

Status-Quo-Analysis of Acceptance and Usage of New Technology in Higher Education: Germany vs. USA

A.Honal¹, L.Seiler¹, N.Buerger¹, S.An⁴

¹Baden-Wuerttemberg Cooperative State University Mannheim, Germany,
E-mail: andrea.honal@dhbw-mannheim.de / luisa.seiler@dhbw-mannheim.de /
nicoletta.buerger@dhbw-mannheim.de

²California State University Long Beach, USA,
E-mail: mshuhua.an@csulb.edu

Abstract

This paper presents the key findings of a cross-cultural survey conducted among a sample of 290 German and American students analysing the effects of new technologies, digital media and innovative methods in higher education from the student's perspective.

The empirical analysis aimed to explore the similarities and differences between German and US-students towards the acceptance, usage and attitude of new (technological) approaches during studying. For the survey taking place from January to May 2017 the Lime Survey online-tool was used. All students were familiar with new technologies for learning, but the intensity of the usage at the two universities was different. The American University had frequently more interactive and virtual elements in teaching, whereas the German University focused more on the traditional way of lecturing and used innovative technologies less often. The paper sums up the core results of this initial cross-cultural study. Moreover, several educational implications are derived and limitations are discussed.

Introduction and Educational Background

In recent decades, there has been an increasing interest in integrating more technology in higher education. The International Society for Technology in Education (ISTE) calls for major changes in education by rethinking education, adapting to a constantly changing technological landscape and preparing students to enter an increasingly global economy [10]. Technological innovation in higher education has been changing the ways that professors teach and students learn. These changes provide great possibilities for academic institutions. Distance education, sophisticated learning-management systems and the opportunity to collaborate from around the world are just some of the transformational benefits that universities are embracing [1, 4].

Various research studies in recent years focused on different topics of technology in higher education. For instance, Araeipour (2013) conducted a comparative study on student learning success in between traditional and distance delivery platforms in the United States [2]. Kim, Mims, and Holmes (2006) explored current trends and benefits of mobile wireless technology use in higher education in the United States [11]. Mtebe (2015) explored an empirical study on increasing learning management systems (LMS or learning portals) usage in higher education in Sub-Saharan Africa [15]. *However, far too little attention has been paid to comparative study on technology at higher education between different countries and cultures. According to Wild (1999), culture has a strong influence on the design, use, as well as management of information, communication and learning systems [20]. It is important to*

see the variations in using technology at higher education between different cultures in order to identify possibilities and develop a culturally adaptive approach [1, 22]. Thus, this paper aims to investigate the similarities and differences in the usage and acceptance of new technology tools and innovative methods at two different universities in Germany and the USA. Besides the theoretical background, this paper summarizes the key results of an empirical pilot study being conducted from January to May 2017 at a university in South Germany and at a university in Southern California in the United States. Moreover, important implications for the academic field are derived. The paper gives deeper insights which kind of technologies German and American students are currently using, how students apply these new tools in their learning process, what support they expect from their universities, and how these experiences impact their attitude in learning, the future use of technology and the evaluation of their home university.

Nowadays, students have high expectations towards their academic education and therefore higher education institutions have to offer student-centred learning environments. Particularly, certain flexibility with respect to the learning location and the content are important as the contact and cooperation with peers [16]. Adapting new technology and innovative learning methods into the teaching process helps to meet with the challenges of digital age. The current generation of students is very familiar with new technological approaches and they use it instinctively [21]. These ‘digital natives’ have no digital boundaries set between private and academic life. *By integrating digital media and innovative technologies effectively in the curriculum, the students’ needs can be met and a more individual learning and teaching can be offered [1]. A new approach in this field is the usage of mobile learning analytics [9, 17, 19].* By using mobile apps to evaluate the personal learning process, the current needs in studying and the performance of professors after each lecture, the students give a nearly real-time feedback towards their current situation. This data is collected, anonymized and analysed by an intelligent IT-system. The key results are submitted to the professors nearly in real-time and used to adapt the actual curriculum and the lecture content for meeting the students’ needs on a higher level. At two German universities, this new concept is currently tested in a profound research project. The first results show the positive benefits of mobile learning analytics in higher education very impressively [14].

Because of the increasing digitization trend in higher education, also the professor’s role has to be adapted to the new technological requirements. Modern approaches like the TPACK (Technology Pedagogical and Content Knowledge) framework help to understand the new teacher’s role. The TPACK approach emphasizes how the connections among teachers’ understanding of content, pedagogy and technology interact with one another to produce effective teaching [12]. The model had a strong impact on theory, research, and practice in teacher education and higher education professional development [13]. The TPACK model suggest that professors should have deep understandings of the content knowledge referring to any knowledge that the person is responsible for teaching and the pedagogical knowledge about the variety of instructional practices, strategies and methods to promote students’ learning. The technology knowledge is the third essential component of the TPACK model. The technological knowledge refers to the teacher knowledge about traditional and new technologies can be integrated effectively into curriculum. According to the digital affine students, a professor 2.0 is needed who is keen on using new technological tools in teaching. According to the TPACK framework in higher education, technological pedagogical content knowledge should be used by professors to develop appropriate and context-specific teaching strategies and learning environments to promote students’ motivation and learning performance [13].

The annually published Horizon Report of the New Media Consortium explores upcoming trends, challenges and effects of modern technologies in higher education in depth.

Moreover, the report (2017) presents best practice approaches for the appropriate usage of these new methods and tools at different universities around the world [1]. The report of 2017 emphasises that universities should be more geared and structured in ways of promoting idea exchanges, identifying successful teaching and learning strategies for the modern world of business and rewarding teaching innovation. Additionally, universities have to deliver intensive, active learning experiences and skills-based training units using technology in meaningful ways. Web-based communities of practice, virtual multi-disciplinary student groups and virtual learning teams are effective concepts in this area [1]. Online, mobile and blended learning concepts are used across the world, but access to such learning remains unequal. Gaps exist hampering college completion rates for student groups by socioeconomic status, race, gender or ethnicity. Moreover, web access remains uneven in some countries or regions. Most institutions apply new technologies, including learning apps or LMS to enrich the traditional training environment on campus. However, in many cases the technology-driven learning and teaching strategies of universities concentrate on 'silo-solutions'. Thus, training has to be extended beyond gaining separated technology skills towards generating a thorough understanding of digital environments, enabling interactive learning to new contexts and co-creation of content with others. Additionally, lecturers should select their favoured methods wisely with regard to their students' characteristics. Nevertheless, lifelong learning is the lifeblood of higher education and the organisations should prioritize and recognize the relevant trends for their students, professors and faculty [1].

Regarding these aspects, a great mixture of mobile learning, blended learning concepts and virtual teaching approaches is needed for higher education now and in the future. Virtual courses enable interdisciplinary knowledge sharing across the world and beyond the physical campus. For instance, the number of virtual universities increased in recent years in Germany and the United States. Students appreciate the direct information access, the opportunity to communicate and exchange with fellow students via the web, and the interactive elements of online-classes [3]. In many cases, the digital technology skills of lecturers are limited and not used as the TPACK framework suggests [13]. By expanding the teachers' knowledge, they can support the new student generation on a higher performance level. Thus, a professional skillset of pedagogical, cultural and technological competencies for lecturers are required and clear work guidelines for learning and teaching are needed [1].

Cultural Background of Germany and United States

The educational systems and cultural structure in Germany and in the United States show some differences [1, 8]. Most of the universities in Germany are publicly funded. Less than 5% of the students attend private institutions in Germany for which they have to pay high charges. In contrast to this, the American students must pay high fees for receiving an academic degree. While American students (and their parents) are weighed down by massive debt, most students (and their parents) in Germany are free from the worry of how they will pay back college or university loans. Moreover, the cultural backgrounds of German and American students are slightly different. Whereas most of the American students are very proud attending a college or studying at a well-established institution, some German students take it for granted going to the university for studying. Because the students don't have to pay very much for taking classes and getting an academic degree, the appreciation of higher education has not such a prominent place in their daily life. These differences in higher education may lead to a partly diverge perception of the acceptance and usage of new technologies and innovative methods in learning and teaching [1, 8]. Corrocher and Ordanini already proposed in 2002 a new model for measuring the digital divide within a set of

countries. The results of their work showed substantial differences in the level of digitalization in very developed countries – like Germany, France, Sweden, USA or UK [6]. The USA emerged as the point of reference for the diffusion of digital technologies, while Germany stood in the middle of the ranking. An important finding of their work was that a set of countries being similar in terms of economic development showed important differences in terms of digitalization. *To close these gaps, governments, universities and global institutions have to work together and initiate global programs to promote the implementation and appropriate usage of technology and digital learning environments in higher education [1, 6].*

Within the last 15 years, the German government supported regularly projects which develop and evaluate innovative pedagogical and technological concepts focusing on digital learning or learning via mobile devices. For instance, various universities, like the Baden-Wuerttemberg Cooperative State University, were supported by the government to test new approaches in teaching students with modern technologies inside and outside the campus. Different empirical papers analyzed the effects of new technologies in different German educational systems with the key results that the right technology enhances students' learning and performance [e.g. 14, 18]. While German students are not forced to rely on college to secure jobs promising a future and further learning can rely on their studying and their credentials, American students often have to acquire even more education to get the job they seek for and to secure a stable future [7]. There are still some challenges e.g. for German universities given. As the university system in Germany is financed at about average levels in comparison with most European nations, but lags behind the United States. In Germany, the salaries for university staff are still linked to the government, whereas in the United States market prices determine higher salaries for faculty members at leading universities. Although Germany seeks to imitate the United States in many ways, the worldwide competition in the creation, development and implementation of human capital is also a challenge for the United States. Thus, the emergence of a more educated population that is shaping a new knowledge landscape and a new set of relationships among the countries are needed. These developments will bring about greater cooperation and more competition among academic institutions worldwide [7]. In summary, the educational systems in Germany and the USA are differently and it will take some time to overcome the given limitations in each country [1].

For a deeper analysis of the impact of new technologies in higher education in Germany and the United States, an empirical pilot study was conducted in 2017. The next chapters of this paper sum up the goals, the design, the core results and the implications of this study. It is planned to repeat the study regularly in different countries to gain deeper insights in cross-cultural acceptance and usage of technologies tools from a students' perspective across the globe.

Research Questions and Study Design

A quantitative method approach was chosen for the empirical study. It comprised a quantitative online-survey via the Lime Survey tool. The sample consisted of 199 students from a South German university and 91 students from the university in Southern California. The total sample size was 290 participants. The main objective of the survey was to compare similarities, but also cultural differences between the two groups of students concerning new technologies and innovative tools in higher education. Additionally, the general attitude towards their university and personal data were analyzed. With respect to the study design, the following research questions were asked in this study:

1. *How effective was the actual access to new technologies among the two countries and which tools were mainly used for learning?*

2. *Were there any differences in level of satisfaction related to the support during the students' learning process between both countries? Had the perception of the home university image an impact towards the satisfaction level of the technological support of the university?*
3. *Which kind of impact did the usage of learning portals, apps and mobile devices (e.g. tablets) have on the learning motivation of German and American students?*
4. *Which concrete recommendations can be derived for the academic world with respect to learning and teaching?*

Sample, Instrumentation and Methods

For the empirical study 199 German bachelor students with a focus on business and management and 91 American students from different educational and management studies field were selected. A more expanded view on cultural differences was given by the two locations of the participating universities. From January to May 2017, the students took part in the web-survey. Within the German sample were 108 female and 91 male students, whereas the American sample consisted of 81 women and 10 men. The average age of the German participants was 22 years. The US-students had an average age of 26 years. The students from Germany were in their 2nd to 6th semester. In contrast, the American students were mostly further than the 6th semester in studying. Within the scope of the questionnaire, the students were asked about the following topics: (1) Attitude towards their university and their technical support; (2) General usage / acceptance of digital media and new technologies; (3) Evaluation of specific tools such as learning apps and mobile devices as learning supporter; and (4) Personal data. Within the questionnaire, only closed answer formats and mostly seven-point likert scales were used. The items and ranking scales chosen for the survey design had to meet with statistic quality criteria [5]. Only quantitative methods were used in data analysis. To answer research questions, the statistical analysis was conducted with the IBM-Software SPSS version 23.0. The results were calculated by descriptive analysis (mean, variance, standard deviation) and logistic regression.

Empirical Results

According to the first research question asked which technologies or technical equipment they ordinary have access to and which devices they use or would like to use mainly for studying. The results from this study show that 89,4% of the German students had access to their own PC or laptop, 45,4% of them had a tablet and nearly every student was a smartphone user. The situation of the American students was very similar: 93,4% of the US-students had an own PC or laptop, 81,3% were smartphone-users and over 50% of the US-sample had a tablet (e.g. iPad). Surprisingly, only 1/3 of the German students and only 25,3% of the US-students would like to use tablets frequently for learning or in the lecture. Similar results were confirmed in the future wish to use own smartphone for learning and lecturing purposes. A possible explanation could be that the German and American students associated with mobile devices only private usage and communication and less learning purposes [16]. By teaching students how to use mobile devices and learning apps effective in academia, the learning support potential of these new tools can be leveraged enormously. Moreover, the survey gave further information about how often various technologies were used for studying. To answer this question a seven-point likert scale with 1 = “strongly disagree” to 7 = “strongly agree” was used. In table 1 a summary of the core results of this question is shown.

Table 1: Usage of different technologies for studying among German and US-students

Please indicate how often you use the following technologies at the moment for studying / working as part of this lecture/ class.	German students (N= 199)		American students (N= 91)	
	Mean	Standard deviation	Mean	Standard deviation
1. Internet search engines	5,6884	1,3793	6,3187	1,2007
2. Social Media: Facebook	3,0151	1,7451	3,4396	2,3056
3. Video portals for education	3,9899	1,8450	5,1758	1,8773
4. Cloud-based groupware for team working	3,9347	1,9334	5,6923	1,8055
5. Learning portals (e.g. Moodle)	4,2513	1,9841	3,1758	2,3266
6. Learning apps	2,4623	1,6506	2,6044	2,1389

Whereas both groups were more or less keen on using internet search engines (e.g. Google) and video portals for educational purposes, the German students used more frequently learning portals like Moodle, whereas the US-students were more active on using video portals for education *in the learning context*. The usage of cloud-based groupware was more popular among the American students in contrast to the German students. Concerning learning apps a low current usage was detected in both countries. Regarding the question towards the future usage of learning apps in higher education a higher willingness-to-use was found (mean of German students = 4,0000 / mean of American students = 4,2527). Additionally, the results from a question about the preferred communication channels with the lecturers in general showed that the students from both universities contacted the lecturers most frequent via email, followed by messages via the university own learning portal (e.g. Moodle) and traditional face-to-face meetings at the university. Contacting the teachers via Facebook or LinkedIn was not very popular.

Regarding the second research question, the participants had to evaluate their satisfaction level with the IT-support by their home university, their own technological competence level and their perceived teachers' competence level when using technology in the lectures. The statistical analysis confirmed interesting differences between the two nations as Table 2 shows.

Table 2: Level of satisfaction related to the technical support during learning among German and US-students

Please state your level of satisfaction with the following relative to support your studying.	German students (N= 199)		American students (N= 91)	
	Mean	Standard deviation	Mean	Standard deviation
1. Your own competence level when using technologies	4,8593	1,2062	5,6374	1,3125
2. The competence level of lecturers when using technologies	4,0151	1,2692	5,3187	1,3734
3. The degree to which lecturers use technologies to support the learning process	3,9045	1,3618	5,2637	1,3403
4. The option of using technologies of your choice for studies / the project & communication	4,2965	1,3512	5,4725	1,3771
5. The scope of technologies available for studies / the project and communication	3,9849	1,3007	5,3516	1,3934
6. The availability of university support services (e.g. IT support centre)	3,5628	1,5324	5,2967	1,5527
7. The availability of information technologies at the university (e.g. PC lab)	4,0101	1,4106	5,3956	1,4823

8. The reliability of technologies at the university / at the campus	3,9497	1,4346	5,4615	1,5078
9. The quality of the university IT service	3,6533	1,4789	5,3187	1,5047

Again the participants stated their level of satisfaction on a likert scale from 1 (“very dissatisfied”) to 7 (“very satisfied”) in the questionnaire. Regarding the results in table 2, the German students were less satisfied with the technical support than the American students. The own technical competences of the US-students were assessed on a higher level in comparison to the German participants. Moreover, the competence level of the American lectures received a higher evaluation than the German teachers.

Regarding the assessment of the university image, the US-students had a better attitude towards their home university than the students in Germany. The image of the home university was measured with a semantic differential with 11 bipolar items being often used in higher education marketing surveys. The summary of the study results is displayed in table 3.

Table 3: Attitude towards the university image between the two student groups

Please state your level of satisfaction with the following relative to support your studying.	German students (N= 199)		American students (N= 91)	
	Mean	Standard deviation	Mean	Standard deviation
1. bad vs. good	4,8040	1,4726	6,3297	0,9894
2. weak vs. strong	4,4221	1,4152	6,1099	1,1968
3. unpleasant vs. pleasant	4,7789	1,3749	6,3626	1,0383
4. unappealing vs. appealing	4,6231	1,3610	6,1429	1,2254
5. incompetent vs. competent	4,4623	1,6959	6,1868	1,1147
6. non authentic vs. authentic	4,9196	1,3793	6,0659	1,1907
7. unreliable vs. reliable	4,5075	1,5171	6,0220	1,2291
8. conservative vs. modern	5,0452	1,6401	6,0220	1,2200
9. bureaucratic vs. flexible	4,0754	1,6451	5,7912	1,4796
10. passive vs. active	4,4673	1,5234	6,0989	1,1061
11. nationally / regionally oriented vs. internationally oriented	4,2513	1,5946	5,8022	1,4081

The results from Table 3 shows that the US students had a more positive image of their university than the German participants. For this question field a seven-point-scale was applied. Although, the students in Germany evaluated their university above the average with mean values over 4,0000. The mean values of the American participants were around 6,0000. This tendency can be seen e.g. in the items “weak vs. strong”, “bureaucratic vs. flexible” or “passive vs. active” in table 3. A regression analysis supported the assumption. In comparison to German students, the American participants rated their university better (unstandardized coefficient $b = 1,507$, $r^2 = ,294$).

To answer the third research question, besides learning apps and mobile devices in higher education, both student groups had to evaluate learning portals, like Moodle or Blackboard, in general. All students showed a positive attitude towards learning portals. The American students assessed the portals a bit better, more user-friendly, more innovative and more facilitating for learning in comparison to the German participants. Both groups accessed learning portals mostly via laptop or PC, less frequent via smartphone and rarely via tablet devices. Moreover, learning apps and mobile devices for studying were likewise evaluate positive from all participants and can therefore be seen as an appealing learning motivator. Generally, both groups had a better attitude towards mobile devices (attitude towards mobile devices for studying, combination of four questions: mean of German students = 4,3430 / mean of American students = 5,2363) than towards learning apps (attitude towards learning

apps for studying, combination of four questions: mean of German students = 3,9460 / mean of American students = 4,7555) for studying. Table 4 sums up the students' results of using mobile devices and learning apps in studying.

Table 4: Evaluation of mobile devices and apps in higher education among the sample

Please indicate the degree to which the statements apply to you.	German students (N= 199)			
	Using a mobile device ...		Using a learning app ...	
	Mean	Standard deviation	Mean	Standard deviation
1. ... improves my studying / learning performance.	4,2462	1,5906	4,0955	1,6624
2. ...enhances my studying / learning effectiveness.	4,2764	1,5728	4,1106	1,5884
3. ...is helpful for studying / learning.	4,5930	1,5110	4,2965	1,5234
4. ... improves my technological / media competencies.	4,5779	1,6614	4,2814	1,5639
Please indicate the degree to which the statements apply to you.	American Students (N= 91)			
	Using a mobile device ...		Using a learning app ...	
	Mean	Standard deviation	Mean	Standard deviation
1. ... improves my studying / learning performance.	5,2527	1,5888	5,0769	1,8271
2. ...enhances my studying / learning effectiveness.	5,2418	1,6353	5,0769	1,8453
3. ...is helpful for studying / learning.	5,3736	1,6908	5,2418	1,7019
4. ... improves my technological / media competencies.	5,6264	1,5322	5,4066	1,6260

Discussion, Conclusions and Outlook

This study detected interesting similarities and differences between the two countries. In general, all students had a high acceptance and usage level of new technologies and access to modern technological equipment. Despite the American participants evaluated a lot of tools and approaches better, the German students assessed these tools above the average. *One of the significant findings to emerge from this study is that the German students used more frequently learning portals like Moodle, whereas the US-students were more active on using Video portals for education in the learning context.* The usage of cloud-based groupware was more popular among the American students in contrast to the German students. A possible explanation for this behaviour could be that the US-students were more familiar with these innovative groupware tools because the teachers encouraged the usage of them very often. Concerning learning apps a low current usage was detected in both countries. *The second major finding was that contacting the teachers via Facebook or LinkedIn was not very popular in both countries.* In general, students use more emails and messages as preferred communication channels with the lecturers. These results are a bit surprising because commonly Facebook, LinkedIn and Co. are the most preferred messengers for 'digital natives'. Furthermore, the students were asked concerning the future communication ways with their lectures. Despite a strong digitalization trend in higher education, email correspondence and personal conversations will remain the most preferred interaction channels for students with their teachers. *Another interesting finding from this study is that the German students were less satisfied with the technical support than the American students. The own technical competences of the US-students were assessed on a higher level in comparison to the German participants. Moreover, the competence level of the American lectures received a higher evaluation than the German teachers. Not surprisingly, the availability, the reliability and the quality of the technologies and the IT-support of the*

American university performed on a higher level in contrast to Germany. Comparing the status-quo of new technology at the two universities, the United States are always ahead in this field. A lot of new trends and innovative methods, e.g. MOOCs (Massive Open Online Course), were born in the USA [1]. Thus, American students seems to be more open to new technological tools and evaluate them better in comparison to German students as the study results indicated. Another interesting finding from this survey is that the US-students had a more positive image of their university than the German participants. A possible explanation for this could be that a technical support of the university helps increasing the image. *The results from this study also indicated that both groups prefer mobile devices for learning in contrast to apps.* A possible explanation for this can be that students are familiar using apps in private life and for communication, but less in the academic context [16]. The future of learning apps is huge as recent studies show [1, 14]. *Therefore, the universities and the professors in each country have to encourage students for a 'learning via apps on the go'.* However, these kinds of tools are only supplements and do not replace established teaching and learning methods.

Overall, this study shows that American institutions make a greater progress in using new technologies in the academic world at the moment. German universities are still a bit behind. But the German government set up several programs to promote digital trends in higher education. Moreover, the organisational structures and processes at German universities began to become more flexible and open to new technological teaching approaches and systems. For instance, the German Baden-Wuerttemberg Cooperative State University started different programs to increase the technical competence level of their teachers according to the TPACK model. Additionally, an education support-center will be implemented for the effective usage of digital media and technological tools for students and teachers in daily university life soon. At the California State University Long Beach several programs to enhance the digitalization in the classroom had been launched. Moreover, virtual courses are offered very successfully since a few years.

The last research question explored which recommendations can be derived for the academic world with respect to learning and teaching. These aspects are discussed in this part of the paper. Current study results shed a positive light on the integration of new technologies in higher education [1]. National governmental and private programs in Germany and the United States help to promote the appropriate usage of innovative learning concepts and technological tools – such as tablets in the classroom – in educational organizations. The American 'National Education Technology Plan' gives recommendations to enable flexible and personalized learning. Teachers should increase their digital literacy to empower all learners. Universities have to teach a new generation of students and should respect their demands and support their technical know-how in various ways – supported by innovative tools [16]. *In general, it requires strongly motivated students and lecturers to use innovative methods and digital tools on the long run. Furthermore, modern technical equipment and infrastructure must be available and a reliable and continuous support should be given.*

The presented study results are limited because only a medium-sized sample was used and two countries participated. Nevertheless, these empirical findings give deeper insights in this new field and help to derive concrete recommendations for universities, teachers and faculties. To get an insight in learning with new technologies in this study, the students' perspective was investigated. *In future surveys, also the teachers' side should be explored to receive a better understanding of both worlds.* New approaches – like TPACK – give teachers guidelines, to use technology individually [13]. Moreover, the sample size must be increased and the study design extended (e.g. selective qualitative interviews with students to gain more details). *Additionally, the study has to be conducted in more countries, e.g. in*

China, Australia or U.K. to generate a broader view of new technologies and innovative concepts in higher education across the globe. Nevertheless, new tools and approaches must always be adapted to cultural and country-specific requirements and needs of the different participants and universities types. With respect to the digital divide and the culture of the different countries specific recommendations should be given [6, 20, 21, 22].

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