

# A Requirements Engineering Process for User Centered IT Services – Gathering Service Requirements for the University of the Future

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**Abstract.** The process of digitalization challenges universities worldwide, in particular the universities' IT. Using ITIL and the ITSM-focused application of software requirements engineering as a basis, qualitative interviews with students were conducted to gather information on service requirements. Three service categories clearly dominate the students' wishes for IT support: study organization, online literature and software provision. As regards the study organization, a centralized platform granting access to all relevant information and services (e.g. schedule, exam administration, certificates, study progress, contact information) is particularly important. From the students' point of view, IT should enable them to focus on the content of their studies, provide support for organizational problems, and grant easy access to resources, such as literature and software, while at the same time require little effort.

**Keywords:** Digitalization · ITIL · ITSM · Service engineering · Qualitative study · Higher education

## 1 Introduction

The digitalization does not stop at higher education and is challenging universities to develop appropriate strategies in order to shape this trend. Particularly in teaching, a great potential is suspected, and that is why the subject increasingly receives attention [1–4]. In this context, it is often referred to as a revolution [e.g. 5–7] or a shift [8]. The discussion is partly fueled by companies who, not least in their own interest, see a multitude of possibilities [e.g. 9]. The question of costs is often focused, since a cost-cutting effect is ascribed to the digitalization in higher education [e.g. 10].

However, the aspect of use is often missed out in the discussion. An insight into the needs of students and their view on digitalization is required in particular. With the students' help the university IT can provide relevant services in order to support the academic studies in an ideal way.

To address the changes that the digital transformation with the ever more pervasive use of information technology creates for the support for teaching and learning in higher education (e.g. time-shifted learning via podcasts, digital materials and

annotation or real-time interaction in class), a comparison of specific characteristics of software and IT services has been done to find out where they differ and if IT services might eventually be suitable for being used with software requirements engineering (SRE) [11–13] processes. In a further step, a literature review has been conducted to identify possible SRE processes with their methods and a checklist has been developed to check which methods might address IT services and their specific characteristics at best. Based on this, we designed workshops to test a prototypical process for SRE use in the field of ITSM. Also, we wanted to identify and develop requirements for specific new services in the area of IT-supported learning. We thus conducted workshops with different student groups, each comprised of 5–6 people. These groups were asked to conduct the full process of requirements engineering under supervision of a researcher, who was introducing the methods and acted as a moderator, but was not taking an active part in the discussion and the development of the requirements.

### 1.1 The IT Infrastructure Library (ITIL)

This study was conducted as part of a joint research project of the IT center (ZIV, Zentrum für Informationsverarbeitung) and the Institute for Information Systems of the University of Münster. The project was set up to establish a service catalog for the ZIV's IT operations. The idea for such a catalog is rooted in the so-called IT Infrastructure Library (ITIL) [14, 15], a de facto standard for managing IT operations. ITIL has been developed since the beginning of the 1990s and its underlying concepts have been discussed in academia under the paradigm of IT service management (ITSM) since the turn of the millennium. According to ITIL and ITSM [16], the IT and the business functions of an organization act like provider and customer – a situation which is called “market-orientation”. As on regular markets, the provider offers services that the customer can order. The customer, on the other hand, has a demand for services that the provider tries to address. To stay competitive, it is necessary for the provider to always look for new service ideas that might be relevant for the customer.

The IT service itself is the core concept of service orientation as described by ITIL and ITSM. Such an IT service supports the customer's business processes by processing a business process object, thereby generating value for the latter. It is provided continuously, automatically and care-free by an IT-based infrastructure, and, furthermore, customizable to meet the customer's specific requirements. Consequently, the customer does not have to know details on how the service is provided or which technical components are used. The support of the business processes and the generated value are in focus [17]. This is in contrast to the traditional approach of IT functions, which were only providing technical assets without questioning for which purpose those assets were used.

Over time, the IT-based infrastructure of the University of Münster has grown a lot. While catering only for a small number of researchers with information technology needs in the beginning, the ZIV nowadays operates an IT infrastructure that supports about 45,000 students and nearly 8,000 employees. But not only the number of users has grown, the spectrum of supported technologies has expanded as well. While only a few mainframe systems were operated in the 1960s, today complex networks, server

systems, application systems and a broad range of end-user devices are maintained. To keep control over this infrastructure, it seems to be helpful to standardize processes and assets. Here, IT services are helpful as they are standardized by definition. This standardization is reflected in the processes that are used to provide a service which in turn leads to a standardization of the result.

Although the idea of a service catalog seems appealing and clear at first sight, it is also challenging: Most practitioners struggle with understanding IT services and therefore find it hard to define them. Furthermore, selecting the ideal range of IT services to be offered is challenging as well. Against this background, the ZIV decided to bring in the Institute for Information Systems to support the introduction of a service catalog. While discussing which services should be included in the ZIV's service portfolio, the management board mentioned that nowadays students and employees do not solely use ZIV services for their studies and work, but also services from commercial providers. Especially apps which support the administration of university life (e.g. exam registration, requesting of grade reports) are used a lot by students. While those apps are convenient for the student, they bear a risk for the university, as system interfaces are used without consultation or knowledge on how to interact with them. What is more, reverse engineering revealed how to access these interfaces, causing not only technical issues on the server side, but also privacy issues as all data is routed via server systems of the commercial providers. Both issues are highly relevant for the university. The use of such apps reflects that the ZIV's services currently do not suit the students' needs well enough. Although the ZIV does not have to prevail on a free market, its services need to be competitive too. Therefore, it does not suffice to improve the existing IT services, but it is necessary to produce and bring forward ideas for new IT services as well.

## 1.2 Challenges of Service Development

The identification of new IT services is a challenging task and relevant literature based on ITIL is quite limited. The few existing contributions suggest different approaches. Zarnekow et al. [18] for example, propose to analyze the business process and derive potential services from them. Other approaches suggest to start with the technical infrastructure (e.g. Braun und Winter [19] or Brocke et al. [20]). They propose to bundle components of the technical infrastructure, so that they support a business process or task. While these approaches might be feasible in organizations with defined business processes, they do not work in a university setting. Here, the typical business tasks, that is teaching and research, are very creative and, thus, hard to standardize in terms of business processes. The same applies to the learning activities of students. Furthermore, it is neither efficient nor good practice to define IT services for the support of students and employees based on speculations.

ITIL proposes to simply ask the customers for new services, assuming that they are able to express their requirements and can also assign them to one of four categories: service demands, solutions, values and specifications. This assumption is astonishing, bearing in mind that according to ITIL it is already hard to understand what an IT service is and thus questionable if customers are really able to reflect their needs in this way.

A first test was conducted by Teubner and Remfert [21], who asked the users of a German university for their service requirements. For the participants, it was indeed difficult to explicitly formulate their requirements: No one was able to specify service demands, only a few mentioned values, and the majority listed solutions or specifications. Although these are just the results of one study, they indicate that it is not enough to simply ask for services – as proposed by ITIL. As a consequence and for a better understanding, the authors extended their interviews asked participants to also explain their daily work routine and corresponding needs.

### **1.3 Digitalization in Higher Education**

Although there are some studies focusing the digitalization in the field of higher education, they are either very specific and their results can only be generalized to a very limited extent, or they are designed as a quantitative study and therefore allow only a very general view of the subject. A good overview of the status of digitalization is provided by the annual ECAR studies by EDUCAUSE, which focus on both the students (50,000 participants) [22] and the lecturers (13,000 participants) [23] in the USA. Despite the lecturers' high willingness to use innovative tools in teaching and the ever-increasing technical equipment available to students, the results show that digitalization is only at an early stage of development. Other studies focus individual subtopics of digitalization, such as the use of mobile devices and online services in university libraries, the use of apps by medical students [24], or the use of online literature and online references for studying [25]. There is still a lack of qualitative studies which provide insights into the digitalization of university life and the wishes of the students, in order to harness their findings for university IT. This is the starting point for this study.

### **1.4 Limitations of the Study**

The present study is deliberately designed as a qualitative pilot study in order to gain first insights into the topic of digitalization from a student's perspective. Due to the method, these insights are subjective assessments of the participating students, which are not representative. Moreover, results have to be evaluated in relation to the circumstances at the University of Münster and are therefore not necessarily transferable to other universities, especially those outside of Germany. We believe, however, that they can give good insights into the study situation and the mindset of the current generation of students.

## **2 Research Methodology**

In the absence of recent studies on the digitalization at universities from the students' point of view, the following study is designed as a pilot study.

## 2.1 Research Questions

First of all, it is necessary to clarify how digitized the academic studies already are from the students' point of view. Differences between the disciplines are to be expected. *Research Question 1 (RQ1): How digitized are academic studies at present?*

To identify improvement opportunities, it is necessary to find out which university IT services are relevant to the students and how their user experience proves to be. *Research Question 2 (RQ2): How do users evaluate their experience with university IT services?*

In this context, it is also interesting to know which applications are used for study purposes that are not offered by the university, but by commercial providers. *Research Question 3 (RQ3): Which commercial services are used for study purpose and why?*

Aside from concrete improvement opportunities, the study also aims to determine which new services the students want the university to provide. *Research Questions 4 & 5 (RQ4, RQ5): What services should the university provide? Which is particularly important?*

We suspect that the prioritization of the services will be different between students from technical disciplines and those from rather non-technical courses. *Research Question 6 (RQ6): Do priorities differ between students from technical and non-technical subjects?*

## 2.2 Setting

Students from various departments of Münster University were recruited by means of flyers, the ZIV's website and Twitter profile, and the university's Facebook group. Vouchers with a value of €25 were used as incentives. The focus groups took place in a neutral meeting room on two dates within a week in January 2017. The conversations were recorded and subsequently transcribed by assistants.

## 2.3 Population

The recruitment was supposed to deliver a diverse picture of the students' situations and wishes. For this reason, it was initially planned to form specific focus groups for first-term students, more experienced students and foreign students. However, targeted recruiting was dismissed, since first-term and foreign students proved to be very difficult to contact because they are (still) comparatively loosely connected with the university and not (yet) organized as a group. The attempt to recruit first-term students through a special flyer handed out at the university's freshmen fair was unsuccessful. It was therefore decided not to differentiate based on the study phase and nationality.

Instead, two homogeneous groups were formed in consideration of the students' subjects of study, differentiating between technical and non-technical backgrounds. It was assumed that students from technical disciplines will have different requirements and wishes regarding IT support and will communicate them differently as well due to their wider knowledge in this field. This approach allows to compare both groups and, simultaneously, avoids that participants with little technical knowledge are intimidated

and, thus, passive. The group size should not extend 6 persons, in order to ensure a dynamic conversation, enough speaking time per person and an efficient management of the discussion.

## 2.4 Data Analysis Strategy

The transcribed interviews comprise a total of 56 pages (30,300 words). The data were cleansed, structured and subsequently assigned to the research questions. Significant statements were extracted and clustered into subject areas. The participants' prioritizations of services were also grouped into thematic areas [26].

## 3 Method

Since no relevant studies are available for the research questions, this survey is designed as a qualitative pilot study. In the run-up, participants were given very limited and general information on the subject of the study to avoid framing. A two-method design was applied. In the first hour of the focus group interview, the participants were given short assignments, which they had to solve with Lego Serious Play (e.g. modeling typical study situations such as group work with its specific problems and possible solutions). This part should introduce the participants to the topic and loosen up the atmosphere. The actual survey consisted of a 1.5-h guided interview.

### 3.1 Interview Instrument

In the run-up to the study, according to the recommendations in the literature [27, 28], an interview guideline was developed to structure the discussion in view of answering the research questions. A guideline from a previous study, which was designed to uncover students' requirements concerning a web portal, was used as a starting point. As the method had proved successful, only content adjustments had to be made.

The guideline divided the focus group interview into three sections: In the first part, after a short round of introductions, the participants were asked to describe their own experiences with the use of IT during their studies. The aim was to determine which parts of the academic studies are already digitized and which are still processed offline. In this context, used services – offered by the university or by external providers such as WhatsApp or Facebook – and usage problems were of particular interest. The usage situation was also discussed. Finally, the participants were asked to make suggestions on how the university could simplify their studies by means of IT.

In the second part, the participants were asked to write down the most important IT services and functions that the university should offer. These were subsequently presented and classified by the participants.

In the third part, the collected services had to be prioritized. For this purpose, each participant could assign a total of ten points to the mentioned services, with the possibility to assign all points to one service. Subsequently, the participants were asked to

disclose their respective decisions and give reasons. A ranking list was formed from the prioritizations.

### 3.2 Participants

Eleven students from various disciplines were selected to participate in the two focus groups. Both groups were formed as homogeneous as possible with regard to the students' subject of study (technical vs. non-technical) in order to check for differences between these groups. The first group was made up of students from IT-related courses such as information systems, computer sciences and mathematics, while the second group consisted of students from non-technical courses such as psychology, history, politics or chemistry. However, most participants in the second group also considered their technical affinity as above-average. The participants were between 20 and 35 years old and studying between the 1st and 11th semesters. Two out of eleven participants were female. The targeted equal distribution of both genders could not be achieved due to the self-recruitment procedure. The participants did not know each other. Five participants had previously studied at foreign universities and were able to contribute these experiences to the discussion. One participant was already working and studying part-time.

## 4 Findings

In the following, the results of the focus group interviews will be presented with regard to the research questions.

### 4.1 Status Quo of Digitalization

The participants perceive the degree of digitalization of their studies very differently. As expected, there are major differences between the fields of study. When it comes to **lecture materials**, about half of the participants still work the traditional way using paper copies. These are usually provided by the lecturer in form of a printed reader.

*RQ1-A: "Sure, the university provides digital slides and digital materials, sometimes a script or something similar. This was always very handy, but in general I print digital materials to work on them – non-digital so to say."*

*RQ1-B: "As regards scripts, in the first session they always say: 'Yes, go to the copyshop in the Frauenstraße. Ask for my name to get a printed material collection.' Then you get a three-thousand-page doorstopper."*

Many participants, however, do not want to change this situation, as they prefer reading printed instead of digital copies. On the one hand, they expect a higher learning effect by working on paper.

*RQ1-C: "I always attach a lot of importance to working on paper, taking notes on paper, writing abstracts on paper. Because, in my opinion, you just learn more comfortably - at least I do. Once you've written and summarized everything by hand, you know it."*

On the other hand, annotating and taking notes with digital tools is still perceived as complicated or not suitable for all situations.

*RQ1-D: “Okay, so I tried it, but in chemistry you have to draw so many formulas. You could write those with OneNote as well by now, but the software just reacts so badly that you can’t keep up.”*

If, on the other hand, the documents are already provided digitally by the lecturer, they are usually processed digitally as well.

*RQ1-E: “I hate working on paper, so I do not print any lecture notes and I never have money on my copy card. No, it would be too much effort to manage all the lectures. I read lecture notes on the computer where I have the PDFs and when I make notes during the lecture I add them directly afterwards. I hardly ever use paper.”*

One participant even takes the trouble to digitize all handwritten notes and hand-outs himself.

*RQ1-F: “I scan the notes afterwards. I don’t keep anything on paper. My handwritten notes lie on the shelf for the current term and if the writing pad is used up, it is disposed of.”*

With regard to teaching, participants also report that the Moodle-based e-learning platform Learnweb is used widely for the provision of materials and has a very good reputation.

*RQ1-G: “I have the impression that there is actually good response, even among professors. There is always an entry for lectures, and slides and materials are available.”*

*RQ1-H: “The professors upload everything, and they do it relatively promptly ... and there actually is nothing else I might want.”*

Sometimes, however, lecturers do not use the Learnweb due to a lack of technical competence.

*RQ1-I: “All of our lecturers in both subjects fail at this. In Chemistry, lectures are not offered in Learnweb as a matter of principle and seminars rarely – and that’s about it.”*

Apart from lectures materials, there are other aspects of studying that are not yet digitized entirely: The **registration for courses and examinations** usually takes place online, but individual participants from the humanities report that in their discipline registration lists on paper are still used sporadically. As regards attendance and performance records, paperwork is still dominant.

*RQ1-J: “For practical courses, which we had to complete in addition to our actual studies, we had to get a copy from the professor and bring it to the Examination Office basically every time. Nothing is digitized yet.”*

When it comes to **literature research**, some departments (e.g. theology) still make use of card indices instead of computer workstations. From the students’ point of view, especially the online provision of literature (i.e. essays and books, in particular) is still in its infancy. The participants strongly agree that all literature should be available online to avoid that students have to compete for scarce book resources or cannot access required literature in time for seminar papers. One participant who had previously studied in the Netherlands would even pay significant tuition fees for online access.



*RQ1-K: “In the Netherlands you are paying about € 1,018 of tuition fees each year and the whole library is available online which makes literature research just super easy.”*

With respect to the issue of digitalization in general, students see the problem that they are faced with ever-increasing demands, not least regarding **technical resources**. But not every student has the necessary hardware.

*RQ1-L: “If you’d say, okay, we do everything computer-assisted, then you would have to presuppose that every student has access, that is a computer, the whole hardware and other things. I’m not sure if this is de facto possible, because that would make it a basic requirement and I don’t think that all students could fulfill it.”*

If the university wanted to increase the degree of digitalization, it would have to solve this problem first.

*RQ1-M: “The process of digitalization is in a transitional phase, where no more than 50% are fulfilled. The reason is that students have to provide the resources themselves – they are not provided by the university.”*

In summary, it can be stated that the degree of digitalization is very heterogeneous: While the registration for examinations is largely digitized, the administration of the examination results is largely paper-based. Digital badges are not yet used. Notes and scripts are only partially digital, but the majority of the students do not regard this as a disadvantage. According to the participants, the university could increase the degree of digitalization in some cases by providing the necessary hardware and training for the lecturers.

In general, the students have a rather conservative understanding of digitalization which, essentially, includes the online provision of material as well as online registration possibilities. New forms of learning such as MOOCS, interactive classroom systems or even virtual reality are irrelevant, and mobility is not a big issue either. Students still predominantly study at home using a PC or a book. According to the students, this will hardly change in the coming years. Lectures where attendance is expected are also considered appropriate and future-oriented. Infrastructural aspects (e.g. audio-visual equipment in the auditorium, WLAN) were of very little importance in the interviews.

## 4.2 User Experiences with University IT Services

Discussing relevant systems of the university IT, participants primarily mention the Learnweb, the exam registration system QISPOS, the cloud storage service sciebo and the library online public access catalog OPAC. In addition, most participants use standard software which is available via terminal servers, the Office 365 software package which is available at a special price to university members, and, to a somewhat lesser extent, the e-mail service. With the exception of the printing service Print&Pay, the students do not bring into focus other university IT services (e.g. websites, communication infrastructure, media technology).

While the Learnweb receives an entirely positive evaluation, the **exam administration system** has the greatest potential for improvement from the students’ point of view. Almost all participants have heard of or made negative experiences because the system apparently is complicated and generates misunderstandings. They have, for

example, not received important examination results and thus had some serious disadvantages in their course of studies.

*RQ2-A: “There were problems with my fellow students. They had, for example, registered online and learned after the registration deadline that the system had kicked them out. They were allowed to register again two terms, that is one year, later and some were not allowed to do the exam before.”*

*RQ2-B: “Someone I know had also met the registration deadline and believed until the end that his registration was successful, but the system had thrown him out after the deadline had passed, without him noticing.”*

*RQ2-C: “For me, QISPOS is confusing, too. You have to click through tree structures until you find your course or module. I think that this is no longer up-to-date and causes problems for the examination office that could be avoided if something better was chosen.”*

Especially in the case of combined degree programs which do not meet the standard, the system seems to reach its limits.

*RQ2-D: “Trying to combine two subjects of study using this system feels like hell.”*

Foreign students in particular, seem to have difficulties with the low degree of standardization regarding exam administration procedures which differ greatly depending on the department, course combination, the responsible examination office and its respective system.

*RQ2-E: “It would be nice if everything was standardized, so that you know at the moment you enter the university how this process works. Otherwise if you’re new, especially for me for instance, I am not, I wasn’t used to the German system.”*

Other universities have a different approach where students are registered for exams automatically with an opt-out option:

*RQ2-F: “For these automatic administration at my home university for my bachelors, we just got registered immediately the moment we sign in for the course, and we could de-register during that semester, so that’s way simpler. We just get automatically registered and then, if you don’t want to take your exam, you can just de-register.”*

Learnweb and QISPOS are university systems that students do not use in private contexts and, thus, there are little opportunities to draw comparisons. This, however, is different for the university **cloud service** sciebo and the **e-mail service** perMail which participants can compare to privately used commercial services such as Dropbox and Google. In comparison, students criticize that university services are more complicated to use (sciebo) and have a rather old-fashioned interface (perMail).

*RQ2-G: “perMail looks as if someone assembled it using Microsoft Frontpage and did not improve it during the last one hundred thousand years. I cannot even look at it, because it really hurts my eyes. The buttons are labeled with Times New Roman, that’s just ... no.”*

From the students’ point of view, commercial services benefit from their high integration with other services and their optimization due to a higher competition.

*RQ2-H: “We’ve talked about user friendliness. Google Drive and Dropbox have proved their worth. They must prevail in the free market and – without addressing reproaches to the university – I would say therefore they are just better. [Using Google*

*Drive,] I can just invite others by e-mail and it is connected with all my Google services and that is just easier.”*

Students perceive these services as better developed and more intuitive in general.

*RQ2-I: “If you look at Dropbox or Google Drive: Just give me your e-mail address and it’s ready. But with sciebo you have to enter the exact university e-mail address. You cannot say, ok, I just enter 25 e-mail addresses. Instead, you must enter each one individually. Drag and Drop, as I know it from Google Drive, OneDrive and other services, does not work either.”*

Often networking effects are relevant as well - for example, when sharing data with sciebo.

*RQ2-J: “If one person does not use it, it doesn’t work for the others either.”*

*RQ2-K: “The situation is already exhausting enough: Someone doesn’t use WhatsApp, so you have to switch to a Signal, Telegram or Facebook group. You end up with seven messengers and do not need another one from your university.”*

The **search engines** of the university and the university library, too, are compared to Google’s search engine and do poorly from the students’ point of view.

*RQ2-L: “The search engines are really super slow and thus totally unattractive. Perhaps you miss out on results because the search engine is just so bad.”*

*RQ2-M: “With the OPAC, you can’t say: Search only items that are available online. That doesn’t work. You have to enter everything super exactly which is really... I don’t know. With Google, you only enter roughly what you are looking for and it will work in some way. The same with Google Scholar. But using the OPAC, you have to enter the exact title or you will get 100 books with “the” in the title.”*

*RQ2-N: “The university’s internal search doesn’t find anything, so I mostly use Google to search something on the university website. The internal search does not find its own contents.”*

In general, the participants are skeptical about university systems and see no need to replace commercial systems with university solutions.

*RQ2-O: “You already know Dropbox. You have it and can also assume that everyone else has that. Thus, it is always a question of convenience if I continue using it. It would be the same with WhatsApp. Even if the university would offer the perfect WhatsApp or Facebook alternative, the acceptance would still be less. Not because of technical features, but simply because of the ‘First come first serve’-principle.”*

*RQ2-P: “It is challenging if the university offers something in this area. I think you cannot dictate which services students should use.”*

Participants who have studied abroad prefer the commercial solutions implemented there, with Google or Microsoft providing the basic services such as cloud, mail and Office software.

*RQ2-Q: “[At my university in the Netherlands] everything is based on Office 365. The university e-mail address, too. All services are based on this. That works quite well actually. Yes, everything is included: Office is included, Cloud is included – virtually everything in one service.”*

*RQ2-R: “[At my university in Australia] everything was based on a Google e-mail address. You got a new account, but you could also link it with an existing account. That was well done, because you already knew the services from your private account.”*

From the students’ point of view, German universities face the disadvantage that they have to implement legal regulations on **data protection** more strictly than private companies.

*RQ2-S: “I believe that the big companies simply do not care about legal matters. In Germany, things have to be a certain way, and the university has to stick to it.”*

The issue of data security is assessed ambivalently by the participants: While they indicate that data security is important to them, they prefer to use commercial rather than university services because the latter are too complicated. Some students believe that security cannot be guaranteed anyway.

*RQ2-T: “When it comes to data security, solutions, no matter how you design them, always remain a bad compromise because no one can guarantee absolute security. This is the problem.”*

*RQ2-U: “There is no place, where the data are absolutely secure, unless they are offline. That’s a fact.”*

Apart from university systems, participants often use software which is provided by the university (e.g. Office 365, SPSS) and wish for further free or discounted software, especially from Adobe. It is criticized that there is no central download platform, making it hard to find the available software.

Overall, the user experience of university IT systems is rather poor. Due to commercial models, the students have very high requirements and believe that the university cannot compete, in particular with regard to the ease of use and the interface design. University applications have a bad image and some are not even given a try if there are commercial alternatives. Regarding data protection, there are concerns about commercial providers, but they do not have an effect in practice because user friendliness and the exchange with other users are of significantly higher importance.

### 4.3 Usage of Commercial Services for Studying

As regards commercial services used by students during their studies, the same providers, which are favored for private use, dominate. These are Facebook, WhatsApp and Skype for the coordination of groups (group function). In some cases, these services are also used to digitize non-digital processes. The participants report, for example, that exam results lists, which the university only releases in form of a bulletin in the faculty building, are photographed by a student and sent to all course participants or published on Facebook.

In addition, the participants use tools that are included in Google and Microsoft 365 suites (in particular, Office and e-mail services) as well as Dropbox for storage purposes. For the students, using these services has a great advantage, because they have already used them before and will still use them after their studies. Thus, they do not have to learn and configure a new system.

#### 4.4 Service Requirements of Students

The new services and service improvements identified by the students can be divided into six categories: study organization and management, literature provision, software provision, learning and communication, minor improvements of existing services, and others. Overall, 19 services were proposed. Most fell into the category of study organization, followed by minor improvements of existing services such as a more stable WLAN or more favorable prices for printing.

#### 4.5 Service Prioritization of Students

By prioritizing the services, individual opinions were filtered out and a clear trend could be identified (see Table 1). The three most important services were a centralized platform where all services are integrated (23 of 110 points, quoted by 7 of 11 participants), the online provision of literature (15 points/7 quotations) and a standardized exam administration system (12 points/5 quotations). The centralized service platform stands out as a clear favorite – especially, since a dedicated university app with quite similar functionalities received another 8 points. All other services received less than

**Table 1.** Prioritization of services

	G1	G2	Total
<i>Study organization</i>	33	19	<b>52</b>
Centralized service platform	15	8	<b>23</b>
Standardized course and exam registration process	10	2	<b>12</b>
University app	0	8	<b>8</b>
Improved schedule planner	5	0	<b>5</b>
Improved administration portal	3	0	<b>3</b>
Course evaluation system	0	1	<b>1</b>
<i>Library</i>	9	8	<b>17</b>
Online literature	9	6	<b>15</b>
Standardized system for literature research	0	2	<b>2</b>
<i>Software and hardware</i>	5	9	<b>14</b>
Software platform	5	1	<b>6</b>
Free software	0	6	<b>6</b>
Soft-/hardware partnerships	0	2	<b>2</b>
<i>Learning and advice</i>	0	7	<b>7</b>
Interactive online learning	0	4	<b>4</b>
Messenger	0	3	<b>3</b>
<i>Other</i>	13	7	<b>20</b>
Minor service improvements (virtual machines, cloud, printing, WLAN)	8	7	<b>15</b>
Media equipment training for lecturers	4	0	<b>4</b>
ZIV service notifications	1	0	<b>1</b>
Total	60	50	<b>110</b>

10 points and a maximum of two quotations. Seven out of 19 services received points from only one person, usually the proposer.

#### **4.6 Differences Between Fields of Study**

Comparing the service prioritizations of the Group 1 (technical background) with those of Group 2 (non-technical background), some minor differences are evident. The issue of study organization is most important in both groups, but in group 1 it is considerably more prominent. Only Group 2, on the other hand, addresses the aspect of mobility (app) with regard to a centralized service platform. The provision of application software is more dominant in group 2 as well. In the case of library services, however, both groups arrive at the same rating.

### **5 Discussion**

#### **5.1 RQ1: How Digitized are Academic Studies at Present?**

The results show that, from the students' point of view, the degree of digitalization has not exceeded a medium level yet. It is striking that the students – in contrast to the stereotype of the digital native and in line with the findings of Bennett et al. and others [29–33] – do not have high expectations of the technical support at their university. In fact, they understand digitalization primarily as the digital provision of lecture notes and online interaction possibilities with the university (i.e. registration for exams, communication with lecturers and fellow students). Nonetheless, the participants would welcome a significantly stronger degree of digitalization, but they predominantly demand minor improvements of individual systems and no fundamental reform of the academic studies (e.g. in form of online lectures).

#### **5.2 RQ2: How Do Users Evaluate Their Experience with University IT Services?**

Students are particularly critical of those university services where they also use commercial alternatives from providers like Google, Dropbox or Microsoft. The latter are generally considered superior, as they must prove themselves in a competitive environment. Compared to commercial services, university services do significantly worse in terms of ease of use and look & feel. The basic advantage of the university services – the higher data protection – is noticed by the students, but it has virtually no effect on their usage behavior.

The participants consider the lack of integration, a feature that they value with services of commercial providers, as a major disadvantage of university systems. At the university, students often need a separate ID for each system, and media disruptions also hinder their use. As a matter of principle, university systems have an image problem and some are not even given a try if commercial alternatives exist.

### **5.3 RQ3: Which Commercial Services are Used for Study Purpose and Why?**

As described above, numerous commercial services are used both privately and for study purposes. They are mainly used to perform communication tasks, such as the exchange of information in group works or with lecturers. For this purpose, the real-time communication services of WhatsApp and Facebook are typical tools. The university's e-mail service, on the other hand, is avoided. The service is perceived as old-fashioned and complicated, but the main reason is the medium e-mail in itself, which it is deemed to be too formal, too slow, too complicated and too little group-based. WhatsApp & Co., on the other hand, offer easy-to-use functions for file sharing, video telephony, chat and status information. If e-mails services are used, it is those of commercial providers like Google or Microsoft which offer an integrated user experience. Overall, a convenient and seamless integration of all services (storage, collaborative work, e-mail, chat, Office applications) plays an important role in the preference for commercial providers, while most university services are not interfaced with each other or with privately used commercial services.

Another advantage of commercial services, such as Dropbox, is the fact that they are used by nearly everyone, so collaboration with others is very easy.

### **5.4 RQ4: What Services Should the University Provide?**

As noted above, the students' pictures of a digitized university are less visionary, but rather pragmatic. Although most of the participants had an above-average technical background knowledge according to their self-assessment, there are hardly any suggestions that go beyond the improvement of existing services. However, the big issue outshining everything else is an integration and standardization of these services.

### **5.5 RQ5: Which Service is Particularly Important?**

From the participants' point of view, it is not a new service, but the integration and standardization of existing services that has top priority. In concrete terms, the students expect a portal in form of a website or an app, which requires only one login and merges the most important status messages, information and a transcript of records. The displayed information should be highly personalized and match their specific subject of study and their study objective (examination regulations, schedule, information about lecture rooms). Ideally, this application would be complemented by intelligent features, which – similar to GoogleNow – take over a counseling function. These features should, for example, display suitable course modules based on examination regulations and previously completed courses, calculate the overall average score or show the next appointment including relevant location plans.

### **5.6 RQ6: Do Priorities Differ Between Students from Technical and Non-technical Subjects?**

Due to the small number of participants and the different group sizes, variances in the response behavior of the two groups have only very limited explanatory power. The only significant differences were observable with regard to software provision, possibly because the technophile group is already better equipped with software. The otherwise rather small differences suggest that the services identified are considered to be important across the disciplines.

## **6 Implications for Research and Practice**

Although this pilot study can only give limited insights due to the small, non-representative sample and the specific situation at the University of Münster, it provides a lot of valuable information, especially for those responsible for university IT. From a practitioner's point of view, the good news is that students have a much more grounded and pragmatic view on the development in the next few years than company representatives suggest at symposia. The students do not want a digital revolution in teaching but essentially minor improvements of the core services of university IT.

However, a major problem of university IT could arise from the fact that users are affected by commercial services of large providers such as Google, Microsoft, Facebook and Dropbox. They expect the same integration of services they are accustomed to as well as an intuitive and simple way of use. However, university systems are usually developed over many years due to historic reasons and are operated decentrally. Thus, numerous unconnected systems co-exist (e.g. university library, data center platforms, university administration platforms, exam registration systems of various departments, various e-learning systems), making it necessary for students to use several IDs and understand different system logics. Furthermore, universities rarely invest in the design of their services. Instead they focus security aspects, which are usually associated with a lower usage comfort. Students, however, value security aspects rhetorically at most. Therefore, the universities have to find a tradeoff between necessary security and desired user friendliness. Students support cooperation between higher education institutions and commercial providers instead of university in-house developments, because they put it past commercial providers only to have the resources for competitive products. As the interviews indicate, most of the university services are no longer in the comfortable situation that they have to be used due to lack of competition, no matter how bad the user experience is.

Great potential inheres in the creation of a centralized access to existing services. But unlike most university apps which merely summarize general information with a cafeteria meal plan and a map, the students wish for a personalized solution that simplifies their study organization.

Depending on their field of study, the participants have made very different experiences with the degree of digitalization, implying that digitalization does not happen automatically, but is strongly dependent on individual actors who are able to



promote or slow down the issue. In order to avoid a two-tier society, universities should develop a digitization strategy at an early stage, in which they define the objectives and the implementation procedures. The results suggest that further research should examine in more detail the question which services the university itself should offer and which it should outsource (either completely or in form of a cooperation) to private providers. A larger sample and quantitative methods are needed, in order to test the validity of the results and support them in a representative way, as well as to transfer them to other universities and, if appropriate, other countries. The requirements of university employees would also be a fruitful research objective, which could be analyzed using the methods developed here.

## 7 Conclusion

To date, digitalization at universities has been an extensively discussed but widely diffuse topic. Most studies focus on single aspects such as mobile apps or e-learning tools, or look into technical issues. Based on the ITIL framework and the basics of service engineering, this study attempts to identify essential IT services which universities should provide from the students' point of view. In addition, it delivers a genuine insight into the current state of digitalization from a user's perspective.

As previous studies have demonstrated, the idea of the modern student as a permanently online, technically well-informed and equipped digital native is a myth. Though the technical background knowledge is extensive, some of the participants do not have the necessary hardware and, moreover, the majority does not strive for a considerably intensified digitalization of the academic studies. New learning formats such as lecture recordings or interactive elements are generally welcomed as additional possibilities, but they are not claimed for insistently.

The degree of digitization within the university differs significantly depending on the particular faculty culture. Reasons include the students' lack of technical equipment as well as the lecturers' lack of knowledge.

For studying, commercial and university services are used in parallel as a matter of course. Commercial services from the private sphere are used in the university sphere as well, provided they seem suitable. University systems are considered old-fashioned, complicated, and less intuitive. In particular, the lack of integration of different services (and the accompanying need for different IDs for each system) is a major disadvantage. Thus, the majority of the participants argues for a cooperation between the university and commercial providers such as Google or Microsoft, although there generally are diffuse concerns about data protection. However, these are ignored because students believe their own data is either undeserving of protection or not protected anywhere anyway, not even at the university.

Three service categories clearly dominate the students' wishes for IT support: study organization, online literature and software provision. As regards the study organization, a centralized platform granting access to all relevant information and services (e.g. schedule, exam administration, certificates, study progress, contact information) is particularly important. From the students' point of view, IT should enable them to focus on the content of their studies, provide support for organizational problems, and

grant easy access to resources, such as literature and software, while at the same time require little effort. In consequence, higher education institutions face significantly higher requirements for the design of their systems, because students measure their value compared to experiences with privately used IT services. However, it is difficult to reconcile the integrated user experience and intuitive handling with the security requirements for university IT systems which are particularly high in Germany. Nevertheless, universities are well advised to develop and implement digitalization strategies in order to actively shape this change.

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