. They might help to solve the challenge of providing convenient access to cheap, centralized and secure data storage and could serve as the fundamental technological basis for the effective implementation of innovative educational concepts.

As already mentioned, the consideration of major technological innovations and trends that universities such as the Technische Universität München face has to be accompanied by an analysis of established IT systems that are already in place and actively used by students on a regular basis. Our approach towards identifying potential areas of innovation with regard to IT services therefore incorporates not only the assessment and evaluation of current and future trends in education and technology, but also the potential of ad-hoc improvements to the IT systems currently in use. Furthermore, the question remains whether all major technological trends can be transferred successfully for use within institutions of higher education and whether they would actually contribute to the fulfillment of the university’s core mission. In the following we would like to provide an overview of the goals of the project, the methods harnessed, our key findings and the implications one can derive from these findings regarding the IT systems at TUM.

### 2. Goals and Methods

#### Goal

The project started with a simple idea: Help students at TUM spend less time on gathering lecture material from numerous places to have more time to focus on their actual studies by simplifying both

access to data and digital collaboration. Often, extracurricular projects like these start extremely ambitiously, with the idea of changing everything by challenging all existing solutions and starting again from first principles. However, this approach usually does not work in practice and most of the time people are brought down to earth rather soon. We knew that we could not change the entire IT landscape at TUM being only a handful of students. Instead, right from the beginning, we tried to aim for more realistic goals and embraced our key ability: providing a customer’s perspective to the people who are responsible for today’s IT systems to help plan those of tomorrow. This strategy enabled us to put some of the greatest concerns of students as well as many innovative ideas to the top of the agenda of the individual decision makers.

#### Methods

In order to really understand all restrictions that might limit the applicability of the changes that were discussed initially and developed over time, we first analyzed the status quo including an investigation into how the established IT systems at TUM have developed and what the underlying rationale has been. Several brainstorming sessions supported by a Design Thinking workshop helped us to define the topics we wanted to cover. In subsequent expert interviews and through in-depth literature research we were able to compile an extensive report on a) the number of different IT services currently in use, b) the responsible management structures in charge of these systems, and c) the financial and legislative framework they are tied to. These investigations were supported by an assessment of the IT systems established at other universities in Europe, North America, and Asia. Furthermore, we worked on developing a visionary concept of how a student’s daily life in the future could look like, given the fact that technology will without doubt play an even greater role.

All acquired and developed points for improvement were bundled together into a portfolio of ideas and were presented to a group of students in a survey. Altogether we wanted to understand which systems are most important at the moment, which improvements promise the greatest benefit from the students’ perspective and thus which of them should be prioritized. The survey was distributed both on paper in selected lectures and online for promotion

in social network student groups. The analysis of this survey enabled us to make evidence-based recommendations to responsible stakeholders about the degree of urgency required to fix existing issues and about which new features should be considered for implementation first. A number of short-term issues have already been fixed as a result of our efforts and members of our team developed prototype implementations as a proof of concept for other ideas. In cases where there have already been independent efforts to solve a given problem, we reached out to the respective parties to reassure them that those efforts were perfectly aligned with the user needs we identified.

### 3. Outcome and Discussion

In the following paragraphs we will discuss some key results of the survey we conducted regarding the use of IT systems at TUM among students. Alongside these findings we present key learnings and results of our project work relevant to the discussed issue. For the survey we decided to focus primarily on two non-computer science faculties so that, out of the 111 respondents to our survey, 35.5% were enrolled in the Faculty of Chemistry and 32.7% in the School of Management. 64.5% were seeking a Bachelor’s degree while 32.7% were pursuing their Master’s.

#### TUMonline

On the topic of TUMonline, the student lifecycle management system at TUM, a number of ideas presented in our survey received overwhelming support by respondents. 95.9% would welcome a login field directly on the homepage, foregoing the need to click a link to reach the login page. When it comes to actual use of the system, or more specifically its search function, a majority of respondents (66.3%) searched for courses at least once a month and a smaller yet still significant share (36.6%) looked up the location of rooms on a regular basis. All of the other search categories were hardly ever used. While these numbers suggest search in its status quo is useful, a large majority of 79.6% rated the introduction of a unified search function, i.e. the ability to search across all categories at the same time, as ‘helpful’ or ‘very helpful.’ Even more pronounced was the wish for additional features and enhancements in the area of general usability. 83.1% rated a dynamic version of

their personal TUMonline homepage, which would for example display mandatory courses or reminders for exam registrations for courses the student is registered in, as ‘helpful’ or ‘very helpful.’ A great majority furthermore expressed strong or very strong support for efforts to optimize the user interface for use with mobile devices via browsers (87.5%) and more than 77% would appreciate or highly appreciate the possibility to access the system through a smartphone app.

In July 2015 a delegation of the team had the opportunity to travel to Graz for a meeting with the lead architects of CAMPUSonline, the system TUMonline is based on. Apart from deep insight into the technical details of the current system, the rationale behind it and possible limitations, the developers shared their ideas and plans for the next major release of the product scheduled for launch in 2016. We presented our own findings from research, benchmarking, surveying, and expert interviews we had conducted throughout the project. The software architects expressed great interest in our results. While discussing some of the major pain points students regularly encounter when using the system, it turned out that they are often merely due to configuration or data administration issues that are fixable in the short term by the respective university or faculty.

Overall the meeting has been highly productive and of great benefit for both parties. At this point we can disclose that the next major version of CAMPUSonline to be released in 2016 and to be introduced at TUM in 2017 will be based on modern web technologies. The main trends it will incorporate are universally accessible application programming interfaces (APIs), usability on mobile devices, and the removal of rarely used features from the core product. All of the aforementioned aspects can contribute to increasing the system’s flexibility, usability, and overall performance. The developers are optimistic about addressing all of the issues we discussed during the meeting either directly within the core product or by giving individual universities the ability to add specific functionality to the platform in a sustainable and easily manageable way. By placing emphasis on subjects such as modularity, testability, and extensibility, the software engineers are furthermore trying to be quicker in adapting to user needs through shorter release cycles.

### Cloud Storage and Collaborative Systems

Inextricably linked to the growing use of cloud storage is the topic of privacy and data protection. The survey results on this subject are, however, somewhat contradictory. While 68% indicated that privacy is ‘important’ or ‘very important’ to them, only 41.8% of the respondents stated that they take active measures to protect it. General adoption of cloud storage services in our sample is high with 60.4% using them for university and 60.4% for private purposes. Almost three out of four respondents would use a cloud storage system offered by the university. When given the choice between placing the focus on privacy or ease of use for such a system no clear consensus is reached with 54.6% voting for a focus on privacy and 45.4% favoring ease-of-use.

Shortly after we started the TUMcloud project we learned that there had already been ongoing efforts in the direction of introducing a cloud storage system inspired by commercial providers such as Dropbox at TUM. The initiative is coordinated by the Leibniz Rechenzentrum. We reached out to the project coordinator and met him not only to learn more about their priorities, plans, timeline, technical choices, and current challenges, but also to discuss ideas on how to integrate the cloud storage system into existing platforms through universal programming interfaces, how to foster collaboration, and how to promote the system to obtain appropriate adoption rates within the university.

The result of this joint effort by LRZ, both Munich universities, and others, is a system based on the commercial PowerFolder software called LRZ Sync+Share which started trial operation in April 2015. We have been actively working with the system ever since and have contributed by providing feedback on synchronization and usability issues as well as by encouraging all involved parties to not just think about creating a stable system, but also about how the platform can enable innovative ideas just by providing open and reliable programming interfaces. As of August 2015 the system is scheduled to start regular operation by the end of the year. It is, however, unclear when support for programming interfaces can be enabled. This currently blocks other parties such as the Medienzentrum from moving forward with interesting ideas such as solutions for simplified collaborative project work.

One of the ideas we presented in the survey is automatic synchronization of course material between an e-learning platform and a cloud storage system. Starting the very moment a user signs up for a course in the campus management system, relevant course material will be available and up-to-date on all of his or her devices. Since 73% of the respondents considered the idea ‘helpful’ or ‘very helpful,’ we decided to develop a small prototype implementation of a system that can synchronize data between Moodle as a central e-learning platform and an arbitrary cloud storage provider. User feedback has been very positive and TUM’s Medienzentrum as the center of competence for e-learning at the university and the owner of the Moodle platform at TUM has expressed great interest in the idea and the code behind our prototype.

One of the weaknesses we could identify in the current environment is the lack of systems that directly support collaboration. In the future Sync+Share could be the central place to store data that several users work on at the same time, although right now the necessary functionality to support such applications is not yet available. At the moment the university does not offer a real alternative to commercial systems such as Google Docs or Microsoft Office Online for collaborative document creation.

There is furthermore no universally accessible version control system for programming projects. Video conferencing is in general not available to all members of the university and the system offered can not compete with other commercial services such as Microsoft’s Skype or Google’s Hangouts in both usability and functionality. As part of our project we set up a test instance of a system for collaborative creation of scientific documents in LaTeX. Feedback from students and researchers has been overwhelmingly positive and our system has been taken over by TUM’s Medienzentrum for further evaluation.

### e-learning / Moodle

95% of all students have used Moodle

Almost 80% of all students download lecture material from two or more platforms

Adoption rates of the university’s primary platform for e-learning are, as expected, very high: 95.3% indicated that they had used Moodle before. This being said, a large majority of 79.8% reported that their lecture materials are located on two or more platforms and a majority of 69.3% considers the current distribution of lecture materials to be ‘uncomfortable’ or ‘extremely uncomfortable.’ As an improvement to the way material is currently distributed through Moodle, an overwhelming majority of 89.3% would like to be notified about changes to existing documents.

Another topic investigated by the survey was demand for and use of collaborative features. 63.3% rated a proposed functionality to add comments and feedback to uploaded documents as ‘helpful’ or ‘very helpful.’ Around half of the respondents use Moodle’s built-in forums on a regular basis. For those reporting their use of the forum to be less than once a month, ‘No need for forum’ was the most frequent answer with 48.8% of responses, followed by ‘use of alternate means for asking questions’ with 46.5%. Facebook groups as an alternate means of discussing study-related topics were not particularly popular, either. 52.8% reported using it at least once a week. The third option included in the survey was by far the most popular one: personal communication with fellow students. 90.6% reported discussing study-related topics with fellow students at least once a week.

Over 90% of students still prefer to discuss study-related topics in person

One of the concerns that was raised repeatedly is the fact that Moodle at the moment is mostly used as a platform for the unidirectional distribution of PDF documents. Our research indicates that increased consulting efforts directed towards lecturers are a promising way to promote the use of advanced features of the platform such as polls, glossaries, quizzes, and forums. As a result, user engagement with the platform increases drastically and so does the rating of the overall user experience.

The idea of developing a plugin that would allow direct communication between students and teaching personnel right next to the uploaded material has been praised by both parties as a great

way both to lower the threshold towards asking questions and reporting errors or ambiguities in the material and to decrease the amount of work for the latter group since questions only have to be answered in one central location.

Among the many other ideas we presented in our survey there are two additional ones that many students would like to see in a top spot of the agenda for the near future: an optimized version of the Roomfinder application and the possibility to access eligible TUM buildings on weekends by using the student card for identification. The former request has been worked on for quite some time now in collaboration with a startup founded by TUM alumni as well as the Internet company Google.

Promising results of preliminary work have been shown, but at the moment no clear timeline for a final product can be given. Forwarding the wish of enabling authorized building access through student IDs, on the other hand, has sparked an initiative by TUM's real estate management department to investigate currently existing solutions for individual buildings and to evaluate campus-wide introduction of a centralized system by launching a pilot project later this year.

#### 4. Summary and Future Goals

In the course of our research we have obtained deep insight into how IT systems are managed within a university; we have met interesting personalities and influential decision-makers; we have learnt a lot personally; and we have been able to make valuable contributions in many areas which we think all members of TUM will benefit from—admittedly to a varying degree.

Being part of the TUM: Junge Akademie community has opened a lot of doors for us and thus definitely contributed to the overall success of the project. Our research has attracted great interest from many institutions and individuals within the scope of the university and beyond. User feedback with regard to our ideas, prototypes, and test instances has been overwhelmingly positive and very encouraging.

For a number of projects we have attracted strong partners who have agreed to pursue our work in evaluating individual systems and aiming towards the goal of making innovative functionalities available to all members of TUM. These partnerships enable us to move forward with our ideas on a scale that is far beyond what a small team of students could achieve on its own. Overall the IT landscape at TUM seems to be in good shape, especially compared to other leading institutions. We have, however, identified two strong trends that we think require additional effort: On the one hand the university's current portfolio seems to be weak with respect to systems that support collaborative work.

On the other hand initiatives in the direction of universally accessible interfaces for data exchange between systems can help to spark innovative solutions and enable faster adoption of changing user needs. Users are, however, not looking for the addition of a plethora of bells and whistles, but wish for solid core functionality that perfectly fits their needs and enables them to focus on the task at hand. In general we remain strongly committed to working with our partners to keep student interests at the top of the agenda and to move forward with the ideas and initiatives created as part of this project.

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#### Acknowledgement

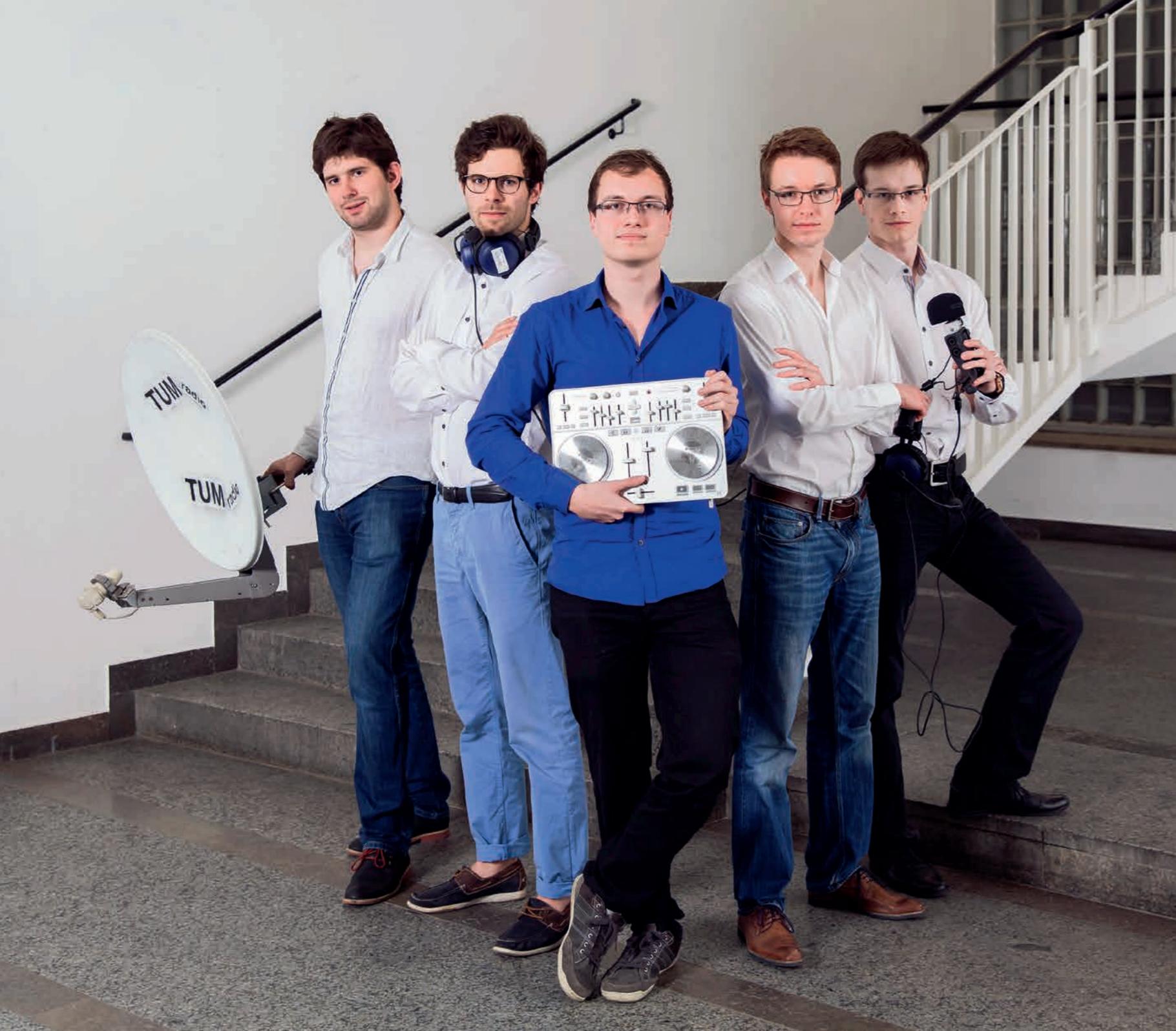
Foremost, we would like to express our sincere gratitude to the head of TUM: Junge Akademie, Prof. Gerhard Müller and his predecessor Prof. Regine Keller, for the opportunity to realize our project within the framework of the institution and for their great support and excellent guidance throughout the project. Furthermore we owe a great debt of gratitude to Peter Finger, Managing Director of TUM: Junge Akademie for his invaluable support and encouragement during our research and for liberally sharing his time and expertise.

We are furthermore very grateful to our mentor Prof. Klaus Diepold for inspiring us to think big and beyond established concepts resulting in unconventional discussions which turned out to be valuable contributions to the visionary parts of this project. We wish to gratefully acknowledge our tutors Bernhard Bohn, Hendrik Heenen and Paul Stursberg for their wide knowledge and structured way of thinking which gave us guidance throughout our project.

We would also like to thank Daniel Straimer, a fellow member of Junge Akademie, who organized and moderated a Design Thinking workshop for us. Finally, our deep gratitude goes to all those people working at TUM and associated institutes who provided us with lots of information, contacts, support and fruitful discussions about the status quo and the future of TUM's IT infrastructure.

We would like to especially mention Hans Pongratz (CIO TUM), Michael Folgmann (Coordinator for e-learning), Dimitri Vorona (Moodle Development), Ina Schmitz (Lecture Recording), Ralf Kossul (ITW), Werner Baur and his team (Storage Group LRZ), Dr. Friedrich Käck, Tina Pellegrino-Fesl and their team (ZA4 building and property management), as well as Lucas Reeh and Michael Lorenzoni from TU Graz.

Last but by no means least we would like to thank all lecturers that allowed us to promote our survey during their valuable lecture time and all participants for sharing their opinions with us.



# Project Report **TUMradio**

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## Why radio?

There was one question at the beginning of the project that struck us more than just a few times. And since then it has continued to arise frequently. Whenever one of us told their colleagues or friends about our project “TUMradio” the first question always emerged: “Why exactly do you want to establish a radio station? Why not video clips for Youtube? After all, the Internet is the medium of our generation. Radio on the other hand... radio is dead! We’ve got Spotify and music on demand now!”

Certainly, parts of our minds instantly agreed! Yet we were still convinced that radio is the medium that fits our goals best. We decided deliberately against video clips and preferred the old-school radio with a plain audio track and without visual aids.

Radio, television and the Internet are means of enjoyment, information and most importantly communication. There is no social interaction without communication, both verbal and non-verbal. And therefore communication dictates every part of our life, whether it be our career, our friendships, our relationships or our family. Very early in life we acquire skills to develop our communication and apply them to reach our goals.

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<< Communication – the human connection – is the key to personal and career success >>

*Paul J. Meyer*

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What hinders communication? Before mass media, you could reach as many people as your voice allowed. Therefore, the biggest obstacle was distance. With the advent of the letterpress, radio and television, a single person could suddenly reach vast numbers of people. The telephone allowed people to talk to each other over great distances and the Internet allowed people to talk to the whole world.

Now, with all the possibilities we have, one might think that distance does not hinder communication any more – write a quick WhatsApp-Message, make a quick call and everything’s clear ... Sadly, this is not true. You get a great deal of information just by being present. If you meet up with someone in person you exchange more experiences than you could ever do through text messages.

The Technical University of Munich is a very big institution. There are three main campuses: Garching, Weihenstephan and Munich. But there is more: the sports faculty in the “Olympiadorf”, two medical clinics and a campus in Singapore (TUM Asia). Overall there are 411 buildings, six Central Research Institutes and three Integrative Research Centers. About 38,000 students, 9,900 employees, 45,000 alumni and 511 professors take part in academic life at TUM.

With that number of people, spread over more than 400 buildings, it is impossible to inform everyone about everything of interest happening at TUM. But it is important to exploit all means of communication we have.

TUM uses two main channels to keep its members informed: print media and the Internet. There are a variety of journals and magazines, written both by students and TUM officials – Reißwolf, Trafo, Klopapier, Chemist, TUMcampus, Faszination Forschung, Technologist... and many more. More print media is used in the form of flyers and brochures, as well as posts on the bulletin board.

On the Internet there is a website for TUM itself, for every faculty, department, student initiative... in short, for every part of TUM. Additionally, social media and newsletters are used to spread news.

Beyond print media in all forms, TUM produces video clips on certain topics, e.g. some courses of study. These videos are pos-

ted on Youtube and on the website, mostly to advertise externally. Also, MOOCs (massive open online courses) are being introduced. This means that lectures are recorded and made accessible for students. They are also uploaded to the Internet.

What about television or radio? From time to time public-service radio and television companies present reports about TUM. Most often these involve professors presenting their most recent research or talking about their initiatives. The everyday life of students is not represented when television only talks about a great new project in which only a few students are involved or when the newspapers only write about prizes professors receive.

We at TUMradio think that the voice of students in television and radio is not strong enough. We focused on radio because in comparison to television it costs less, in terms of both money and time, and you can listen to radio without being too distracted. This means that without too much effort you can inform yourself about what is happening at TUM while you take the bus or the subway to university, or while you are driving home or standing in the laboratory.

We wanted to establish a broadcast service from students for students. So not only is our target audience the student body of the Technical University of Munich, but also we and our production team are students from that same body.

We are all members of a single university spread across a variety of different locations. Our goal is to unite students of all campuses here, in and around Munich, and even in Singapore, and to establish a true corporate feeling, a single identity for our university.

<< TUMradio. Your radio, your voice, your university >>



## Abstract

**Radio has always been a simple communication tool and our survey showed the demand for a radio station at our university. So our goal was to create a true TUMradio – from students for students.**

### 1. Background

#### History and recent developments

Radio has a long tradition in Germany: The country's first public broadcast – of a Christmas concert – took place on December 22, 1920. From then on the spread of broadcasting began in Germany. The audience grew particularly strongly when radio receivers became cheaper and more manageable. From 1949 onward radio was broadcasted via USW, which has survived to this day in almost unchanged form and has only been supplemented by additional features like digital technology. Hence radio is still the most used communication channel in Germany: With the largest audience ever achieved for a single broadcast standing at 93.5% of capacity and an average daily reach of 79.7%, radio is by far the most widespread channel and more commonly used than television or the Internet.[1]

Surprisingly, for many young people, radio is the main source of news. According to a survey made by the magazine Neon, 27% of the interviewed young adults between 18 and 35 use radio as the main source for news; 19% use television, followed by 18% who use news websites as their primary medium of information.[2] Although young adults and teenagers tend to listen to radio less than older people, the amount of time which a person between 10 and 29 years spends listening to radio each day is still remarkable: 141 minutes on average.[3]

These statistics clearly show that radio is still an important source for news even for younger generations. In times when the Internet is accessible nearly everywhere and 6 out of 10 Germans use a smartphone,[4] radio has still maintained a crucial role in the transmission of information. This is due to its easy access and handling.

Moreover, information is obtained passively via radio, i.e. the auditor does not have to search actively for information as is necessary in the case of Internet websites or television.

Since the cost for mobile Internet has rapidly decreased in the last few years and new technologies like LTE enable people to download larger amounts of data, many people have started listening to webradio on their mobile devices. This model has established itself next to the traditional radio frequencies. In 2013 there were 2851 webradios in Germany and every fourth download was made through a mobile device. Ninety-seven percent of these webradios are Online-Only Provider, i.e. 97% of the webradios offer their programs just on the internet and don't broadcast their programs via radio frequencies. [5] Consequently, webradios are highly popular among university radio stations in Germany because of their easy installation and access via the Internet.

1. "ma 2014 Radio II." 2014. A. Media-Analyse. Frankfurt.
2. "Generationenumfrage." 2014. Neon.
3. "ma 2014 Radio II." 2013. A. Media-Analyse. Frankfurt.
4. "44 Millionen Deutsche nutzen ein Smartphone." 2015. Bitkom. Berlin.
5. "Webradiomonitor 2013." 2013. Goldmedia, B. a. Berlin, Munich.

#### Different types of radio

Private radio stations or the radio stations of public-service broadcasters are so-called standard-format radios, i.e. they have a strictly planned program. The amount of music, word posts or advertisement is determined in advance following a specific ratio. The format is mostly based on a pre-defined target group. In order to reach young people up to 28, for instance, the stations play mainly the current chart list, reducing the word share to a minimum and employing entertaining presenters in front of the microphone. Standard-format radio has the great advantage that it is cheap to produce because it follows standard patterns and presenters use similar techniques. Furthermore time-consuming and costly word posts or articles take up a small proportion of time in standard-format radios.

Cultural radio stations are characterized by a high proportion of talks. They address an audience which does not only want to be entertained, but also to be informed. Instead of charts, cultural radios play world music, jazz and classical music, often in their own journalistic music magazines. There are also formatted broadcasts, e.g. current-affairs magazines, and other specialist genres such as radio drama or documentaries. The disadvantages of cultural radios are their high running expenses which make the programs highly unprofitable for private operators. The high costs are due to a large network of correspondents and competent professional editors. Radio drama productions and own-orchestra recordings, especially, increase running costs greatly. Therefore, it is almost exclusively public-service broadcasters who operate cultural radio stations in Germany.

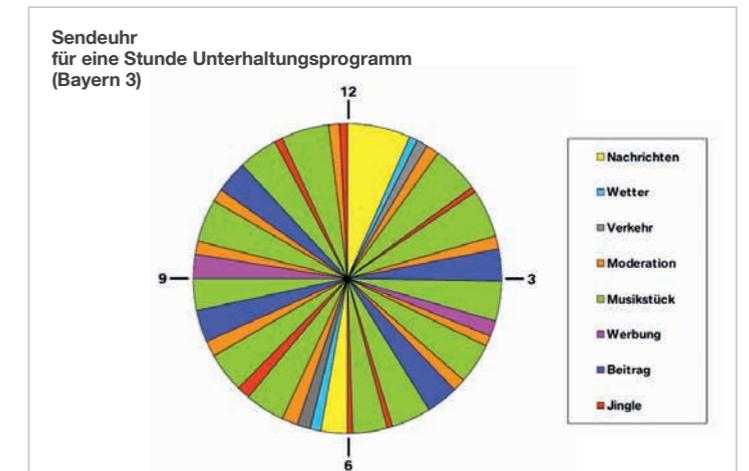
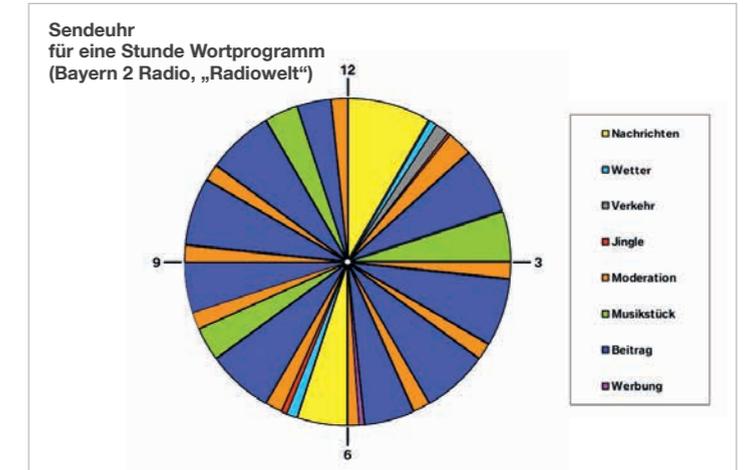
The difference between the two types of radio is clearly visible in the two transmission clocks shown here. These represent the contents of an hour-long program in graphic form.

### 2. Goals

#### Communication and networks

The main goal of TUMradio is to inform students and to be a platform which establishes networks. Students at the TUM can choose from a variety of different sources to inform themselves about campus life, e.g. news, events, programs. A radio program can provide an additional source of information for the students and workers of TUM. Hence, TUMradio improves communications within the university, particularly between different faculties and campuses. The program does not aim to reach every student at the university, but rather to be an alternative to websites and roadshows. TUMradio is not designed to compete for students' attention with other sources of information. It is more a supplementary tool for students as well as workers at TUM to obtain information and news.

Furthermore, TUMradio is intended to facilitate publicity for student groups. Articles broadcasted by TUMradio can also be used to inform people about the work of student groups. Therefore our



program can be used to advertise students' projects with the aim of connecting people with same interests. TUMradio will be serving as a new method at TUM to reach students and to inform them. As it has the capability to introduce student groups in different ways than printed media, it might be of specific interest to groups which deal with music or sound in general. They could present their work via TUMradio more vividly and authentically. Established alongside the numerous magazines and newsletters, TUMradio will henceforth be a part of the communications network of TUM.

Another goal of our project is to offer students the possibility of becoming familiar with radio production. By providing the equipment and specialist knowledge, TUMradio should be an open student group which encourages students to participate and make their own features. To help them produce their own work, students will be taught by older members how to use the recorder and the audio software. Furthermore active members should assist and motivate new students to report on projects they are interested in. TUMradio is open for all students and it's one of our main goals to recruit new members from different faculties. That will diversify the contents of our radio programs and thereby hopefully increase the group of listeners. By acquiring new members, TUMradio will not be a one-year project, but a sustainable education program of TUM.

### Audience and actors

TUMradio should be established primarily to address and inform students. Initially, we want to consider students as the main audience for our radio programs. Under the motto "a radio by students for students" our main goal is to attract as many students as possible to listen to our programs. Nevertheless, we hope to be able to reach a significant number of non-students with TUMradio as well, e.g. staff, lecturers and alumni. Hence the program is scientifically oriented but puts its main focus on the lives and needs of students. The articles and interviews broadcasted by TUMradio should aim to answer students' questions first and foremost and to display the TUM community from the standpoint of a student.

However, all the articles which are part of our program should also to some extent consist of information and questions which are broader and not specifically related to students. With a good mixture of general and student-specific information we hope to be able to cover each topic from a wide perspective and to make it interesting for students as well as for non-students. We are aware, though, that bridging the gap might be a difficult task sometimes and that even a balanced and well investigated article won't be able to address all members of TUM equally.

### 3. Methods and Results

Since the main goal of TUMradio is to provide a suitable radio program for students, a survey was conducted among students to ask them what they would expect from a radio program of the university, what should be its focus and range of accessibility.

The idea of establishing a radio program for TUM arose when we thought about a new medium for informing students about campus life in general. In a first survey, 71% of students from TUM said that they listen to radio frequently, and more than half of that number listen to webradio. This is higher than in the general population in Germany where only 39% of all respondents listen to webradio daily. Therefore we have chosen the special audience of webradio-listeners as our main target group.

A large majority of the students at TUM listen to radio stations on a regular basis, most of them in the morning (71.4%) and in the evening (58.1%). In the afternoon there are fewer listeners (37.8%). Most of them listen in the car (78.3%) and at breakfast (49.8%) or generally at home (46.5%).

Since only 2% daily listen to cultural radio on the internet, it is important to find a compromise between standard-format radio and purely cultural radio. The requirements of our respondents reflect the compromise which is necessary. The most desired option is good music (85%) along with an up-to-date and informative pro-



gram (65%). In addition, emphasis is placed on humor. In terms of specific content, respondents would particularly like the station to include events and deadlines of the university, announcements of parties and research events, satire, university politics and other topical subjects.

In the light of the survey's findings, we have created a transmission clock which we believe will meet most of the requirements of the students. We have planned programs with a duration of 30 minutes, each consisting of components of similar length: an interview, news, an introduction of a new band, satire and articles, e.g. reports of events.

To produce these programs, we need partners. These include many institutions of TUM such as the Corporate Communications Center. For contents and information, there are a number of sources, ranging from the student councils and Asta, as well as journals of TUM, to student groups and clubs such as TUfast or tu-film. We have conducted interviews with many personalities in September, especially the heads of institutions which are important for students, such as the Students' Union, the International Center and the less well-known Institute for Advanced Studies.

For those interviews, professional recording equipment and headsets were bought to ensure a sufficiently high standard of recording. Thus we now have mobile recording equipment which makes it possible to conduct interviews anywhere. In addition, we have been offered the opportunity to use a professional studio at the Weihenstephan campus to produce articles.

It was particularly gratifying to see such strong interest for a radio program among students of TUM. Indeed, we received several emails from students offering assistance. Our survey has already revealed that there are a large number of students at TUM who would like to implement their own ideas at TUMradio. To demonstrate the potential of TUMradio, we plan to produce at least one pilot program on the website of the TUM: Junge Akademie.

### 5. Summary and Future Goals

Our project demonstrates that students happily continue to use the radio and value it highly. The pilot episodes have served to test and quantify this view. Our project has established a solid foundation over the last year and we would now like to investigate how to make a radio program within the TUM community a sustainable option for the long term.



# Project Report **zusammen.sammeln**

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## zusammen.sammeln

Even with the elimination of tuition fees in winter semester 2013/14, students still have to spend a huge amount of money for living, especially in and around Munich. As a consequence, only few have enough financial resources to support charities. When the umbrella term for the 2014/15 projects of the TUM: Junge Akademie, „Campus of the future“, was released, the project group *zusammen.sammeln* was formed to change this situation.

The aim was to design, implement and evaluate a donation system for the Technical University Munich, which guarantees a maximum of accessibility and affordability for students. To this end, the concept of social micro-crowdfunding was chosen. The core idea was: If everyone contributes a little every once in a while, a lot will accumulate to help others in need. In the course of the past year, two types of pilot projects were designed and implemented, conscientiously considering scientific methods and standards during the process. After getting to know the preferences and dislikes of the target group by conducting a representative survey, two separate systems were designed.

First, **#Pfandevent2015**, consisting of a two-week campaign realized at the City Centre Campus and the Campus in Freising (WZW) of the TUM, gave students and employees the opportunity to donate their „Pfand“ by throwing their deposit bottles in designated donation-bins to support the Lebenshilfe Werkstatt GmbH München. The distinctively shaped and coloured blue donation-bins were handcrafted in a workshop for metal works and welding, which was taken by *zusammen.sammeln*'s team. They are practical containers for donated deposit bottles as well as stylish markers to establish the *zusammen.sammeln* brand on campus.

Secondly, **#Spendenessen2015** was implemented in cooperation with the Studentenwerk München (STWM) as the first charity meal ever to be conducted in Studentenwerk's facilities in Germany. While students, employees and guests had the chance to choose between a variety of meals next to the donation meal, an astonishing 6.000 of them decided to go for the „Spenden-Currywurst“ and more than 2000 „Spenden-Joghurts“ were sold in order to support the Studentenhilfe München e.V..

Countless positive reactions and interactions by and with students and employees during and after the pilot projects strengthened the belief of *zusammen.sammeln* to be on the right track. The overwhelming support and appreciation by the target group solidified the belief that a social campus did not have to be invented - it is already reality. The ability to activate the huge sleeping potential among TUM members and to provide them with attractive social projects in their daily academic lives is going to be a keystone for the future social capacities of the TUM.

Besides the positive impact on the supported people's lives by *zusammen.sammeln*'s social crowdfunding projects, these can also contribute to the social characteristics of the TUM. As a pledge to its alma mater, these projects are going to affect daily life at TUM in two distinct directions: Inwards as a solidification of the TUMs ever increasing school-spirit and self-understanding as a responsible and meaningful institution. Outwards as a strengthening moment, tightening the bond between the TUM and its hometown of Munich.

In the future, when you walk around the campus and see one of the donation-bins or the advertisement for the next donation meal, go ahead and participate. It is not much for an individual, but together we can achieve great things. Together, we are strong. Together, we can make a change!

## Abstract

**The giving behavior of young people differs from the average donor. Our goal was to analyze the donations of students and develop means of “social crowdfunding” tailored to their needs. After scientific investigation we implemented two projects to test micro-crowdfunding at TUM. Both tools achieved great acceptance and successfully integrated micro-donations into the students' daily routines.**

### 1. Background

Donations play an important role in modern society: They are not only a sign of sympathy and compassion with the poor, but show helpfulness, solidarity and support for the ones in need. Through their care in selecting causes to donate to, people can assume responsibility and express their will to shape society (Priller 2009). Most typical are monetary and in-kind donations, but also the donation of time, blood or organs should not be forgotten. The common factor in all forms of donation is that the donor gives something of value without expecting anything in return.

Statistics show that the total volume of donations has been steadily increasing in Germany, having reached a new all-time record of 4.96 billion Euro in 2014 (Spendenrat 2015). Yet, there is a huge imbalance between the contributions of the different age groups in the German population. As chart 1 shows, people at the age of 60 or more account for 60% of the total contributions while only representing 31% of the population. In contrast to this, people younger than 40 account for 35% of the population, but only contribute 9% to the total donation volume.

This disparity cannot be explained only by the unequal distribution of income and wealth: Average income peaks when people are in their 30s and 40s (Bundesbank 2013) and wealth peaks for people in their mid-50s (Sachverstaendigenrat 2013). It is understandable that younger citizens, especially students, are not able to donate as much money as older age groups with a mostly assured income. Still, there is a potential to raise more money for charitable causes from this age group than at present. It should be emphasized that people with an academic background and therefore former students are particularly expected to assume social responsibility in German society.

The challenge is to motivate young people to make donations despite their limited financial assets. Social crowdfunding appears to be an attractive way to better leverage their donation potential. In the context of this paper, social crowdfunding describes fundraising for social projects from a large group of people by means of easily feasible micro-donations: Rather than aiming at high single donations, the potential is seen in a small contribution from everyone.

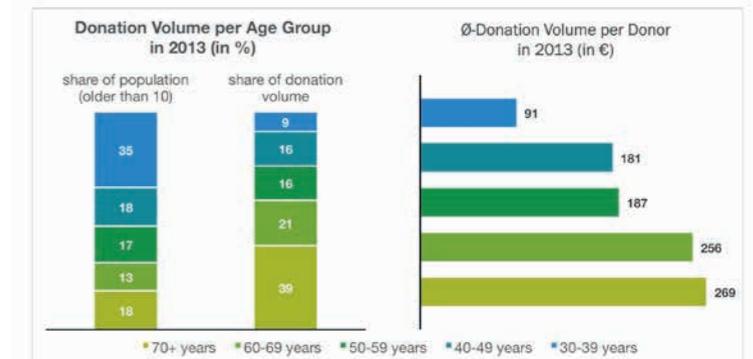


Chart 1: Donation volume per age group and average donations [Spendenrat 2015]

### 2. Goals and Methods

The main goal of our project is the development and implementation of social crowdfunding-tools specifically tailored to the needs of students. As aforementioned, the tools focus on micro-donations of a large number of students due to the limited average financial assets of our peer group. Our project purposely does not consider voluntary work (donation of time), as the latter has been subject to „TUM Social,“ a previous project within the TUM: Junge Akademie. Our project's main goal is divided into several sub-goals which are listed in Table 1 and will be explained in the following. The table also lists the methods that were applied to fulfill the respective goals.

First, it was crucial to understand why and how people generally donate for charitable purposes. As scientific and social institutions have comprehensively analyzed the giving behavior in Germany and other countries, a review of the relevant literature and the publicly available statistical data was conducted.

Goals	Methods
1 Find out why and how people donate	Literature review on giving behavior
2 Develop social crowdfunding-concepts by means of micro-donations aiming at increasing the donation volume among students	Brainstorming and other creativity methods, review of existing projects
3 Analyze the giving behavior, principal motivation and potential for donations among students	Survey: - Apply scientific methods how to develop and conduct a survey
Analyze the difference between the donation behavior of students and the whole population.	- Review existing surveys analyzing giving behavior, motivation and potentials of donors
Receive feedback on developed social crowdfunding-concepts	- Present social crowdfunding-concepts, ask for acceptance and motivating factors
4 Evaluate the effectiveness of the developed social crowdfunding-concepts	Pilot projects: - Implement concepts as pilot projects with collaborative partners
Identify the most important factors for the success of social crowdfunding among students	- Support projects with (social) media campaign
Increase the awareness of social institutions/projects at the university	- Observe the perception of the students and conduct interviews following a questionnaire
5 Establish successful pilot projects in the long run	- Evaluate the success of the projects on a monetary basis - Discuss the results of the pilot projects with collaborative partners, define steps for a long-term implementation

Table 1: Goals and Methods

Simultaneously, we developed social crowdfunding-concepts by means of brainstorming and other creativity techniques. We also conducted a review of existing projects collecting micro-donations for social purposes. The concept development focused on ideas being feasible in the university environment of our peer group. Next, we conducted a survey concentrating on two core goals: On the one hand, we wanted to better understand the giving behavior, motivation and potential to donate of the students. On the other hand, we asked the students for feedback on the proposed crowdfunding-projects, including motivating factors. The development, execution and analysis of the survey followed scientific and statistical methodologies..

In order to prove the effectiveness of the developed concepts, we implemented them as pilot projects with collaborative partners. The pilot implementations included a promotion campaign focusing on the utilization of social media. During the pilot projects, we carefully observed the perception of the students and conducted interviews with them aimed at the identification of success factors for the projects. Eventually, we performed a monetary evaluation of the pilot implementations.

Finally, we discussed the pilot projects with our partners and defined steps for a long-term implementation. These steps are necessary for a sustainable implementation of the projects in the long run.

### 3. Outcome and Discussion

#### 3.1. Literature review on donation behavior

Recent studies about the donation behavior of the German population show that about 79% of all donations aim at humanitarian aid. As chart 2 depicts, child and youth support as well as religion/church are the most common causes that people donate for. Further important causes are those to do with diseases and disability as well as disaster relief. Non-humanitarian aid, which includes culture and heritage protection, environment and nature conservation, animal protection, as well as aid for sports, amounts up to 21% of the total donation volume. The graph also illustrates that bank transfers, online transfers and direct debiting dominate the donation methods. Direct deposits and collections are less common.

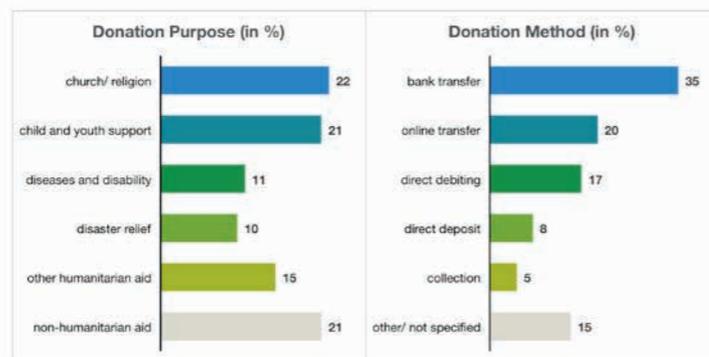


Chart 2: General giving behavior in Germany 2014 [Spendenrat 2014, Spendenrat 2015]

#### 3.2. Concept development

Two different concepts for a social crowdfunding-system were developed in the scope of our project: a deposit bottle donation system as well a charitable dish in university canteens.

The deposit bottle donation system allows students to donate their returnable bottles by throwing them into two boxes particularly designed for this purpose. As returnable bottles are worth 8, 15 or 25 Euro cents in Germany, they represent a good medium for micro-donations. Similar projects have been implemented at other

German universities and also in supermarket chains. Early talks with responsible persons of TUM confirmed the general feasibility of a deposit bottle donation system at TUM.

Besides the deposit bottle donation system, the vision of an automated donation system utilizing the student chip card, which is the dominant payment method in Munich universities, was developed. The chip card has to be regularly recharged and is based on RFID technology. It allows rapid transactions of virtual money at almost any payment counter of canteens, cafeterias, coffee shops etc. Based on this payment principle, the concept of automated very small donations (e.g. 1% of payment, 1 cent) with every transaction was proposed. The Studentenwerk München (STWM) organizes the student chip cards and the payment system. IT experts from the STWM assessed the technical effort for the implementation of the automated payment with the student card as too high.

That is why the idea of a charitable dish was developed as a more feasible alternative. The concept proposes that students can choose to pay a little extra by purchasing a certain dish on some days during the semester. The fixed donation sum is automatically added to the dish price and paid by the students and all other employees with their chip cards, which makes the system very convenient. The feasibility of the concept was confirmed by the responsible persons of the STWM, among them managing director Dr. Wurzer-Faßnacht.

#### 3.3. Survey on giving behavior of students and concept approval

Following the literature review and the concept development, the survey analyzing the giving behavior, motivation and potential of students to donate was conducted. The survey's goal was to unveil the difference between the donation behavior of students and the whole population. Additionally, the acceptance of the two social crowdfunding-concepts was tested, in order to use the insights obtained from these questions in the later pilot projects. In total, 23 nominal-, Likert- and ratio-scaled questions and four open questions in four categories were asked (the number in brackets indicates the number of questions per category):

- Current giving behavior, donation purposes (11)
- Motivation to donate (2)
- Particular questions on developed social crowdfunding-projects (8)
- General information of the respondents (6)

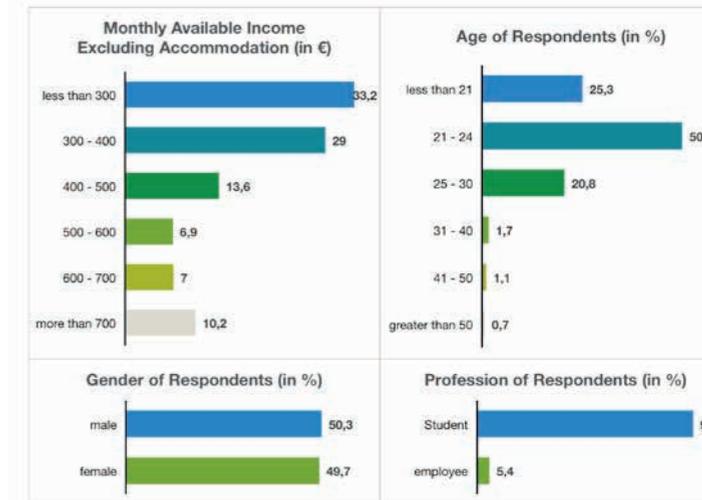


Chart 3: Sample composition (n = 759)

All students and employees of TUM were selected as the total population to be investigated. From this population, a sample was drawn by arbitrary selection. We published requests for our survey via social media and mailing lists. In total, n = 759 responses were obtained. Chart 3 shows that the majority of the respondents of the survey were students, more than half of them within the age group of 21-24 years. Interestingly, the number of male and female respondents was approximately the same, although the ratio between female and male students at TUM is 1:2. Chart 2 also demonstrates the low income of our target group. The available income, excluding accommodation, of more than 60% of the respondents is less than or equal to 400 €. By contrast, the share of incomes higher than 700 € is only 10.2% and employees account for a large proportion of this figure.

The results from the survey depicted in chart 4 indicate that there are only minor differences between students and the average donor when it comes to the choice of the donation purpose: Disaster relief as well as child and youth support were selected most often by the respondents. The motivation to donate for religious reasons was not surveyed, as religious donation purposes are mostly relevant for members of the church and therefore do not apply to

every student. In general, the support for humanitarian aid was high which is similar to the analyses of the Spendenrat (Spendenrat 2014, Spendenrat 2015). As child and youth support was the option named secondly most often, the choice of the Studentenhilfe München e.V. as one of the recipients of the pilot projects (see 3.4) is supported by the survey. The Lebenshilfe Werkstatt was selected as the other recipient of the donations of the pilot projects (see 3.4), based on the finding that 35% of the students would donate for disabled and sick people.

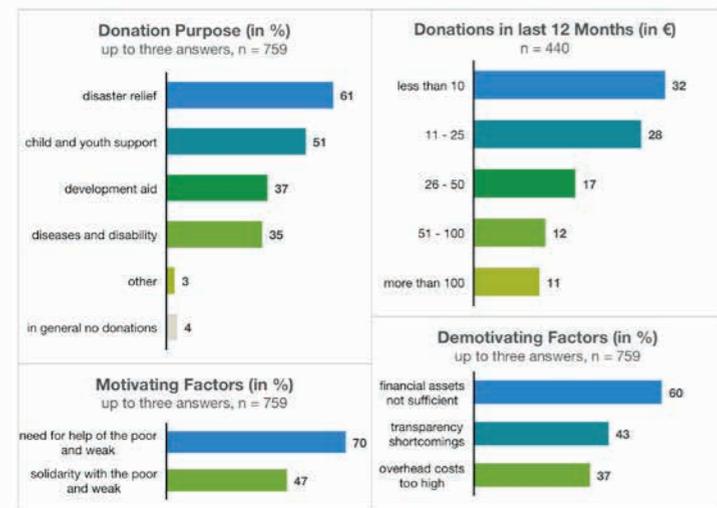


Chart 4: Survey Results I

Sixty percent of the respondents stated that they do not have enough money to make large donations. Sixty percent of donations being smaller than 25 € demonstrates the need for the option of micro-donations. Because wire transfers are not feasible for micro-donations as they are associated with comparatively large administrative efforts, other ways of collecting the micro-donations are supported by the survey.

Chart 5 shows that a donation based on a fixed amount per purchase in the canteens as well as a donation of deposit bot-

tles achieved great consensus among the students. In both cases, 71% of the students stated that they would participate in the respective donation system. In general, the results confirm that social crowdfunding based on micro-donations is a suitable approach to increase the giving behavior of students.

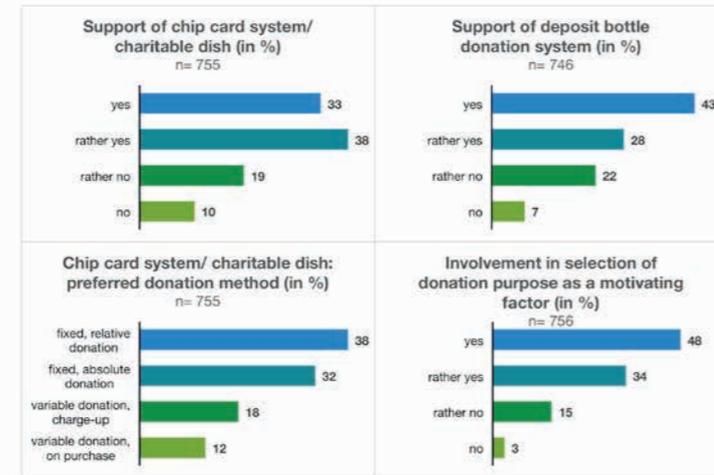


Chart 5: Survey Results II

### 3.4. Scope of pilot implementation

For the pilot project of the deposit bottle donation system, suitable containers were built and placed at two highly frequented places on the university's main campus: one close to the entrance of the main canteen and the other one close to the main lecture hall. The selection of the spots was based on the expected number of students passing by with deposit bottles: Both places are close to university canteens, where students consume lots of drinks. All necessary building directives, most importantly the fire safety regulations, have been met.

The pilot phase lasted ten days in May 2015 and therefore took place during the lecture period of the summer term. The "Lebenshilfe-Werkstatt," a non-profit organization in Munich, which supports

the integration and participation of disabled people in working life, was chosen as the recipient of the donations. The selection was based on the survey results, which indicated high acceptance of a charitable institution like the Lebenshilfe-Werkstatt.

The evaluation of the pilot phase of the deposit bottle donation system was performed by analyzing the number of bottles donated per day. The donations were counted three times daily. Additionally, personal interviews were conducted to analyze the project's perception among the students. The pilot project aimed at testing the acceptance and feasibility of the system, spotting necessary adjustments for a long-term establishment and forecasting the amount of donations in case of a university-wide system. A second pilot phase of the deposit bottle donation system at the campus "Weihenstephan" of TUM in June was used as a reference for comparison with the first test phase.

The pilot project for the charity dish was implemented in cooperation with the STWM, the operator of all canteens and cafeterias of all major universities in Munich. The "currywurst" was selected as the main dish since it is the most popular food in the canteens of the STWM. Moreover, the strawberry yoghurt dessert was chosen as an alternative for the students, also to provide an option for vegetarians. The cooperation with the STWM ensured that both dishes were available in all STWM canteens and cafeterias.

The "Studentenhilfe München e.V." was selected as the recipient of the donations raised with the charitable dish pilot project. The Studentenhilfe is a charitable organization that helps students in need and its support eventually aims at equal opportunities for all students. The choice of the Studentenhilfe was made for two reasons: First, we wanted to offer another donation purpose than that of the deposit bottle donating system in order to evaluate the different levels of acceptance by the students. Second, the STWM is one of the assisting institutions of the Studentenhilfe and was strongly in favor of their support.

The effectiveness of the charity dish was assessed by a monetary evaluation of the donations made as well as a quantitative comparison of the number of dishes sold relative to the last times

the same dishes were sold. Factors that influence the demand for university meals like weather, day of the week and season were considered in the analysis. A qualitative evaluation was conducted by interviewing customers as well as STWM employees in order to collect more information on the acceptance and feasibility of the system.

Both projects were supported by a social media campaign as well as an on-site campaign with flyers and billboard advertisement. Additionally, advertisements in different newspapers, magazines, a radio station and a cinema were used to raise awareness of our undertaking. The impact of the campaigns was studied based on the individual feedback of the students participating in the pilot projects.

In the final stage of the project, options for a long term implementation of the suggested systems were evaluated by interviewing the project team's cooperating partners: The STWM, the Lebenshilfe-Werkstatt and the university administration. The most important factors for success were aggregated and necessary adjustments elaborated.

### 3.5. Evaluation of pilot projects

The two pilot projects confirm the benefit and acceptance of the social crowdfunding approaches among the students: In the case of the deposit bottle donation system, 720 bottles were donated within 10 days as well as another 330 bottles in Weihenstephan, which amounts to a total donation volume of 180 €. The boxes proved to be feasible: A negligible number of glass bottles were broken and the containers were not abused as trash cans. The choice of the place of installation plays an important role: The number of bottles donated was significantly higher in case of the main lecture hall (559) when compared to the main canteen (161).

We received a lot of positive feedback about the usefulness of a deposit bottle donation system and were overwhelmed by students asking about the absence of the donation boxes once we had terminated the project. These impressions strongly support a permanent installation of the system at TUM. The charitable dish

was a full success as well: 6134 meals and 1988 desserts were sold on one day which results in a donation volume of 1425.60 € in total.

Furthermore, individual interviews conducted during the pilot projects following a pre-defined questionnaire showed that the transparency of the charitable organization and the possibility to participate in the selection of the donation recipient are major factors in determining the success of a social crowdfunding system. Eighty-two percent of the respondents stated that they are more motivated to donate when being involved in the selection process. Moreover, 43% of the respondents said that a lack of transparency prevents them from making donations.

Last but not least, the projects showed that media play a key role in social fundraising. Personal interviews conducted during our pilot projects confirm the high utility of social media to raise awareness for charitable projects. This is in accordance with a recent study published by the German Spendenrat (Spendenrat 2015), which stated that especially donations for diseases and disabled persons were significantly influenced by media. The study also unveils that social media play a particular role for people younger than 40: 24.5% of the study participants aged younger than 40 said that they are encouraged to make donations via social media compared to 9% of the overall population (Spendenrat 2015). It is assumed that the share of students being motivated by social media is even higher than 24.5%.

### 3.6. Long-term establishment of concepts

Considering the long-term establishment of the projects, the interviews with the project partners showed that both projects require a framework which allows a simple application of the systems and facilitates future modifications. Overhead costs have to be reduced to a minimum. In the case of the deposit bottle donation system, a collaborative partner able to accept and process deposit bottles is essential for an implementation in the long run.

### 4. Summary and Future Goals

Our project demonstrates that new social crowdfunding-tools need to be developed to leverage the donation potential of students. Micro-donations are one suitable approach to motivate students for donations despite their limited financial assets. Our two pilot projects - a deposit bottle donating system and a charitable dish - showed great results considering their acceptance among the students and the donation volume. The success of the projects strongly supports their advancement and the development of more innovative social crowdfunding-concepts featuring micro-donations.

Regarding future research, it is recommended that this should focus on efficient and sustainable social crowdfunding-systems in particular. Furthermore, the application to other environments than the university and the expansion to other regions need to be investigated due to the highly increased donation potential. This also includes the extension of the target group, e.g. young people in general and not just students.

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- All students participating in our survey
- All donors for our pilot projects and students giving us individual feedback

# Projects in Flow

*inspired by*  
**TUM: Junge Akademie**



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TUMitfahrer is part of the Mobility Services Lab ([www.mobility-services.in.tum.de](http://www.mobility-services.in.tum.de)) at the Chair for Information Systems ([www.winfobase.de](http://www.winfobase.de))

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TUMitfahrer

Ride-Sharing as a Trend

Owning a car used to be an ultimate symbol of freedom, independence and glossiness. Recently our perception of cars has been shifting from personalized objects to common goods. There has been a growing tendency towards car-sharing, ride-sharing and car-pooling concepts in the world. These concepts are becoming increasingly popular with their promise of personal convenience and social improvement (Figure1). It is time to explore this new age where access is preferred to ownership.

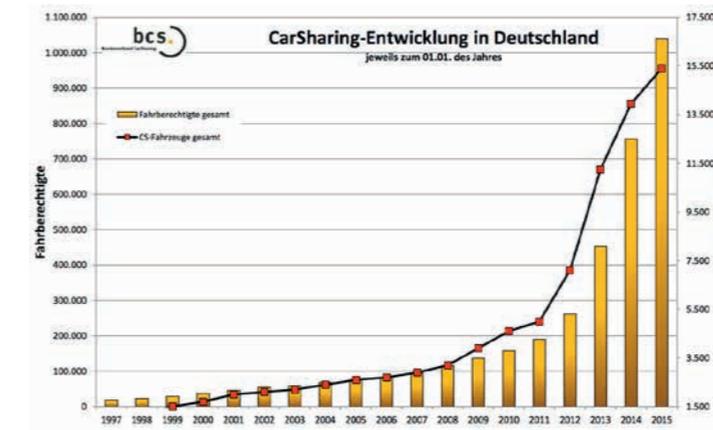


Figure 1: Growth of car-sharing in Germany

To satisfy the demand in the market, many different types of car-sharing models have been established in recent years. The P2P (Peer-to-peer) model is characterized by the community supplying itself. The marketplace brings the owners of cars and other drivers together and matches them according to their needs. Its globally prominent examples are Wheelz, Whipcar and RelayRides as well as Drivy and Tamyca in Germany. Additionally, companies are also offering cars to consumers and facilitate sharing between them. Mainly, car manufacturers and rental companies offer car-sharing

services in this model, which is called “B2C” (Business-to-consumer). The most popular examples are DriveNow of BMW and Sixt, car2go of Daimler as well as flinkster of Deutsche Bahn. In addition to car-sharing, ride-sharing services are also gaining popularity. Its biggest multi-billion global player is Uber. It is followed by some local startups such as BlaBlaCa or flinc. These examples and models show that there is a large market and that the services can be tailored to specific needs.

The Concept of TUMitfahrer

The campus of Technische Universität München is spread around Munich and beyond. Sometimes students need to get from one campus to another between two lectures. TUMitfahrer was founded with the idea of providing a ride-sharing platform for rides to the university or between the campuses. Apart from going to lectures, the platform also supports activity rides, e.g. weekend trips to the Alps or a shopping trip to IKEA. Using the TUMitfahrer platform does not only provide financial benefits to both drivers and passengers, but also has environmental benefits such as reduced traffic and social benefits such as meeting with new peers.

TUMitfahrer was first developed in 2011 as a TUM: Junge Akademie project. The focus was to ramp-up the idea and build prototypes for web and mobile applications. As a result, an Android and iPhone application as well as a website were developed. In January 2013 the applications became available in the app stores for the Android and iOS platforms. Then, the TUMitfahrer project was transferred to the Chair for Information Systems (Prof. Dr. Helmut Krcmar). After the transfer, the initial focus was on improving the design, the look-and-feel, and on migrating the back-end to Ruby on Rails. Lastly, the whole server architecture was moved into TUM infrastructure for convenience and financial reasons. Since the beginning of 2014, the application has been improved by several teams, project groups and individual theses.

Now that the application has been redesigned and relaunched, the current team is working on fixing bugs, changing the architecture to provide a better frontend/backend communication, improving

the system in terms of stability, flexibility and reusability, adding new features to increase the value of TUMitfahrer for students and finally having a launchable version of the TUMitfahrer web/mobile application by the end of September 2015.

### Example Use Cases

In order to explain the functionality of TUMitfahrer, example screenshots from the iOS app are shown. These screens demonstrate a scenario starting with the login. Figure 2 shows the screen that appears after starting the app. If users are already registered, they can login with their emails and passwords. If users do not have an account, they can simply click on the “Register” button to create one.

Figure 3 shows the “Timeline” screen that users can reach directly after logging in. The timeline lists the recent rides and searches created by other users. In Figure 4 the main menu is displayed. From the main menu, users can go to campus and activity rides, add a new ride as a passenger or a driver, search for a ride and see their profile. “Campus rides” and “Activity rides” are shown in Figure 5 and Figure 6.

If users cannot find a suitable ride for themselves in the timeline or in the campus and activity rides view, they can easily use the search function. Figure 7 represents the search screen. They can set the departure, destination, radius and time according to their specific needs. Last but not least, they can add a new ride if there are no available results from their searches. Figure 8 depicts adding a ride as a passenger.

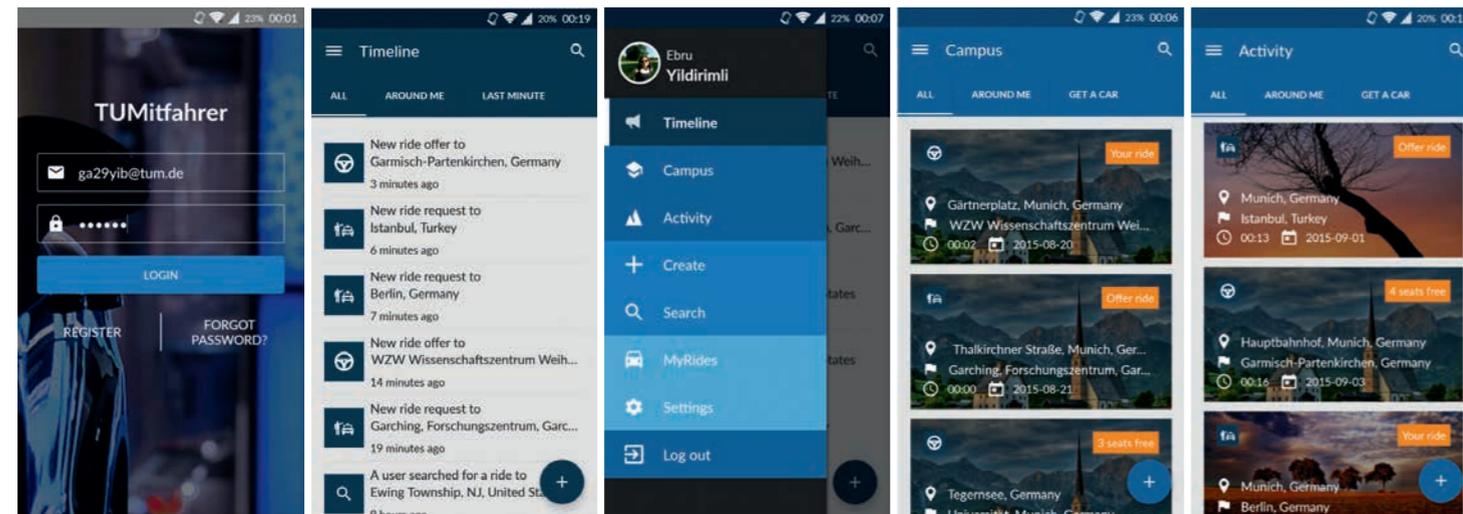


Figure 2: Login screen      Figure 3: Timeline screen      Figure 4: Main menu      Figure 5: Campus rides      Figure 6: Activity rides

### Software Architecture and Development

After the migration of TUMitfahrer to the Chair for Information Systems, the core of the system was designed as a Ruby on Rails application. Naturally, it can serve as a web application running on a nginx Apache webserver. However, it was extended to provide a RESTful web service to the mobile Android and iOS clients. It was a good decision to keep all the backend functionalities and business logic on the same platform. However, the web application cannot be totally separated from server architecture because it was already integrated into the server role to provide web service to clients. This created two main challenges. First, the web application controllers, which handle the requests from the web appli-

cation, and the API controllers, which handle the requests from the other clients, were different. Consequently, all backend features and logic had to be implemented and maintained twice. Second, the server-client structure is not sufficiently clear, which impedes the system from growing further.

To overcome these issues, the current version of TUMitfahrer uses simplified client-server architecture. On the client side, there are iOS and Android applications and a web application. On the server side there is a JAVA web server that connects to a PostgreSQL database and provides a RESTful API to all possible clients. All relevant information is stored in the Database. Figure 9 depicts the overview of the architecture of TUMitfahrer.

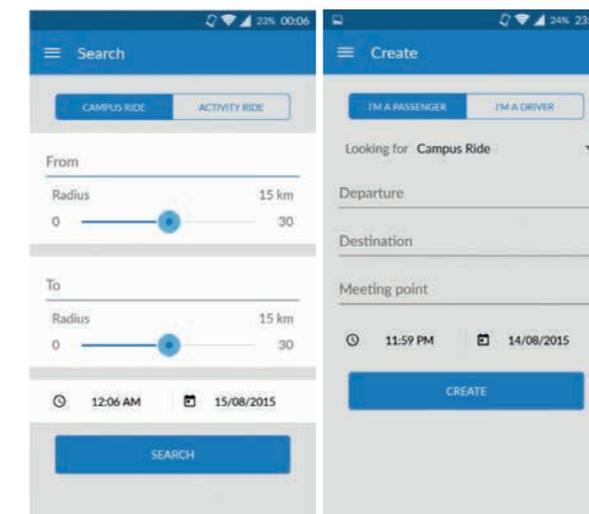


Figure 7: Search for campus ride      Figure 8: Create ride as a passenger

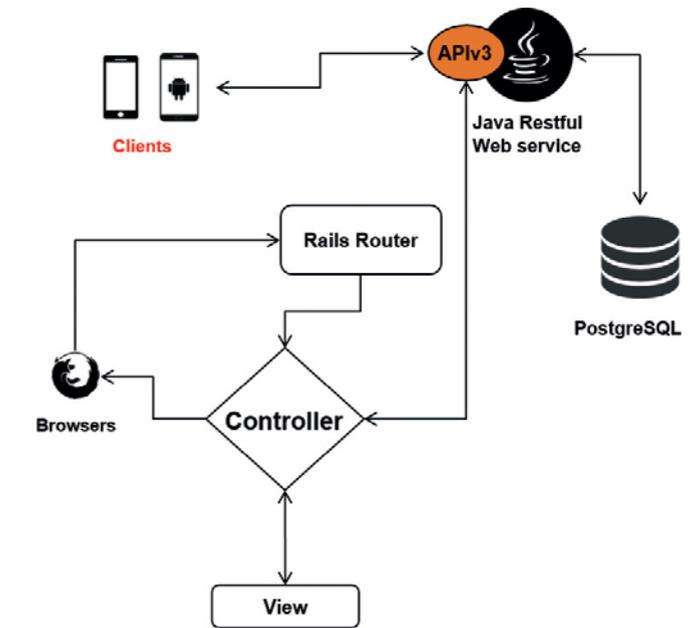


Figure 9: Architecture of TUMitfahrer

During the project period starting from early 2015, the current project group has completed the following tasks:

- A standalone RESTful Java-based web service has been developed. It serves as a single point of contact to the data model. A PostgreSQL database instance has been used on the database layer. All client applications connect to the web service via the API.
- The web application has been migrated to the API-based server-client architecture. Rails controllers make HTTP RESTful requests to the API and retrieve the relevant response. Also frontend bug fixes on the rails views are executed. Certain tests and checks are done for responsive design via the Bootstrap library.
- The Android as well as the iOS application have been migrated to the new API based server-client architecture. A push notification mechanism has been added to the features and the applications have been tested for bugs.

### Future Works

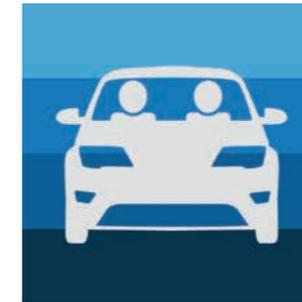
It is planned to launch the improved version of TUMitfahrer in the winter term 2015. At the same time, a new team of students will join the project to ensure support and continuous improvements.

The TUMitfahrer app has a well-written, extendable and well-documented code and provides a clear structure for future works. Furthermore, there are possible features that might improve the user experience of TUMitfahrer.

Sharing is a social activity and car-sharing has the same nature. People might want to connect with others during or after this activity. Friendship and messaging tools would increase the level of usage and bonding with the product. Additionally, getting users' locations through WLAN or GPS and displaying it on a map together with potential rides could help users find potential ride-sharing partners who are nearby. Another main challenge for the TUMitfahrer ride-sharing concept is to attract drivers. Some gamification features like badging and level mechanism would build trust between users and motivate drivers to participate.

### Get the App

Try out the all new application and give us feedback:



Android



iOS



Web





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**TUM Social**  
 ... macht Helfen einfach!

## TUMsocial – Doing social is easy

### Who seeks will find

About 23 million Germans are engaged in social voluntary services. The need for volunteers is constantly increasing and especially the need for short-term support. The reason is not the lack of interest but rather the lack of publicity in advertising these short-term positions.

The goal of the project TUMsocial is to create a web platform that connects volunteers and social organizations with a focus on short-term support roles. Requests for volunteers from internal (i.e. part of TUM) and external institutions are listed in a virtual bulletin board and can be filtered due to users' interest. Contacting the institution of interest is made as easy as possible with the focus on lowering the inhibition threshold. The web page is officially part of the TUM public web appearance and serves as a first step towards the connection between external social associations and internal university members.

### TUM thinks social!

The first step of the project was to collect the opinions from 310 students and employees of TUM by conducting an online survey about social commitment. Eighty-eight percent of all participants have already thought about engaging in social volunteering and Eighty-one percent are prepared to do it in principal. Most of the survey participants ranked the reputation of social commitment as "over average" or "high". Forty-nine percent said the main reason preventing them from active volunteering is missing support in finding and choosing an appropriate position.

These results were really encouraging and were the basis for our next steps. The missing support in finding and choosing an appropriate position was exactly the problem that the web platform should solve. The platform does not only facilitate social volunteering for interested persons, but may also enhance the social image of TUM in the community. As a positive side effect, students who are new to Munich can easily get in touch with local groups and associations and thus make their adaption phase easier.

### Social engagement is treasured

Not only the opinions of TUM members were important to us. We also asked social organizations about their experience with volunteers and their way of handling them. Different social organizations were selected based on the results of this survey (see figure 1).

These organizations were personally contacted to introduce the idea of TUMsocial and were asked about their need for volunteers. They all supported the idea and encouraged us to realize TUMsocial in the way we intended. They also emphasized the importance of offering short-term tasks and minimizing the burden of administration.

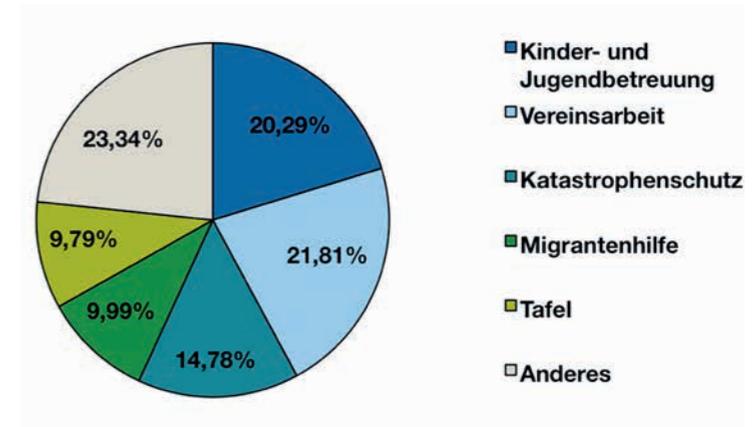


Figure 1: Most favored subjects for social commitment (source: own survey)

## TUMsocial becomes part of the TUM

After evaluation of the opinions and requests collected in the mentioned surveys, the development of the web platform was started. The main requests were: logging in easily by using the LRZ user name, automatic communication based on email notifications, and a newsletter for recently published volunteering opportunities. In addition the platform should be recognizable as a TUM project at first sight. Therefore the platform was adapted according to the design and layout rules of the TUM Corporate Communications Center. Since TUM is a public institution, an open registration process and an approval function for every new position offered had to be implemented to prevent illegal or inappropriate positions being advertised.

During the benchmark analysis we found several “service learning” seminars that are already offered at universities in Germany. The goal of these seminars is to combine theoretical knowledge with practical experience. In order to reach this goal, these seminars are usually embedded in social projects. A seminar like this had already been offered by TUM and the Carl von Linde-Akademie in cooperation with Chancenwerk e.V.. Our enthusiasm about this idea led us to the responsible person of the Carl von Linde-Akademie, Prof. Brenner. Together with him the idea of creating a new seminar using TUMsocial as a connection to social projects was developed. A result of this was that TUMsocial had to be able to track the working hours of the users in their volunteering task,

feature we called “virtual time sheet”: After a volunteering role was accepted, the host institution had to provide the number of hours the user had actually worked in that role. The users may print a summary of all their volunteering assignments with the corresponding working hours to use it as verification for a seminar or in job applications.

The process of development was not always easy and a lot of iteration loops were necessary. Additionally we had to deal with our own exam periods and study-stays abroad, which resulted in a development time of more than one year. After a final test run of all functions (with about 300 single steps), the platform was finally ready to launch in mid-June 2014.

## Acknowledgement

We want to thank everyone who has supported us and given useful advice. This includes the management of TUM: Junge Akademie, especially Ms. Schulz from the Corporate Communications Center, Ms. Schwarz from the TUM Legal Office and Prof. Brenner from the Carl von Linde Akademie, who always answered our questions during the development process and supported us with useful advice. A very special thanks goes to Adrian Vogelsong, who programmed the biggest part of the platform by himself, and to our mentor Prof. Welpé as well as our tutors Martin Kaumanns and Eskander Kebsi for their guidance and for keeping us motivated.

## TUMsocial is launched

TUMsocial went online in June 2014 and access is now available for everyone. We were proud when we were finally able to start the advertising campaign. The websites of the TUM: Junge Akademie and TUM itself wrote news articles about the TUMsocial launch and the platform was mentioned in the students’ and employees’ newsletter (see figure 2).

Several social organizations have asked to publish their notices on TUMsocial platform during its development phase. Therefore several volunteering opportunities were already listed on the day

the platform started online. Since then, 62 organizations have put 120 offers on the webpage; 264 students and employees showed interest in the project by logging in and 64 applications were submitted (September 2015).

The feedback was consistently positive and we hope that the platform will become more popular among students and organizations. For this reason, we regularly advertise the platform by flyers and posters and (if possible) news articles. Our long-term goal is to establish the platform in the TUM family as well known and important portal to increase the communication between university and social organizations and perhaps foster innovative collaborations in the future.

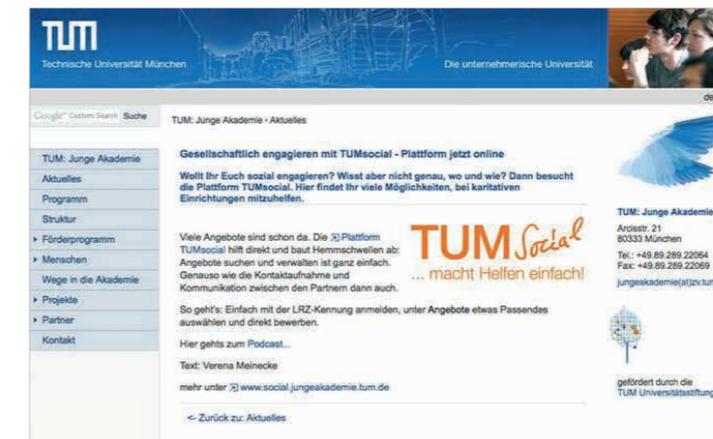


Figure 2: News about social commitment with TUMsocial (source: <http://www.jungeakademie.tum.de/aktuelles> and <https://www.tum.de/studium/studineWS/ausgabe-032014>)



<b>Team</b>	Marcel Dann Meric Firat Hendrik Heenen Lukas Jung Johann Kratzer Julian Pfrombeck Moritz Werb
<b>Tutor</b>	Juliane Hafermann Robin Weiss
<b>Mentor</b>	Andrea Kick, M.A. Prof. Dr. Kristina Reiss



## visiTUM

visiTUM established during the project year 2013/2014 by a team of seven students and two tutors. It provides a format where students can share their experiences from everyday life at university and from their degree course, preparing pupils graduating from high school. Students present their personal impressions via a structured talk followed by questions, which give the pupils a more profound idea about a subject and related courses. This approach reduces the well-known struggle of pupils to choose the right degree course among the abundance of possibilities. After a successful setup of the project, the Studenten-Service-Zentrum (SSZ) of TUM has started partially integrating visiTUM in their repertoire and was included into some organizational aspects of the project.

The original founder group continues to guide the project until it is fully integrated into the SSZ. In order to enlarge the small pool of volunteering students after a first recruiting workshop in November 2014, a second one is foreseen in October 2015. The application process for this workshop has already started and interested students can apply until September 20th, 2015. For further information, please see: <https://www.jungeakademie.tum.de/projekte/projekte/projekte-1314/visitum/>

### What is visiTUM?

The visiTUM project started in summer 2013 and officially ended in October 2014. Within these 15 months we developed a program enabling motivated students to present the degree courses they are enrolled in to pupils.

To facilitate beneficial encounters between students and pupils, visiTUM embraces three major aspects. Firstly, it provides a presentation format suitable for the audience addressed. Secondly, motivated students are recruited as volunteers for the presentations. Thirdly, visiTUM provides the organization of presentations at schools or at TUM.

In the first year, these three threads were elaborated independently to make the program launch possible in the second year.

### Summary of the first year's progress

As described above, the first year consisted of the setup of the visiTUM project. The work was split in three different aspects which were elaborated independently.

#### Presentation format

When the presentation format was designed, two primary problems had to be tackled: (1) what is the best way to share information and (2) how can the audience be addressed successfully. Whereas the first aspect called for a universally applicable content structure which would fit most university courses, the second aspect aimed for a design attracting the audience's attention. For the latter, we had to consider that the presentations are targeted towards single classes consisting of 10 to 20 pupils as well as towards larger groups consisting of up to 120 pupils.

In order to ensure a good information transfer the presentation was separated into two parts:

- A general part addressing the first-year problems with an authentic view of students' everyday life. This includes how students manage to find a flat (in Munich), whether it is possible to have a part-time job during the first year or not and some tips how you can get everything organized.
- A degree course specific part, giving an overview of content, workload, formats of teaching, opportunities and possible difficulties. Every presenting student additionally explains some basics of his or her degree course such as what kind of compulsory modules exist, which advanced modules are available, which major and minor subjects can be chosen.
- This is usually backed up with experiences within the particular study program so that the audience can get an impression of how students perceive their degree course.

During the presentation in front of pupils the general part is usually initiating, followed by several specific parts depending on the number of presenting students. The presentations contain many pictures and videos in order to draw and maintain the pupils' attention. After the setup of the program and a pilot phase of four or five presentations at schools in the suburban area of Munich, the program was evaluated by the audience and adapted to common demands and suggestions. In this way the quality and utility of the intuitively developed program were ensured.

#### Recruitment of volunteers

Due to the limited time after the pilot phase of the presentations, only marginal effort was put into advertisement for the project. However, some participants were found, admitted to the project and presented their courses at TUM.

When the involvement of the SSZ increased, the policy for admitting and recruiting students had to be restructured. We agreed to introduce an elaborated introduction workshop in order to ensure a certain quality level among the volunteers.

#### Organization of presentations

To find schools interested in our project, an early cooperation with the SSZ, whose members regularly visit schools or have classes visiting TUM, was established, and the participants of visitUM had the possibility to present their university courses during these visits. On such occasions the SSZ noticed the value that visitUM added to their program, paving the way for a further cooperation.

#### Follow-up of the visitUM project after the first year

The second year consisted mainly of the implementation of the project's concepts. To find motivated students who are interested in our program, an advertising campaign was conducted. We received about 25 applications and finally admitted 12 students to visitUM. However, before being admitted, these students had to attend an

interactive and interdisciplinary workshop, which was held in November 2014. This workshop was held in cooperation with the SSZ (Student-Service-Zentrum) and the Carl von Linde-Akademie.

From November 2014 until July 2015 about 14 presentations at TUM and at schools have taken place. The average size of the presentation team was 3-6 students, while the size of the audience varied between 10 and 120 pupils.

During that "post-project-phase", the SSZ agreed on the partial implementation of the visitUM program in their repertoire in April 2015. This was advantageous for both sides: On the one hand, the project became more sustainable and not only dependent on the involvement of the original team, and, on the other hand, the presentations served as supplementary part in the SSZ's own school presentations program.

In this way, a close collaboration between the SSZ and four of the seven group members has evolved. So far, the SSZ has taken over the organization of student applications as well as the organization of school visits. However, a full integration of the visitUM program is still our ultimate goal, in order to maintain the visitUM program. This summer, we decided to launch a second introductory workshop aiming at an enlargement of the volunteer pool. Therefore, we are currently looking for motivated students who would like to share their experiences with others. The application process started in June 2015 and it is still possible to apply until September 20th, 2015. More information about the application process can be found on our website (link indicated above).

As a concluding remark, we have to say that we are delighted that visitUM is continuing and has found its place within the SSZ. It was a great experience to set up such a project and it goes beyond our expectations how far it developed.

We would like to thank in particular Andrea Kick and her team for their openness and great support as well as all students participating in visitUM for their relentless effort and engagement, great ideas and inspiration.



# Projects in Prospect 2015/16

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## Food security

The continuously growing world population has led to a complex of severe problems, which is affecting a steadily rising proportion of humanity:

How can we influence today's dealings with foodstuff to secure food provision for future generations on planet earth, whose balance ratio between supply and demand has already shifted today below one?

Due to the rising global impact of this issue and the evidence that industrial companies play a critical role in regulating food supply and demand, food security captures more and more political and public attention.

We, the project team "Food Security" of the TUM: Junge Akademie, are motivated and willed to tackle this emerging global issue through a wide-ranging analysis of its complex structures and causes on political, industrial and social levels, as well as propose solutions to this dilemma and realize our ventures. Furthermore, we seek to evaluate the approaches of existing social and industrial organizations, which are already working on solutions to main-

tain food security. Due to the globality of this issue, we need to reach and focus as many forces as possible, to be able to create impactful solutions. Therefore, we additionally pursue to find collaborative partners from the industry, politics and academia.

In the first block of our project time-line, we investigated the economic stability of the agricultural sector, political and especially industrial guidelines, which categorize foodstuff according to manufacturability and looks, as well as transport routes and the handling of food in developing and industrial countries, which varies significantly.

Reaching the second module of our project time-line, we started to categorize and evaluate the possibilities of a defined project, which can be realized within the given time frame of one and a half years. Referring to the guiding principle "Think big!" our team has recently been working on combining different project categories and ideas to define a final project direction, which is capable of influencing the global food supply in a positive way, aiming to maintain food security for each individual of our planet earth. ■

### Team

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Paul Badow	Jan Mathony
Andreas-David Brunner	Josef Oberndorfer
Fabian Finger	Simon Rieß
Christian Grätz	Philipp Rinner
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Franziska Hauler	Fabian Schmitz
Maximilian Held	Mareike Spindler
Max Juna	Tobias Wörl

### Tutor

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Carolin Thiem

### Mentor

Prof. Dr. Alwine Mohnen (TUM School of Management)  
Prof. Dr. Peter Wilderer, EoE (Civil, Geo and Environmental Engineering)

## Migration in the 21st century

"In reality, life as we live it here is already far more diverse. [...] In our heads we know this, but the spirit sometimes lags behind. We as a nation must redefine ourselves, as a collective of different people, but who all accept common values," said Germany's Federal President Gauck (New York Times, 2015). This year the German Federal Government foresees 800,000 applications for asylum. This demonstrates that change is necessary.

We as a project group are trying to identify potential starting points and to recognize where there is special need for support.

Therefore, we carried out semi-structured interviews with 14 institutions that work with refugees, including Caritas: ALVENI, Bayerischer Flüchtlingsrat, Lighthouse and McGraw-Kaserne. Results of preliminary analysis indicate that there is a variety of information about core issues like education, legal assistance and medical care. Some of the interviewees mentioned that one of the refugees' biggest problems is the lack of information about what daily life in Germany is like. This concerns for instance information about public transport, doing one's shopping at supermarkets or managing a bank account. Another issue was that several refugees suffer from a clash of cultures. As this is a sensitive issue, it is very

important to present the German culture in a cautious way without imposing it on anyone.

As a next step, we want to contact refugees personally in order to find out whether information about everyday issues is really missing and which topics are the most important ones. The missing information should be provided in a suitable medium to communicate it as effectively as possible, for example by creating an app or organising a workshop. However, the greatest challenge is to decide on how information should be presented. Language barriers, illiteracy, different associations with colours and symbols complicate implementation. Therefore, we will try to find new ways to present information, so that, finally, there is a minimum of misunderstandings with a minimum of text. Especially, on topics about cultural differences, a careful evaluation and a very prudent approach are crucial and will be central to our work.

Our vision is to support integration, to improve mutual understanding and to assist refugees in questions of everyday life. ■

### Team

Caroline Adam	Philipp Marzak
Lena Appel	Franz Seitz
Christoph Dehner	Jasmin Sowa
Sonja Fuchs	Cheng-Hui Wu
Ekaterina Grib	Benedict Zillinger
Rupert Heindl	Martin Zirngibl

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Elisabeth Gleisinger  
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### Mentor

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Felix Mayer (MCTS)  
Dr. Manuel Wiesche (Information Systems)

## The Future of Mobility

When outlining the mobility of the future, people tend to derive the future from the present. More or less linear assumptions are made based on what we know today and what we are expecting for the future. This process is framed by corporate technology roadmaps and broad economic interests, by political considerations and concepts of development. People tend to think about the present future, a future grounded in the present.

But how can we shape the future present? The kind of present that will be in the future, regardless of what there is today? How can we break with our present and develop the future of mobility rather than the mobility of the future? Mobility which is required as an end in itself rather than an end in technology?

Based on this critical inversion of common forecasting, the TUM: Junge Akademie project „The Future of Mobility“ will focus on the human beings, with their various needs in mind, to create a vision for a future of mobility in which it is not technology and large

companies that shape the ways we move, but the need and the experience and ultimate purpose of, changing places – on both physical and mental planes. A future where stress gives way to experience, where sufficiency replaces the constant need for efficiency.

So what happens if we try to separate mobility from the simple need to change places and add a dimension of purpose, of deliberate enjoyment? In order to answer this question and design a vision for the future of mobility, we will follow a set of guiding questions: Why do we move? Why do we use particular means of transportation? How do different means of transportation relate to one another? How can the environment be experienced? And which technology is needed to fulfill the identified needs of mobility?

The results of this empirical process will be used to develop a vision of the future of mobility and its underlying lifestyle, technology, and infrastructure. ■

### Team

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Philipp Hulm  
Maximilian Kern  
Martin Schafhirt  
Tobias Stahl  
Sebastian Weiss

### Tutor

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Lisa Janker  
Tim Kratky  
Simone Stegbauer

### Mentor

Prof. Dr. Ignacio Farías (MCTS)  
Prof. Peter Latz, EoE (WZW, Landscape Architecture)  
Prof. Dr.-Ing. Gernot Spiegelberg (TUM-IAS Rudolf Diesel Industry Fellow)

## wisTUM

Our current way of life is, to a large extent, based on scientific discoveries and developments of the recent past. In this context, our society is aptly described as “scientific”, with knowledge held in high esteem. „Knowledge“ in all its facets consists of more than a mere collection of facts. It also encompasses know-how of scientific methods as well as experience – in short, “wisdom”/“wisTUM“. First and foremost, knowledge is not a fixed entity but a dynamic flow subject to changes. Developing further the idea of dynamic knowledge, its creation can be seen as a flow through various institutions – from pioneering theorists through fundamental experimental research towards its application, teaching and dissemination as well as the transfer of knowledge from generation to generation. This being said, the concept of “knowledge transfer” opens vast and expanding grounds of opportunities and challenges to explore and on which to operate.

While this has always been the case, recent years have witnessed an increasing number of scientific publications and patents – a phenomenon resembling a production line which may, or may not, be desirable. However, it contributes to the accelerated rise of generated “knowledge”. Aside from these considerations, we are intrigued by the basic mechanism of transferring knowledge.

Although an important aspect of continuous and sustainable scientific and technological progress on a global scale, it is heterogeneous and difficult to model. An immense number of agents, including society, science, industry, politics and education, have to be taken into account when considering the fairly well-connected developed nations alone; when also considering the developing countries, the process becomes a great deal more intricate.

With its high degree of complexity, knowledge transfer inevitably encounters many obstacles and may, at times, fail – not without consequence. Therefore, we aim to better understand the overall process as well as selectively to investigate how methodological know-how proceeds in and between different scientific fields. ■

### Team

Maria Baumgartner  
Martina Gschwendtner  
Johannes Herms  
Sebastian Kaltenbach  
Marvin Lechner  
Vivien Lechner

Jaakko Nurkka  
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Felix Schweighofer  
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Maximilian Zwiebel

### Tutor

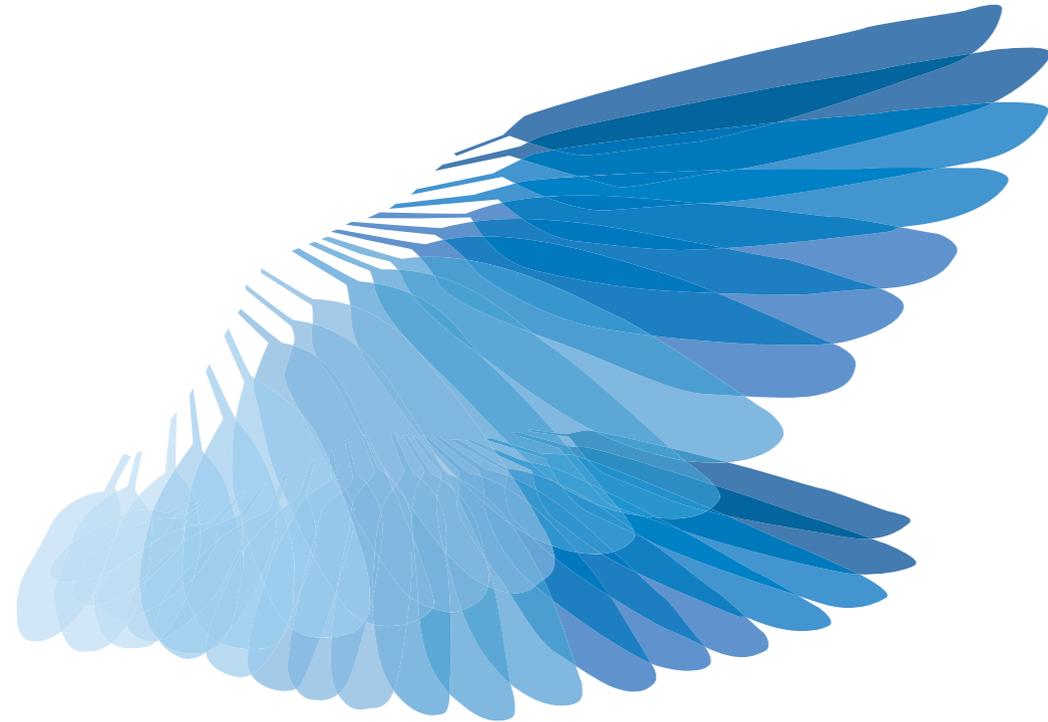
Matthias Lehner  
Kristina Schick  
Robin Weiss

### Mentor

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Prof. Dr. Klaus Mainzer (MCTS)  
Prof. Dr. Christina Raasch (TUM School of Management)

# TUM: Junge Akademie

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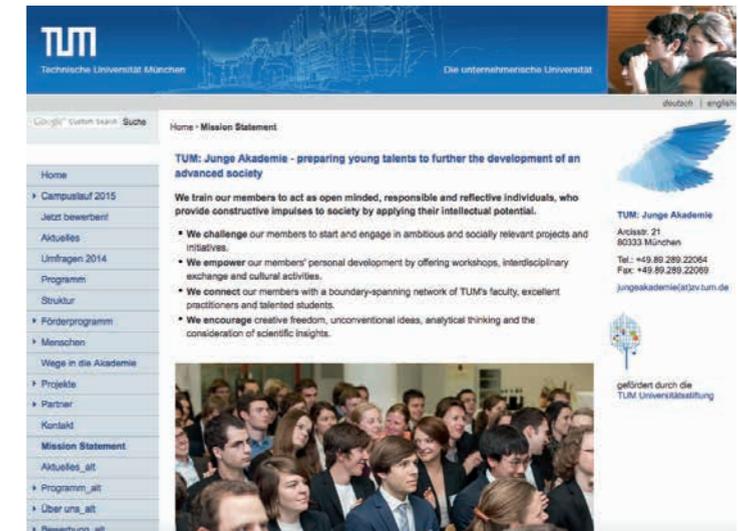


## The Academy

The Academy of talents promotes the assumption of responsibility by its members. Taking over responsibility for one's own development and for society is not always easy in this day and age. Therefore, young people who want to meet the demands of a continuously changing society need the freedom to actively participate in its design. The TUM: Junge Akademie – as the talent support programme of the Technical University of Munich – therefore strengthens extraordinarily hard-working students on their way to taking on responsibility in society. In this regard, the Academy focuses methodically on providing creative leeway, where students receive the opportunity to work freely on self-imposed questions, unfold their individual talents and learn to take responsibility for their technical and scientific ideas.

Based on this principle, the TUM: Junge Akademie additionally encourages members to take responsibility for other members. This is particularly evident in the many forms of volunteer work. Members also contribute to shaping the Academy's future within the Board of Members and the Advisory Board. Others are more devoted to operational tasks and thus join one of the Taskforces: "Event", "Marketing" or "Sponsoring". In both cases, they contribute to the Academy's development in terms of successful capacity building as an organisation within the Technical University of Munich. The tutors of the project teams are usually other members or former Academy members. By coaching and supporting the students in challenging situations that might occur within the project development, they often serve not only as advisors but also as trusted friends.

During the three-year advancement, the members not only have the opportunity to realize ideas in a protected environment with plenty of freedom, but also the opportunity to build up an inter-



disciplinary network and enter into dialogue with one another. The responsibility during the years also continues to grow as the students are introduced to this development. In this connection, great importance is attached to the circumstance that experienced members are taking over tasks in their second and third year of membership that benefit the younger generations.

Right from the beginning, the participants are involved in a vibrant network consisting of alumni of the Academy, members of both the active professors and the TUM Emeriti of Excellence, as well as the young researchers. There are exclusive workshops and cultural events as well as financial resources to implement project ideas and to facilitate comprehensive measures of training and personal development beyond the respective fields of study.

## The Boards of the Academy

Since the Academy's foundation in 2010, the Advisory Board represents the organisational unit of the TUM: Junge Akademie with decision-making power. At the members' request, the Board of Members was launched in order to collect the members' views as a design committee and to pass those ideas on to the steering committee.

### The Advisory Board – Where decisions are made

The Advisory Board represents the Academy's governing body, whose members meet six times a year. It primarily decides on the medium to long-term strategic and organisational issues of the TUM: Junge Akademie.

The strategic themes include in particular the purpose and direction of the TUM: Junge Akademie as well as its interaction with TUM's several institutions and their programs, such as the Munich Center for Technology in Society (MCTS) or the TUM University Foundation. Furthermore, proposals from the Board of Members are discussed.

In addition, the Advisory Board is responsible for key operational tasks, which include the selection of new members or the definition of possible project topics from the wide variety of the submitted project ideas.

The Advisory Board is composed of the director, three representatives of the former professors, three representatives of the active professors and six elected members of the TUM: Junge Akademie.

### Members of the Advisory Board 2014/15:

**Director:**

Prof. Dr.-Ing. Gerhard Müller,  
Senior Vice President Academic and Student Affairs

**Members:**

Andrea Geipel  
Tim Lauer  
Christof Niedermeier  
Felix Örley  
Paul Stursberg  
Lena Weber

**Active professors:**

Prof. Dr. Isabell Welpé  
Prof. Dr.-Ing. Klaus Diepold  
Prof. Dr. Jürgen Geist

**Emiriti of Excellence:**

Prof. Dr.-Ing. (em.) Georg Färber  
Prof. Dr. (em.) Manfred Kleber  
Prof. Dr.-Ing. Eike Jessen, † 18. März 2015

### The Board of Members – The Academy by members for members

In order to represent and bundle the members' interests within the TUM: Junge Akademie, the Board of Members was set up at the beginning of 2014. Here, representatives of the current projects, the Taskforces and dedicated members of all years meet regularly.

At the meetings current questions regarding the projects and the activities of the Taskforces are discussed. In this connection, also, strategic issues such as opportunities for continuous development of the TUM: Junge Akademie or changes within the support programme are broached. The members' representatives are appointed to the Advisory Board from among the Board of Members. By this tight integration, a direct flow of information between the Advisory Board and the membership is ensured and the members are able to participate actively in the decision-making process.

Every active member is invited to present his/her opinion and ideas at the meeting of the Board of Members in order to help the TUM: Junge Akademie to evolve into an institution by members for members.

### Currently active members in the Board of Members:

Lorenz Baumgartner	Josef Kimberger
Mario Berk	Marlies Köpke
Benedict Biebl	Tim Lauer
Eva Biehl	Rebecca Metzger
Julian Biendarra	Nikolai Morin
Beatrice Boekstegers	Christoph Niedermeier
Carl Ebbinghaus	Christine Nöhmeier
Wolfgang Enzi	Felix Örley
Meric Firat	Stefan Röhrli
Andrea Geipel	Andrea Schlegel
Dennis Goldner	Anna Schmidt
Hendrik Heenen	Daniel Schwinger
Jennifer Herrmann	Daniel Straimer
Dominik Irber	Paul Stursberg
Martin Kaumanns	Lena Weber
Christian Keimel	Sebastian Zäpfel

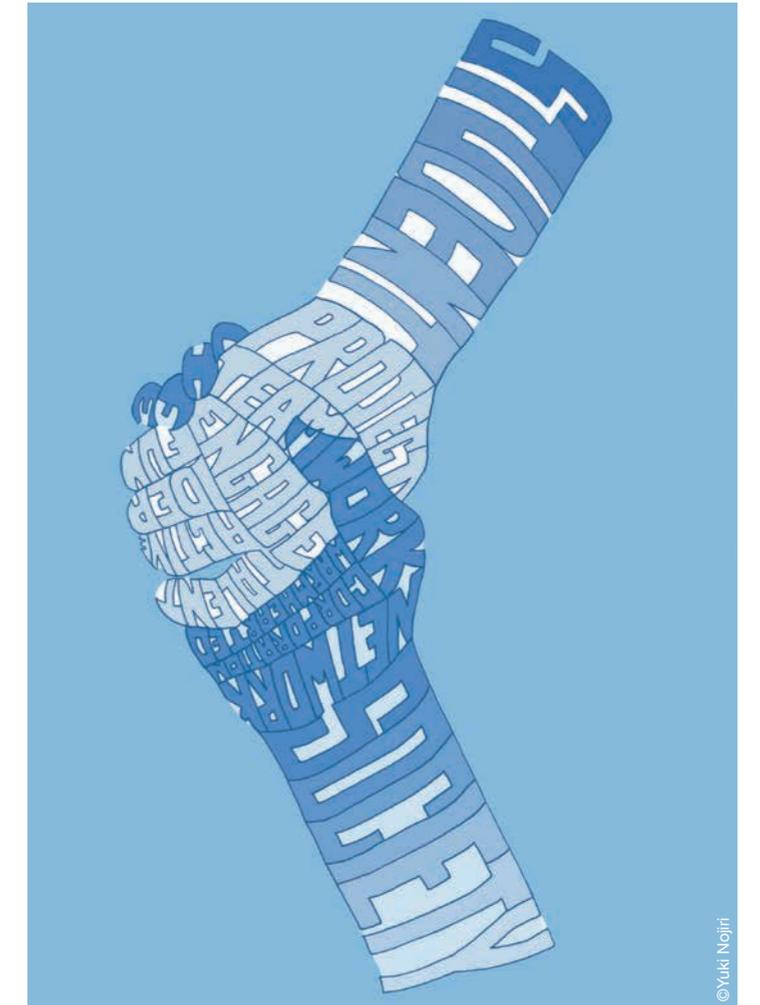


## Committed: Taskforces, Tutors, Mentors, Office

The statement “Members for members” is understood as a leit-motif at the TUM: Junge Akademie: Members are actively taking part in the creation of the Academy’s programs. This is reflected, among other things, in the selection of workshops, such as the workshop on “creative writing”, which bolsters the development of the participants’ skills concerning editorial work and scientific writing.

In addition, the Academy provides access to experts at the Technical University of Munich as well as to external experts, it financially supports the realization of events and it offers its members the necessary space to carry out activities in support of the Academy’s network.

In this way, members of all years and alumni get involved in the Taskforces or as tutors for one of the project groups. To facilitate the operations, the office team supports and encourages all members in their commitment and work.



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TUM: Junge Akademie







## Tutors

To take on the task of a tutor is one of the ways of involvement within the TUM: Junge Akademie. Several tutors support each group of students with respect to their ideas throughout the whole project year. They assist and advise the teams in the project realization, from concept to practical implementation. In this context, the tutors draw on experiences from their own project work. In the search for and the address of experts and other contacts they represent important interfaces for the project teams because of their already existing networks. The tutors benefit from their commitment as well, as they gain important experiences that strengthen their skills by taking over management tasks, motivating the team, giving feedback and moderating conflicts, without interfering with the team's own freedom of decision.

[See List of Tutors](#)

## Mentors

Mentors are recruited mainly from the group of active and retired professors of the Technical University of Munich. However, they might also be employees in TUM's scientific management or TUM alumni with specific expertise. As part of their mentorship, they support their respective project team throughout the whole project work. Due to their years of experience they are ideally prepared for this task: They advise the project groups regarding the orientation of their concepts, they critically question the aims and methods

used, they bring expertise in scientific issues and keep quality standards in mind. Due to their work inside and outside TUM they are also part of a large network that can often be used to support and promote the projects and this therefore represents a profitable factor for all sides.

[See List of Mentors](#)

## Office

In order that the members are able to develop their projects and to work on different ideas within the Taskforces as well as the Board of Members, the office team oversees the general operation. That includes, amongst other things, the proper management of finances, the development and implementation of attractive training opportunities and communication with external and internal partners. The office team acts as specified by the Advisory Board and ensures that current and former members of the TUM: Junge Akademie perceive and experience themselves as a network.

The TUM: Junge Akademie is managed by the Executive Vice President for Academic Affairs of the Technical University of Munich, Mr Professor Gerhard Müller. In this regard, he is operatively supported by the office team that currently consists of the Managing Director, the Team Assistant and a Student Assistant.

The Office Team

[Peter Finger](#), [Maria Hannecker](#), [Carmen Klinger](#)

## A different support program

Being a member of TUM: Junge Akademie for me means being part of a highly motivated group. You can share experiences at a high level and get to know interesting people and opinions. Last but not least the fun factor is great! I have some good memories of the last years.

Verena Friedl

In addition to the invaluable experiences, learning and networking directly associated with the projects, the TUM: Junge Akademie also offers members the benefits of an attractive supporting program of training with varied opportunities for personal and professional development. In this context, they are able to participate in a wide range of events such as discussions and workshops, and cultural events such as concerts.

In addition, the annual summer festival, the monthly regulars' table and the Academy's festive annual conference provide a pleasant setting to meet and exchange views. The members are integrated actively by the Event Taskforce in both the selection of event-formats as well as in their organisation and implementation and so can contribute their ideas, wishes and expectations. In this way, each semester anew the TUM: Junge Akademie is able to offer a unique programme to its members, friends and supporters.

Selection Day



Kick-off in Feldafing



Workshop Project Management



Annual Conference of the Academy



2014 April May June July August September October November



TUM: Junge Akademie goes classic



Visiting the BR3 Studios



Project Development Seminar



Teambuilding Carpalast

Communication Workshop



Alumni to Newbees



Akademy Talk with Dr. Volker Kefer



3. TUM Campus Run



December

2015

January

February

March

April

May

June

July



Ongoing project presentations



TUM: Junge Akademie goes Brussels



Workshop Project Management



TUM: Drachenbootrennen

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## List of Tutors

We would like to thank the tutors who have supported the project groups of the year 2014/15 in their project work.

### LectureLab

- Andrea Geipel, PhD student at MCTS / TUM
- Matthias Lehner, PhD student at Heinz Nixdorf-Chair Mathematics Education / TUM
- Ann-Kathrin Straub, PhD student at Max-Planck-Institute for Physics

### openTUM

- Philipp Geyer, PhD student at Max Planck Institute of Biochemistry
- Josef Kimberger, Student at TUM School of Life Sciences Weihenstephan
- Robin Weiss, PhD student at the Chair of Medical and Polymer Engineering / TUM

### TUMcloud

- Bernhard Bohn, PhD student at Max-Planck-Institute of Quantum Optics
- Hendrik Heenen, PhD student at the Chair of Theoretical Chemistry / TUM
- Paul Stursberg, PhD student at the Chair of Applied Geometry and Discrete Mathematics / TUM

### TUMradio

- Dr.-Ing. Christian Keimel, Academy Senior
- Adrian Vogelsang, Student of Informatics / TUM

### zusammen.sammeln

- Johannes Feldmaier, PhD student at the Chair for Data Processing / TUM
- Jeremias Heinrich, Academy Senior
- Andreas Volmering, Student of Aerospace Engineering / TUM
- Lena Weber, Academy Senior

## List of Mentors

These eminent personalities have generously offered to mentor the project groups of the year 2014/15.

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- Prof. Dr. Alfred Laubereau, Professor (Emeritus) of Physics
- Prof. Dr. Annette Noschka-Roos, Head of the Education Department, Deutsches Museum München & Associate Professor for Museum Education, TUM School of Education
- Prof. Dr. Kristina Reiss, Dean of TUM School of Education, Head of Heinz Nixdorf Chair of Mathematics Education at TUM

### openTUM

- Prof. Dr. rer. nat. Bertold Hock, Professor (Emeritus of Excellence) of cell biology at the TUM School of Life Sciences
- Prof. Dr. Sabine Maasen, Head of the Friedrich Schiedel Endowed Chair in the Sociology of Science at TUM

### TUMcloud

- Prof. Dr.-Ing. Klaus Diepold, Senior Vice President for Diversity and Talent Management at TUM & Head of Chair of Data Processing at TUM

### TUMradio

- Dr. Hannemor Keidel, Presidential representative of TUM, responsible for academic relations with France & the integration process of the Bavarian School of Public Policy (HfP) to TUM
- Stefanie Reiffert, Media Relations officer of TUM Corporate Communications Center

### zusammen.sammeln

- Dr. Frank Frieß, Head of department fundraising at TUM
- Prof. Dr. Alwine Mohnen, Head of Chair of Corporate Management TUM School of Management
- Dr. Michael Schermann, Head of a research lab with Ph.D. students at the Chair in Information Systems

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