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INTEGRATING THE SMARTPHONE: APPLYING THE UCONSTRUCTS APPROACH ON THE CASE OF MOBILE UNIVERSITY SERVICES

Thomas Sammer
University of St. Gallen, thomas.sammer@unisg.ch

Fabio Armon Camichel
University of St. Gallen, fabio.camichel@student.unisg.ch

Andrea Back
University of St. Gallen, andrea.back@unisg.ch

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Sammer, Thomas, University of St. Gallen, Institute of Information Management 3, Müller-Friedberg-Strasse 8, CH-9000 St. Gallen, Switzerland, thomas.sammer@unisg.ch

Camichel, Fabio Armon, University of St. Gallen, Institute of Information Management 3, Müller-Friedberg-Strasse 8, CH-9000 St. Gallen, Switzerland, fabio.camichel@student.unisg.ch

Back, Andrea, University of St. Gallen, Institute of Information Management 3, Müller-Friedberg-Strasse 8, CH-9000 St. Gallen, Switzerland, andrea.back@unisg.ch

Abstract

Mobile technologies in general and smartphones in particular have an increasing impact on our daily lives. In contrast to other mobile devices, smartphones can be seen as new class of devices with new characteristics enabled by new forms of connectivity and built-in sensors. By the use of those new features various tasks can be supported and even new task can evolve. However, the adoption of these new possibilities and integration in an organization-wide IS-strategy is not trivial and involves several challenges for IT-departments. We use the case of mobile university services to guide the decision which tasks should be supported by smartphone applications applying the U-constructs approach. To verify our results we perform a demand survey for mobile university services at the University of St. Gallen obtaining 980 completed questionnaires. Additionally we review the current state-of-practice for mobile university services of European universities and research whether their offered functionality fits student's needs. Results show that most of the available solutions do not fully meet student's needs in terms of functionality but that decisions on the selection of smartphone supported tasks can be guided by the U-constructs approach. We conclude by giving new insights to guide development of mobile university services and identifying a research agenda for information systems scholars to pursue studying the use of smartphones.

Keywords: mobile university services, mobile devices, education, smartphone, U-constructs, ubiquitous computing.

1 INTRODUCTION

Living in a world with nearly ubiquitous Internet access, mobile technologies have an increasing impact on our daily lives. According to (Gartner 2010), smartphone sales reached 172.4 million units compared to mobile phone sales of 1.211 billion units worldwide in 2009. This equals a worldwide smartphone sales share of 14.24% in 2009 and shows a 23.8 % increase compared to 2008. Gartner expects an increase in annual mobile phone shipments from 1,222 million units in 2008 to 1,908 million units in 2014. In the same period, smartphone shipments are expected to increase from 139 million units to 770 million units. Hence we see an increase in the share of shipped smartphones from 11.40 % to 40.35 %. For Switzerland the 2011 Weissbuch reports a current smartphone market penetration of 38.1 % (Weiss 2011). Comparable increases can be seen on marketplaces for smartphone applications (so called apps). Within the last years the Apple App Store (application marketplace for iOS devices / Apple smartphones and tablets) rose to more than 300,000 available applications (148apps 2011) useable on more than 100 million iPhones at the present (Warren 2011) which are accountable for more than 10 billion downloads of iOS applications (Musil 2011). Smartphones are also gaining importance as devices for mobile Internet access. Morgan Stanley Research forecasts that the number of mobile Internet users will overtake desktop Internet users by 2015 (Meeker et al. 2010; 2009). Mobile Internet has become important to companies and customers. The E-Expectations research group surveyed more than 1,000 college-bound high school students, polling them on their online behaviors and expectations. Their results show, that 25 % of the participants report, that they would remove a school from their prospective list because of a bad experience on that school's website and that 23 % search for college sites using their smartphones (Noel-Levitz 2010). But due to their characteristics, smartphones are more than just devices that provide portable Internet access. Describing characteristics of smartphones, definitions have changed over time and being influenced by technological innovations. Summarizing, the basic characteristics of smartphones especially in comparison to ordinary mobile phones, the following four aspects can be named (Pitt et al. 2010):

1. Diverse sets of media capture capabilities turning the smartphone in an omnipotent media capturing and playing tool enabling a rich user-interaction portfolio.
2. Accelerometer allows the device to recognize movements and motion.
3. Positioning capabilities enable the device to detect the exact position of its owner.
4. Mobile application market open the device to software developed by independent software vendors enabling a rich variety of applications.

Combined, those four characteristics enhance the possibilities for new use cases and enable smartphones to become a true new kind of device. Using those features, new possibilities arise like the visualization of virtual data shadows of real life objects or other use cases (e.g. summarized by Tim O'Reilly as the so called "web squared" what basically names the next step after Web 2.0 (O'Reilly and Battelle 2009)).

Thinking of new use cases in an educational or organizational context, one can image many different potential ways of using those new features. For educational purposes those use cases can be summarized under the term "mobile-learning smartphone" which covers topics like media delivery (e.g., audio and video), exploratory learning using augmented reality, educational games, collaboration and project work, e-books, surveys, tests, data gathering, real-time feedback or simulations (Jones 2008; Lowendahl 2010). In an organizational context focused on universities, use cases can range from on-campus navigation like room or parking lot finders to cafeteria menu pre-order or location based appointment reminders. Speaking of mobile university services, we define this term as any mobile applications operated on smartphones and offered by a university to enhance or improve education or organisational processes necessary for students or university staff. In reference of the term "wireless" we refer to the form of transmission (e.g. wireless data transmission) whereas the term "mobile" is used in order to refer to applications that support users "on-the-move" (Varshney and Vetter 2000). We focus a more task-centred than technical view.

Acknowledging those potentials in combination with the high availability of smartphones, the question arises if students demand such services. For that purpose we performed a first survey in Spring 2010 at the University of St. Gallen (N = 110, students and university staff) to assess the demand for mobile university services. Results show that most of the participants are interested in such services and more than 50 % are even willing to pay for such a service (Back and Walter 2010).

Being in the position of offering, maintaining and implementing IT-related services for students and university staff, university IT-departments face the questions of how to deal with mobile technologies respectively smartphones. Recognizing those circumstances, we propose the following research questions:

RQ1: What is the current state-of-practice for mobile university services?

RQ2: Does the current state-of-practice fit students' needs and demand?

RQ3: How should IT-departments decide which tasks-supporting functionality to implement on smartphones?

The remainder of this article is structured as follows. First we will review related literature and draw out the theoretical foundation. Then we will describe our method and present the results of our observations. Last, we will conclude and discuss our results with both theoretical and practical implications. Limitations of our study and possible future research topics will also be discussed.

2 THEORETICAL FRAMEWORK

2.1 Theoretical Fundament

To identify relevant literature that contributes to our proposed research questions we performed a literature review using scientific databases (EBSCO Computer Source and Business Source Premiere, ACM Portal, Gartner Advisory Intraweb, Science Direct, Google Scholar SFX and Mendeley Literature Search) and the following search query: (uni* OR academic) AND (mobile service OR mobile OR smartphone).

Our literature review showed that research focuses on the topic of mobile learning but not in particular on the implications for universities or the implementation of mobile university services. A recent state-of-the-art article on mobile learning projects by Frohberg et al. reviewed 102 mobile learning projects and rated them by different criteria (Frohberg et al. 2009). The authors conclude with the finding that the great potential of mobile learning is still hidden and not fully used in present projects. Focusing on mobile university services this limited area has attracted little attention until now. A summary of the on going discussion and research in this field given on the Eduserv symposium 2010 about the mobile university concludes that the question whether and how mobile technology will play a role in the delivery of higher education is not answered yet (Minocha 2010). Basic questions like if students really want to learn on the move or if it is the access to mobile services related to administration such as reminders for deadlines or maps to reach classrooms are the functionalities that they really value remain unanswered.

Both of the mentioned articles on the current state of research point out that neither student's expectations in terms of mobile services or the technology and its implications on educational institutes are fully understood and reviewed. Other work on the general usage and usage patterns of mobile applications in different contextual situations (Cui and Roto 2008; Lee 2009; Mallat et al. 2009; Verkasalo 2008) answer those question to some extend, but do not survey mobile usage in educational context in particular. In contrast to that, if we open our view on the general acceptance and use of mobile technologies, there is a lively discussion going on in the IS community. Thinking of smartphones as information systems, general IS models like the technology acceptance model (Davis 1985) or the IS success model by DeLone and McLean (Delone and McLean 1992; 2003) possibly serve as fitting approaches for answering our questions and to guide the development of smartphone applications that serve the needs of students and university staff. To support decisions whether or not one should apply new technologies, acceptance research developed several theories and models that predict user acceptance. One of the most established models is the technology acceptance model (TAM) by Davis (Davis 1985) that is based on the theory of recent action by Fishbein und Ajzen (Fishbein and Ajzen 1975). Based on the TAM various adaptions modified for several purposes emerged. One modification of the TAM that is used for smartphone applications is the TAM UC (ubiquitous computing) by Beier et al (Beier et al. 2006). Slide adaption of the TAM have been widely used to understand mobile service acceptance, e.g. (Gu et al. 2009; Lin 2011) applied TAM on the case of mobile banking, (Mallat et al. 2009) to understand mobile ticketing, (Jung et al. 2009) for mobile TV acceptance and (Gerpott 2011) on the acceptance of mobile Interet in general. The IS success model has been applied on the case of mobile banking (Lee and Chung 2009) and to understand success factors for mobile work in healthcare (Chatterjee et al. 2009). Other approaches that could be used for our purpose emerged from the task technology fit model (TTFM) by Goodhue and Thompson (Goodhue and Thompson 1995; Goodhue 1998). In contrast to the TAM that assumes the attitude of the user is influenced by the usefulness and ease of use of the technology, the TTFM suggests that users evaluate a technology on its ability to help them with a certain task. Other theories that have developed approaches, useable in the context of mobile technology acceptance, are the concept of flow (Csikszentmihalyi 1992), the dynamic phase model (Kollmann 1998) or the unified theory of acceptance and use of technology (Venkatesh and Morris 2003).

Anyhow, if we follow the argumentation that smartphones have to be seen as a new kind of device, some authors like Pitt et al. argue that our established IS models are not fitting for the purpose of developing smartphone applications (Pitt et al. 2010). Furthermore Pitt et al. argue that due to new features, offered by smartphones new models have to be developed. In addition Pitt et al. suggest to use the very generic organizational change framework (Leavitt 1964) which is based on the four interdepend elements task, technology, structure and people (also known as Leavitt's diamond) in extend with the U-constructs approach (Junglas and Watson 2006) which derived of the work on U-commerce (Junglas and Watson 2003a; 2003b; Watson et al. 2002) and covers four information drivers respectively technology characteristics (ubiquity, uniqueness, unison and universality) of the next generation computer environment as the theoretical foundation for the development for smartphone applications. The U-constructs approach (Junglas and Watson 2006) summarizes U-commerce and its characteristics on a more generic level. As pointed out by (Junglas and Watson 2006), the U-construct approach with its four characteristics includes also the approaches of ubiquitous computing (Baca et al. 2009; Want et al. 1995; 1996; Weiser 1993a; 1993b; 1999) and nomadic computing (Bagrodia et al. 1995; Duda and Perret 1997; Kleinrock 1995; Kleinrock 1996; Lyytinen and Yoo 2002) which also target on the characterization of the next generation computer environment. Envisioned in the pre smartphone era, u-constructs have recently been applied to explain success of green smartphone apps (Pitt et al. 2010) and green projects in general (Watson et al. 2011). (Junglas and Watson 2006) defined the four information drivers as follows:

Ubiquity is access to information unconstrained by time and space or reachability and accessibility combined with portability.

Uniqueness means knowing precisely the characteristics and location of a person or entity. Uniqueness combines localization, identification and portability.

Universality describes the desire to overcome the friction of information systems incompatibilities. Examples are the drive for standards or multi-functional smart phones (e.g., phone, GPS, camera, PDA, media player).

Unison is information consistency and includes ideas such as a single view of the customer and synchronization of calendars across devices. One recent example for unison is the application "Dropbox" that allow consistency of files across multiple devices. Cf. (Watson et al. 2011).

To use the four information drivers as technology characteristics (Junglas and Watson 2003a) use quantifications such as high, medium, and low to explain the current readiness of information systems. Figure 1 shows an update of the original illustration, representing the current readiness of three different information systems used by consumers. In contrast to hardwired PCs and laptop computers respectively notebooks, the smartphone has the capabilities to ace on all four dimensions. As unison improved in the last years on all three devices (e.g. with the adoption of services and applications like Dropbox, Windows Live Sky Drive, Apple iCloud aso.), gains in universality (smartphones combine various devices), uniqueness (GPS and accelerometer are standard features of most smartphones) and ubiquity are mostly exclusive to smartphones.

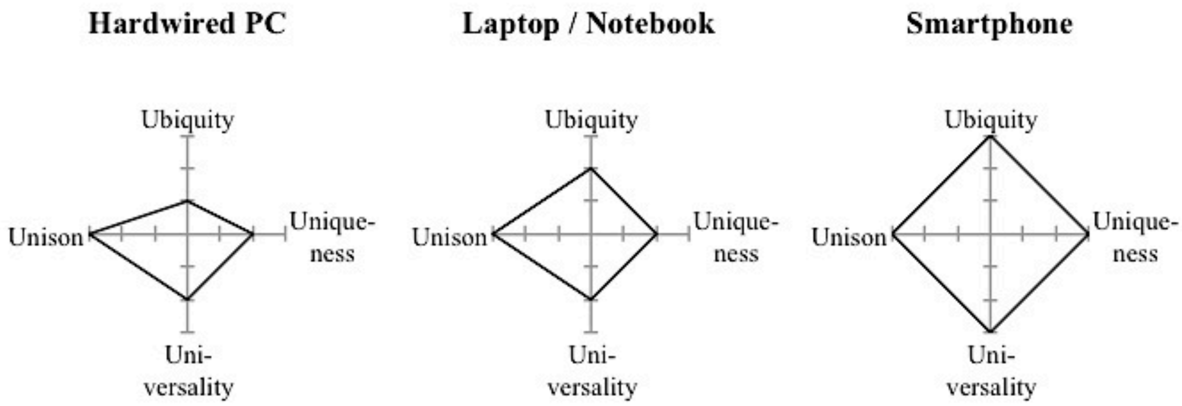

Figure 1. Current IS and their U-commerce readiness, an update on (Junglas and Watson 2003a).

As a second part, (Junglas and Watson 2006) developed a U-taxonomy for tasks, to establish a clear separation between technology- and task-characteristics as both, tasks and technologies, interact and co-evolve in a cycle of innovation of task improvement. (Junglas and Watson 2006) define following three task characteristics:

Time-dependency: Tasks that need to be executed immediately, irrespective of time or location, require technology ubiquity. Such tasks can be initiated by the task doer or triggered by an external actor.

Location-dependency: Tasks that require location information either about the position of the user or somebody else need a combination of ubiquity and uniqueness that enables location-dependency support.

Identity-dependency: Tasks that require a unique identification of a user and information about the user or others. Examples are billing information or personal preferences.

By comparing characteristics of a certain task with characteristics of a technology, we can decide if there is an under-, over- or ideal-fit between technology and task. As time-dependency is assigned to ubiquity and location- and identity-dependency are assigned to uniqueness we can derive combinations of task-technology-fit for our three proposed devices (Table 1).

Results of (Junglas and Watson 2003b) suggest that perception of ease of use is not significantly different between over- and ideal-fit. In contract to that an under-fit condition tends to devalue the perception of ease of use dramatically. Hence we see an advantage for over- and ideal-fit over under-fit. Combinations where an advantage for smartphones exists are marked in table 1.

Task- vs. Technology-Characteristics	Hardwired PC	Laptop / Notebook	Smartphone
TI(Y) / LO(Y) / ID (Y)*	Under-fit	Under-fit	Ideal-fit
TI(Y) / LO(N) / ID (Y)*	Under-fit	Under-fit	Over-fit
TI(Y) / LO(Y) / ID (N)*	Under-fit	Under-fit	Over-fit
TI(Y) / LO(N) / ID (N)*	Under-fit	Under-fit	Over-fit
TI(N) / LO(N) / ID (N)	Over-fit	Over-fit	Over-fit
TI(N) / LO(Y) / ID (N)*	Under-fit	Under-fit	Over-fit
TI(N) / LO(N) / ID (Y)	Ideal-fit	Ideal-fit	Over-fit
TI(N) / LO(Y) / ID (Y)*	Under-fit	Under-fit	Over-fit

TI	Time-Dependency
LO	Location-Dependency
ID	Identity-Dependency
Y	Yes
N	No

*Table 1. Task-Technology-Fit for different devices (*conditions with an advantage for smartphones).*

Based on U-constructs and the U-taxonomy for tasks, (Junglas and Watson 2006; Junglas and Watson 2003b) developed an extended task technology fit model that introduces the four information drivers of U-constructs as sub-characteristics of technology characteristics and extends three sub-characteristics (time-dependent, location-dependent, identity-depend) of task characteristics (Junglas and Watson 2006) as shown in Figure 2. Applying the extended TTFM it is possible to predict if the implementation of a function on a smartphone that supports a certain task will create user benefit.

As the extended TTFM is applicable to explain which task implemented on a smartphones creates benefit for users we will use this model in our research in order to answer RQ3. Due to our approach we will only survey the two dimensions task characteristics and technology characteristics and limit our view. Individual characteristics will not be surveyed and technology characteristics are fixed as we focus on the usage of smartphones.

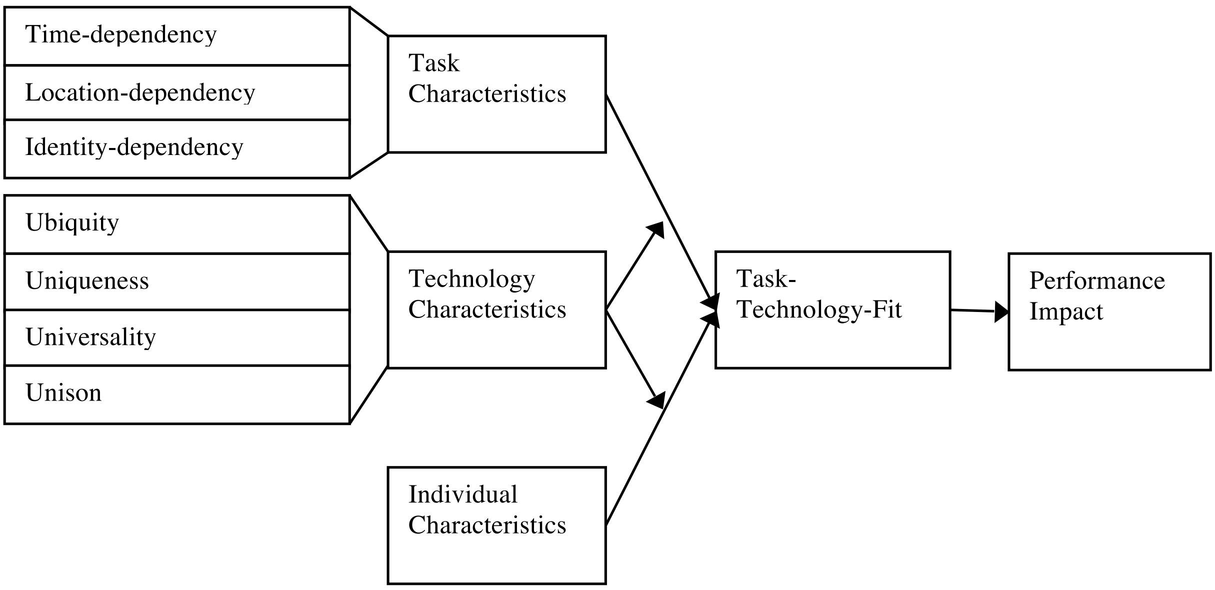

Figure 2. *Extended task-technology-fit model* (Junglas and Watson 2006).

2.2 Research Design

Our research design consists out of four parts. First, we perform an empirical survey to determine available mobile university services and review the implemented functions. Second, we develop a questionnaire to survey students' and university staff's demand for mobile university services at the University of St.Gallen and evaluate the result. We assume the sample is representative, as tasks of students do not widely vary between different universities. Furthermore research (Sugai 2005) suggests, that perceptions of mobile services (e.g. mobile Interet) are culturally comprehensive and comparable. Within the third part we match our previous two result sets to determine if the current offer meets student's needs. For the last part we assign task characteristics to tasks that occur in students' daily life using the U-taxonomy for tasks and decide based on the patterns shown in table 1, if usage of smartphone technology creates an advantage over the existing technology (hardwired PCs and laptop computer / notebook). By that we test the following hypothesis:

H1: Demand for mobile solutions is higher if the new technology creates an advantage over the existing technology in terms of task-technology-fit.

By testing H1 we answer RQ3. Figure 3 shows the research design for H1 respectively RQ3.

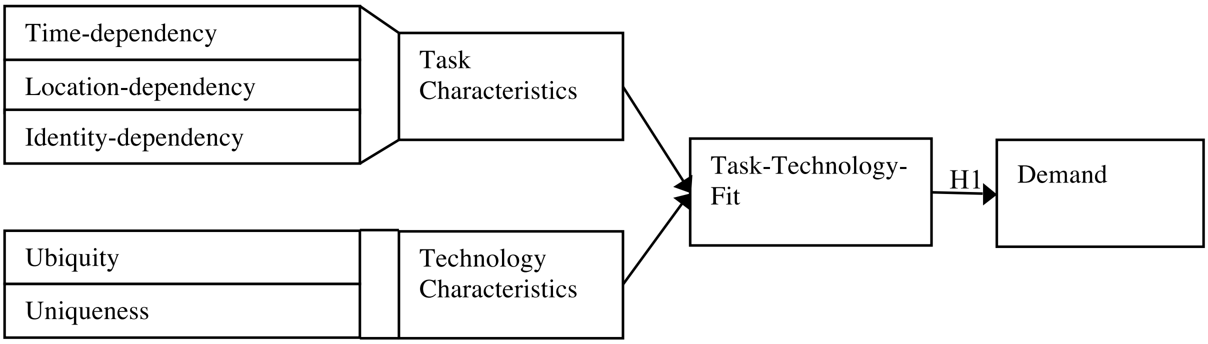

Figure 3. Research design for H1 respectively RQ3.

3 RESEARCH METHOD

3.1 Sampling

In order to assess RQ1 we surveyed Universities from Austria, France, Germany, Italy, Switzerland, the UK and the USA. We limited our survey to native, hybrid and pure web-based applications for Android and iOS (Apple) smartphones gaining a sample representing more than 50 % of the smartphone market (Flosi 2011; The Nielsen Company 2011). In addition, we limit to official applications from the university administration and neglect student unions and other not official applications. Furthermore we limit our sample to applications that cover at least three functions. As a result, we ignore all university rss-feed reader applications for smart-phones.

To collect the needed data we perform a three steps process. First, we searched the Apple App Store and Android Market[1] for applications provided by universities. Second, we searched the web using Google to find lists of university applications and web based mobile university services using the following search terms: mobile university service, mobile university app, university Android, university iPhone, higher education mobile, mobile campus. Third, we use the program muasearch[2] to search for mobile optimized websites hosted by European universities. The program searches automatically for websites with the extensions “m.”, “mobile.” or “/mobile”. Combined with a list of all state approved universities we check the websites systematically for mobile web solutions.

To answer RQ2 we developed a questionnaire using five-point scale and open text questions. The survey was hosted using the open-source software “LimeSurvey” and open for 7 days. We limited the survey to students and staff of the University of St. Gallen and promoted it on Facebook and via a mailing through the university mailing list (9,060 e-mail addresses; 6,955 students and 2,105 employees) covering all university affiliated. The questionnaire was started by 1,162 (921 students; 241 university staff) and completed by 980 participants (770 students; 210 university staff; return rate of 10.82 %). We received 28 % of all answers by female participants (percentage of female students overall: 30.82 %[3]). Average age of students’ participants had been 23.33 and 38.45 years for university staff. In context of RQ3 we selected a sample of 16 functions identified within answering RQ1 and RQ2 and assigned them with task characteristics. Comparing the task characteristics with the technology characteristics of smartphones, we identify if there is an advantage in terms of task-technology-fit over the existing technology (hardwire PCs and laptop computers / notebooks). Based on this separation in tasks for which smartphones will have an advantage and tasks where smartphones have no advantage, we compare these two groups in terms of the measured demand.

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[1] https://market.android.com/ tracks every Android application.

[2] Muasearch can be downloaded from https://github.com/fcamichel/muasearch.

[3] http://www.unisg.ch/en/UeberUns/PortraetUndStruktur/HSGInZahlen.aspx

3.2 Coding

Three raters (Ph.D. students in the field of IS) independently categorized functions using the suggested criteria. All raters are specialized in IS. We choose this setting to ensure the practicability of the approach for IT-departments. The requirement is to assign for each function if the supported task matches the following three characteristics: time-dependent, location-dependent, identity-dependent.

After a first round, raters compared and discussed their assignments. An inter-rater reliability analysis showed, that especially the association of the first attribute, time-dependent, is difficult (Fleiss' kappa for time-dependent = 0.08; location-dependent = 0.33; identity-dependent = 0.49). After few rounds of discussions and modifications, they were able to reach consensus. We assume this as representative for the decision finding process practiced at IT-departments.

3.3 Analysis

In order of RQ1 we give a market overview and visualize the distribution using descriptive statistics. To answer RQ2 we also use descriptive statistics. For the answering of RQ3 we use Wilcoxon rank sum test with continuity correction. Statistics have been calculated using R programming language.

4 RESULTS

RQ1: What is the current state-of-practice for mobile university services?

In a US-centric view, only 9% of schools, which granting bachelor or advanced degrees, have mobile university services (Olsen 2011). In Europe this value will be approximately lower. Within our research using muasearch, we searched the website of 388 universities covering six European countries identifying 25 universities offering mobile services (6.44 %). 21 of them are full mobile web services. The other 4 applications are either password protected or only for internal purposes. Only Oxford University offers informative explanations about the web service. The majority (68 %) of the services is provided by universities from the UK. Most universities with mobile services use free or commercial frameworks like Blackboard Mobile, campusM or iMobileU and their derivates. These frameworks do not differ substantially from each other in functionality. They typically offer news, events, course information, directories and maps.

RQ2: Does the current state-of-practice fit students' needs and demand?

The most used mobile operating system in our sample is iOS by Apply (share of 53.7 % for students; 59.2% for university staff) followed by Android (15 %) and Symbian (9.1%). 80 % of the participants answered that they have mobile Internet access on their smartphone available at the campus and 73 % have a GPS positioning module integrated in their smartphones.

Function	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Frequency of implementation	12	11	10	9	5	5	4	4
Demand (1-5)	3.36	3.87	3.28	3.27	3.57	3.98	4.26	4.16
Rank offer	1	2	3	4	5	6	7	8
Rank demand	6	4	7	8	5	3	1	2
Rank change	-5	-2	-4	-4	0	3	6	6

Table 2. Matching of offered and demanded functions: (1) News, (2) Maps, (3) Directory, (4) Events, (5) Directions, (6) Library, (7) Course information, (8) Learning content.

In another section of the questionnaire we asked the participants to rate on a five-point scale how often they use certain services related to the university (1 = never; 5 = daily). In a second part we asked for the same services if mobile access via smartphone would be useful (1 = not useful; 5 = very useful). Results are shown in figure 4 and table 3. We assume that to meet the expectations respectively needs of students, those services with a high mean value according to our survey should be implemented in mobile university services. In order to answer RQ2 we compared the results on the offered and demanded functions (table 2).

We propose that if there is a mismatch of offer and demand, the rank correlation will be negative. Using the Spearman rank correlation coefficient rho we observed a negative rank correlation (rho = -0.6905; S = 142; p-value = 0.06939).

RQ3: How should IT-departments decide which tasks-supporting functionality to implement on smartphones?

For each function we rated if the task that is supported is time-, location or identity-dependent by assigning null for no and one for yes. By comparing task- and technology-characteristics, we assign if there is an advantage of the new technology over the existing technology (table 3). Using Wilcoxon rank sum test with continuity correction and true location shift "greater" for advantage over disadvantage as alternative hypothesis. The alternative hypothesis is supported with a p-value of <2.2e-16. This indicates that H1 is also supported. Results are presented in table 3. Figure 4 shows a boxplot of the demand for tasks with no advantage and tasks with advantage.

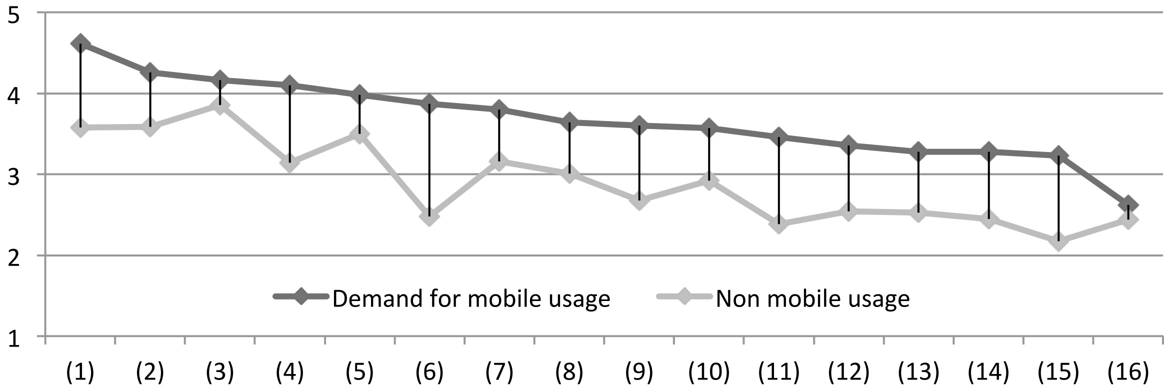

Figure 4. Non-mobile usage and demand for mobile access for certain university services. (1) Personal timetable, (2) Course information, (3) Course material, (4) Exam grades, (5) Library, (6) Campusmap, (7) Exam registration, (8) Semester registration, (9) University sports program, (10) Public traffic schedule, (11) Room reservation, (12) Newsfeed, (13) Register of persons, (14) Calendar of events, (15) Cafeteria menu, (16) General information.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Mean*	4.62	4.26	4.16	4.1	3.98	3.87	3.8	3.64	3.6	3.57	3.46	3.36	3.28	3.27	3.23	2.62
SD *	0.87	1.16	1.25	1.27	1.3	1.32	1.41	1.47	1.42	1.54	1.44	1.32	1.37	1.35	1.5	1.31
Mean**	3.58	3.58	3.85	3.14	3.5	2.48	3.15	3.01	2.68	2.92	2.38	2.54	2.53	2.45	2.17	2.44
SD**	1.21	1.2	1.31	1.07	1.18	1.19	1.06	1.02	1.33	1.43	1.25	1.18	1.22	1.05	1.3	1.03
Rank change	2	0	-2	2	-1	6	-2	-1	0	-2	4	-2	-2	-1	1	-2
Time-d.	1	1	1	1	1	1	0	0	0	1	1	0	1	0	0	0
Location-d.	1	1	0	0	1	1	0	0	1	1	1	0	1	0	0	0
Identity-d.	1	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0
Fit	I-fit	I-fit	O-fit	O-fit	I-fit	O-fit	O-fit	O-fit	O-fit	O-fit	I-fit	O-fit	O-fit	O-fit	O-fit	O-fit
Advantage	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	No	No	No

*Table 3. Values used in figure 4, rank change from non-mobile usage compared to the demand for mobile access (*Demand for mobile; **Non-mobile usage; SD = Standard deviation; I-fit = Ideal-fit; O-fit = Over-fit) and rating results (1 = Yes; 0 = No).*

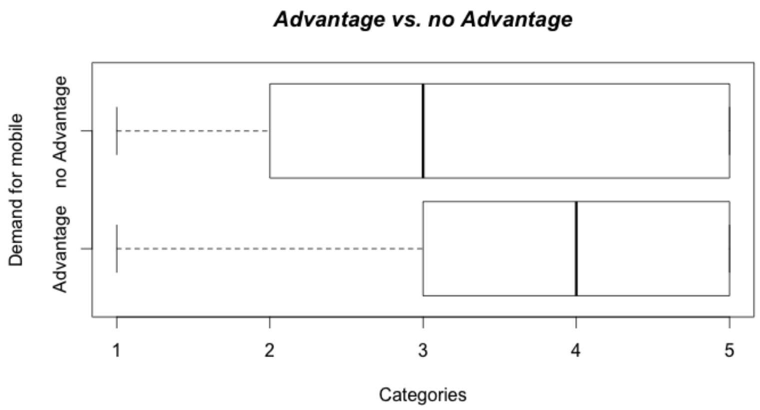

Figure 5. *Boxplot of ratings from functions with advantage vs. functions without advantage for smartphones.*

5 DISCUSSION, CONCLUSION AND IMPLICATIONS

We observed that most universities have not yet implemented mobile university services and that the currently offered services don't meet the expectations of users. Results indicate that by using an extended task technology fit model the decision of which services to implement can be supported by the three characteristics time-, location- and identity-dependency. Furthermore results show that the usage of services correlates with demand for mobile access to those services. Nevertheless we believe that successful mobile services are not just mobile accessible existing services, but services that make use of new features offered by smartphones. Having only applied the extended TTFM partly and limited to the two dimensions task and technology characteristics this limits our findings related to RQ3. Furthermore we gained data only on one case and gained it by using a questionnaire. We suggest that empirical usage data would by more precise. Due to the limitations, our future research will test our results and finding by implementing selected functions as a prototype and supply an observed user-test group with it. Thus we will gain empirical usage data by tracking and recording our participants. Furthermore we will work on the definition of the different task characteristics as raters experienced difficulties (especially for time-dependent) by assigning them to task respectively functions. We see that the question of how to use and apply smartphones to support tasks is still not fully covered and answered. First models on predicting user acceptance for smartphone applications exist, but are not fully researched yet. Especially the questions of how to effectively integrate smartphone applications into the existing IT infrastructure and IT strategy needs more attention. The herby used dimensions are a first hint of how to select functionality and develop smartphone applications but need further attention and research. Follow-up research should question if there are other factors that influence the success of smartphone applications and how they influence each other. Anyway, for practitioners we can recommend to use the here used dimensions even they are not fully scientifically proven and understood they should be considered in the decision finding and development process of smartphone applications.

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