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Acceptance of Digital Technology Among Male and Female University Students: With a Focus on STEM Students

Angela Schorr[1,*], **Alexander Gorovoj**[2]

[1]Media Psychology Lab, University of Siegen, Siegen, Germany.
[2]Fraunhofer IAO, Stuttgart, Germany.

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***Corresponding author:** Angela Schorr, Media Psychology Lab, University of Siegen, Siegen, Germany.

Abstract

The acceptance of digital technologies is an important, cross-disciplinary indicator for the scientific and professional development of university students, especially STEM students. The study is based on Davis' Technology Acceptance Model and Ajzens' Theory of Planned Behavior. To find out whether and how both genders still differ in this area, students from three university faculties (education, economic sciences, natural sciences; N=428) were surveyed. The digital technology acceptance scale and scales recording the test subjects' personal media biography, digital skills, self-efficacy, performance goal orientations, control beliefs, and stress were applied. As a result, female and male students differ as far as digital technologies are concerned: In the total group, female students exhibit significantly lower values in digital technology acceptance, computer affinity and digital media self-efficacy. The separate analysis of STEM students yields encouraging results: In STEM, the profiles of both genders match in almost all points. Nevertheless, the regression models for predicting digital technology acceptance show that while the attitudes, skills and social support perceptions recorded naturally connect with male STEM students' digital technology acceptance, only the variable digital media self-efficacy predicts the criterion among female STEM students. For future research, it is recommended to focus the research field on measures to promote the sustainable development of study and career-related interests among female STEM students during their studies.

Keywords

Digital technology acceptance (TAM), gender, STEM, career development, performance goal orientations, locus of control

1. Introduction

The topic of digital technology acceptance is of particular importance for research on the academic success and career development of university students. Driven by the high pace of digitalization the understanding of technology is changing inside and outside of science. There is no science today that can afford to ignore the potential of digital technologies for scientific progress and sustainable university education. As a prerequisite for academic studies digital technology acceptance becomes a key indicator for students' successful processing of scientific content and procedures. This is especially true for the STEM fields. A high level of acceptance of digital technologies is required here. In the past, there was evidence of gendered access to the disadvantage of girls and women in terms of knowledge and experience with digital media/technologies (Leaper & Starr, 2019; Schorr, 2019). Research on the acceptance of digital technologies offers the opportunity to find out whether this situation is changing for the better and makes it possible to examine the role of gender in the various university disciplines (here: education, economics, STEM sciences) with an overarching, cross-disciplinary theme.

The purpose of this study is twofold: (1) To examine the acceptance of digital technologies among university students from three different faculties. (2) To examine a number of psychological variables that promote learning and performance, as well as selected ICT indicators, for their relevance to the acceptance of digital technologies and, more generally, to research the professional identity development of university students. A particular focus is on (female and male) STEM students.

2. Theory

2.1 Technology and Technology Acceptance

Before turning to the topic of digital technology acceptance, it is useful to briefly address the concept of technology itself. Standard definitions of technology often equate technology with applied science. Arthur (2009) presented a comprehensive analysis of the concept of technology in the monograph "The Nature of Technology": According to him, technology "is a means to fulfill a human purpose". As such, technologies must meet requirements such as utility, usability, and safety. To achieve some practical results, technology development may draw upon many fields of knowledge. According to Arthur, people place a lot of hope in technology but don't really trust it that "our unconscious makes a distinction between technology as enslaving our nature versus technology as extending our nature" (Arthur, 2009, p. 216). To summarize: technology is based on applied science, but can only develop its full potential if the user perspective is properly taken into account. This is especially true for digital technologies.

2.1.1 Davis' Technology Acceptance Model (TAM) and Subsequent Research

This study is based on Davis' (2015) Technology Acceptance Model (TAM). Today, there is a whole range of technology adoption models that are used in organizational change projects, digitalization research, as well as in consumer, health, and educational research. *However, none of these models has generated as much scientific research on digital technology acceptance as the TAM (TAM1-3), not even the UTAUT developed from it* (Granić & Marangunić, 2019; Lai, 2017; Rahimi et al., 2018; Rosli & Saleh, 2022; Shachak et al., 2019).

Davis' "motivational model" was heavily influenced by the Theory of Reasoned Action (TRA) and its successor, the Theory of Planned Behavior (TRB) (Ajzen, 2020, Davis; 2015). It was developed to improve the understanding of user acceptance processes when dealing with digital software and hardware. From the beginning, the TAM has been a *digital* technology acceptance model. Over the years, in which the model was expanded and revised (TAM1-TAM3), Davis successfully provided the developers and users of digital technologies with a scientific basis to evaluate their products prior to and/or during implementation[1]. In TAM1 the two key beliefs, *perceived usefulness* and *perceived ease of use* form the *attitude toward using* (TRA/TPB variable) which is followed by a behavioral reaction (TRA/TPB variable) i.e., the *actual use* of the technology. Later a growing number of so-called *"external variables"* supplemented the original model (e.g., subjective norm, facilitating conditions, voluntariness, perceived behavioral control, self-efficacy etc. (e.g., Venkatesh & Bala, 2008).

2.1.2 Discussions on methods and theory expansion

In Davis' first study on digital technology acceptance, the researchers had to rely on the test subjects' self-reported use of the software in the MIT data center (Davis, 2015). At the time, however, their declared goal was to objectively record the use of technology. In the years that followed, capturing objective user behavior often proved to be not only technically, but also practically difficult in their clients' companies. In order to test the model structure of the TAM and to compare the prediction accuracy of TRA and TAM, Davis and his team carried out several projects in which components of both models were to be examined for their usefulness in predicting technology acceptance. Thereby, a significant correlation between the TRA variables *behavioral intention to use* and *user behavior* was confirmed. It was therefore decided to include the TRA/TPB variable *behavioral intention to use* in the model (see Fig. 1).

[1]Companies in which Davis and his research teams carried out implementation studies include Alltel, AT&T, Bell Laboratories, Chevy Chase Bank, Chrysler, Citibank, Dillard's, Federal-Mogul, IBM, Ford Motor Company, J.B. Hunt, Johnson & Johnson, Marriot Lodging, Morgan Stanley, Sam's Club, Tyson Foods, Xerox, as well as departments of federal, state, and local government. The simplicity of the TAM allowed to measure the acceptability of new technologies in a "quick and dirty" manner (Shachak et al., 2019).

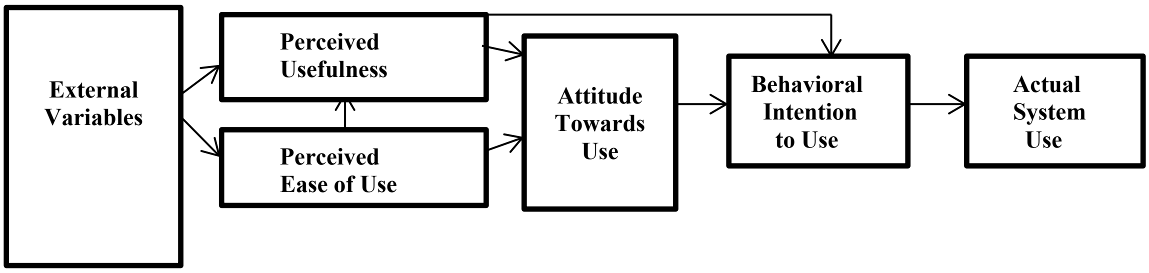

Figure 1. Technology Acceptance Model (TAM2).

Over time, *the behavioral intention to use* became the new criterion in TAM research. To this day, the standard procedure in research on digital technology acceptance is to rely on survey-based subjective information on user behavior. Occasionally the *use* or the *self-reported use* of the system is alternatively queried. Until today, this research approach has triggered controversy in the information science community (Ammenwerth, 2019; Lai, 2017; Opoku, 2020; Rahimi et al., 2018). Davis explained his decision to rely on subjective information about user behavior by pointing out that the user's subjective perception is more relevant to his/her decision whether or not to use the system (Davis, 2015). Also, using the same instruments (self-report scales) in different organizational contexts instead of relying on different operationalizations of objective user behavior facilitates the comparison of research results between different studies. Over the last three decades, the technology acceptance model formed the basis for a wealth of studies in information management research, consumer research, education research, and health research.

As for the *external variables* in TAM2/TAM3 studies, there was not only approval but also criticism of their rapidly growing number. The critics complained that the model's increased complexity did not result in significant improvements in the explanation of the acceptance and use process (Agudo-Peregrina et al., 2014; Park et al., 2022). This also applies to the successor model of the TAM3, the Unified Theory of Acceptance and Use of Technology (UTAUT), presented by Venkatesh et al. (2003). In both theories, the preference for structural equation models that were used for theory development played an important role (Granić & Marangunić, 2019). In combination with the fact that digital technology acceptance is defined by several core variables (perceived ease of use, perceived usefulness, attitude toward use, behavioral intention to use) this approach led to complex, less and less comparable models. The current models (TAM3, UTAUT 1 and 2) mostly realized within the framework of so-called "TAM++" versions still enjoy great popularity. But the majority of critics agree that versions of the original sparse technology acceptance model (TAM2) are much better suited for practical use.

For the purpose of this study, the Digital Technology Acceptance Scale (DTAS) is applied, a scale that has been previously tried and tested for its reliability and validity (Gorovoj & Schorr, 2020; Schorr, 2020). The scale's items have been widely used and validated in digital technology acceptance research. They represent the four key variables/dimensions of TAM2 (perceived usefulness, perceived ease of use, attitude towards use, behavioral intention to use), i.e., the core concept of acceptance of digital technologies is operationalized in this scale.

2.2 Emergent Adulthood, Identity Work, and Studying STEM Subjects

In emergent adulthood (18-29 years) the areas of gender and career goals are psychological hotspots of identity work (Arnett, 2007). Schwartz et al. (2013) describe the identity statuses of emerging adults as representing semi-permanent personality profiles that include a searching moratorium, meaning a phase of identity work where new potential identity commitments are considered (with or without discarding current commitments). As for their social life, university students may live independently from their parents or are still living with them. Whatever the case, in this phase of life parents still provide important emotional and instrumental support. University students' social life on campus is usually characterized by having more same-gender than cross-gender friends (Mehta & Wilson, 2020).

With regard to STEM studies, it is well documented, that female university students still experience little encouragement from their families to consider STEM subjects for study and work (e.g., Lloyd et al., 2018). In STEM subjects, particularly engineering and computer science, it is noticeable that female graduates enter the labor market significantly less often than male graduates, indicating a mismatch between education and occupation (Schwerter & Ilg, 2023; Lehman et al.,2017; Lehman et al., 2023). As university students make more same-gender friends, this means that where female students in STEM subjects are in the minority from the start, they are also more socially isolated in their field of study.

There is much evidence that male STEM students feel significantly more at home in STEM fields during their studies. The research results e.g. of Förtsch and Gärtig-Daugs (2020) indicate that it has been easier for male information science graduates to develop professional commitments to the field of study and thus to build self-confidence in their abilities. Female computer science graduates rated their skills lower but performed as well as men on exams. However, one finding about the male computer science graduates' identity work after graduation was surprising: they showed higher self-confidence, regardless of their grades or their knowledge at the time of graduation.

Current research on the formation of students' professional commitments in STEM disciplines, as in other university disciplines, continues to focus on capturing and strengthening attitudes toward future careers (e.g., Kelly et al., 2020). There is a dearth of research on interventions/measures to capture and strengthen motivation related to the field of study itself and its content.

3. Materials and Methods

3.1 Hypotheses on the Group Differences between Male and Female Test Subjects

Hypothesis 1 (H1). Students in the three faculties differ in terms of their digital technology acceptance. In the field of educational science, reservations about the use of digital media are traditionally more pronounced, so lower acceptance values can be expected (e.g., Rath & Delere, 2020; Basilotta-Gómez-Pablos et al., 2022).

Hypothesis 2 (H2). Male and female students still differ in terms of their ICT biography (including parental support, pre-university formal and informal digital media training, and self-assessed math competence). In comparison, the male subjects received ICT training earlier and more consistently (male role models), as well as more social support (Qasi et al., 2022; Schorr, 2019). This also applies to the group of STEM students.

Hypothesis 3 (H3). On the scales measuring the acceptance of digital technologies, digital media self-efficacy, and computer affinity, the female test subjects rate themselves lower than the male test subjects. This applies to the total group of students surveyed as well as to the STEM students.

Hypothesis 4 (H4). The two genders do not differ with regard to general learning and performance-enhancing psychological traits (self-efficacy, learning goal orientation, internal locus of control). This applies to the total group as well as to the STEM students.

Hypothesis 5 (H5). Male and female test subjects differ with regard to performance-inhibiting stress i.e., female students report higher stress levels (Graves et al., 2021). This also applies to STEM students.

3.2 Hypothesis for Predicting Digital Technology Acceptance

Hypothesis 6 (H6). The ICT competence variables, the psychological variables relevant to learning and performance, as well as the perceived parents' support, are suitable for predicting the test subjects' digital technology acceptance in the total group and the subgroup of STEM students based on regression analyses. By finding out what role the aforementioned variables play in predicting both genders' digital technology acceptance the results should provide further information if and why it is much easier for male STEM students to form a career-oriented, professional commitment to the chosen field of study, i.e., to feel settled and at home in it.

4. Present Study

4.1 Study Design: Test Subjects and Procedure

The collection of data was carried out based on questionnaires. The test subjects were approached on-site on the university campus. They were informed about the procedure and objectives of the survey; participation was voluntary and anonymous. The final sample consisted of N=428 test subjects; the STEM students form the youngest group of the sample. The three groups were made up as follows: education sciences students (N=181; M^{age}= 23;5; women 68,0%; men 32,0%), economic sciences students (N=130; M^{age}= 24;6; women 51,5%; men 48,5%), STEM students (natural sciences, engineering, computer & information science): N=117; M^{age}= 21;4; women 40,2%; men 59,8%).

4.2 Measures: Selection and Statistical Quality of the Scales

The following instruments were used in the present study: *(1) ICT acceptance and competence scales:* Digital Technology Acceptance Scale; Digital Media Self-efficacy Scale; Computer Affinity Scale. *(2) Psychological* *variables, relevant to learning and performance:* Generalized Self-efficacy Scale (learned trait), Learning Goal Orientation Scale, Performance Goal Orientation Scale; three Locus of Control Scales (standardized test), Perceived Stress Scale; *(3) Questions/Scales covering informal/formal digital media training and support:* Parents' Support Scale (i.e., the parental belief in the student's ICT talent); informal digital media trainers; IT Schoolteachers' Quality of Teaching Scale; Math Competence Scale; Questions on the test subjects' digital media use biography: First time: computer use, internet use, smartphone use. The scales which are presented below are listed in Table 2. All scales use a five-point response format (1 = strongly disagree, 5 = strongly agree). Exceptions are the Perceived Stress Scale with a four-point response format and the Locus of Control Test which has been standardized on a six-point response format (Krampen, 1980). Next follows a presentation of the instruments.

4.3 ICT Acceptance and Competence Variables (see Table 2, Section 1)

4.3.1 The Digital Technology Acceptance Scale

The Digital Technology Acceptance Scale (DTAS) consists of 13 items and has a four-factor structure. It is based on the dimensions confirmed to be relevant: *Perceived usefulness* (4 items), *perceived ease of use* (4 items), *attitude towards usage (3* items), and *behavioral intention to use (2 items)*. Since the point here is no longer to prove the TAM but to continue research on digital technology acceptance with a reliable and valid scale that can be adapted to different digital technology contexts, it was examined whether the scale is suitable as a one-dimensional instrument for measuring digital technology acceptance as a whole. The factor analysis confirms the four-factor structure of the DTAS but also allows to use as a one-dimensional instrument, since with the one-factor solution the explanation of the variance is already 42.5% and the internal consistency of the scale as a one-dimensional instrument is excellent (eigenvalue: 5.53; Cronbach's alpha is α=0.88).

4.3.2 The Digital Media Self-efficacy Scale

The issue of self-efficacy is considered by many TAM and UTAUT researchers when exploring the determinants of key beliefs. This cornerstone of Bandura's Social-Cognitive Learning Theory (1997) was included in TAM3 as (domain-specific) *computer* self-efficacy by Venkatesh and Bala, who defined it as the "degree to which an individual believes that he or she can perform a specific task/job using the computer" (Venkatesh & Bala, 2008, p. 279). The 4-item version of the scale used in the present study measures *digital media self-efficacy* and *internet self-efficacy* (Schorr, 2020); the scale's Cronbach's alpha is α=0.78.

4.3.3 The Computer Affinity Scale

To measure computer affinity there are longer scales (e.g., Heerwegh et al., 2016). The scale used in the present study consists of only two items, which is not necessarily a disadvantage if some rules are followed (Eisinga et al, 2013). The inter-item correlation is r=0.61, p<.001, the Cronbach's alpha reaches a value of α=0.76.

4.4 Psychological Variables Relevant to Learning and Performance (see Table 2, Section 2)

For the purpose of the study psychological variables relevant to learning and performance were selected that can be classified as *learned traits.* This means traits or trait-like variables that are shaped by situational factors.

4.4.1 The Generalized Self-efficacy Scale

There is an open discussion about whether self-efficacy beliefs should be classified as a trait variable or whether it is better to capture it as a domain-specific variable (Ajzen, 2020). Rammsayer and Weber argue that self-efficacy expectations "may generalize across different content domains and take the form of a general competency expectation; in this case, a person expects to be generally able to deal with difficult situations" (2010, p. 102). Following this, Jerusalem and Schwarzer developed the Generalized Self-efficacy Scale (GSE) to record self-efficacy expectations conceived as a learned trait (Jerusalem & Schwarzer, 2003). To test *Hypothesis 6*, the authors of this study decided to include scales to measure both variables, domain-specific digital media self-efficacy (see 4.3.2.) and generalized self-efficacy. The Generalized Self-efficacy Scale's Cronbach's alpha is α=0.82.

4.4.2 The Goal Orientation Scales

The Goal Orientation Scales are based on Dweck's Social-Cognitive Goal Orientation Theory (Dweck & Leggett, 1988). Goal-oriented actions to achieve desired states, especially in performance situations, are characterized by underlying goals. Dweck distinguishes between two classes of goals: *learning goals* and *performance goals*. Learning goals include goals in which an increase in one's competence is pursued through learning processes to understand and master new challenges. Performance goals, on the other hand, involve showing or hiding own competencies depending on whether a person seeks to receive positive feedback about them or to avoid negative feedback. When people pursue learning goals they orientate themselves towards individual reference norms i.e., feedback from outside – positive as well as negative – is considered as informative and relevant to learning. When people pursue performance goals they orientate themselves towards social reference norms: Negative feedback is perceived as threatening and avoided, and positive feedback is appreciated (Kleinbeck, 2010). Button et al. (1996) could prove that the two goal orientations form independent dimensions, which is why the person can pursue performance goals and learning goals at the same time. Often characterized as fairly stable personality traits, but can be influenced by situational factors (Orvis et al., 2009).

In research on decisions to engage in professional development and to put into practice what has been learned, it was found that the two goal orientations produce different results: While learning goal orientations had a performance-enhancing effect, performance goals according to a research review by Johnson and Beehr (2014) mostly generated "weak and mixed findings". TAM researchers found that goal orientations have a positive influence on acceptance behavior when using new digital technologies and that individuals with a strong learning goal orientation see learning new digital technologies as a challenge and continue to use them even when technical difficulties arise (Mun & Hwang, 2003; Al-Aulamie, 2013). In the present study, the Goal Orientation Scales in the version of Köller and Baumert (1998) were used. The *Performance Goal Orientation Scale* achieves a Cronbach's Alpha of α=0.79; the *Learning Goal Orientation Scale* achieves a Cronbach's Alpha of α=0.85.

4.4.3 The Locus of Control Scales

The construct locus of control as a trait-like variable goes back to Rotter's Social Learning Theory (Rotter, 1975) and is based on the idea that reinforcement has different effects on a person's behavior depending on whether the person perceives the reinforcement as a result of his or her behavior or not. Locus of control can be defined as "beliefs about whether one's actions enable the achievement of a goal or whether the achievement of the goal is influenced by external factors and is therefore beyond one's influence (internal versus external locus of control)" (Brinkmann, 2014, p. 438). Levenson (1981) expanded Rotter's theory and developed the three-dimensional scale that is widely used today. It consists of three dimensions: *Internal (I-Scale)*, *Powerful Others (P-Scale)*, and *Chance (C-Scale)*. An individual who scores high on the I-Scale scale perceives his or her own life primarily as the result of his or her actions. Conversely, when the P-Scale scores high, the person believes not to be responsible for the events in his or her own life, but that other more powerful people are in control. A high score on the C-Scale means that the person experiences the world as unstructured and disordered, and that fate, chance, or luck are responsible for certain behavioral consequences occurring.

People with a high internal locus of control are better learners. When coping with tasks and problems, they are more competent in the search for information and have a higher performance orientation compared to people with high external values. This goes along with better performance in various areas of life (Stemmler et al., 2016). In TAM research, Klebl (2014) was able to show that the internal locus of control of users has an impact on the perceived degree of technical difficulties when using a web conference system. In a study on the acceptance of e-learning systems, Hsia and colleagues (2014) found that the internal locus of control correlates with the TAM constructs of perceived usefulness and perceived ease of use. Both studies confirm the importance of high internality for good performance outcomes. Krampen's (1980) Locus of Control Test (IPC) measuring the three loci of control was used for the present study. He translated Levenson's scales into German and developed them into a standardized test so that further investigations into the reliability and validity of the scales could be dispensed with here.

4.4.4 The Perceived Stress Scale

Stress can be understood as a damaging environmental stimulus, as a reaction of the organism to stress, or as a transactional event (Schwarzer et al., 2014). Stress has a negative effect on memory performance especially when retrieving information (Kuhlmann et al., 2005). A representative study of undergraduate college students in the USA in 2019 showed that the top impediment to learning was stress (Frazier et al., 2019). Based on the Transactional Stress Model, Cohen and colleagues (1983) developed the Perceived Stress Scale (PSS). Surveying N=448 university students, Graves et al. (2021) reported that 4.4% of the test subjects indicated a mild perceived stress level, 82.3% of the test subjects indicated a moderate stress level, and 13.3% suffered from severe stress. Female students suffered more from severe stress than male students (21.6% compared to 7.1%). The scale's short version with 10 items by

Golden-Kreutz et al. (2004) was applied here, which is presently the most widely used stress scale worldwide. The scale achieved a Cronbach's Alpha of α=0.78.

5. Data Analyses and Results

5.1 General Procedure

First, the three groups of test subjects (three faculties) were tested for group differences i.e., between students of the three faculties and between male and female students on all scales (two-way analyses of variance; GROUP3 X SEX; N=428). In the second step, STEM student data (N=117) were analyzed separately for group differences using t-tests and Chi^2 tests. The scales that significantly correlated with the Digital Technology Acceptance Scale (criterion) subsequently served as predictors within the framework of multiple linear regression analyses to clarify which of them predicted the criterion (digital technology acceptance) with the highest explained variance.

For a better understanding of the results, the presentation begins with the results of the category 3 data on the test subjects' *pre-university digitalization experiences* (ICT use biography, parental support; see Table 2).

5.2 ICT Biography: Results on Pre-University Informal/Formal Digital Media Training, Support, and Use (see Table 2, Section 3)

The test subjects' pre-university experiences in dealing with digital technologies were recorded with the Parents' Support Scale, the test subjects' information on informal digital media trainers, the IT Schoolteachers' Quality of Teaching Scale, and the Math Competence Scale. Information on the test subjects' digital media use biography (first-time computer, internet, smartphone use) was also collected.

5.2.1 Parents' Support Scale Results (Talent in IS)

For a closer look at the family socialization process, the test subjects were asked if they believe that their parents are convinced of their computer competence and their suitability for an IT job. The Parents' Support Scale consisting of six items (Schorr, 2019) achieves a Cronbach's Alpha of α=0.75. The two-way analysis of variance for the total group of test subjects GROUP3 X Sex has a significant effect on the SEX factor only (M^{male}=21.55, M^{female}=20.07); $F(1, 420)=9.617$, $p<0.05$, i.e., the female students rate their parents' support statistically significant lower compared to their male peers. *There are no differences between the sexes for the STEM group (M=21.41) as confirmed by the t-test.*

5.2.2 Results of Informal and Formal pre-University Digital Media Training

As part of the test subjects' media biography, questions were asked about their informal and formal training in dealing with digital media/information technology. Regarding their informal training, they were asked: *"By whom did you learn the most about computers, the Internet and digital media?"* The Chi^2 test indicates statistically significant differences between female and male test subjects (Chi^2=12.51, df =3, p< .01; N=393) for the total group. The female students were introduced to the handling of computers primarily by their friends (53.5%, compared to 67.3% for the male students), their fathers (23.9%, compared to 19.8% for the male students), and their teachers (16.7%, compared to 12.3% for the male students). The mothers' contribution to informal learning of ICT skills is 5.9% among the female students and 0.6% among the male students. Informally, male and female students learned the most from their friends in terms of acquiring ICT skills. The contribution of teachers to the test subjects' digital media education (formal training) is small; female students benefited more.

Table 1. Informal learning environment family, STEM students only (*N*=108).

	Male	Female
Father	24.7%	25.5%
Mother	1.5%	**9.3%**
Friends	**60.0%**	**51.2%**
Teachers	13.8%	14.0%

In Table 1, the results of the Chi^2-test for the subgroup of *STEM students* are presented. *No statistically significant differences between the sexes could be found for this group.* Although parents as trainers also play a role among STEM students, it is worth noting that the mothers – the female students' primary role models in adolescence – were much less involved compared to the fathers in their daughters' informal ICT training. Overall, 34.8% of female STEM students state that their parents taught them the most ICT skills – compared to just 26.2% of the male STEM students who more often acquired these skills independently from friends. This applies to all STEM test subjects: the majority of them stated that they learned the most about ICT from their friends (see Table 2).

5.2.3 IT Schoolteachers' Quality of Teaching Scale Results

As for the quality of teaching of their former IT school teachers, a total of nine items were presented to the test subjects: Four negative and four positive statements. A critical statement on the ICT equipment of teachers was added. The scale achieved a Cronbach's Alpha of α=0.91. This scale was only completed by *N*=354 test subjects, another 74 test subjects had no IT courses during their schooldays! The proportion of test subjects without an IT course is distributed evenly across the three groups (faculties).

On average, the test subjects rated the IT competence and thus the teaching quality of their former IT teachers with *M*=23.64 with a mean value (highest score: 45 points; *the higher, the more critical!*). The two-way analysis of variance GROUP3 X Sex has a significant effect on the GROUP3 factor only (N=354, $M^{education}$ =23.85, $M^{economic\ sciences}$ =25.20, M^{STEM} =21.59; F (2, 348) =5.311, p<0.01. The most negative evaluation comes from the economic sciences students and the most positive evaluation from the STEM students. There are no differences between the sexes for the total group. *This also applies to the subgroup of STEM students, who do not differ (t-test) in the evaluation of their IT schoolteachers' teaching quality.*

5.2.4 Math Competence Scale Results

Two standard questions of STEM research on math competence were used, the test subjects' self-esteemed talent for mathematics and their perceived relevance of mathematics. The two items correlate with r= 0.69, p< 0.001 (N=427); Cronbach's Alpha has an acceptable value of α=0.81. The result shows that both the total group of test subjects and the subgroup of STEM students rate their math competence relatively high, i.e., on average they achieve values around 7 (out of 8) points (M=7.33, N=427). The two-way analysis of variance GROUP3 X Sex has a significant effect on the GROUP3 factor (N=427, $M^{education}$ =6.94, $M^{economic\ sciences}$ =7.29, M^{STEM} =7.97; F(2,421)=6.696, p<0.005. The STEM students, as expected, rate their math competence the highest. In the total group, there is also a significant difference on the SEX factor (M^{male} =7.66, M^{female} =7.06); F(1, 421)=4.351, p< 0.05, i.e., the female students rate their math competence statistically significant lower compared to their male peers. *However, this does not apply to the STEM students: Calculated separately (t-test), there is no significant difference between both genders (M=7.97).*

5.2.5 Digital Media Use Biography Results

All test subjects were asked about the age of their first computer use, first internet use, and first smartphone use. *There are no age differences between the sexes for all three technologies.* At *M*=9;3 years (9 years, 3 months), the test subjects first time used a computer, at the age of 11;0 they first time used the internet, and at the age of 11;5 the first used a smartphone. However, the two-way analysis of variance GROUP3 X Sex has a significant effect on the GROUP3 factor for internet use and smartphone use: In terms of internet use (N=405), it turned out that STEM students started using it one year earlier ($M^{education}$ =11;1 years, $M^{economic\ sciences}$ =11;3 years, M^{STEM} =10;4 years, F (2,399)=3.869, p = 0.05). As for the smartphone use, STEM students are also ahead in terms of starting age ($M^{education}$ =11.5 years, $M^{economic\ sciences}$ =12.0 years, M^{STEM} =11.1 years; F(2,399)=3.869, p<0.05).

5.3 Results on ICT Acceptance and Competence Variables (see Table 2, Section 1)

5.3.1 Digital Technology Acceptance Scale Results

The test subjects rated their digital technology acceptance with an average of *M*=49.45 out of a maximum of 65 points (*N*=426). For the total group of test subjects, the two-way analysis of variance GROUP3 X Sex has a significant effect on the GROUP factor ($M^{education}$ =48.12, $M^{economic\ sciences}$ =50.90, M^{STEM} =49.91; F (2, 426)=3.888, p <0.05, i.e., the economic sciences students rated their digital technology acceptance the highest, the education students the lowest. There is also a significant effect on the SEX factor (M^{male} =50.69, M^{female} =48.44); F (1, 420)=6.379, p <0.05), i.e., female students rated their digital technology acceptance statistically significant lower than their male peers.

Examining the group of STEM students (N=117) by using a t-test, both genders do not differ in terms of their digital technology acceptance (M=49.91).

5.3.2 Digital Media Self-efficacy Scale Results

The test subjects rated their digital media self-efficacy with an average of M=15.92 out of a maximum of 20 points (N=423). For the total group of test subjects, the two-way analysis of variance GROUP3 X Sex has a significant effect on the SEX factor only (M^{male} =17.12, M^{female} =14.94); F (1, 417)=45.307, p <0.001, i.e., female students rated their digital media self-efficacy statistically significant lower than their male peers. Examining the group of STEM students (N=114) by separately using a t-test, the scores also turned out to be statistically significantly lower for the female than for the male test subjects (M^{male} =17.09, M^{female} =14.96), t (114)=3.84, p <0.001.

5.3.3 Computer Affinity Scale Results

The test subjects rated their computer affinity with an average of M = 4.78 out of a maximum of 10 points (N=427). For the total group of test subjects, the two-way analysis of variance GROUP3 X Sex has a significant effect on the SEX factor only (M^{male} =5.49, M^{female} =4.20); F (1, 421)=36.702, p<0.001, i.e., the female students rated computer affinity statistically significantly lower than their male peers. Examining the group of STEM students (N = 117) by separately using a t-test, the scores also turned out to be statistically significantly lower for the female than for the male test subjects (M^{male} =5.71, M^{female} =4.06), t(115)=3.96, p<0.001.

5.4 Results on Psychological Variables Relevant to Learning and Performance (see Table 1, Section 2)

5.4.1 Generalized Self-efficacy Scale Results

The test subjects rated their generalized self-efficacy with an average of M = 30.18 out of a maximum of 40 points (N=417). For the total group of test subjects, the two-way analysis of variance GROUP3 X Sex has a significant effect on the SEX factor only (M^{male} =30.69, M^{female} =29.77); F(1, 411)=5.937, p<0.01, i.e., female students rated their generalized self-efficacy statistically significantly lower than their male peers. *Examining the group of STEM students (N=117) by using a t-test, both genders do not differ in terms of their generalized self-efficacy (M=30.29).*

5.4.2 Goal Orientation Scales Results (2 subscales)

The test subjects rated their *learning goal orientation* with an average of M=32.99 points (N=425) out of a maximum of 40 points. They rated their *performance goal orientation* at almost the same level with M=31.10 points (N=422) out of a maximum of 40 points. For both scales, the two-way analysis of variance GROUP3 X Sex shows no statistically significant group differences for either of the two factors. This also applies to the group of STEM students who were examined separately using a t-test for differences between the sexes: *The values on the Learning Goal Orientation Scale (N=116) as well as on the Performance Goal Orientation Scale show no statistically significant differences between the sexes.*

5.4.3 Locus of Control Scales Results (3 subscales)

Krampen's (1980) scales were used to determine the test subjects' *locus of control*. Because the scales are available as a standardized psychological test, the raw data for the three loci of control subscales were first analyzed using variance analysis and t-test for group differences. In the second step, the existing standardization was used to further interpret the data. In the case of the *Internality Subscale* (I-Subscale) and the *Chance Subscale* (C-Subscale), the two-way analysis of variance GROUP3 X Sex (total sample) did not result in statistically significant group differences for either of the two factors. In the case of the *Powerful Others Subscale* (P-Subscale), the two-way analysis of variance GROUP3 X Sex has a significant effect on the SEX factor for the total sample (M^{male} =26.58, M^{female} =24.43); F (1, 272)=11.631, p<0.005, i.e., the male students are statistically significant more convinced that more powerful people are in control of their life than the female students.

For the STEM students, the difference calculated on the basis of the raw values on the P-Subscale is also statistically significant with M^{male} =26.82 and M^{female} =24.17, t(107) = 2.85; p<0.001. Based on the test standardization, however, a clear difference between the sexes can be seen among the STEM students – and only in this group – on both dimensions of externality (P-Subscale, C-Subscale): *39.7% of male STEM students show an above-average or far above-average externality on the Powerful Others Subscale (P-Subscale)*. In contrast, only 17.1% of female STEM students have an above-average or far above-average externality on the P subscale, which means that only 17.1% of them are convinced that they are not (always) responsible for the events in their own lives, but that other more powerful people are in control of their lives. On the Chance Subscale (C-Subscale), based on the testing standards a second difference can be observed: *35.3% of male STEM students show an above-average or far above-average externality on the C-Subscale, i.e., they believe that fate, coincidence or luck are responsible for what happens in their lives*. Among the female STEM students, only 22.5% have an above-average or far above-average externality on the C-Subscale, i.e., only 22.5% of them share this belief. *Concerning the dimension of internality, which is important for academic success, the results for female and male STEM students do not differ.* A total of 26.6% of STEM students have above-average or far above-average internality, i.e., they see their own lives primarily as the result of their own actions. If one also includes the group of those STEM students who have an average level of internality, 75.1% of the STEM students surveyed have an internality that is conducive to performance.

5.4.4 Perceived Stress Scale Results

On the Perceived Stress Scale, the test subjects (N=420) reach an average value of M=21.92 points out of a possible 40 points. The two-way analysis of variance GROUP3 X Sex has a significant effect on the SEX factor for the total group of test subjects (M^{male} =21.51, M^{female} =22.25); $F(1, 414)= .182$, $p< 0.05$, i.e., the female students report statistically significant higher stress levels. *In the subgroup of STEM students, however, no gender difference can be found. In fact, female STEM students show the lowest stress level compared to female students in other subjects.* If one checks the stress level (3-stage, mild, moderate, severe stress) for the total group of test subjects using the standardization of the PSS in the total group of the sample – as an alternative to the variance analysis in which the results were compared purely arithmetically – the Chi^2 test confirms that there are no significant differences between male and female students (GROUP3): 0.7% of the test subjects signaled a mild stress level, 87.6% a moderate stress level, and 11.7% a severe stress level (N=420). In the case of the STEM students, the Chi^2 test result – no significant gender differences – also corresponds to that of the above-mentioned t-test: 0.9% of the test subjects signaled a mild stress level, 86.2% a moderate stress level, and 12.9% a severe stress level (N=116).

5.5 Summary of Results: Hypothesis confirmed (+), not confirmed (-)

First of all, the four hypotheses on group differences were mostly confirmed (see also Table 2).

Hypothesis 1: Hypothesis 1, that students from the three faculties differ in terms of their digital technology acceptance, is confirmed (+). The assumption that the educational sciences students have the lowest digital technology acceptance is also confirmed (+).

Hypothesis 2: With regard to their digital media training, in the total group of test subjects the female students state more frequently that they have benefited from their parents' informal digital media training (primarily from their fathers). They state more frequently that they have benefited from the formal training of the teachers. The male students more often state that they have learned ICT skills from male role models (father, friends; +). In relation to the age of first use of digital media, the STEM students are ahead (earliest smartphone and Internet use). *Here the two genders do not differ* (-). *Also, the STEM students indicate the highest math competence; the two STEM genders do not differ.* As far as the parents' support (talent in ICT) is concerned, the female students' values in the total group of test subjects are statistically significant lower (+). *Again, in STEM, the two genders do not differ in terms of their parents' beliefs in their ICT talents* (-).

Hypothesis 3: As expected, the female students of the total group indicate a statistically significant lower level of acceptance on the Digital Technology Acceptance Scale (+). *This is not the case for the subgroup of female STEM students!* (-) However, *Hypothesis 3* is confirmed as regards to the results for the Digital Media Self-efficacy Scale and the Computer Affinity Scale: The values of the total group of female students as well as the values of the female STEM students on both scales are statistically significant lower than those of the male students respectively the male STEM students(+).

Hypothesis 4: With regard to the psychological variables relevant to learning and performance, there are, as expected, no differences between the sexes for the two Goal Orientation Scales. *This also applies for the STEM subgroup* (+). Unexpectedly, however, the female students' (total group) self-ratings on the Generalized Self-efficacy Scale indicate a statistically significant lower level of generalized self-efficacy(-). *But this is not the case for the subgroup of female STEM students!*(+) On the performance-enhancing trait internal locus of control, measured by the Internal Locus of Control Subscale, *no differences between the sexes in the total group and in the STEM subgroup were found as expected* (+).

However, among male students in the total group and also in the STEM subgroup, there were statistically significant elevated scores on the Locus of Control Powerful Others Subscale and on the Locus of Control Chance Subscale.

In both groups, the male students achieve higher values on the Powerful Others Subscale i.e. they are significantly more convinced that other powerful people are in control of their lives than their female peers. *In the subgroup of male STEM students, the standardized values for the Chance Subscale are also significantly increased compared to those of female STEM students* i.e., more than the female STEM students they believe that also fate, coincidence, and luck are responsible for what happens in their lives.

The assumption in *Hypothesis 5* that the female students report statistically significant higher stress levels is confirmed for the total group (+). However, this does not apply to the subgroup of STEM students: *Male and female STEM students don't differ in their reported stress level. The female STEM students have the lowest stress levels of all female students in the present study* (-). For an overview of the results see Table 2.

Table 2. Results for the three groups of university students (education, economic sciences, STEM).

	Results N=428 ***VAs comparing three groups x sex***	***Results N=117*** ***t-tests comparing women and men in STEM fields***
1. ICT acceptance and competence variables		
Digital Technology Acceptance Scale (DTAS)	*women lower; education lowest, economic sciences highest*	*n.s.*
Digital Media Self-efficacy Scale	*women lower*	*women lower*
Computer Affinity Scale	*women lower*	*women lower*
2. Psychological variables relevant to learning and performance		
Generalized Self-efficacy Scale (GSE; learned trait)	*women lower*	*n.s.*
Learning Goal Orientation Scale	*n.s.*	*n.s.*
Performance Goal Orientation Scale	*n.s.*	*n.s.*
Locus of Control Scale (FPI, internal)	*n.s.*	*n.s.*
Locus of Control Scale (FPI, powerful others)	*men higher*	*men higher; standardized values men higher*
Locus of Control Scale (FPI, chance)	*n.s.*	*n.s.; standardized values men higher*
Perceived Stress Scale (PSS, general)	*women higher, STEM women lowest*	*n.s.*
3. ICT biography: Informal/formal digital media training, support, use		
Parents' Support Scale (talent in IS)	*women lower*	*n.s.*
Informal Digital Media Training (home)	*(see text)*	*(see text)*
IT Schoolteachers' Quality of Teaching Scale	*most negative rating: economic sciences; most positive rating: STEM*	*n.s.*
Math Competence	*Women lower, STEM highest*	*n.s.*
First-time computer use	*n.s.*	*n.s.*
First-time Internet use	*STEM earliest*	*n.s.*
First-time smartphone use	*STEM earliest*	*n.s.*

Note. All comparisons are statistically significant except for those marked by n.s. (i.e., not significant)

6. Results of the Multiple Linear Regression Analyses

6.1 Regression Results for the Total Group of Test Subjects (N=427)

The following scales were found to be statistically significant correlated with the criterion digital technology acceptance and therefore proved to be suitable as predictors to the criterion *(see Hypothesis 6)*: Digital Media Self-efficacy Scale, Generalized Self-efficacy Scale, Computer Affinity Scale, Learning Goal Orientation Scale, Performance Goal Orientation Scale; Locus of Control Scales (I-Subscale, P-Subscale, C-Subscale; standardized test), and Parents' Support Scale. The first group of regression analyses aimed to predict the digital technology acceptance for the total group of test subjects: Multiple linear regression analyses were calculated for the total group (N=428) and separately according to gender (see Tables 3 to 5).

Table 3. Multiple linear regression analysis to predict digital technology acceptance (criterion)
Results for the total sample (N=428)

Predictors	*r*	*B*	*SE B*	*β*	*t*	*p*
Digital media self-efficacy	0.43	0.54	0.11	**0.23**	4.91	0.0000
Self-efficacy (general)	0.23	0.26	0.09	**0.13**	2.78	0.0057
Learning goal orientation	0.27	0.19	0.08	**0.11**	2.52	0.0121
Performance goal orientation	0.19	0.22	0.07	**0.14**	3.31	0.0010
Computer affinity	0.36	0.87	0.15	**0.24**	5.71	0.0000
Parents' support	0.33	0.26	0.08	**0.14**	3.29	0.0011

Model Summary: R=0.56; $\mathbf{R^2=0.32}$; *adj.* R^2=0.31; $F(6, 421)=32.36$, $p< 0.001$

The R^2 for the overall model is R^2=.32, indicative of a high goodness-of-fit according to Cohen (1988). 32% of the variability of the criterion digital technology acceptance can be explained with these predictors. As expected, the predictors of digital media self-efficacy and computer affinity with high beta weights make the greatest contribution to explaining the variance. Both goal orientations and the (perceived) parental conviction that the test subjects are well versed in the field of information and communication technologies (ICT) and are gifted for it also play an important role.

To find out whether the predictors differ by gender, separate regression analyses were run for male and female students (see Table 4 and Table 5).

Table 4. Multiple linear regression analysis to predict digital technology acceptance (criterion)
Results for the total sample, male test subjects (N=191)

Predictors	*r*	*B*	*SE B*	*β*	*t*	*p*
Digital media self-efficacy	0.53	1.03	0.18	**0.35**	5.80	0.0000
Self-efficacy (general)	0.30	0.49	0.12	**0.23**	3.98	0.0001
Performance goal orientation	0.30	0.47	0.10	**0.27**	4.84	0.0000
Computer affinity	0.41	0.88	0.21	**0.25**	4.26	0.0000

Model Summary: R=0.66; $\mathbf{R^2=0.44}$; *adj.* R^2=0.43; $F(4, 186)=36.72$, $p< 0.001$

The R^2 for the overall model (male test subjects) is R^2=.44, indicative of a high goodness-of-fit according to Cohen (1988). 44% of the variability of the criterion digital technology acceptance can be explained with these predictors. Again, the variables of digital media self-efficacy and computer affinity make a major contribution to explaining the variance. Added to this is the generalized self-efficacy variable as a learned trait. The performance goal orientation also makes a significant contribution to explaining the variance.

Table 5. Multiple linear regression analysis to predict digital technology acceptance (criterion)
Results for the total sample, female test subjects (N=237)

Predictors	*r*	*B*	*SE B*	*β*	*t*	*p*
Digital media self-efficacy	0.30	0.50	0.13	**0.23**	3.70	0.0003
Computer affinity	0.23	0.81	0.24	**0.20**	3.40	0.0008
Parents' support	0.29	0.37	0.10	**0.22**	3.65	0.0003

Model Summary: R=0.42; $\mathbf{R^2=0.18}$; *adj.* R^2=0.17; $F(3, 233)=16.93$, $p< 0.001$

The R^2 for the overall model (female test subjects) is R^2=.18, indicative of a medium goodness-of-fit according to Cohen (1988). Only 18% of the variability of the criterion of *digital technology acceptance* can be explained with these predictors. All three variables have a comparable share in explaining the variance. The digital technology acceptance of the female test subjects can be clarified less well with the existing variables. In addition to the two ICT variables digital media self-efficacy and computer affinity, only the variable parents' support plays a role here, i.e., the perceived parental belief that the test subjects are well-versed in the field of information and communication technologies (ICT) and are gifted for it.

6.2 Regression Results for the Subgroup of STEM Students (N=117)

Multiple linear regression analyses were calculated for the group of STEM students as a whole and separately according to gender (see Tables 6 to 8).

Table 6. Multiple linear regression analysis to predict digital technology acceptance (criterion) Results for the STEM students (N=117)

Predictors	*r*	*B*	*SE B*	*β*	*t*	*p*
Digital media self-efficacy	0.58	1.11	0.20	**0.44**	5.67	0.0000
Performance goal orientation	0.29	0.43	0.12	**0.25**	3.65	0.0004
Internal locus of control	0.35	0.33	0.13	**0.18**	2.47	0.0151
Parents' support	0.38	0.31	0.13	**0.18**	2.34	0.0210

Model Summary: R=0.68; $\mathbf{R^2=0.46}$; *adj.* R^2=0.44; $F(4, 112)$=23.65, p< 0.0001

The digital technology acceptance for the total group of STEM students can be determined with four predictors with an R^2=0.46, indicative of a high goodness of fit of the model according to Cohen (1988), namely with digital media self-efficacy (β=0.44), performance goal orientation (β=0.25), and two other predictors contributing equally to the prediction of the criterion, namely parents' support (β=0.18) and internal locus of control (β=0.18). 46% of the variability of the criterion digital technology acceptance can be explained with these predictors.

Separate regression analyses were run for male and female STEM students to further clarify the central research question (RQ) of the study.

Table 7. Multiple linear regression analysis to predict digital technology acceptance (criterion) Results for the male STEM students (N=70)

Predictors	*r*	*B*	*SE B*	*β*	*t*	*p*
Digital media self-efficacy	0.63	1.29	0.26	**0.47**	4.91	0.0000
Performance goal orientation	0.36	0.49	0.15	**0.28**	3.31	0.0016
Parents' support	0.39	0.33	0.16	**0.18**	3.29	0.0432
Internal locus of control	0.36	0.35	0.16	**0.20**	1.14	0.0286

Model Summary: R=0.73; $\mathbf{R^2=0.54}$; *adj.* R^2=0.51; $F(4, 65)$ =18.99, p< 0.001

In the male STEM students' regression model, the R^2 is R^2=.54, indicative of a high goodness-of-fit according to Cohen (1988). 54% of the variability of the criterion digital technology acceptance can be explained with these predictors. Although all four independent variables made a significant contribution to predicting digital technology acceptance, according to the standardized beta coefficient the strongest unique contribution explaining the variance is made by the variable digital media self-efficacy. In second place is the performance goal orientation, followed by the variable internal locus of control, and the variable parents' support. Not surprisingly, the regression result for the sample of male STEM students is similar to that of the overall – male-dominated – sample of STEM students (see Table 4).

Table 8. Multiple linear regression analysis to predict digital technology acceptance (criterion) Results for the female STEM students (N=47)

Predictors	*r*	*B*	*SE B*	*β*	*t*	*p*
Digital media self-efficacy	0.42	1.03	0.33	**0.42**	3.13	0.0031

Model Summary: R=0.42; $\mathbf{R^2=0.18}$; *adj.* R^2= 0.16; $F(1, 45)$=9.80, p< 0.003

In the case of the female STEM students, the R^2 for the overall model turns out to be only R^2=.18, indicative for a medium goodness-of-fit according to Cohen (1988) respectively (only) 18% of explained variance of the criterion digital technology acceptance by this predictor. Despite significant correlations between criterion and predictors, only digital media self-efficacy makes a contribution – albeit a significant one – to explaining the variance in this model.

6.3 Summary of Regression Results

For the total group of test subjects, the two self-efficacy variables, the variables computer affinity, learning and performance goal orientation, and parents' support emerge as key predictors in the regression model to predict digital technology acceptance. However, the regression models separated by gender show that in the case of the male students in addition to computer & internet self-efficacy and computer affinity, the variables general self-efficacy and performance goal orientation lead to a very good prediction model for digital technology acceptance (44% explanation of variance). For the female students, their digital media self-efficacy, computer affinity, and the variable parents' support lead to a prediction model with only 18% explained variance in the criterion.

For the total group of STEM students, the predictors of digital media self-efficacy, performance goal orientation, internal locus of control, and parents' support led to a very good prediction model for digital technology acceptance (46% explained variance). Calculated separately according to gender, the identical predictors in the male STEM students produce an even better, very good explanation of the variance for 54%. In contrast, the variable digital media self-efficacy as the only predictor (with 18% explained variance; medium goodness-of-fit) in the regression model of the female STEM students – albeit based on a small sample – contributes to the prediction of digital technology acceptance.

Overall, the selected predictors prove to be suitable for predicting the digital technology acceptance of the test subjects, as the regression models of the total group of students and also the total subgroup of STEM students show. While for the male students in the total group and the subgroup of STEM students, an almost identical broad base of predictors leads to a good prediction, for the female students a prediction is made possible only based on digital media self-efficacy and skills indicators (in the total group) resp. based on digital media self-efficacy alone among female STEM students. Although they do not differ from their male peers on most of the ICT indicators and indicators relevant to learning and performance (e.g., general self-efficacy, internal locus of control, goal orientations, perceived parents' support), these dimensions do not contribute to the prediction of digital technology acceptance in their case. This result needs to be finally discussed with a view to the central research question (RQ).

7. Discussion and Outlook for Future Research

Acceptance of digital technologies is a research topic of professional education for university students. Of course, it is only one indicator of the multi-faceted issues that this research addresses. However, digital technology skills are key skills for successful graduation in all university disciplines, not only in STEM. This study has yielded some astonishing cross-curricular results: Male and female students differ less than assumed in terms of their ICT biography, their self-assessed digital skills, and variables relevant to learning and performance. Among STEM students, the youngest group in the sample, the profiles of both genders related to these variables even match in almost all points. Nevertheless, the research question **(RQ)** can only be answered in a fragmentary way.

The case study for the STEM students shows that – according to the regression model – while performance-enhancing attitudes and social support perceptions naturally connect with male STEM students' digital technology acceptance, only domain-specific self-efficacy predicts digital technology acceptance among female STEM students. With them, even the (high) performance and competence-enhancing variables recorded don't matter. For female STEM students, their predominantly equal digital technologies socialization in the family and school environment does not seem to continue at the university level. Despite the small number of gendered group differences discovered among STEM students, it can be concluded that we still know far too little about how discipline-specific career-oriented commitments in both genders develop. On a positive note, although women usually state higher stress levels, this does not apply to the female STEM students surveyed here. The two genders also do not differ in terms of their general self-efficacy. Concerning the female STEM students, it can be concluded that suspected higher stress levels and/or a lower general self-efficacy are definitely not their problem!

Nevertheless, it is much easier to deduce, as the results show, how male STEM students early on feel at home in the chosen STEM field as far as digital technologies are concerned. About them we even learn more in this study:

What is remarkable about the male STEM students is their willingness, signaled early on, to consider that they are not in full control of their lives, but that their lives could also be controlled by powerful others or by fate, chance, or luck (external loci of control). In this way, they give themselves more chances beyond what can be achieved through performance. It also might make it easier for them to find their way into hierarchies during university studies and later in professional life. The female STEM students – often a minority in their field of study – on the other hand primarily trust in their strength (general self-efficacy; internal locus of control) and as a result may orientate themselves less flexibly.

8. Conclusions

The gender gap across disciplines revealed here in terms of female test subjects' lower acceptance of digital technologies is concerning. Current research on career orientation and professional identity, which - like this study - is often a one-time measurement, falls short here (e.g., Leaper & Starr, 2019). The findings of this study should provide an impetus to intensify longitudinal research on the development of study-related career commitments among university students that incorporate this important topic.

Despite what we hope will continue to be a general increase in the similarity of both genders' profiles on ICT biographical, attitudinal, and performance indicators, we conclude that the focus of research for the group of female STEM students should additionally be on interventions that are likely to maintain female students' interest in STEM and allow them to develop a sustained, professional interest in their field of study. This is because the regression results found for female STEM subjects may be the vanguard of a trend that confirms the old finding that successfully reducing early causes of a problem (manifested here in the nearly identical profiles of female and male STEM students in ICT biographies and other indicators) does not automatically reduce later problems (e.g., low numbers of female students and graduates in STEM subjects, increased dropout intentions, lower entry into the workforce after graduation; see Lehman et al., 2023; Sax et al., 2017; Schwerter & Ilg, 2023). Promising interventions could be, for example, the creation of (scientifically and professionally progressive) new interdisciplinary degree programs. To this end, lighthouse projects already exist that combine STEM courses (especially in computer science and engineering) with application areas in other subjects (e.g., biomedical engineering, business informatics, digital medical technology, digital health care, computer science education, etc.). Such innovative "blended" degree programs, which combine research and application areas with information science solutions, can help to sustainably increase the number of women starting in these degree programs (Diekman et al., 2017).[2]

Limitations: This study has limitations that can be overcome in future research. Future studies may warrant a larger sample size to more fully illuminate the results and to allow more accurate hypotheses generation. This is especially true with regard to the small samples of female STEM students. Larger samples require projects that involve several universities (national and international).

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References

Agudo-Peregrina, Á. F., Hernández-García, Á., & Pascual-Miguel, F. J. (2014). Behavioral intention, use behavior and the acceptance of electronic learning systems: Differences between higher education and lifelong learning. *Computers in Human Behavior*, *34*, 301-314.

[2] At German universities, the proportion of female bachelor and master students in such courses increased to up to 70% (e.g., University of Munich; University of Siegen).

https://doi.org/10.1016/j.chb.2013.10.035.

Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies, 2*(4), 314-324. https://doi.org/10.1002/hbe2.195.

Al-Alaumie, A. (2013). Enhanced technology acceptance model to explain and predict learners' behavioral intentions in learning management. PhD thesis. University of Bedfordshire. http://hdl.handle.net/10547/323773.

Ammenwerth, E. (2019). Technology acceptance models in health informatics: TAM and UTAUT. *Studies in Health Technology & Informatics*, *263*, 64-71. https://doi.org/10.3233/shti190111.

Arnett, J.J. (2007). Emerging adulthood: What is it, and what is it good for? *Child Development Perspectives, 1*(2), 68-73. https://doi.org/10.1111/j.1750-8606.2007.00016.x.

Arthur, W. B. (2009). *The nature of technology: What it is and how it evolves*. New York, N.Y.: Simon & Schuster.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: W.H. Freeman.

Basilotta-Gómez-Pablos, V., Matarranz, M., Casado-Aranda, L. A., & Otto, A. (2022). Teachers' digital competencies in higher education: a systematic literature review. *International Journal of Educational Technology in Higher Education*, *19*(1), 1-16. https://doi.org/10.1186/s41239-021-00312-8.

Brinkmann, R. D. (2014). *Angewandte Gesundheitspsychologie*. Hallbergmoos: Pearson Verlag.

Button, S. B., Mathieu, J. E., & Zajac, D. M. (1996). Goal orientation in organizational research: A conceptual and empirical foundation. *Organizational Behavior and Human Decision Processes*, *67*(1), 26-48. https://doi.org/10.1006/obhd.1996.0063.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd Ed.). Hillsdale, N. J.: Lawrence Erlbaum Associates Publishers.

Cohen, S., Kamarck, T. & Mermelstein, R. (1983). A Global Measure of Perceived Stress. *Journal of Health and Social Behavior*, *24*(4), 385. https://doi.org/10.2307/2136404.

Davis, F. D. (2015). On the relationship between HCI and technology acceptance research. In *Human-Computer Interaction and Management Information Systems: Foundations* (pp. 409-415). New York: Routledge.

Diekman, A. B., Steinberg, M., Brown, E. R., Belanger, A. L., & Clark, E. K. (2017). A goal congruity model of role entry, engagement, and exit: Understanding communal goal processes in STEM gender gaps. *Personality and Social Psychology Review*, *21*(2), 142-175.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95*(2), 256-273. https://doi.org/10.1037/0033-295X.95.2.256.

Eisinga, R., Grotenhuis, M. T., & Pelzer, B. (2013). The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown? *International Journal of Public Health*, *58*(4), 637-642. https://doi.org/10.1007/s00038-012-0416-3.

Förtsch, S. M., & Gärtig-Daugs, A. (2020). Trust yourself: You have the IT-Factor! Career coaching for female computer scientists. *International Journal of Gender, Science and Technology*, *11*(3), 490-527. Retrieved from https://genderandset.open.ac.uk/index.php/genderandset/article/view/660.

Frazier, P., Gabriel, A., Merians, A., & Lust, K. (2019). Understanding stress as an impediment to academic performance. *Journal of American College Health*, *67*(6), 562-570. https://doi.org/10.1080/07448481.2018.1499649.

Golden-Kreutz, D. M., Browne, M. W., Frierson, G. M., & Andersen, B. L. (2004). Assessing stress in cancer patients: A second-order factor analysis model for the Perceived Stress Scale. *Assessment, 11*(3), 216-223. https://doi.org/10.1177/1073191104267398.

Gorovoj, A., & Schorr, A. (2020). Zur wahren Bedeutung von Einstellungs- und Persönlichkeitsfaktoren für die Akzeptanz Digitaler Medien (On the role of attitude and personality factors for the acceptance of digital media). Gesellschaft für Arbeitswissenschaft (Ed.). *Digitaler Wandel, Digitale Arbeit, Digitaler Mensch? Dokumentation des 66. Arbeitswissenschaftlichen Kongresses*, No.35, B.20.3, 1-6.

Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. *British Journal of Educational Technology*, *50*(5), 2572-2593. https://doi.org/10.1111/bjet.12864.

Graves, B. S., Hall, M. E., Dias-Karch, C., Haischer, M. H., & Apter, C. (2021). Gender differences in perceived stress and coping among college students. *PloS one*, *16*(8), e0255634. https://doi.org/10.1371/journal.pone.0255634.

Heerwegh, D., De Wit, K., & Verhoeven, J. C. (2016). Exploring the self-reported ICT skill levels of undergraduate science students. *Journal of Information Technology Education: Research, 14*, 19-47. https://doi.org/10.28945/2334.

Hsia, J.W., Chang, C.C., & Tseng, A.H. (2014). Effects of individuals' locus of control and computer self-efficacy on their e-learning acceptance in high-tech companies. *Behavior & Information Technology, 33*, 51-64. https://link.springer.com/article/10.1007/s12528-015-9103-8.

Jerusalem, M., & Schwarzer, R. (2003). SWE-Skala zur Allgemeinen Selbstwirksamkeitserwartung.psycharchives.org.

Johnson VA, Beehr TA. Making use of professional development: Employee interests and motivational goal orientations. *Journal of Vocational Behavior, 84*, 99-108. https://doi.org/10.1016/j.jvb.2013.12.003.

Kelly, R., Garr, O. M., Leahy, K., & Goos, M. (2020). An investigation of university students and professionals' professional STEM identity status. *Journal of Science Education and Technology*, *29*(4), 536-546. https://doi.org/10.1007/s10956-020-09834-8.

Klebl, M. (2014). Lernen mit Fehlern: Kontrollüberzeugungen bei Fehlfunktionen in kooperativen webbasierten Arbeitsumgebungen. Gesellschaft für Medien in der Wissenschaft, http://2014.gmw-online.de/wp-content/uploads/533.pdf.

Kleinbeck, U. (2010). Handlungsziele. In Heckhausen, H. (Ed.). *Motivation und Handeln* (pp. 285-307). Berlin: Springer Verlag. https://doi.org/10.1007/978-3-642-12693-2_11.

Köller, O., & Baumert, J. (1998). Ein deutsches Instrument zur Erfassung von Zielorientierungen bei Schülerinnen und Schülern. *Diagnostica, 44*(4), 173-181.

Krampen, G. (1980). IPC-Fragebogen zu Kontrollüberzeugungen. Göttingen: Hogrefe Verlag.

Kuhlmann, S., Piel, M., & Wolf, O. T. (2005). Impaired memory retrieval after psychosocial stress in healthy young men. *Journal of Neuroscience*, *25*(11), 2977-2982. https://doi.org/10.1523/JNEUROSCI.5139-04.2005.

Lai, P. C. (2017). The literature review of technology adoption models and theories for the novelty technology. *JISTEM-Journal of Information Systems and Technology Management*, *14*, 21-38. http://dx.doi.org/10.4301/S1807-17752017000100002.

Leaper, C., & Starr, C. R. (2019). Helping and hindering undergraduate women's STEM motivation: Experiences with STEM encouragement, STEM-related gender bias, and sexual harassment. *Psychology of Women Quarterly*, *43*(2), 165-183. https://doi.org/10.1177/0361684318806302.

Lehman, K. J., Sax, L.J., & Zimmerman, H.B. (2017). Women planning to major in computer science: who are they and what makes them unique? *Computer Science Education*, 26, 277-298. http://dx.doi.org/10.1080/08993408.2016.1271536.

Lehman, K. J., Newhouse, K. N., Sundar, S., & Sax, L. J. (2023). Nevertheless, they persisted: Factors that promote persistence for women and racially/ethnically minoritized students in undergraduate computing. *Computer Science Education*, *33*(2), 260-285. https://doi.org/10.1080/08993408.2022.2086401.

Levenson, H. (1981). Differentiating among internality, powerful others, and chance. *Research with the locus of control construct*, *1*, 15-63. https://doi.org/10.1016/B978-0-12-443201-7.50006-3.

Lloyd, A., Gore, J., Holmes, K., Smith, M., & Fray, L. (2018). Parental influences on those seeking a career in STEM: The primacy of gender. *International Journal of Gender, Science and Technology*, *10*(2), 308-328. Retrieved from https://genderandset.open.ac.uk/index.php/genderandset/article/view/510.

Mehta, C. M., & Wilson, J. (2020). Gender segregation and its correlates in established adulthood. *Sex Roles*, *83*(3), 240-253. https://doi.org/10.1007/s11199-019-01099-9.

Mun, Y. Y., & Hwang, Y. (2003). Predicting the use of web-based information systems: Self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human-Computer Studies*, *59*(4), 431-449. https://doi.org/10.1016/S1071-5819(03)00114-9.

Opoku, M. O., & Francis, E. K. (2019). Relevance of the technology acceptance model (TAM) in information management research: a review of selected empirical evidence. *Research Journal of Business and Management*, *7*(1), 34-44. http://dx.doi.org/10.17261/Pressacademia.2020.1186.

Orvis, K. A., Horn, D. B., & Belanich, J. (2009). An examination of the role individual differences play in videogame-based training. *Military Psychology*, *21*(4), 461-481. https://doi.org/10.1080/08995600903206412.

Park, I., Kim, D., Moon, J., Kim, S., Kang, Y., & Bae, S., (2022). Searching for New Technology Acceptance Model under Social Context: Analyzing the Determinants of Acceptance of Intelligent Information Technology in Digital Transformation and Implications for the Requisites of Digital Sustainability. *Sustainability*, *14*(1), 579. https://doi.org/10.3390/su14010579.

Rahimi, B., Nadri, H., Afshar, H. L., & Timpka, T. (2018). A systematic review of the technology acceptance model in health informatics. *Applied Clinical Informatics*, *9*(03), 604-634. https://doi.org/10.1055/s-0038-1668091.

Rammsayer, T., & Weber, H. (2010). Differentielle Psychologie - Persönlichkeitstheorien: Hogrefe Verlag.

Rath, M., & Delere, M. (2020). Media Skepticism as a Prejudice-Attitudes of German Prospective Teachers Towards Digital Media. In *INTED2020 Proceedings* (pp. 5851-5858). IATED. https://doi.org/10.21125/inted.2020.1582.

Rosli, M. S., & Saleh, N. S. (2022). Technology enhanced learning acceptance among university students during COVID-19: Integrating the full spectrum of Self-Determination Theory and self-efficacy into the Technology Acceptance Model. *Current Psychology*, 1-20. https://doi.org/10.1007/s12144-022-02996-1.

Rotter, J. B. (1975). Some problems and misconceptions related to the construct of internal versus external control of reinforcement. *Journal of Consulting and Clinical Psychology*, *43*(1), 55-66. https://doi.org/10.1037/h0076301.

Sax, L. J., Lehman, K. J., Jacobs, J. A., Kanny, M. A., Lim, G., Monje-Paulson, L., & Zimmerman, H. B. (2017). Anatomy of an enduring gender gap: The evolution of women's participation in computer science. *The Journal of Higher Education*, *88*(2), 258-293. https://doi.org/10.1080/00221546.2016.1257306.

Schorr, A. (2019). Pipped at the post: Knowledge gaps and expected low parental IT competence ratings affect young women's awakening interest in professional careers in information science. *Frontiers in Psychology*, *10*, 968. https://doi.org/10.3389/fpsyg.2019.00968.

Schorr, A. (2020). Skala zur Erfassung der Digitalen Technologieakzeptanz – Weiterentwicklung zum testtheoretisch geprüften Instrument Gesellschaft für Arbeitswissenschaft (Ed.) *Digitaler Wandel, Digitale Arbeit, Digitaler Mensch?* Dokumentation des 66. Arbeitswissenschaftlichen Kongresses, No. 35, B.20.5, pp. 1-6.

Stemmler, G., Hagemann, D., Amelang, M., & Spinath, F. (2016). *Differentielle Psychologie und Persönlichkeits forschung*. Stuttgart: Kohlhammer Verlag.

Schwartz, S. J., Zamboanga, B. L., Luyckx, K., Meca, A., & Ritchie, R. A. (2013). Identity development in emerging adulthood: Reviewing the field and looking forward. *Emerging Adulthood, 1*(2), 96-113. https://doi.org/10.1177/2167696813479781.

Schwarzer, R., Bowler, R. M., & Cone, J. E. (2014). Social integration buffers stress in New York police after the 9/11 terrorist attack. *Anxiety, Stress & Coping*, *27*(1), 18-26. https://doi.org/10.1080/10615806.2013.806652.

Schwerter, J., & Ilg, L. (2023). Gender differences in the labour market entry of STEM graduates. *European Journal of Higher Education*, 13(3), 308-326. https://doi.org/10.1080/21568235.2021.2010226.

Shachak, A., Kuziemsky, C., & Petersen, C. (2019). Beyond TAM and UTAUT: Future directions for HIT implementation research. *Journal of Biomedical Informatics*, *100*, 103315. https://doi.org/10.1016/j.jbi.2019.103315.

Venkatesh, V., Morris, M. G., Davis, G. B. & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, *27*(3), 425-478. https://doi.org/10.2307/30036540.

Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences*, *39*(2), 273-315. https://doi.org/10.1111/j.1540-5915.2008.00192.x.