

ORIGINAL RESEARCH ARTICLE

Are students getting used to Learning Technology? Changing media usage patterns of traditional and non-traditional students in higher education

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In 2012 ($N = 2339$) and 2015 ($N = 1327$), a longitudinal analysis was carried out to investigate changes in the media usage patterns of German higher education (HE) students, with a special emphasis on differences between traditional students (TS) and non-traditional students (NTS). Based on an online questionnaire, the students provided information about the digital devices they own or have access to, on the frequency of use as well as perceived value of digital media, e-learning tools and services for their learning in HE. The presented results indicate implications for the instructional design of teaching and learning in HE. In general, the findings show a shift towards using mobile devices. Unexpectedly, the frequency of media usage is slightly, but significantly, decreasing from 2012 to 2015. Furthermore, the results are discussed based on a media usage typology that distinguishes between *entertainment users*, *peripheral users*, *advanced users* and *instrumental users*. NTS are over-represented in the group of *instrumental users* who tend to apply e-learning tools a lot. Moreover, NTS state a higher demand for digital teaching and learning formats than TS.

Keywords: media usage patterns; media usage typology; non-traditional students; instructional design; media selection

Introduction

In the 1950s, the traditional students (TS) in the German higher education (HE) system were males, younger than 25 years, financially independent, studied full-time and went to university directly from school (Garz 2004). In fact, TS were known to study full-time and usually got admitted to university immediately after undergoing high school education. In recent times, increased diversification of the student body in HE is a common feature. For example, the current post-secondary education population in the United States includes 40% of mature age students (Ke 2010). The analysis, based on the data of the National Center for Education Statistics in the USA by Knapp, Kelly-Reid and Ginder (2011), reveals that 39% of the 21 million undergraduate and

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graduate students in the USA are over 25 years of age, and 11% are older than 40 years. The same trend can be observed in German HE institutions (Hanft and Brinkmann 2013). From 1975 to 2015, the number of HE students in Germany increased by more than 200%, from 840 000 to 2.76 million students (Destatis n.d.).

It seems reasonable that the increased number of students entails a diversification of student profiles (Guri-Rosenblit and Gros 2011; Schuetze and Slowey 2002) along with an increasing number of non-traditional students (NTS). The increased diversity of student profiles is challenging. According to Moore and Kearsley (2011), educational challenges are evident in university curricula, delivery modes and student support systems. Precisely, universities are not in a position to address the diverse issues and needs exhibited by their diverse student body. From this perspective, education researchers have examined various solutions. Establishing e-learning and distance learning has been sighted as one possible solution towards serving the diverse needs of students. Thus, online distance education has moved from the periphery into mainstream HE (Allen and Seaman 2013).

It is important to focus on how the media reaches the target group and addresses the needs of the students. To design appropriate e-learning environments and to avoid failure and dropout, it is essential to give attention to learner characteristics and needs (e.g. their context, motivation, experience and prior knowledge). Therefore, learner and context analysis are the first fundamental steps in the instructional design process (Morrison *et al.* 2011). Another important aspect in instructional design is to understand media behaviour.

In most cases, studies proposed typologies of the ways young people are using the Internet outside formal educational settings (Eynon and Malmberg 2011). Of all the new media, the Internet was the most studied media, in particular in relation to online communities or networking sites. Based on a comparative meta-analysis of 22 media usage typologies published between 2000 and 2009, Brandtzaeg (2010) proposed a media user typology that consists of eight different user types, reflecting different types of media usage behaviour. Only a single study of 22 media usage typologies explored by Brandtzaeg (2010) dealt with Internet usage patterns of college students in the USA (Johnson and Kulpa 2007). The same lack of knowledge concerning media usage typologies can be identified for HE students in Germany. In a literature review of 13 media typologies, only two focussed on HE students (Zawacki-Richter *et al.* 2015; Schulmeister 2009). At this stage, it is not clear how students in HE use media, tools and web-based services for their learning and not just for entertainment.

Thus, this paper reports results of a study that investigated media usage patterns of students in HE in 2012 ($N = 2339$) and 2015 ($N = 1327$) in Germany. The aim of this study is to explore media usage patterns with a specific focus on NTS in HE. In this regard, the purpose of this paper is to address the following research questions:

- Which digital devices do students own or have access to?
- Which media and e-learning tools and services are used for learning and how often are they used?
- What are the differences between traditional and non-traditional students regarding the acceptance of media, tools and services for their learning and regarding their demand for online distance learning?
- What kind of different media usage types can be identified and how do these profiles relate to individual and contextual factors associated with the students?

In light of the above research questions and the dynamic development of the application of digital media in HE, a longitudinal analysis is carried out to investigate changes in media usage patterns between 2012 and 2015.

Literature review

Profiles of non-traditional students

There are various definitions of how this group of the so-called NTS can be described (see Stöter *et al.* 2014a). The term *non-traditional student* (Ely 1997, p. 1) has sparked a debate in the Anglo-American region, as well as in Germany (Schuetze and Wolter 2003).

According to Johnston *et al.* (n. y.), a NTS is defined as a mature learner with no previous HE qualifications. In this regard, the non-traditional learner is significantly older than other students undergoing HE. Based on case studies in 10 Organisation for Economic Cooperation and Development (OECD) countries, Schuetze and Slowey (2012) profile NTS under six subcategories of lifelong learners: *Second chance learners* pursue higher education out of passion and desire to acquire knowledge. They voluntarily engage in education as an ongoing process. *Deferrers* include students who do not get admitted to an institution of HE in their initial application due to low grades or lack of proper recommendation documents. *Recurrent learners* are students who repeatedly resume education after dropping out of the academic year due to lack of finances, low grades or work-related reasons. *Returns* are students who want to extend their university education. *Refreshers* are categorised as students who undertake short courses to improve their career prospects. Refresher courses are developed for students who have careers in disciplines such as nursing, teaching and information technology, and require constant updates on new career practices. *Learners in later life* are considered the sixth subcategory of lifelong students. Individuals who resume HE after retirement age, for reasons such as fun and new discoveries, are known as learners in later life (Schuetze and Slowey 2012).

Pituch and Lee (2006) outline a general profile of NTS: NTS enrol into HE through unconventional means. In most cases, NTS do not fulfil the required entrance qualifications for HE and they have a strong desire for studying part-time and distance learning.

The concept of NTS can be broadened in various ways. For example, first-generation academics, part-time students (Duong and Püttmann 2014), students from a migrant background or students from a lower socio-economic status parental home (Freitag 2012), or students with physical or mental impairments (Crosling, Thomas and Heagney 2008) can be defined as NTS.

An approach to combine the various definitions is established by Wolter (2011a;2011b). He outlines the following five characteristicly, nationally as well as internationally used criteria for NTS:

- (1) Age – NTS are older (reference date: 25 years)
- (2) Origin/Social discrimination – NTS come from underrepresented or socially disadvantaged groups (e.g. migrants)
- (3) Educational biography/Curriculum vitae – NTS have discontinuous educational biographies and decide to go studying later
- (4) University entrance qualification/Access – NTS do not have the conventional entrance qualification (in Germany: Abitur)
- (5) Form of study – NTS choose a study mode (e.g. part time, online) that corresponds to their life plan (e.g. occupation, child care)

In Germany, a definition of NTS by Teichler and Wolter (2004) has been established (Alheit, Rheinländer and Watermann 2008; Schuetze and Slowey 2002). According to this definition, three characteristics are viewed as central (Teichler and Wolter 2004): It concerns students,

- (1) who have not come to an HE institution on a straight path or in a dominating timely fashion (e.g. students who start their academic studies after an apprenticeship/job)
- (2) who do not fulfil the general entrance qualifications for HE institutions acquired in school (e.g. students without general qualification for university entrance) and/or
- (3) who do not study full-time and on campus (e.g. part-time students or distance education students).

Dealing with this target group always means a demarcation of *traditional students*, whose image has drastically changed since the 1950s, when in industrialised countries little more than 5% of an age group took up studies (Teichler and Wolter 2004) and studying was a privilege for a few, mainly young men from a prosperous parental home (Garz 2004). In the 1960s and the 1970s, education was acknowledged as the basis for wealth and the creation of value by society (Gould and Cross 1977). Until today the number of students in Germany has multiplied (Destatis 2018). Universities began to open their doors for non-traditional target groups, which entails a diversification of student profiles (both of TS and NTS) (Guri-Rosenblit and Gros 2011; Schuetze and Slowey 2002). In parallel with this process, social changes led to a differentiation of individual life plans, study programmes, access paths as well as variations of HE students (Alheit, Rheinländer and Watermann 2008). Overall, an increasing heterogeneity of the whole student body can be assumed: NTS differ among themselves and from TS in various specific ways, and some students can be classified as traditional in certain aspects and non-traditional in other aspects (Schuetze and Slowey 2002; Teichler and Wolter 2004). For some countries this is not a recent development. In the USA, for example, these changes have been observed since the 1970s (Gould and Cross 1977; Wedemeyer 1981).

More recent empirical studies have been trying to give an exact description of the group of NTS and a depiction of the changing terms of studying for 'regular students'. Based on 112 qualitative interviews, Alheit, Rheinländer and Watermann (2008) identified four different types of students: 'patchwork', 'promotion', 'career' and 'integration'. A project group with a focus on the compatibility of studying and working conducted a survey with 3687 students in order to find out to what degree they deviated from the 'model type' of a traditional student (Wilkesmann *et al.* 2012). The impact of increasing job commitments was in particular viewed critically and resulted in an impulse to extend the percentage of e-learning offers also in the field of undergraduate studies in order to provide a greater flexibility regarding time and space (*ibid.*, p. 74 ff.).

Typologies of students' media usage behaviour

Typologies classify individuals or objects based on their typical behaviour or other patterns (Barnes *et al.* 2007). According to Brandtzaeg (2010):

the term *user typology* is defined as a categorization of users into distinct user types that describe the various ways in which individuals use different media, reflecting a varying amount of activity/content preferences, frequency of use and variety of use. (p. 941)

A general overview on existing media usage types is given by Lee, Kim and Lee (2016). In a systematic review of 32 retrieved media usage typologies between 2010 and 2015, they identified 14 representative usage types: *inactives, advanced user, heavy user, hedonic user, sporadic user, onlooker, refusals, first stepper, communicator, utilitarian user, socialiser, the angel, the virtuosi* and *attention attractor* (see Table 1).

Brandtzaeg (2010) analysed eight types of users from 22 media usage typologies in a meta-study: *non-users, sporadic users, debaters, entertainment users, socialisers, lurkers, instrumental users* and *advanced users*. They can be described as follows: *Non-users* are the largest group of NTS who do not utilise any form of media for learning and prefer conventional methods of learning. The disinterest with media-based learning is promoted by a lack of Internet access. *Sporadic users* do not exhibit active behaviour in usage of media-based technologies. In most cases, they access the Internet to check on emails from friends or assignments from lecturers. In contrast, *debaters* are highly social and frequently engage in discussions with fellow students, using various asynchronous and synchronous communication tools. *Entertainment users* are focused on downloading music, videos and games, rather than using digital media for their learning. *Socialisers* also use the Internet as a platform to engage in recreational activities. *Lurkers* are considered the largest Internet user group, who use

Table 1. User types identified by Lee et al. (2016) (own presentation, taken from Lee et al. 2016, n.p.)

User types	Identified characteristics
Inactives	Those who do not use the service or quit the service
Advanced user	Those who use services frequently with the most varied usage pattern
Heavy user	Those who cannot imagine a life without the service
Hedonic user	Those who seeks fun and enjoyment by using the service
Sporadic users	Those who have less service access and fewer skills
Onlooker	Those who use the services and engage in several activities, but having small participation degree with low performance
Refusals	Those who have no perceived service needs and prefer to use old way
First stepper	Those who know the service is necessary for themselves and start using it, but are not used to control it yet
Communicator	Those who play a role as bridges among different communities, sharing information
Utilitarian User	Those who select and choose the service for utility with particular purpose
Socialiser	Those who mainly focus on communication and social behaviour
The Angels	Those who fond sharing advice, information and knowledge with high loyalty for services
The Virtuosi	Those who try to get used to all of the functions of services and use all of them until they master
Attention attractor	Those who enjoy showing their lives and thought to others and sharing their achievement

the Internet for recreational purposes and other activities. *Instrumental users* do not use the Internet and related media for entertainment and socialisation. They prefer using the Internet to access important information on goal-oriented activities such as business, services and education. *Advanced users* prefer using the Internet and digital media in various ways.

Eynon and Malmberg (2011) found that media usage typologies are mainly focused on free time usage (game consoles, TV, online shopping, etc.) and rarely examine their use for formal and informal learning processes, especially in the HE sector: 'Yet there is a need for more empirical research that provides a better understanding of the complex ways in which young people are using new technologies and what this may mean for teachers, librarians and parents' (p. 585).

However, further studies, which are descriptive in nature and do not aim at general media usage typologies in HE, still reveal interesting results. For example, a representative longitudinal study on the technology usage of undergraduate students in the USA has been conducted by the Educause Center for Applied Research (ECAR) since 2004. Students in the USA have very good access to digital media and devices. The study also sheds light on technology experience and the usage of mobile devices (smartphones, tablet computers, etc.) in the academic environment (Dahlstrom *et al.* 2015). The representative study ($N = 4400$) by Kleimann, Özkilic and Göcks (2008) is an exception, putting an emphasis on the usage of Web 2.0 applications in HE. Students use the Internet intensively for information and communication processes, and also for shopping and entertainment. Of the students, 23% actively use the Internet for 4–6 h per day. Social networks are frequently used and 34% stated that they use them to discuss academic matters. Thus, a great potential for active media usage in HE is attributed to the so-called Web 2.0 tools (Beldarrain 2006). It can be assumed that a consistently growing number of learners have experience and are skilled in using digital technologies when starting HE (Stöter *et al.* 2014).

Also, different studies have shown that HE students generally use a limited range of particularly established technologies (e.g. Margaryan, Littlejohn and Vojt 2011; Thompson 2013), need more help to understand the importance of technology (e.g. Margaryan, Littlejohn and Vojt 2011; Thompson 2013) and need increased scaffolding to be able to use technology effectively (e.g. Sumuer 2018; Thompson 2013). This differing results can also be discussed in light of the ongoing 'digital natives' (Prensky 2001) or 'net generation' (Tapscott 1997, 2009) discourse (Judd 2018). According to this discourse, the generation born approximately between 1980 and 2000 uses technology in a different more experienced way. However, there has been a lot of empirical evidence that refuted this (e.g. Bennett, Maton and Kervin 2008; Bullen, Morgan and Qayyum 2011; Helsper and Eynon 2010; Margaryan, Littlejohn and Vojt 2011), assuming that it is questionable 'to attribute a particular learning style or even general preferences to a whole generation' (Bennett, Maton and Kervin 2008, p. 780).

Overall, it has been shown that there is a range of research investigating HE students' use of technology for learning. However, media usage typologies as a way to categorise media users by their actual usage behaviour and not by individually prescribed predictors, such as gender, age/generation or context variables like experience, field of study and provided scaffolding, provide a valuable and necessary supplement to design media-supported teaching and learning.

Method

Sample and instrument

Between April and June 2015, 1327 students from German HE institutions participated in an online questionnaire concerning their media usage behaviour. A previous survey, which was conducted in the same period in 2012, was answered by 2339 German students ($N_{total} = 3666$). Both surveys used the same questionnaire. To collect the data, a mailing list of the project leaders and coordinators of the BMBF¹ programme ‘Offene Hochschulen’ [‘Open Universities’] (in 2012 and 2015) and of the project ‘eCompetence and Utilities for Learners and Teachers’ (eCULT) (in 2012) were used. The contact persons distributed the online questionnaire via the homepage and the learning management system (LMS) of the universities. Participation was voluntary and self-recruited.

The questionnaire was developed along the dimensions of Johnsson-Smaragdi (1994) and Bonfadelli’s (1993) model of media usage: (1) environment (media and learning environment), (2) socialisation (education and media relevant sociodemographic dimensions), (3) behaviour (media usage and learning behaviour) and (4) personality (education and media relevant dispositions). To take the dynamic development of digital media and educational technology into account, two (new) media, tools and services (etherpads and MOOCs) were added in 2015. In total, 51 ($N_{2012} = 49$) media, tools and services were classified according to the media typology of Grosch and Gidion (2011) as printed and digital text media ($N = 2$), general web tools and services ($N_{2015} = 22$, $N_{2012} = 21$) (e.g. search engines, email accounts, Skype, blogs and etherpads) and e-learning tools and services ($N_{2015} = 27$, $N_{2012} = 26$) (e.g. MOOCs, Internet-based learning platform, reference management software and lecture recordings).

In 2015, 62% of the students were females and 38% were males. There was no significant difference in the distribution of female and male participants in the surveys of 2012 and 2015 (χ^2 (df = 1; $N = 3586$) = 0.20; $p = 0.664$). The average age in 2015 was 27 years ($N = 1314$), with a standard deviation of 7.94. On average, the students of 2012 were younger (MV (mean value) = 25, $N = 2310$, $SD = 7$).

Out of the 1327 students who participated in the survey of 2015, 610 (47%) can be classified as NTS. Following the definition of Teichler and Wolter (2004), which is highly applicable to the German context (Zawacki-Richter *et al.* 2015; Brunner *et al.* 2015), NTS are

- enrolled in a distance education or online programme
- study part-time
- work more than 19 h a week during the semester or
- are more than 29 years old.

To be classified as an NTS, at least one of the stated criteria must apply to a person. With a view to the ‘digital natives’ or ‘net generation’ discourse, the students who were 29 years old in the 2012 and 2015 surveys are on the cusp of being considered ‘digital native’ by their birth year.

Compared to the 2012 study, the proportion of NTS in 2015 has increased (see Table 2). There is a significant difference between the proportion of students who can be classified as NTS in 2012 and 2015 (χ^2 (1, $N = 3506$) = 49.93; $p = 0.00$).

Table 2. Distribution after student type for the survey, 2012 and 2015.

Student type	Survey year		total
	2012	2015	
TS	64.7% ($N = 1436$)	52.6% ($N = 676$)	60.2% ($N = 2112$)
NTS	35.3% ($N = 784$)	47.4% ($N = 610$)	39.8% ($N = 1394$)
			$N = 3506$

On average, TS have studied five semesters ($SD = 3.21$) and NTS have studied six semesters ($SD = 4.5$) in the 2015 survey ($N_{2015} = 1303$). As expected, the amount of semesters studied is distributed more heterogeneously within the group of NTS. With 31 semesters, NTS have a higher maximum amount of semesters studied than TS who studied 18 semesters maximally. There exist significant differences in the distribution of the studied semesters of NTS and TS for both years: 2015 ($t(1076.9) = -217$, $p < 0.05$) and 2012 ($t(3466) = -735$, $p < 0.001$).

As in 2012, information regarding employment (hours worked per week on average during enrolment) shows statistically significant differences between NTS and TS in 2015 ($t(715.26) = -25.1$, $p < 0.001$). NTS work five times more hours than TS. Moreover, both surveys show a wide dispersion of the weekly employment of NTS. When interpreting these results, it is pertinent to remember that working at least 20 h a week is one criterion for being an NTS, meaning that TS can work a maximum of 19 h per week by definition.

Another criterion that distinguishes NTS from TS is that NTS have more often received a professional and/or HE qualification than TS. In 2015, 59.5% of TS and only 22.9% of NTS had no qualification. The data of 2012 show the same result (Zawacki-Richter *et al.* 2014). It can be assumed that this also has an impact on their media usage behaviour.

Limitations

From the variety of existing definitions and descriptions of the NTS, the application of this construct seems problematic. A precise definition is not possible, as some students can be classified as traditional in certain aspects and non-traditional in others.

Furthermore, the sample might not be perfectly randomised. Because the online questionnaire was distributed via the homepage and/or the LMS of the participating universities, students with technical experience and students who are enrolled in a distance education or online programme might be over-represented in the sample.

Results

Which digital devices do students own or have access to?

In 2012, as well as in 2015, more than 99% of the participating students had Internet access at home, which illustrates the full expansion of the Internet among students in HE.

Overall, students are very well equipped with digital devices. Both in 2012 ($MV = 4.87$; $SD = 1.42$) and 2015 ($MV = 5.07$; $SD = 1.56$), students owned five different digital devices² on average. In each case, one-third of the students owned six or

more different gadgets. Having a closer look at which digital devices are owned, the ranking of the proportional values shows no difference between TS and NTS. Above all, a strong increase in the possession of *smartphones with Internet connection* (56.2% in 2012, 90.6% in 2015) as well as a strong decrease in the possession of *mobile phones without Internet connection* (60.3% in 2012, 25.1% in 2015) can be identified. This finding indicates a shift towards more flexible ways of using mobile digital devices like smartphones, laptops and tablet PCs.

Which media and e-learning tools and services are used for learning and how often are they used?

In 2015, students spent significantly more time actively on the Internet than in 2012 ($t(2488.4) = -5.02, p = 0.000$). In the 2015 survey, students ($N_{2015} = 1288$) quoted that they were using the Internet actively for 4.2 h per day ($SD = 2.48$) on average. In the 2012 survey ($N_{2012} = 2259$), the average use of Internet by students was 3.8 h per day ($SD = 2.28$). With regard to student type, there is a significant difference in daily hours spent on the Internet in both survey years (2012 $t(2166) = 4.31, p = 0.000$; 2015 $t(1249) = 3.60, p = 0.000$). TS spend about half an hour longer online than NTS.

The proportion of students who participated in an online only course, as well as the proportion of students who participated in a blended learning course, increased from 2012 to 2015. In 2012, only 11% students attended an online course, whereas in 2015 they were 18%. The proportion of participants in a blended learning format increased from 14% to 23%. Students who have experience in online or blended learning courses can mostly be identified as NTS. Even if the number of students who participated in an online or blended learning course is rising, it is a small value compared to an international level. In 2015, a representative longitudinal study on the use of educational media by undergraduate students in the USA showed that 61% of the students had already participated in at least one online course. Over the past year, 49% of the students attended an online class (Dahlstrom *et al.* 2015).

Unexpectedly, the frequency of use of all three media types – text media, general web tools and services, and e-learning tools and services – decreased significantly from 2012 to 2015 (see Table 3).

The only service that was significantly used more often in 2015 than in 2012 was the use of a university email account ($t(2915.41) = -2.57, p = 0.010; MV_{2012} = 3.18, MV_{2015} = 3.32$). As expected, there is a difference between TS and NTS concerning their frequency of use of e-learning tools and services ($t_{2015}(1146.5) = -4.11, p = 0.000$) and their use of social networks ($t_{2015}(1279) = 4.96, p = 0.000$). NTS ($MV = 2.13$) use e-learning tools and services significantly more often than TS ($MV = 2.03$) and TS ($MV = 3.47$) use social networks significantly more often than NTS ($MV = 3.04$). These results apply to both the 2015 and 2012 surveys.

What are the differences between traditional and non-traditional students regarding the acceptance of media, tools and services for their learning and regarding their demand for online distance learning?

The acceptance is a statistical size that illustrates the frequency of use and the perceived usefulness of media. The values for the 51 (49 in 2012) media, tools and

Table 3. Frequency of use of media, tools and services in 2012 and 2015.

	Year	<i>N</i>	<i>MV</i>	<i>SD</i>	<i>T</i>	df	sig.
Text media	2012	2305	3.76	0.75	3.66	3620	0.00*
	2015	1317	3.66	0.73			
General web tools and services	2012	2029	2.25	0.46	8.38	3349	0.00*
	2015	1322	2.11	0.44			
e-Learning tools and services	2012	1866	2.24	0.48	9.94	3021	0.00*
	2015	1324	2.08	0.43			

* $p < 0.01$ (2-tailed).

services result from the averaged ratings of the frequency regarding the use of media in university (5=almost every day; 4=a few times a week; 3=between once a week and once a month; 2=less than once a month; 1=never) and the perceived usefulness of media for academic purposes (5=very useful; 1=not useful at all). Cases where 'I'm not familiar with that' or 'I don't know' were chosen were defined as missing values.

Search engines, computer terminals outside of the university, external email accounts and Internet-based learning platforms head the acceptance ranking in 2015 as well as in 2012. Social bookmarking, geo tagging and virtual worlds are unalterably irrelevant. Appreciable is the increase of acceptance for cloud computing (2012 $MV = 1.82$, rank 31 of 49; 2015 $MV = 2.82$, rank 21 of 51) and chat/instant messaging (2012 $MV = 2.77$, rank 20 of 49; 2015 $MV = 3.40$, rank 13 of 51). Another remarkable finding is the decrease of acceptance for lecture recordings. In 2012, they were ranked at place 12 (out of 49), and in 2015 they dropped to place 34 (out of 51).

The students were also asked about how important the use of digital teaching and learning approaches are to them (demand) in their relevant field of study (1 = not important at all; 5 = very important) and how often those approaches are deployed (supply) (1 = very often; 5 = not at all). In 2015, as well as in 2012, it stands out that the actual values are not as high as the values for the demand for digital learning formats. This gap between demand and supply indicates an expandability of digital teaching and learning formats at German universities. Overall, the gap decreases in the survey of 2015, but only the differences for 'materials accompanying courses' ($t(2673.21) = 2.03$, $p = 0.043$) and *online exams and exercises* ($t(2313.79) = 3.27$, $p = 0.001$) are significant. The largest demand concerns the provision of materials on a university platform (e.g. Blackboard or Moodle) throughout courses and is widely fulfilled ($\Delta MV_{2015} = 0.16$). The highest differences between desired values and actual values exist regarding *web-based trainings/courses on the intranet or Internet* ($\Delta MV_{2015} = 1.48$), *online exams and exercises* ($\Delta MV_{2015} = 1.23$) and *lectures as podcasts or vodcasts* ($\Delta MV_{2015} = 1.21$) (see Table 4).

In 2015 (see Table 5), as well as in 2012 (see Zawacki-Richter 2015), the expressed demand for digital teaching and learning approaches is significantly higher among NTS than among TS. Only the demand for the provision of *materials accompanying courses* does not show any significant differences. That NTS state a significant higher demand for digital teaching and learning is no surprise: Many of them have employment and family responsibilities and prefer to choose programmes that are flexible in terms of time and space.

Table 4. Desired and actual values for digital teaching and learning formats (2015 and ΔMV_{2012} for comparison).

Digital teaching and learning format	Demand			Supply			ΔMV 2015	ΔMV 2012
	<i>N</i>	<i>MV</i>	<i>SD</i>	<i>N</i>	<i>MV</i>	<i>SD</i>		
Materials accompanying courses	1266	4.63	0.75	1279	4.47	1.01	0.16	0.27
Interactive educational multimedia	1210	3.62	1.20	1192	2.54	1.30	1.09	1.15
Virtual seminars/tutorials with distance collaboration	1119	2.80	1.39	1177	1.67	1.04	1.13	1.21
Lectures as podcasts or vodcasts	1123	2.86	1.44	1174	1.65	1.04	1.21	1.28
Virtual internships and labs	947	2.26	1.30	1068	1.27	0.72	0.98	1.00
Online exams and exercises	1182	3.29	1.31	1188	2.05	1.19	1.23	1.41
wbts/courses on the intranet or Internet	1048	2.98	1.38	1103	1.50	0.93	1.48	1.55
e-Portfolios/learning logs on the intranet or Internet	961	2.51	1.36	1066	1.46	0.94	1.05	1.16

Table 5. Demand for digital teaching and learning formats, differences between TS and NTS (2015).

Digital teaching and learning format	Stud. type	<i>N</i>	<i>MV</i>	<i>SD</i>	<i>T</i>	df	sig.
Materials accompanying courses	TS	652	4.67	0.69	1.79	1142	0.07
	NTS	578	4.59	0.81			
Interactive educational multimedia	TS	605	3.45	1.21	-5.35	1173	0.00*
	NTS	570	3.82	1.15			
Virtual seminars/tutorials with distance collaboration	TS	550	2.45	1.27	-8.88	1067	0.00*
	NTS	537	3.17	1.41			
Lectures as podcasts or vodcasts	TS	567	2.67	1.42	-4.94	1087	0.00*
	NTS	522	3.09	1.43			
Virtual internships and labs	TS	470	2.01	1.17	-6.18	882	0.00*
	NTS	451	2.54	1.38			
Online exams and exercises	TS	592	3.09	1.29	-5.10	1146	0.00*
	NTS	556	3.49	1.30			
wbts/courses on the intranet or Internet	TS	506	2.71	1.34	-6.68	1017	0.00*
	NTS	513	3.27	1.37			
e-Portfolios/learning logs on the intranet or Internet	TS	472	2.37	1.31	-3.74	928	0.00*
	NTS	458	2.70	1.39			

* $p < 0.01$ (2-tailed). NTS, non-traditional students; TS, traditional students.

What kind of different media usage types can be identified and how do these profiles relate to individual and contextual factors associated with the students?

Based on the survey data of 2012, a typology of media usage patterns (Zawacki-Richter *et al.* 2015) was established by means of a latent class analysis (LCA) (Hagenaars and McCutcheon 2002). Four types of profiles of media usage patterns were identified: *entertainment users*, *peripheral users*, *advanced users* and *instrumental users*. Figure 1 shows the distribution of media usage types in 2012 and 2015. There is no significant difference in the distribution between 2012 and 2015 ($\chi^2 (3, N = 2516) = 5.66, p = 0.129$).

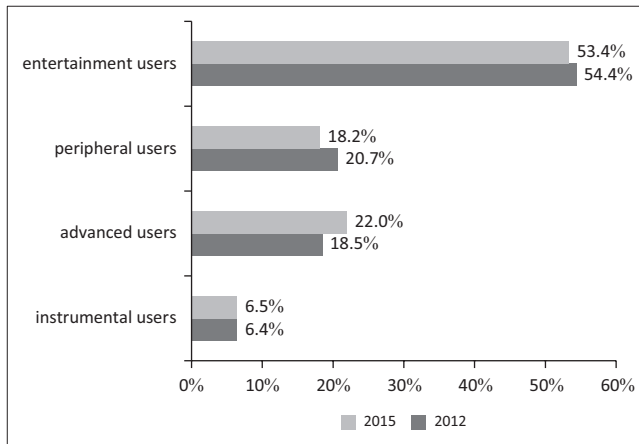


Figure 1. Distribution of media usage types in 2012 ($N = 1596$) and 2015 ($N = 920$).

With about 54%, *entertainment users* are the biggest cluster. A relatively high recreational use of media and the use of social networks for their studies are characteristics of this media usage type. Office software and e-learning tools are used rather below average. About 19% of the students can be assigned to the clusters *advanced users* and *peripheral users*. Compared to the other three clusters, *peripheral users* apply and accept media, tools and services for their learning the least. In contrast, *advanced users* apply media, tools and services the most, with an emphasis on the use of social networks and the recreational use of the Internet. With 6.4% or 6.5%, *instrumental users* are the smallest cluster. Most frequently they use office software and e-learning tools. Social networks and the recreational use of the Internet are less prevalent.

Table 6 presents the distribution of media usage types in terms of TS and NTS for 2012 and 2015. In both survey years, there are more NTS in the *instrumental users* cluster than TS. In the *peripherals* cluster, there are also more NTS than TS. TS are more likely to be *entertainment users*. The proportion of TS and NTS in the *advanced users* cluster changed from 2012 to 2015. In 2012, TS were more likely to be *advanced users*, whereas in 2015 more NTS are in the *advances users* cluster.

Using a univariate variance analysis we compared the age and the media usage types with each other. As in the previous survey (Zawacki-Richter *et al.* 2014), there were highly significant age differences between the four clusters ($F_{2015}(3, 909) = 23.12, p = 0.000; \eta^2 = 0.071$). A post hoc test (Games-Howell test) shows that both *entertainment* and *advanced users* differ significantly from *peripheral* and *instrumental users*. Compared to *peripheral* ($MV = 29$ years) and *instrumental users* ($MV = 31$ years), *entertainment users* ($MV = 25$ years) and *advanced users* ($MV = 26$ years) are significantly younger.

Conclusion and further research perspectives

The development of digital media is expanding rapidly in a very dynamic space. For this reason, the study of media usage of HE students from 2012 needed to be replicated, to identify new trends, especially with regard to the need for the use of

Table 6. Distribution of media usage types in 2012 and 2015 divided into traditional and non-traditional students ($N = 2429$).

Media usage type	Student type/year			
	TS		NTS	
	2012	2015	2012	2015
Entertainment users	59.4% ($N = 594$)	63.0% ($N = 301$)	44.8% ($N = 240$)	42.4% ($N = 176$)
Advanced users	19.3% ($N = 193$)	18.6% ($N = 89$)	16.4% ($N = 88$)	25.8% ($N = 107$)
Peripheral users	18.6% ($N = 186$)	15.7% ($N = 75$)	25.2% ($N = 135$)	21.0% ($N = 87$)
Instrumental users	2.7% ($N = 27$)	2.7% ($N = 13$)	13.6% ($N = 73$)	10.8% ($N = 45$)
	100% ($N = 1000$)	100% ($N = 478$)	100% ($N = 536$)	100% ($N = 415$)

media, tools and services within the framework of digital learning environments at universities, and to be able to consider this in the design of future learning environments/modules.

A clearly significant change is the direction towards the use of mobile devices. In 2012, only 56.2% of students reported that they owned a smartphone with Internet access, whereas in 2015 this had risen to 90.6%. The use of tablets (and iPads) also rose by 8.6% to 39.4%, and among NTS the proportion was 46.0%. Desktop computers were replaced due to the emergence of devices such as laptops, making them increasingly unnecessary.

It has been shown that the use and the perceived benefit of media, tools and services are relatively stable. Of particular note is the growing acceptance of instant messaging services, which is certainly in connection to the widespread use of WhatsApp³ on smartphones, and the increased use of cloud applications. Also interesting is the much lower acceptance of web lectures in comparison to 2012 (from rank 12 to rank 36).

Also noteworthy is the finding that the frequency of use of e-learning-specific media, tools and services from 2012 to 2015 was not higher, as might have been expected. These findings correspond to the current Digitalisation Index in Germany (Initiative D21 2016). In the Index, the factors *competence* (40%), *openness* (20%), *access* (30%) and *use* (10%) are measured on a scale from 0 to 100 points (ibid.). The result was that people with HE, for which we also count the students here, markedly decreased from 63 in 2015 to 55 in 2016. This particularly concerns the subscales *openness* (from 62 to 51) and *competence* (from 63 to 51). People with a HE are evidently more critical of new developments in digitalisation and ‘do not want to be at the forefront of all technology trends’ (ibid., p. 27, own translation). As an explanation, it is speculated that:

people who are more familiar with certain applications or programs, tend to overlook what is still possible and what they cannot do, thereby assessing their competencies more critically. The more self-critical assessment of competence clearly reflects the fact that the complexity of digitalisation has arrived in society. (ibid., p. 27, own translation)

Many people who are highly educated and active in a strongly networked society are increasingly wanting to be offline. Why this tendency is also observed among

students with regard to the use of media during their studies cannot be explained in this study and therefore should be the subject of further (qualitative) research.

With regard to the comparison of media usage between TS and NTS, the results of the 2012 survey are basically confirmed. TS and NTS are well supplied with digital devices. Overall, TS use the Internet about half an hour longer per day. In contrast to TS, who use social networks more often than NTS, NTS use e-learning tools and services more often and are more experienced with online and blended learning. Furthermore, NTS express a higher desire for e-learning, also when the gap between supply and demand slightly decreased. This result reflects the theoretical assumption that NTS and TS differ according to their life plan and that NTS use and need/value more flexible ways of studying like online- or blended-learning formats more often than TS. Moreover, NTS continue to be disproportionately over-represented in the group of *instrumental users* who tend to apply e-learning-specific media and tools. However, NTS have also grown considerably in the group of *advanced users* and are now more strongly represented. This shows that NTS are catching up in means of advanced use of digital tools and services. Here, too, further qualitative research is recommended in order to illustrate, validate and deepen the results of the quantitative analysis.

The aim of the present study was to capture and describe the transition of media usage patterns of German HE students from 2012 until 2015. To build upon the results of this quantitative study, a subsequent qualitative research project is recommended. According to Mayring (2001), a quantitative study with a big sample should be followed by a qualitative study in order to deepen and broaden the results. This further research can disclose influencing factors and explain patterns that might not have been considered thus far (Mayring 2001).

End notes

1. BMBF = Bundesministerium für Bildung und Forschung (Federal Ministry of Education and Research).
2. Queried devices: desktop PC, printer, scanner, notebook/laptop, netbook, tablet PC, ebook reader, smartphone with Internet connection, mobile phone without Internet connection, MP3 player.
3. An instant messaging service that is quite popular in Germany.

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