The Paradox Evaluation of IT Stereotypes – A Post-hoc Analysis of Women’s Missing Interest in IT Study Programs

Abstract

Various stereotypes are attributed to education and work within the information technology (IT) domain. Although stereotypes do not necessarily establish bad examples, they tend to carry a negative connotation for the attractiveness of this domain. Furthermore, especially women are accredited to be easily influenced by stereotypes related to technical domains. Previous research admittedly addresses stereotypes being a motivational constraint for engaging with a career in IT, but does not reveal how they affect career interests. Therefore, the paper explores how stereotypes affect young women’s interest leading them to not consider an IT study program. Referring to social cognitive career theory, interviews with 23 female students were conducted in order to reveal the influence of IT stereotypes on the development of interest.

Keywords

Women in IT, stereotypes, IT studies, social cognitive career theory.

Introduction

‘IT students are geeks!’, ‘IT professionals are nerds and wear socks in sandals!’, ‘An IT study program requires excellent math skills!’ These statements represent common stereotypes that are attributed to education and work within the information technology (IT) domain. Although stereotypes do not necessarily establish a bad example (Judd and Park 1993; McGarty et al. 2002), they tend to carry a negative connotation for the attractiveness of this domain (Annabi and Lebovitz 2018). Furthermore, especially women are accredited to be easily influenced by stereotypes related to technical domains (Almquist 1974; Cadaret et al. 2017; Cheryan et al. 2011).

As the IT workforce is still dominated by men, women are identified as one target group that should be attracted pursuing a career within the IT field to counteract the skill shortage in this domain (Panko 2008; Wilson 2004). From a theoretical perspective, the reasons why women choose a career within the field of IT is discussed within research by now (Couger and O’Callaghan 1994; Panko 2008; Panteli 2012; Walstrom et al. 2008; Weinberger 2004). Thereby, it has been well recognized that it is difficult to attract and retain women in the field of IT. Whereas education represents an important access to the IT domain as education produces graduates well equipped to enter the IT workforce (Gorgone et al. 2003), only a small percentage of young women chooses an IT-related subject during academic education (Croatshedell et al. 2011; Quesenberry and Trauth 2012; Reid et al. 2010). Thus, a wide range of reasons exists that seem to prevent women from doing so. These also include stereotypes that prevent women from being motivated to engage with an IT study program or a career in the field of IT (Annabi and Lebovitz 2018; Butterfield and Crews 2012; Cadaret et al. 2017; Crotasdel et al. 2011; Rouibah 2012). Nevertheless, previous research states that it is essential to arouse the individuals’ interest so that their motivation increases to engage with career-
related issues. Interest and motivation are thereby two different, but linked factors insofar that just out of interest motivation is created (Deci and Ryan 1985). Consequently, the arousal of interest in an IT career represents a substantial factor that will be explored in this context.

Previous research admittedly addresses stereotypes being a motivational constraint for engaging with an IT career. However, the influence of stereotypes on the individual career interest is only barely considered, Therefore, the paper aims at exploring this in detail by proposing the following research question:

How do stereotypes affect young women's consideration of an IT study program?

To answer this research question, 23 female students from numerous universities in Germany, who decided against an IT study program, were interviewed. The paper further refers to Social Cognitive Career Theory (SCCT) as this theory explains the development of interest related to career issues. The structure of the paper is as follows: initially, basic knowledge about SCCT and stereotypes related to career choice is provided in the theoretical background. The applied methodology is explained in the next section and followed by the study results in section four. Furthermore, the results are discussed in section five and the paper concludes with a view on future research.

**Theoretical Background**

Upon answering the research question, how stereotypes affect women's interest to study an IT study program, an overview of essential and linked knowledge is provided first. As the arousal of interest within the career-related context underlies a defined process explained by SCCT, this theory serves as an appropriate theoretical foundation. In the following subsections, theoretical essentials about SCCT and additional information about stereotypes are revealed.

**Social cognitive career theory**

When students face the decision to choose a particular educational or occupational path, different factors influence this decision (Abele 2003). The underlying process is explained by SCCT, which refers to the social cognitive theory model of triadic reciprocity (Lent et al. 1994). This illustrates the interplay of behavior, personal factors, and environmental factors as co-determinants (Bandura 1986). Regarding SCCT, an individual’s choice of pursuing a certain education or occupation as resulting behavior represents the dependent variable, whereas personal and environmental influences operate as independent variables (Lent et al. 1994). In addition, prior research proves SCCT to be useful for examining IT major or career intentions of students (Akbulut and Looney 2007; Heinze and Hu 2009; Lent et al. 2008; Lent et al. 2011).

Whereas SCCT includes numerous sub-processes of career development and career-related topics (Lent et al. 1994), the research especially addresses the formation of career interests and the influence of stereotypes on these. Therefore, the focus lies on the one part of SCCT that draws on interest formation. In the context of IS, the development of interest in an IT study program represents a crucial driver with regard to the individual career decision (Downey et al. 2011). Therefore, we focus on the formation of interest, which is explained using the Major Choice Goals Model (MCGM). The model includes four factors: self-efficacy, outcome expectations, interest and choice goals (Akbulut and Looney 2007). Thereby, self-efficacy represents a student’s perception of the own capability to effectively pursue an IT study program. Outcome expectations refer to the student’s perception the likelihood that s/he will achieve valued rewards out of pursuing the study subject. Interest is described as an emotion of aroused attention and curiosity about the study subject, whereas choice goals represent the student’s aspirations to choose this study subject. Previous research in this context reveals that self-efficacy and outcome expectations positively affect interest, which positively affects choice goals in turn (Akbulut and Looney 2007).
MCGM declares that the more students feel capable of effectively pursuing an IT study program, and the more they expect to achieve their own defined rewards, the more they develop interest in this study subject (see Figure 1, Akbulut and Looney 2007).

As the study on hand explores the influence of stereotypes on career interest, relevant information about stereotypes in the context of career choice is provided in the following subsection.

**Stereotypes and career choice**

Stereotypes, as the central aspect of this research, represent a cognitive component developed from social psychology that reflects widely adopted perceptions about certain individuals, groups or behaviors. These perceptions are mostly illustrated in a metaphorical and memorable way, although they do not necessarily reflect reality. Withal, stereotypes reduce complexity and offer possibilities for identification (Judd and Park 1993; McGarty et al. 2002). Stereotypes further contain negative as well as positive evaluations and affect outcomes upon this evaluation (Czopp 2008; Fiske et al. 2002).

In the context of career choice, previous research early gives evidence that especially gender stereotypes represent an influence on career choice and intentions that should not be underestimated (Almquist 1974). Stereotypes in this domain developed as occupations are increasingly divided into female and male professions through the years (Eagly 1987). This arises out of the perception that certain occupations are related to specific characteristics and requirements, which are either feminine or masculine (Crawley et al. 2008). Thereby, especially women feel threatened by stereotypes that are attributed to male-dominated fields during education and work life (Guimond and Roussel 2001; Hippel et al. 2011). As a consequence, women react to these stereotypes by understating their own abilities, developing a lower self-esteem or putting own goals back, which affects career development in turn (Deemer et al. 2014; Guimond and Roussel 2001; Hippel et al. 2011).

The IT domain, which is definitely gendered by the dominance of men (Abele 2003; Baroudi and Igbaria 1994), is particularly related to stereotypes (Butterfield and Crews 2012; Cheryan et al. 2011; Michie and Nelson 2006; Rouibah 2012; Schelhowe 1993). Previous research already reveals that men’s affinity for computers can be traced back to the stereotype that men rather think analytically, objectively and rationally (Schelhowe 1993). In the following years, numerous stereotypes attributed to IT professionals, such as IT professionals are usually male and unstylishly dressed (Cheryan et al. 2011), as well as to IT subjects, IT studies include lots of math courses (Butterfield and Crews 2012), occur. These are partially memorable insomuch that women cannot envision a career in the IT domain, which refers to the cause as women cannot imagine their selves conforming with these classical stereotypes (Cadaret et al. 2017; Rudman and Phelan 2010). Moreover, self-doubts and deteriorating performance reduce the interest in male-dominated fields (Hardin and Longhurst 2016). Consequently, stereotypes determine the degree of motivation of women engaging with IT (Cheryan et al. 2011; Hardin and Longhurst 2016).

**Methodology**

A qualitative methodology was considered, because the research aim is to study the influence of stereotypes on career interests Whereas prior research admittedly addresses these two factors, a further connection between them is missing (Croasdell et al. 2011). Therefore, interviews with 23 female students from numerous universities in Germany were conducted in order to reveal stereotypes that persuaded them to not consider an IT study program.

![Figure 1. Major choice goals model (Akbulut and Looney 2007)](image-url)
To collect relevant data, female students at the universities’ campus were asked about their study program. When those were not enrolled in an IT study program and agreed to take an interview, an appointment for the interview in person or by phone was arranged. Data collection was realized through conducting focused interviews. Focused interviews are characterized by the focus the interviewer decides in advances. Because the objective is to rather understand the interviewee’s perceptions than generalizing behavior, focused interviews are mostly designed as semi-structured questionnaires containing open-ended questions. This approach ensures to react to each individual case by achieving high data validity (Merton and Kendall 1946). The questionnaire was semi-structured to allow additional, individual questions. It was further structured contrary to the MCGM process. Thus, the participants were initially asked, why they have not been interested in an IT study program. Based on their answers, they were surveyed forward to their perceived self-efficacy and their outcome expectations towards their perceptions connected with the IT domain to increasingly set the focus on what prevented them from developing interest. Thereby, it was explicitly paid attention not to mention words such as stereotypes, prejudices or equivalent until it was necessary. In the further course of the interview, the participants were asked whether they evaluate the mentioned stereotypes as positive or negative.

The interviews were conducted between January and March 2017. The average age of all interviewees is 23.7 years. 16 participants are enrolled in bachelor studies and seven in master studies. Their period of time being enrolled at university ranges from the second semester of bachelor studies to the fifth semester of master studies. A certain number of interviews that should be conducted at least was not defined in advance. Instead, the procedure followed recommendations on executing qualitative research and conducting interviews until no more new insights could be added (Sarker et al. 2013). Each interview took between seven and 15 minutes and was anonymously recorded on tape with the interviewee’s agreement. To ensure confidentiality, the participants were assigned pseudonyms (101–123). Afterwards, the interviews were transcribed verbatim and coded following qualitative procedures for descriptive and interpretative coding (Myers 2013). The coding process was performed using a software program for qualitative analysis, MAXQDA (VERBI GmbH), to facilitate computer-based analysis of the data.

Data analysis was realized performing two steps. First, the mentioned stereotypes that the interviewees associate with a career in the IT domain were identified. To do so, a coding scheme was developed that classified the stereotypes into related categories and upon their positive or negative evaluation. Second, the identified stereotypes were examined concerning their quality as antecedents of the former described part of SCCT. Thereby, connections between the identified stereotypes and the interviewees’ interest in studying an IT study program were elaborated.

**Results**

The findings resulting from 23 focused interviews are presented in this section separated into two subsections. First, the identified stereotypes based on the interviewees’ statements are structured according to two categories being introduced in the first subsection and according to their positive or negative meaning. Next, the influence of these stereotypes on the participants’ interest is explained in the second subsection.

**Categorization of IT stereotypes**

Upon conducting the interviews, the participants reported stereotypes referring to two different aspects. On the one hand, they linked several stereotypes to individuals, who study an IT program or work within the IT domain. On the other hand, numerous stereotypes address circumstances related to an IT career such as an IT study program or an IT occupation. This differentiation was used in order to structure the coding scheme on this base. Thus, the study distinguishes between the categories personal stereotypes and career-related stereotypes. Both of these categories include several manifestations, which are presented including exemplary interview statements in the following.

**Personal stereotypes**

This category refers to persons, who have a direct relation to the IT domain. These include students enrolled in IT study programs or employees in IT occupations.
Focusing personal stereotypes that are evaluated as positive, numerous interviewees mentioned that they consider persons in this context to be wise. Individuals in the IT domain are intelligent (‘I also accredit them really positive characteristics. For example, they are very intelligent to my mind’, I12) and think logically (‘They especially possess a logical way of thinking’, I22).

<table>
<thead>
<tr>
<th>Stereotype manifestations</th>
<th>Interviewee #1</th>
<th>Relative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT students/professionals are wise people.</td>
<td>3,8,9,11,12,13,20</td>
<td>30.4%</td>
</tr>
<tr>
<td>Negative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT students/professionals are different.</td>
<td>2,6,8,9,11,12,15,16,23</td>
<td>39.1%</td>
</tr>
<tr>
<td>IT students/professionals are nerds.</td>
<td>1,2,6,7,8,9,10,12,13,15,16,17,18,21,23</td>
<td>65.2%</td>
</tr>
</tbody>
</table>

Table 1. Overview of personal stereotypes

In contrast to those, other stereotypes are accredited a negative evaluation. These include perceptions that these people are rather unsocial (‘Regarding IT, these people are rather introverted. And by programming, they are a special type of people, who are different from others doing sport or engaging in similar social hobbies in considering openness’, I09) and weird (‘They are strange in some way, and socially incompetent’, I11). In addition, most interviewees regard IT students or IT professionals as real nerds or freaks, because they do hacking (‘These nerds either program applications, games and suchlike or they hack into any systems’, I21), always play computer games (‘They sit in their rooms, see not daylight and play online games without interruptions’, I18) or spend their leisure time in front of computers (‘IT people are these kind of nerds being busy with their computers all day long’, I23). Furthermore, they are couch potatoes (‘When I think about IT people, pictures of couch potatoes, who do not leave their rooms come to my mind’, I16) and do not look attractively (‘Considering their appearance, I would rather say that they do not correspond to my personal picture of beauty’, I12).

Career-related stereotypes

The category of career-related stereotypes refers to circumstances that the interview participants directly link to a career in the IT domain such as an IT study program or an IT occupation.

Regarding the positively evaluated stereotypes in this context, the interviewees believe that pursuing a career in IT provides diverse and multiple directions of development due to broad-based courses and various fields of application (‘IT represents a large field today and consequently, you have a range of opportunities to develop yourself’, I03). Moreover, pursuing an IT career offers good job perspectives due to great demands and forward-looking occupations (‘IT grows and therefor, more occupations and employees are required in the future’, I10).

As opposed to those, the interviewees mentioned also certain types that they evaluate as negative. Among those, they believe an IT study program is related to big efforts as students need to learn a lot by heart and studying is time-consuming (‘Studying IT takes a long time, because you have to learn many complex contexts’, I07). Pursuing an IT career means also that people run the risk of seclusion, because their way of working isolates them from their peers and colleagues (‘Studying IT is not really communicative than other study programs’, I13). Furthermore, a career in IT is characterized by monotony as especially boring and monotonous tasks have to be performed (‘In the long run I guess working would be very boring without a variety of tasks’, I17). Withal, pursuing an IT career exhibits a high level of difficulty as contents and activities complex, challenging and abstract (‘Everything sounds extremely complex, theoretically and for a certain degree, contents are not even tangible’, I11). In addition, the dominance of men in this domain is also perceived by the interviewees (‘Managing with men is not the problem, but to gain acceptance seems to be difficult’, I14). Most interviewees also mentioned that they associate a career in IT with a rash of math, engineering and programming (‘In my imagination, you have to do a lot of technical things when engaging with IT. Consequently, you have to deal with lots of analytical, mathematical stuff at great depth’, I13), and work in front of computers (‘I imagine, it means sitting at the computer in the office or even in a dark room and programming all night long’, I17).
Stereotype manifestations | Interviewee #1 | Relative frequency
---|---|---
Positive
Diverse directions | 3,6,8,9,23 | 21.7%
Good job perspectives | 3,4,6,7,8,9,10,11,12,13,15,17,21 | 56.5%
Negative
Big efforts | 7,10,13 | 13.0%
Seclusion | 10,11,13,14,15,19,20,21 | 34.8%
Monotony | 1,5,10,11,12,16,17,18,19,20 | 43.5%
Level of difficulty | 1,2,3,4,5,6,7,8,9,11,12,18,20,23 | 60.9%
Dominance of men | 1,2,3,4,6,7,10,14,15,17,18,21,22 | 56.5%
Math and engineering | 2,3,4,5,6,7,8,13,15,16,17,19,20,21,22,23 | 69.6%
Computer | 1,2,3,4,5,6,7,10,11,12,13,14,15,17,19,20,21,23 | 78.3%
Abstraction | 2,4,5,7,9,11,14,17,18,19,20,21,22 | 56.5%

Table 2. Overview of career-related stereotypes

In summary, the interviewees mentioned more stereotypes, which are evaluated as negative (see Table 3).

| Positive | Negative |
---|---|
Personal | IT students/professionals are wise people. | IT students/professionals...
...are different.
...are nerds. |
Career-related | Diverse directions
Good job perspectives | Big efforts
Seclusion
Monotony
Level of difficulty
Dominance of men
Math and engineering
Computer
Abstraction |

Table 3. Categorization of IT stereotypes

Influence of IT stereotypes

Continuing the analysis, the focus lay not only on different stereotypes, which can be attributed to a career in IT, and their categorization, but also on how these stereotypes affect the interest of the interviewees.

The results reveal that the mentioned stereotypes do not directly affect the participants’ interest. Instead, they show an influence on self-efficacy and outcome expectations, which are both drivers for the development of interest (Akbulut and Looney 2007; Lent et al. 1994). Thereby, an influence on both self-efficacy as well as outcome expectations ensuing from positive stereotypes has not been determined. However, an influence of negative stereotypes on outcome expectations and especially on self-efficacy is illustrated. Considering outcome expectations, the interviewees reported for example that they could not imagine working in the IT domain due to different stereotypes (‘Later, you have to work a lot in front of
your computer and this would not be fun. So, why should I engage in something that I do not like?’, I10; ‘I can absolutely not imagine to be responsible every time a colleague at work has problems with his mouse, keyboard or similar’, I12). With regard to self-efficacy, most interviewees also mentioned that they do not dare to perform in an IT study program or an IT occupation, because of bearing no relation to IT skills (‘I do not have any access to this field such as new software programs, applications I18) or lacking knowledge (‘I do not think that I would ever succeed. I never did programming before! And this is a huge inhibition to me’, I09). Thus, a negative influence of negative stereotypes on self-efficacy and outcome expectations is determined as the stereotypes lower the interviewees’ self-efficacy and outcome expectations related to an IT career.

<table>
<thead>
<tr>
<th>Influence</th>
<th>Interviewee #I</th>
<th>Relative frequency</th>
</tr>
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<tbody>
<tr>
<td>Negative stereotypes → self-efficacy</td>
<td>1,2,4,5,7,8,9,11,12,13,14,17,18,19,20,21,22,23</td>
<td>78.3%</td>
</tr>
<tr>
<td>Negative stereotypes → outcome expectations</td>
<td>3,5,7,8,10,12,13,15,16,19,20</td>
<td>47.8%</td>
</tr>
</tbody>
</table>

Table 4. Overview of the influence of negative stereotypes

Considering the relative frequency of these two influences (see Table 4), negative stereotypes predominately affect the interviewees’ self-efficacy. In turn, only a few interviewees reported that negative stereotypes influenced their outcome expectations related to a career in IT.

**Discussion**

The research aim was to explore the influence of IT stereotypes on women’s interest in an IT study program. Previous research reveals that stereotypes represent an important factor of influence on women’s motivation to engage with a career in the IT domain (Annabi and Lebovitz 2018; Butterfield and Crews 2012; Cadaret et al. 2017; Croasdell et al. 2011; Rouibah 2012). However, before motivation is generated, interest has to be aroused first. Thus, the interest in an IT study program should be aroused. To explore the influence of stereotypes, focused interviews with 23 female students were conducted. Based on the results, a number of theoretical contributions and practical implications is provided in the following subsections. Additionally, possible limitations of the current research are explained.

**Theoretical contributions**

The paper contributes to research by identifying and categorizing several stereotypes that women link to a career in the IT domain and which keep women from developing interest in an IT study program. In contrast to previous research focusing stereotypes in this context (Butterfield and Crews 2012; Cadaret et al. 2017; Croasdell et al. 2011; Rouibah 2012), this study refrains from pure listing of different stereotypes, but classifies identified stereotypes in two different categories: personal and career-related stereotypes. Personal stereotypes refer to perceptions related to individuals, who study or work in the IT domain. Career-oriented stereotypes correspond to perceptions that the interviewees directly link to a career, such as a study program or an employment, within the IT domain. Furthermore, the interviewees were asked to indicate whether they perceive the identified stereotypes as positive or negative. Based on the participant’s statements, a matrix illustrating the affiliation of each stereotype regarding category and evaluation was created. The results show that the majority of the mentioned stereotypes is evaluated as negative.

Moreover, the influence of the mentioned stereotypes on the interviewees’ interest to study an IT study program is examined. Thereby, SCCT (Lent et al. 1994) and the MCGM (Akbulut and Looney 2007) serve as appropriate theoretical lenses as these provide the most obvious theoretical foundation for the formation of interest in the context of careers in IT domains (Heinze and Hu 2009; Lent et al. 2008; Lent et al. 2011). The results show that the different stereotypes influenced either the interviewees’ individual self-efficacy or outcome expectations or both. Self-efficacy and outcome expectations trigger the formation of interest in turn (Akbulut and Looney 2007; Lent et al. 1994). In the further course of the research, the study additionally distinguishes between positive and negative stereotypes as prior research reveals that stereotypes differently affect outcomes whether they are positive or negative (Czopp 2008; Fiske et al. 2002; Judd and Park 1993; McGarty et al. 2002). In this regard, the results illustrate that negative stereotypes negatively influence self-efficacy and outcome expectations. Positive stereotypes, in turn, do not positively affect self-efficacy and outcome expectations, but rather show no noticeable influence on these factors (see
Figure 2). This can be affiliated to the circumstance as negative stereotypes represent threats in such a way that positive stereotypes are not attached importance and are consequently not considered for evaluation (Deemer et al. 2014; Hippel et al. 2011). According to this, the participants base their missing interest in an IT study program upon stereotypes that they perceived as negative. In turn, positive stereotypes had no effect on this. Thus, the study elaborates two general propositions:

Proposition 1: *Positive IT stereotypes have no effect on self-efficacy and outcome expectations, and consequently no indirect effect on interest in an IT study program.*

Proposition 2: *Negative stereotypes have a negative effect on self-efficacy and outcome expectations, whereas the effect on self-efficacy is stronger than the effect on outcome expectations.*

![Figure 2. Influence of IT stereotypes](image)

The stronger influence of negative stereotypes on self-efficacy is affiliated to the fact as self-efficacy is proven to be the key determinant and consistent predictor of behavioral outcomes in the context of career choices (Akbulut and Looney 2007; Bandura 1986; Lent et al. 1994). According to this, if negative stereotypes show a stronger effect on outcome expectations than on self-efficacy, the participants would have chosen a career in IT though.

**Practical implications**

In addition, practical implications for universities, employers and other institutions that aim at attracting women for a career in the IT domain are also provided. Although prior research states that it is often complicated to change or clarify established stereotypes (Judd and Park 1993; McGarty et al. 2002), it is up to affected institutions to counteract negative stereotypes at the best. It is important to impart reality behind these stereotypes to women, who have not decided for a career path yet. For example, IT employers should communicate that they employ a diverse group of people within their IT departments, not only unattractive men. Universities and other educational institutions should further demonstrate the breadth of IT study programs and report the amount of math courses for instance. In contrast to those negative stereotypes, positive stereotypes, such as good career opportunities, should be strengthened so that they manifest a positive influence of outcome expectations and self-efficacy in the best case.

**Research limitations**

The research is further subject to several limitations. First, the study was only conducted at universities in Germany. Nonetheless, it cannot be ensured that the results are completely transferable to other countries or cultures. In addition, only female students, who decided against an IT study program, were interviewed. Therefore, statements of women, who decided upon an IT study program despite perceiving stereotypes about this domain, cannot be revealed.

**Conclusion and Future Research**

The research focuses the influence of IT-related stereotypes on the formation of women’s interest in an IT study program. For this purpose, it refers to SCCT and MCGM and includes interviews with 23 female students, who decided against an IT study program. The results show that numerous stereotypes in this context persist. These were classified into two categories including an evaluation according to their positive or negative meaning. In addition, the results reveal that negative stereotypes negatively affect women’s self-efficacy and outcome expectations toward an IT study program. Positive stereotypes show no noticeable
influence on these antecedents of interest in turn. Future research should therefore measure the identified influences as well as possible, mediating effects of positive and negative stereotypes on interest using quantitative methods.

References


VERBI GmbH. MAXQDA, Berlin.

