

Best of Germany: How Are Students' Digital Media Behaviour and Self-Efficacy Related to Academic Achievement?

Marina Isabel Pumptow

Taiga Brahm

Eberhard Karls Universität Tübingen

Germany

marina.pumptow@uni-tuebingen.de

taiga.brahm@uni-tuebingen.de

Abstract: Research suggests a link between students' social background, e.g. parents' educational back-ground, academic self-efficacy expectations and study behaviour. Often, lower academic achievement is expected of those students' whose parents are characterized by lower educational background. Although digital media are prevalent in several areas of everyday life, their relevance for academic achievement is not satisfactorily explored. Furthermore, it remains largely unknown in this context whether media usage is related to social background factors. In consequence, it is important to investigate if existing inequalities in higher education are stable, further enhanced or even reduced by means of "digitalisation". The present study aims at analysing the connection of individual, contextual as well as social background factors, with a special focus on academic and digital media self- efficacy expectations. Data was collected at four German universities in summer 2018 (n = 2039). Results give first insights into the relations and emphasizes the importance of further research on this topic.

Keywords: Academic achievement,digital media self-efficacy,digital media in higher education

1 Introduction and theoretical foundation

Although digital media are prevalent in several areas of everyday life, their role in academic settings and their relevance for academic achievement are not satisfactorily explored. Research concerning the link between students' self-efficacy expectations, motivation and academic attainment (e. g. Komarraju & Dial, 2014; Pajares & Schunk, 2001; Putwain, Sander, & Larkin, 2013; Zimmerman, 2000) identifies self-efficacy expectations as an important predictor for academic goal setting and achievement. In addition to this relation, academic achievement varies between different social groups, such as migrants, students with children or low socio-economic status (SES) (Röwert, Lah, Dahms, Berthold, & Stuckrad, 2017). In this regard, research suggests that students' SES may affect academic achievement via self-efficacy (Weiser & Riggio, 2010). Students stemming from lower socio-economic background show higher academic performance when indicating higher self-efficacy; however, usually such students are only equipped with lower self-efficacy expectations (Weiser & Riggio, 2010). Therefore, in addition to the skills needed to successfully master a course of studies, self-efficacy expectations and motivation might be important factors in the SES-achievement relation.

Surprisingly, whether media usage is related to social background factors remains largely unknown in this context. Previous work on digital media at universities is predominantly based on empirical studies that describe different types of media usage patterns. These studies show that students with different characteristics (e.g. age, family status or ambitions) show differing patterns of digital media use in academic settings (Grosch, 2012; Zawacki-Richter, 2015; Zawacki-Richter, Dolch, & Müskens, 2017). However, as these studies focus on such media usage patterns, the scales are naturally limited to the assessment of behaviour and use of digital media and applications. As a result, a more in-depth analysis of coherences with the observable media usage patterns has not been conducted yet. Furthermore, in addition to the digital media topic in these earlier studies, little is revealed about the study context and students' individual study behaviour and media-related attitudes. Factors such as underlying motivations or attitudes are not yet considered. Also, little is known about the relevance of digital media for mastering academic studies. In consequence, it is unknown if existing inequalities in higher education are stable, further enhanced or even reduced by means of "digitalisation". The present study therefore aims at analysing the relationship of university students' digital media behaviour and study performance in order to fill this gap and supplement current research in the subject area. Therefore, data was collected by using a recently developed survey instrument that allows addressing the multi-faceted character of academic studies and digital media behaviour (Pumptow & Brahm, under review).

Bandura's social cognitive theory (SCT) (e. g. 1977, 2012) offers a theoretical frame to analyse thoughts, motivation and behaviour and therefore appears to be well suited to the aim of the study at hand. One central aspect of the SCT are self-efficacy beliefs: One always has expectations regarding one's capabilities to successfully master given individual or study-related tasks and situations. Bandura (1986, p. 391) defines self-efficacy as "people's judgement of their capabilities to organize and execute courses of action required to attain designated types of performances". A person's self-efficacy belief affects several determinants of human behaviour such as goals, proclivities and perceived opportunities and may also serve as a predictor for motivation and actual behaviour (Bandura, 1995). The higher the self-efficacy belief, the higher the effort people will put into an activity, the longer they will persevere when confronted with obstacles (Pajares, 1996, p. 544). Thus, focusing on self-efficacy may be useful in terms of learning behaviour or in examining digital media use.

Since digital media are supposedly relevant in terms of a successful studying, i. e. obtaining good grades and a university degree, self-efficacy expectations regarding digital media use (DMSE) might also be relevant factors for academic achievement. Furthermore, in other research on academic achievement, evidence for the association with the following constructs were often found: previous academic performance (Talsma, Schüz, Schwarzer, & Norris, 2018); motivation and goal orientation (Hsieh, Sullivan, & Guerra, 2007) because of its relevance for interest and self-regulation and its dependence on self-efficacy (Honicke & Broadbent, 2016); emotions like anxiety (Hsieh, Sullivan, Sass, & Guerra, 2012); perceived control over actions and outcomes (Pekrun, 2006) and certain personality traits like conscientiousness, because of its link to self-discipline (Lievens, Ones, & Dilchert, 2009).

A sketch of the assumed relationships is shown in Figure 1. Next to these often found connections, we aim to explore the relevance of digital media and of the associated self-efficacy expectations for academic achievement (highlighted).

2 Data & Methods

In order to analyse the above mentioned relationships, data was collected by using a standardised online survey instrument that allows to capture self-efficacy expectations, attitudes and media use (Pumptow & Brahm, under review). The scales of the questionnaire are based on approved scales, taken from instruments in current research in the subject area. Attitudes towards the general academic context and studying are measured by partly adapting the questionnaires for the 'Assessment of Students' Attitudes towards Studying (ASAtS)' (Brahm & Jenert, 2015) and CHE-Quest (Leichsenring, 2011). Academic self-efficacy expectation are measured with the corresponding instrument by Jerusalem and Schwarzer (2002). Aim and frequency of students' media use and different attitudes

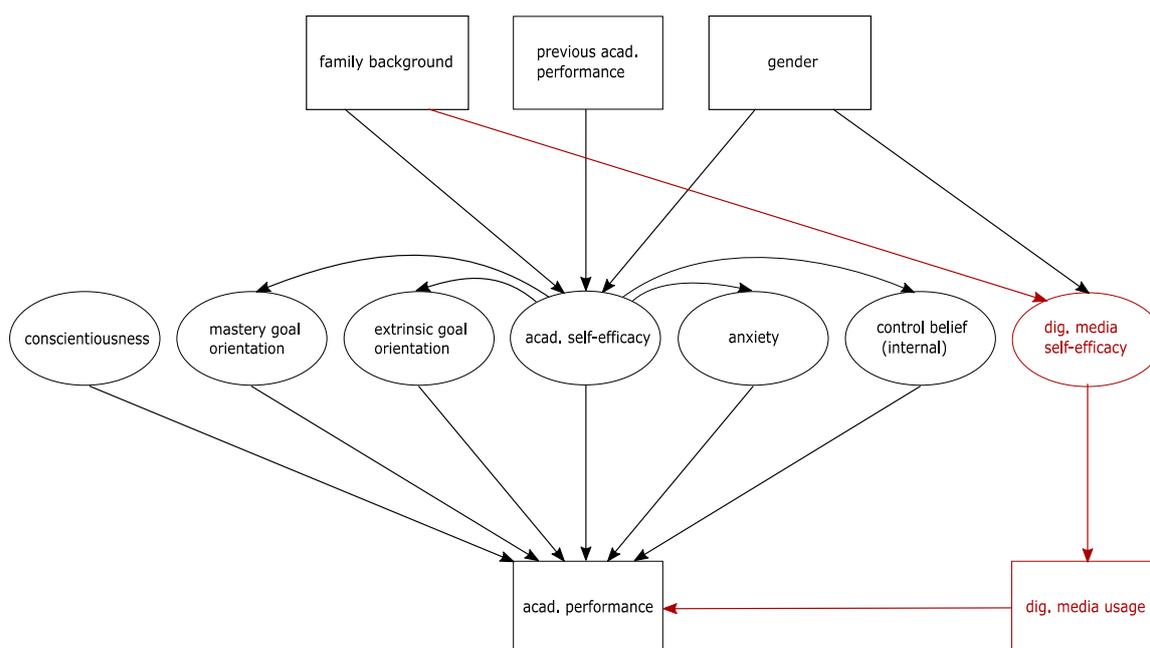


Figure 1: Path diagram of theoretically assumed relationship of constructs.

regarding those media are inquired according to approved instruments by Grosch and Gidion (2012) and Zawacki-Richter (2015). Additionally, based on the general self-efficacy scale by Schwarzer and Jerusalem (2010), a scale for self-efficacy in terms of digital media was newly constructed to capture students' media-related self-efficacy. Self-assessed competencies regarding digital media application are included as well. For the above-mentioned scales, the students were each presented with statements and were asked to indicate on a scale from 1 = "not at all" to 7 = "fully" to what extent these statements apply to them. For example, in the case of intrinsic motivation, such a statement was "I work and learn for my studies because I am interested in the learning content". In such cases, a test value was calculated for each person by determining the mean value of the items.

Constructs and scales for age, sex, educational qualification, nationality, partnership, occupational status and income will be oriented on a study conducted at a German university in 2014 (Lang & Hillmert, 2014). Parental characteristics (e. g. educational qualification) will be assessed as well. The data is used to classify the respondents' socio-economic status according the 'International Socio-Economic Index of Occupational Status (ISEI)' (Ganzeboom & Treiman, 2003).

Data collection took place at four German universities from May to July 2018. In total, 135,464 enrolled students were addressed and 3342 students participated in the online-survey of which 2039 cases remain after excluding cases due to missing values. The proportion of female participants in the sample is 59.6%, 39.6 % are male. The students' mean age is $M = 24.03$ ($SD = 4.01$, $min = 18$, $max = 59$). As expected, our sample is not representative for the German students' population in general since female students are slightly overrepresented

in our sample.¹ For this paper, regression analyses were conducted to analyse the data in terms of the above mentioned relationships.

3 Results

In our analyses, our aim was to explore the assumed relationships, especially concerning digital media usage, self-efficacy, motivation and study performance. Below, the descriptive results of these as well as of the regression analyses are given.

Digital devices are very common among students as nearly everyone owns a smartphone and a notebook. We found that in 2018 96% of our student sample owns a smartphone, 94% a laptop, and 45% a tablet. Still, these devices differ regarding the amount of usage on campus and also regarding applications. Accordingly, we found that smartphones are used very often on average ($M = 6.2$, on a scale from one to seven), laptops less often ($M = 4.1$) and tablets even lesser ($M = 3.6$). On campus, laptops are mainly used for visiting the university (e-learning) platforms and for writing tasks. Smartphones, on the other hand, are used very often for text messaging, social networks (in particular Whatsapp and Facebook) or internet search. Using social networks for study purposes (81%), students mostly exchange questions (77%), also regarding exams (82%), and send each other class and study materials (88%). For our analyses of the influence of digital media usage on study performance, we categorised the frequency of usage of different digital media applications into e-books, university platforms (e. g. homepage, e-learning portal, online library services), communication tools (e. g. facebook, WhatsApp), study related online tools (virtual lectures, literature databases, cooperation tools such as google docs), and general online tools (search engines, wikis, cloud services).

Regarding their self-efficacy, the students in our sample tend to trust their ability to deal with digital media applications ($M(DMSE) = 4,8$ ($SD = 1.14$)). This value is even slightly higher than their self-assessed ability to successfully deal with academic tasks ($M(ASE) = 4,6$ ($SD = 1.22$)). The two scales show a moderate correlation of $r = 0.34$, which indicates that although they are not completely independent, they are nevertheless clearly different dimensions of self-efficacy expectations.

The study distinguishes between two constructs of student motivation: Mastery goal orientation and the extrinsic goal orientation. The test values of mastery goal orientation and extrinsic goal orientation are moderately correlated with $r = 0.28$. Both are also moderately correlated with study performance, i. e. grade average ($r = -$

¹ The proportion of female students in Germany in 2017 was 48% compared to 60% in our sample (Statistisches Bundesamt, 2018).

0.28 for mastery goal orientation and $r = -0.32^2$ for extrinsic goal orientation). Students who enjoy studying also show higher mastery goal orientation ($r = 0.83$) and have a higher academic self-efficacy ($r = 0.39$). The mastery goal motivation is on average higher ($M = 5,3$) than the extrinsic goal orientation ($M = 4,6$), i.e. there is on average a somewhat higher interest in the contents of the course of study than purely in the performance.

The potential relations to students' performance were examined in a first model by means of linear regression. The independent variables ASE, DMSE, mastery goal orientation and extrinsic goal orientation, anxiety during studies, perceived participation opportunities in class, the personality trait conscientiousness and aggregated media use categorised as e-books, university platforms, communication tools, study related online tools, and general online tools, were considered. In Table 1, the results of the model estimation in several steps are presented. Model nine in the far right column shows the final model, with which 29% of the variation in the dependent variable study achievement can be explained.

All variables except mastery goal orientation, conscientiousness, university platforms and general online tools have a significant correlation with study achievement. ASE, extrinsic goal orientation, perceived opportunities for participation, and higher frequency of usage of e-books are negatively related to grades in studies. Importantly, this means that the higher the values of these variables, the lower the grade value, i.e. the better the grades are in the German grading system. It is noticeable that the variable 'mastery goal orientation' is no longer significant after the variable 'anxiety' is added, which becomes clear when comparing models six and seven. The use of communication tools and study related online tools as well as DMSE have a small, significantly positive effect on grades. This means that a higher frequency of use and a higher digital media self-efficacy result in higher, i.e. worse grades, on average.

Table 1: Results of regression analyses of students' achievement (grade average).

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>	<i>Model 6</i>	<i>Model 7</i>	<i>Model 8</i>	<i>Model 9</i>
	<i>B</i> (<i>SE</i>)								
Intercept	3.18*** (0.07)	2.25*** (0.08)	2.91*** (0.09)	3.17*** (0.10)	3.27*** (0.09)	3.41*** (0.10)	2.74*** (0.11)	2.76*** (0.14)	2.65*** (0.14)

² Negative correlation due to the German grading system with 1 being the highest performance and 6 indicating the worst performance.

ASE	-0.18*** (0.01)	-0.22*** (0.01)	-0.18*** (0.02)	-0.19*** (0.01)	-0.17*** (0.01)	-0.05*** (0.02)	-0.05*** (0.02)	-0.05** (0.02)	
DMSE	0.002 (0.01)	0.08*** (0.01)	0.08*** (0.01)	0.08*** (0.01)	0.08*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	
MGO			0.08*** (0.01)		-0.05*** (0.01)	-0.02. (0.01)	-0.02 (0.01)	-0.01 (0.01)	
EGO				-0.11*** (0.01)	-0.10*** (0.01)	-0.11*** (0.01)	-0.11*** (0.01)	-0.11*** (0.01)	
Anxiety						0.12*** (0.01)	0.12*** (0.01)	0.11*** (0.01)	
Particip.						-0.09*** (0.01)	-0.08*** (0.01)	-0.08*** (0.01)	
Conscien.							0.004 (0.02)	-0.01 (0.02)	
E-Books								-0.05*** (0.01)	
Online Uni								-0.003 (0.02)	
Comm. T.								0.04*** (0.01)	
OT study rel.								0.08*** (0.02)	
OT gen.								-0.03 (0.02)	
Female	-0.18*** (0.03)	-0.12*** (0.03)	-0.12*** (0.03)	-0.12*** (0.03)	-0.12*** (0.03)	-0.11*** (0.03)	-0.09** (0.03)	-0.09** (0.03)	-0.10*** (0.03)
R^2	0.11	0.001	0.13	0.14	0.18	0.18	0.27	0.27	0.29

ASE – academic self-efficacy; DMSE – digital media self-efficacy; MGO – mastery goal orientation; EGO – extrinsic goal orientation; *particip.* – participation in classes; *Conscien.* – conscientiousness; *E-Books* – frequency of usage e-books; *Online Uni* – freq. o. usage university platforms; *Commn. T.* – freq. o. usage communication tools (e. g. facebook); *OT study rel.* – freq. o. usage study related online tools; *OT gen.* – freq. o. usage general online tools.

Signif. codes: ***p < 0.001; **p < 0.01; * p < 0.05; ° p < 0.1.
n = 1699.

4 Discussion

In total, the initial multiple regression analyses of study performance on self-efficacy, motivation, digital media use and other relevant factors indicate that many expected relationships between the above mentioned scales may be found in our data. However, these initial results on the basis of regression analyses may be only of limited

relevance because, on the one hand, both academic achievement and media use could be modelled more appropriately. The media typology will be further elaborated, possibly on the basis of latent class analyses, in order to distinguish more appropriately between different patterns of student use. Also, a performance index with grades weighted according to the ECTS points achieved in relation to the number of ECTS points that should have been achieved in the respective semester according to the study plan is constructed. On the other hand, interrelationships between the independent variables may influence interpretability and validity. Additionally, mediator and moderator effects are also assumed theoretically and are difficult to show with these models. For further analyses, structural equation models appear more useful in order to adequately model the scales and the assumed correlations. Therefore, currently an overall model by means of multilevel-structural equation models is examined. In these models, it can be included that digital media use and evaluation most likely depend on the study subject and the university context.

5 Conclusion

The results show first insights into the relevance of certain types of digital media behaviour for academic success in higher education. First results of the in depth-analyses regarding the interaction of individual, contextual as well as social background factors and their influence on study performance, with a special focus on academic and digital media self-efficacy expectations, will be presented at the conference. It will be shown how digital media self-efficacy is linked to this observable media behaviour and to students' social backgrounds. In this regard, our research contributes to the important question of the relation between students' digital media use, their social background and their study success.

References

- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191–215.
- Bandura, A. (1986). *Social Foundations of Thought and Action. A Social Cognitive Theory*. Englewood Cliffs: Prentice Hall.
- Bandura, A. (1995). *Self-efficacy in changing societies*. Cambridge, New York: Cambridge University Press.
- Bandura, A. (2012). Social cognitive theory. *Handbook of Social Psychological Theories*, 2012, 349–373.

- Brahm, T., & Jenert, T. (2015). On the assessment of attitudes towards studying – Development and validation of a questionnaire. *Learning and Individual Differences*, 43(October 2015), 233–242. <https://doi.org/10.1016/j.lindif.2015.08.019>
- Ganzeboom, H. B. G., & Treiman, D. J. (2003). Three internationally standardised measures for comparative research on occupational status. In J. H. P. Hoffmeyer-Zlotnik & C. Wolf (Eds.), *Advances in Cross-National Comparison: A European Working Book for Demographic and Socio-Economic Variables* (pp. 159–193). Boston, MA, s.l.: Springer US.
- Grosch, M. (2012). *Mediennutzung im Studium: Eine empirische Untersuchung am Karlsruher Institut für Technologie*. Zugl.: Karlsruhe, Karlsruher Inst. für Technologie, Diss., 2011 u.d.T.: Grosch, Michael: Phänomene und Strukturen der Mediennutzung im Studium. Aachen: Shaker.
- Grosch, M., & Gidion, G. (2011). *Mediennutzungsgewohnheiten im Wandel: Ergebnisse einer Befragung zur studiumsbezogenen Mediennutzung*: KIT Scientific Publishing.
- Grosch, M., & Gidion, G. (2012). Media Use for Learning by Students in Higher Education An International Empirical Survey. In T. Bastiaens & G. Marks (Eds.), *Proceedings of E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2012* (pp. 1805–1812). Montréal, Quebec, Canada: Association for the Advancement of Computing in Education (AACE). Retrieved from <https://www.learntechlib.org/p/41869>
- Honicke, T., & Broadbent, J. (2016). The influence of academic self-efficacy on academic performance: A systematic review. *Educational Research Review*, 17, 63–84. <https://doi.org/10.1016/j.edurev.2015.11.002>
- Hsieh, P.-H., Sullivan, J. R., & Guerra, N. S. (2007). A Closer Look at College Students: Self-Efficacy and Goal Orientation. *Journal of Advanced Academics*, 18(3), 454–476. <https://doi.org/10.4219/jaa-2007-500>
- Hsieh, P.-H., Sullivan, J. R., Sass, D. A., & Guerra, N. S. (2012). Undergraduate Engineering Students' Beliefs, Coping Strategies, and Academic Performance: An Evaluation of Theoretical Models. *The Journal of Experimental Education*, 80(2), 196–218. <https://doi.org/10.1080/00220973.2011.596853>
- Jerusalem, M., & Schwarzer, R. (2002). Das Konzept der Selbstwirksamkeit. In M. Jerusalem & D. Hopf (Eds.), *Selbstwirksamkeit und Motivationsprozesse in Bildungsinstitutionen* (pp. 28–53). Weinheim: Beltz (Zeitschrift für Pädagogik, 33. Beiheft).

- Komaraju, M., & Dial, C. (2014). Academic identity, self-efficacy, and self-esteem predict self-determined motivation and goals. *Learning and Individual Differences*, 32(0), 1–8. <https://doi.org/10.1016/j.lindif.2014.02.004>
- Lang, V., & Hillmert, S. (2014). *CampusPanel User Handbook VI. 1: Documentation for the Student Panel of the ScienceCampus Tuebingen (wave 'a' Tübingen: Institut für Soziologie)*.
- Leichsenring, H. (2011). CHE-Quest-Ein Fragebogen zum Adationsprozess zwischen Studierenden und Hochschule-Entwicklung und Test des Fragebogens.
- Lievens, F., Ones, D. S., & Dilchert, S. (2009). Personality scale validities increase throughout medical school. *Journal of Applied Psychology*, 94(6), 1514.
- Pajares, F. (1996). *Self-Efficacy Beliefs in Academic Settings*. *Review of Educational Research*, 66 (4), 543-578.
- Pajares, F., & Schunk, D. (2001). The development of academic self-efficacy. *Development of Achievement Motivation*. United States, 7.
- Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review*, 18(4), 315–341.
- Putwain, D., Sander, P., & Larkin, D. (2013). Academic self-efficacy in study-related skills and behaviours: relations with learning-related emotions and academic success. *The British Journal of Educational Psychology*, 83(Pt 4), 633–650. <https://doi.org/10.1111/j.2044-8279.2012.02084.x>
- Röwert, R., Lah, W., Dahms, K., Berthold, C., & Stuckrad, T. von. (2017). Diversität und Studienerfolg: Studienrelevante Heterogenitätsmerkmale an Universitäten und Fachhochschulen und ihr Einfluss auf den Studienerfolg - eine quantitative Untersuchung. *CHE Centrum Für Hochschulentwicklung - Arbeitspapier*. (198). Retrieved from https://www.che.de/downloads/CHE_AP_198_Diversitaet_und_Studienerfolg.pdf
- Schwarzer, R., & Jerusalem, M. (2010). The general self-efficacy scale (GSE). *Anxiety, Stress, and Coping*, 12, 329–345.
- Talsma, K., Schüz, B., Schwarzer, R., & Norris, K. (2018). I believe, therefore I achieve (and vice versa): A meta-analytic cross-lagged panel analysis of self-efficacy and academic performance. *Learning and Individual Differences*, 61, 136–150. <https://doi.org/10.1016/j.lindif.2017.11.015>
- Weiser, D. A., & Riggio, H. R. (2010). Family background and academic achievement: Does self-efficacy mediate outcomes? *Social Psychology of Education*, 13(3), 367–383. <https://doi.org/10.1007/s11218-010-9115-1>

- Zawacki-Richter, O. (2015). Zur Mediennutzung im Studium – unter besonderer Berücksichtigung heterogener Studierender. *Zeitschrift Für Erziehungswissenschaft*, 18(3), 527–549. <https://doi.org/10.1007/s11618-015-0618-6>
- Zawacki-Richter, O., Dolch, C., & Müskens, W. (2017). Weniger ist mehr? Studentische Mediennutzung im Wandel. *Synergie Fachmagazin Für Digitalisierung in Der Lehre*. (3), 70–73.
- Zimmerman, B. J. (2000). Attaining Self-Regulation. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of Self-Regulation* (pp. 13–39). San Diego: Academic Press.