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Digitalization in Dental Teaching - Personality Affects Digital Learning Behavior

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Abstract

Purpose: The aim of the survey was to evaluate the digital learning behavior in oral surgery of students of dentistry in Germany and Austria. Correlations between psychological aspects such as personality (TIPI-G) with regard to the use of digital media were to be investigated.

Methods: A total of 101 students of dentistry in Ulm and Krems were interviewed. The students were in their 6th, 7th and 8th clinical semester of dentistry.

Results: Personality does affect digital learning behavior: Male students displayed a weak negative correlation between the Ten-Item Personality Inventory TIPI-G value "conscientiousness" and the general use of digital media (social networks, online diary). This correlation (r= -0.357) is significant (p=0.011). There is thus a correlation between an increased use of digital media and low values for conscientiousness amongst male students. In contrast, there was a significant (p=0.022), positive correlation (r=0.324) between the TIPI value "conscientiousness" and the "general use of digital media" amongst female students. Consequently, a high level of conscientiousness is related to the increased use of digital media amongst female students. If one considers the scale for the use of analogue teaching formats (books), there is a significant difference (p=0.004) between the two age groups ≤ 23 and >23. The age group of ≤ 23 use more analogue teaching formats than the >23-year-old students. In a direct comparison of the use of digital and analogue teaching formats, an overall increased use of analogue teaching formats can be identified for all students of dentistry who were questioned. It could be shown that the increased use of digital media leads to a more frequent use of digital teaching formats (Internet, apps) amongst all of the students. This positive correlation (r=0.418) was significant (p=0.001).

Conclusion: It could be shown that the use of digital media and digital teaching formats is affected by not only the age but also the personality traits (Big Five, TIPI-G) as well as the gender of the student. The integration of digital media in lectures on dentistry and the sensitization of students for this development have to be personalized to achieve their increased use.

Keywords: Dental education; Digitization in teaching; Gender aspects of digitization

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Introduction

The way digital media is used has changed drastically over the past 50 years. Whereas the focus of digital applications in 1975 was on computers, these were joined in 1985 by the Internet and the use of multimedia. The starting point for mobile communication and the "Generation Facebook" was 1995. Since 2005, the "touch-screen generation" has dominated our media actions and usage with the key medium of "Web 2.0" [1]. One consequence of this general digitization of our society is that the upcoming generation is acquainted with the use of digital media from an early age. In 2019, 99% of young people between the ages of 12 and 19 had a smart phone and 98% had a computer or laptop. Books were only used by 14% on a daily basis [1]. Young people nowadays also use less secondary literature and more generalized articles on the Internet for their research work. In a survey conducted by the Federal Agency for Civic Education in 2017, the young people who were interviewed said that the Internet was their preferred source of information for 8 out of 14 topics [2]. Because digital media are now embedded in the everyday life of young people, this also leads to a change in requirements with respect to teaching. According to Süss, Ross the use of the "social web" is influenced by the user's personality. For example, extroverted people use the "social web" more often [1,3]. A "conscientious" person, on the other hand, tends to not try out new media

[1]. "In everyday psychology, a person's personality is understood as meaning the sum total of all of their characteristics (dispositions and physical traits) that distinguish them from other people" [4,5]. Personality dimensions are recorded in the Ten-Item Personality Inventory (TIPI-G). These consist of the big five: extroverted, agreeable/warm, conscientious, emotionally stable (*vs.* neuroticism) and open to new experiences [6]. The objective of this present study amongst students in Germany and Austria was to evaluate the state of digitized teaching in the field of oral surgery. In addition, it also aimed to record the way digital teaching aids are used with regard to personality. In the 2019 summer semester, 101 students of dentistry (51 at the University of Ulm (Germany) and 50 at the University of Krems (Austria)) were asked to complete a questionnaire about their digital learning behavior.

Material and Methods

The lectures on gender dentistry at the Danube Private University (DPU) Krems, and on radiology as well as dentistry, oral medicine and orthodontics at the University of Ulm were chosen for the survey of 101 students. At the time of the survey, the students were in the clinical semesters of their education (DPU 6th semester, University of Ulm 7th and 8th semester). The average age of the students was 24. The students were interviewed during the lectures so as to achieve a high response rate (100%) to the questionnaires. Participation in the study was anonymised and took place as a "paper pencil" survey. The study was designed in accordance with international ethical standards for human surveys and verified by the ethics commission of the university (proposal 111/20, University of Ulm). The 15-page questionnaire was drawn up on the basis of an App about oral diseases. The questionnaire recorded the socio-demographic backgrounds (age, gender, nationality) for the use of digital, analogue teaching formats and digital media. The newly created scales on the use of digital teaching formats, analogue teaching formats and digital media will be described below. Correlations between the use of digital teaching formats and personality (TIPI-G) were also recorded. The Ten Item Personality Inventory (TIPI-G) questions the "Big-Five" personality characteristics: Extroverted, open to new experiences, conscientious, agreeable/warm, and emotionally stable. The TIPI-G consists of 10 items. There are 7 possible responses for each item ranging from 1 (strongly disagree) to 7 (strongly agree). Each personality dimension forms one scale. Two items each form one of the five personality dimensions of the Big-Five. These two items are then summarised in a scale and their average value calculated. The higher the value, the more extroverted, agreeable, conscientious, open and emotionally stable the respondent.

Scale for the use of digital teaching formats

This scale summarizes the questions B 3 "What do you consult if you are uncertain when diagnosing changes in the oral mucosa?" and B7 "Should the following learning aids be offered in addition to the app?" as well as F 4 "Do you use apps and similar digital offerings (e-books etc.) when learning?" Questions B 3 and B 7 each have two possible responses on the use of digital teaching formats. In question B 3, the students were able to evaluate the way they use the digital diagnostic aids "apps" and the "Internet". Question B 7 asked about the use of the digital aids "virtual classroom" (exchange with students in an online chat) and "online lectures". The possible responses to question F 4 "not a lot" and "sparsely" were coded with 1, the response "hardly" with 2, and the responses "a great deal" and "a lot" with 3 so as to create a common scale of responses. The scale for the use of digital teaching formats consists of 5 items. The sum totals of these items were created. The lowest value on the scale is 5 and means a low use of digital teaching formats. The highest value on the scale is 15 and means an increased use of digital teaching formats.

Use of analogue learning supports

This scale was created to verify the way in which students used analogue learning aids. Questions B 3 "What do you consult if you are uncertain when diagnosing changes in the oral mucosa?" and B7 "Should the following learning aids be offered in addition to the app?" were used. Questions B 3 and B 7 each have three possible responses on the use of analogue teaching formats. Question B 3 asked whether support was used during learning in the form of a book, fellow students or registrars. Question B 7 asked whether the students would prefer an "external tutor", "group work during the study time" or "group work with a peer (tutor) during the study time" as learning support. A scale with 6 items was created from these values from which the sum total was calculated. A lesser use of analogue learning supports was described by the value 6 and frequent use with the value 18.

General use of digital media

Questions F 5 "Do you use apps in daily life?" and F 7 "Do you use digital media and/or apps such as social networks, digital diaries etc. in your course of studies?" are summarised in the scale "general use of digital media". The scale consists of 13 items that are summarised in a sum total. The possible responses to question F 5 "not a lot" and "sparsely" were coded with 1, the response "hardly" with 2, and the responses "a great deal" and "a lot" with 3 so as to create a common scale of responses for questions F 5 and F 7. A value of 13 "no/hardly" indicates a very low use of digital media by the students. The value 39 "a lot/is used" indicates the frequent use of digital media.

The questionnaire consisted primarily of multiple-choice questions with a Likert scale. All of the students answered the same questionnaire. The responses were initially entered into an Excel table. The questionnaire was then evaluated by means of SPSS Statistik, Version 25. A descriptive, statistical evaluation is initially performed with a calculation of the absolute and relative frequency, average value and standard deviation. The significant differences for the nominally scaled variables were calculated with a contingency table and Pearson's chi-square test or a 2×2 table Fisher's exact test. The ordinal- and interval-scaled variables were calculated using the Man-Whitney U test. Relationships between variables were shown in correlation according to Spearman (not parametrically). The significance level was set at $p \leq 0.05$. Significant differences were categorized in the group's age and gender.

Results

We were able to evaluate a total of 101 questionnaires from students of dentistry in Ulm and Krems (response rate 100%). A total of n=51 were male and n=50 were female students of dentistry. Of these, n=29 male students were from the Private University Krems (Austria) and n=22 from the public German University of Ulm. The share of female students is higher at the University of Ulm (n=29) than at the Private University Krems (n=21). The students were classified into the age groups ≤ 23, representing the "Generation Facebook", and >23. Of the 101 students who were questioned, 62.4% (n=63) were from the group of ≤ 23-year-olds. 37.6% (n=38) of the students were in the age group >23. The standard values of the TIPI-G according to Gosling for "extroverted" women between the ages of 21 and 31 is n=46530; M=4.07. The standard value for male

Table 1: Amount of interviewed students. Classification according to gender and age.

	male	female	≤ 23-year-old	>23-year-old	total
Amount	51	50	63	38	101

For the survey of the students, the lectures Gender Medicine at the Danube Private University (DPU) Krems (n=50), the lecture Radiology at the University of Ulm (n=24) and the lecture ZMK at the University of Ulm (n=27) were chosen

Table 2: Gender-specific differences in the use of digital teaching formats compared to analog teaching formats and the use of digital media, (students were in their 7th, 8th semester at the University of Ulm and in their 6th semester at the University of Krems, 2019).

	m			f			s
	a	MW	SD	a	MW	SD	
digite[1]	50	10.94	1.95	50	11.38	1.76	ns
anate[2]	51	13.86	2.33	49	14.78	1.60	0.055
digite/anate[3]	50	0.98	0.27	49	0.93	0.15	ns
digimedia[4]	50	21.60	2.79	50	21.98	3.09	ns

m: male; digite: use of digital teaching formats; f: female; anate: use of analog teaching formats; a: amount; digite/anate: use of digital teaching formats divided by analog teaching formats; MW: Average; digimedia: use of digital media; SD: Standard Deviation; ns: not significant; s: significance (U-Test)
[1]digite: Scaled from 1 (little) to 15 (increased use of digital teaching formats).
[2]anate: Scale values are between 6 (little) and 18 (increased use of analog teaching formats).
[3]The cut-off value calculation of digital teaching formats compared to analog teaching formats (digite/anate) <1 indicates an increased use of analog teaching formats compared to digital teaching formats. The cut-off value > 1 means that students prefer digital teaching formats.
[4]digimedia: Smallest value is 13 (no/hardly), highest value 39 (a lot/is used).

Table 3: Differences in the use of digital teaching formats compared to analog teaching formats and the general use of digital media according to age (≤ 23 and > 23), (students were in their 7th, 8th semester at the University of Ulm and in their 6th semester at the University of Krems, 2019).

	≤ 23			>23			s
	a	MW	SD	a	MW	SD	
digite[1]	63	11.22	1.93	37	11.05	1.76	ns
anate[2]	63	14.71	1.90	37	13.62	2.13	0.004
digite/anate[3]	63	0.93	0.23	36	0.99	0.21	ns
digimedia[4]	63	22.05	3.18	38	21.37	2.48	ns

≤ 23: younger than 23; >23: older than 23; digite: use of digital teaching formats; anate: use of analog teaching formats; a: amount; digite/anate: use of digital teaching formats divided by analog teaching formats; MW: average; digimedia: use of digital media; SA: Standard Deviation; ns: not significant; s: significance (U-Test)

Table 4: Correlation between the use of digital learning formats and personality, in total and by gender, (students were in their 7th, 8th semester at the University of Ulm and in their 6th semester at the University of Krems, 2019).

	Use of digital teaching formats								
	Male			Female			Total		
	a	r	s	a	r	s	a	r	s
TIPI E	50	-0.138	ns	49	0.021	ns	99	-0.044	ns
TIPI V	50	-0.019	ns	50	0.266	ns	100	0.115	ns
TIPI G	50	-0.083	ns	50	0.322	0.023	100	0.120	ns
TIPI ES	50	-0.004	ns	50	0.047	ns	100	-0.34	ns
TIPI OE	50	-0.183	ns	50	0.113	ns	100	-0.36	ns

a: amount; TIPI E: TIPI Extroversion; r: correlation coefficient (Spearmans-Rho); TIPI V: TIPI Tolerance; s: significance; TIPI G: TIPI Conscientiousness; ns: not significant; TIPI ES: TIPI Emotional Stability; TIPI OE: TIPI Openness to New Experiences
TIPI-G: The Big Five personality traits: Extroversion, tolerance, conscientiousness, emotional stability and openness to new experiences of the TIPI-G from Muck et al. [8] used in this study, are higher the larger the values are. The average is calculated

extroverts is n=40737; M=3.73. In our gender-specific comparison of the TIPI G average values in Table 1, the values for "extroverts" of both genders are higher (female n=49; M=4.72; male n=51; M=4.46); compared to the TIPI-G standard values. Similarly, the average values on the TIPI scales for "agreeable" (female students =50; M=5.50, male students, n=51; M=5.31); were higher than the standard values for "agreeable": Female n=46530; M=4.88; male n=40737; M=4.5. In contrast, the students in our study showed lower average values for "open to new experiences" (female: n=50; M=5.45; male: n=51; M=5.32) compared to the standard values (female n=46530; M=5.55, male n=40737; M=5.49). The average values for "conscientious" were higher for both the female (n=50; M=5.74) and male (n=51; M=5.17) students than the standard values (female n=46530; M=4.78, male n=40737; M=4.57). The standard values for "emotionally stable" for women are n=46530 with M=4.09. The standard values for men are higher at n=40737; M=4.64. The "emotionally stable" values for the students in our study are higher than the standard values (female: n=50; M= 4.66; male: n=51; M=5.37). The "conscientious" value for female students in our study was significantly higher (p=0.01) than for male students (female: n=50; M=5.74; male: n=51; M=5.17). In contrast, the value for "emotionally stable" was significantly higher for male students (p=0.005) than for female students (female: n=50; M= 4.66; male: n=51; M=5.37). What is striking is the weak negative correlation (r= -0.183) for students between the TIPI-OE values

Table 5: Correlation between the use of digital media and personality, in total and by gender**,** (students were in their 7th, 8th semester at the University of Ulm and in their 6th semester at the University of Krems, 2019).

	Useof digital media								
	Male			Female			Total		
	a	r	s	a	r	s	a	r	s
TIPI E	50	0.013	ns	49	-0.041	ns	99	-0.012	ns
TIPI V	50	-0.055	ns	50	-0.052	ns	100	-0.050	ns
TIPI G	50	-0.357	0.011	50	0.324	0.022	100	-0.032	ns
TIPI ES	50	-0.097	ns	50	-0.148	ns	100	-0.150	ns
TIPI OE	50	0.081	ns	50	-0.058	ns	100	0.008	ns

n: amount; TIPI E: TIPI Extroversion; r: correlationcoefficient (Spearmans-Rho); TIPI V: TIPI tolerance; s: significance; TIPI G: TIPI conscientiousness; ns: not significant; TIPI ES: TIPI emotional stability; TIPI OE: TIPI openness to new experiences

and the "use of digital teaching formats" (Table 2). The TIPI value "conscientious" and the "use of digital teaching formats" show a weak positive correlation (r=0.322) with a significance (p=0.023) for female students. Male students displayed a weak negative correlation between the TIPI value "conscientiousness" and the general use of digital media (Table 3). This correlation (r= -0.357) is significant (p=0.011). In contrast, there was a significant (p=0.022), positive correlation (r=0.324) between the TIPI value "conscientiousness" and the "general use of digital media" amongst female students. Consequently, a high level of conscientiousness leads to the increased use of digital media amongst female students. A relationship between the general use of digital media and digital teaching formats could be determined for all students with a significant (p=0.001) positive correlation (r=0.418). The gender-specific difference (Table 4) in the use of digital and analogue teaching formats and the general use of digital media by students was analyzed. Furthermore, a direct comparison was made between the use of analogue and digital teaching materials. A gender-specific significant difference (p=0.055) could be identified in the use of analogue learning supports. It is thus evident that female students use analogue teaching formats more often than their male counterparts. If one considers the scale for the use of analogue teaching formats, there is a significant difference (p=0.004) between the two age groups (Table 5). The age group of ≤ 23 use more analogue teaching formats than the >23-year-old students.

Discussion

Our study identified a greater use of "analogue teaching formats" such as books or printed texts amongst the questioned students of dentistry. In contrast, the study by the Initiative D21 e.V. on the "Digital Gender Gap" indicated that more men (52%) than women (44%) expand their knowledge with the help of the Internet, in forums or through YouTube videos [7]. The 17th position paper of the university forum for digitization discovered that students do not use the entire spectrum of available digital media to compile an individual learning portfolio [6].

Our study is able to confirm this statement. Although both the female students who were questioned as well as the complete age group ≤ 23 use more digital teaching formats, the use of analogue teaching formats in both groups is significantly higher than the comparative groups (male, >23). It can thus be concluded that students of dentistry put together their own individual learning portfolio. However, preference tends to be given to analogue teaching formats. Further studies should investigate whether our results are also representative for students of human medicine. The increased use of analogue teaching formats by all of the students in our study indicates that this format is provided more often by the lecturers at the respective university. The 17th position paper of the university forum for digitization confirms this assumption. This also assumes that the majority of students are more results-driven with respect to their learning behavior. Students use the digital media that is needed to achieve the performance target and that is provided by the lecturers [8]. The "Learning with digital media from a student's point of view" study was able to show that male students in particular used interactive tools and formats a little more often [8]. Our study, on the other hand, indicates that the use of these interactive tools, summarised in the scale of digital media, is more widespread amongst female students. It is surprising that the result of our study shows that female students use more digital teaching formats than their male counterparts if they also use more analogue teaching formats. This allows us to conclude that the female students who were questioned invest more time on the whole to consolidate their knowledge with both analogue and digital teaching formats. The relationship between the TIPI value for "conscientious" and the use of "digital teaching formats" in our study corroborates this assumption. According to Süss, Ross et al., [1,3] the use of the "social web" is influenced by the personality. Our study confirms this result. The stronger the personality characteristic "conscientious" is amongst female students, the more they will use digital media and digital teaching formats. A particularly conscientious learning process on the part of female students thus includes the use of digital teaching formats and digital media. Unlike female students, male students with a higher value for the personality characteristic "conscientious" use fewer digital media. A lower use of digital media is therefore related to higher "conscientiousness" amongst male students. A more manifest personality characteristic "conscientious" according to TIPI-G amongst female students of dentistry apparently leads to an increased use of digital media in the learning behavior of these students. A comparable result was achieved in the study by Steiner-Hofbauer et al. [9]. This study was able to demonstrate a significantly higher effort for study-related activities of 42.6 hours a week among female students of human medicine compared to their fellow students (38.5 hours a week). The students under investigation were in their 3rd and 4th semesters. Interestingly, this study shows that there is more than just a gender-dependent component to the students' hard work. Changes in the learning commitment as the course of studies progressed were also observed. The effort invested by male students of human medicine in their 12th semester of 42.8 hours is higher than that of female students, namely 37.8 hours a week [9]. Extroverted or extrovert describes a person who likes to interact socially. Süss, Ross et al. showed that the "social web" tends to be used more by extroverted personalities [1,3]. Our study is able to confirm this hypothesis. Female students displayed slightly higher values on the TIPI scale for extroverted than their male counterparts in the descriptive statistics. "Extroverted" refers to a personality trait

that is characterized by interaction with one's social environment [1]. Female students also use more digital media. Zorn believes that because digital media are embedded in the daily life of young people, this has also led to a change in the digital requirements in teaching [10]. Our study was able to confirm this statement. Both male and female students use significantly more digital teaching formats (Internet, apps) if their basic "consumption" of digital media (online chats, social networks, e-books and online diaries) is higher. A more frequent use of digital teaching formats could also be shown for the student age groups ≤ 23 and >23 if these used more digital media in general. An increased use of digital teaching formats by students has also been proven whenever digital media are actively included in the teaching concepts and integrated as an obligatory part of the courses. Consequently, the use of digital teaching formats only works if more of them are actively integrated in lectures by the lecturers [8]. Our study is able to confirm this statement. The possibility of being able to actively design content in Web 2.0 could lead to an increased interest amongst students in digital teaching formats such as massive open online courses (MOOC's). All of the students use more digital teaching media if they use more digital media on the whole. The gender-specific differences between the average TIPI-G values for students in our study correspond to the standard values in literature [11]. What is striking is that the students who were questioned in our study displayed higher average values compared to the standard TIPI-G values for all of the personality characteristics except "open to new experiences". These deviations should be investigated further in a larger random sample of students of dentistry.

Limitations of the Study

This study involved only a small random sample of n=101 students; further studies should cover a larger sample of students of dentistry. Our study shows a cross-section of the 6th, 7th and 8th semester. It would be important to observe a cohort covering a longitudinal section so as to identify possible changes in behavior. In addition, this would allow a comparison of the respective periods of study.

Conclusion

It could be shown that the use of digital media and digital teaching formats is affected by not only the age but also the gender of the student. Personality characteristics such as increased conscientiousness lead to a greater use of digital teaching formats amongst females. Fewer digital media are used by more conscientious males. The use of different digital teaching formats is a process that depends on the user and the utilization. This is why the continuous digitization of teaching in dentistry has to take account of individual and age-dependent factors.

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