

Why do few women choose IT-related programmes? A study of gender-specific perceptions and preferences in the context of business informatics

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Abstract

Purpose – Digital transformation is a key factor in the competitiveness of modern businesses. However, the shortage of IT specialists poses a significant challenge. The significant underrepresentation of women in IT-related programmes in higher education further increases the skills shortage and reduces diversity and creativity. Against this background, this study aims to investigate the gender-specific factors influencing the decision to pursue IT-related degrees in the context of business informatics (B-Inf) in Germany to understand why few young women choose this field of study.

Design/methodology/approach – A quantitative survey was conducted with 186 undergraduate students in Germany. The survey examined the perceptions and priorities of both male and female students when choosing their field of study.

Findings – The results reveal that women place greater emphasis on job security and societal impact when selecting their field of study, whereas men tend to prioritise interest in technology, personal development and enjoyment of IT-related work.

Originality/value – Although previous research has focused on computer science programmes, little attention has been paid specifically to B-Inf programmes, which are a distinct discipline combining computer science and business administration. This study contributes new insights into the gender-specific preferences influencing the choice of B-Inf degrees, offering practical implications for increasing female participation and addressing the IT skills gap.

Keywords Education, Informatics, Gender, Computer science, Information systems

Paper type Research paper

1. Introduction

Digital transformation is a decisive factor for the competitiveness of companies. Technologies such as artificial intelligence (AI) in particular play a key role in shaping the digital future. However, according to a study by Bitkom Research, there is a shortage of around 137,000 IT specialists in Germany alone, which has a significant impact on the economy (Bitkom, 2023).



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In addition to traditional computer science (CS), related disciplines such as information systems (IS) and business informatics (B-Inf) are essential for the development and implementation of innovative solutions. B-Inf from the German-speaking world is related to North American IS, both of which research business information systems. Nevertheless, there are differences in the research methods and objectives (Schauer and Frank, 2007). B-Inf focusses primarily on the practical development and application of information systems. In contrast, the discipline of IS emphasises more theoretical research and understanding of how and why information systems work, using more rigorous scientific methods (Heinrich *et al.*, 2011).

Despite the growing importance of B-Inf in the context of digital transformation, only around 20% of students in Germany are female, although the discipline is not only closely related to CS but also to business administration, which has a proportion of women of over 45% (DESTATIS, 2023). The underrepresentation of women in IT not only affects equality but also reduces diversity and creativity in the research and innovation process and exacerbates the shortage of skilled labour (Ihsen, 2019).

While extensive international research already exists on the factors influencing CS-oriented degree programmes for both men and women (e.g. Acilar and Sæbø, 2021; Corley, 2016; Croasdell *et al.*, 2011; Kuechler *et al.*, 2009; Zhang, 2007), no studies could be identified that specifically address the factors influencing the choice of study in B-Inf programmes. Against this background, the aim of this study is to investigate which factors influence the decision of potential students for or against a degree programme in B-Inf and what the differences are between women and men. The focus of this study is on differences in perceptions and preferences, whereas deterrent effects and barriers that affect women, such as stereotypes, are not in focus. The following research questions can be defined:

RQ1. How does the perception of B-Inf differ between women and men?

RQ2. What differences exist between men and women in the importance of general factors influencing their choice of study programme?

This study was conducted in the form of a quantitative survey of undergraduate students in Germany using an online questionnaire, in which 186 people took part. The findings of this study offer important implications for universities, which can contribute to the development of targeted measures to increase the attractiveness of B-Inf degree programmes for women. In the long term, this could promote diversity among B-Inf students and also help to counteract the shortage of skilled labour in the IT sector, if more women choose to study IT-related programmes and thus help to increase the overall number of graduates in this field.

The structure of this paper is organised as follows: First, in Section 2, the previous research is reviewed to highlight existing studies on gender-specific preferences and other streams of research. This is followed by an exploration of the research gap, focusing on the lack of studies specific to B-Inf. Next, in Section 3, the research design is described, including the methodology, sampling and survey instrument used for data collection. Subsequently, Section 4 presents the empirical results, which compare perceptions and influencing factors between male and female students. This is followed by the discussion of the findings, relating them to existing literature and identifying practical implications in Section 5. Finally, Section 6 summarises the study's contributions, suggests potential strategies to attract more women to B-Inf programs and proposes directions for future research.

2. Previous studies and research gap

The factors influencing CS-oriented degree programmes have already been extensively investigated, particularly in the USA. Numerous international studies have analysed the

factors influencing IS degree programmes, including general studies (e.g. Burns *et al.*, 2014; Havelka and Merhout, 2020) and studies that specifically analysed the influencing factors for women or in a gender comparison (e.g., Corley, 2016; Zhang, 2007). Similar studies also exist for CS, with general studies on the influencing factors (e.g. Alshahrani *et al.*, 2018; Carter, 2006) and studies specifically focussing on women or gender differences (e.g. Malik and Al-Emran, 2018; Tsagala and Kordaki, 2005). In addition, for MIS study programmes (e.g. Chipidza *et al.*, 2019; Ferratt *et al.*, 2010) and IT (e.g. McNerney *et al.*, 2006; McKenzie and Bennett, 2022), including comparisons of the influencing factors between MIS and CS (Downey *et al.*, 2009).

Despite the different results in the individual studies, some general trends can be identified. External influences, in particular, play a significant role for women. These include, above all, support from family and teachers, which were frequently cited as decisive factors in the choice of a CS-oriented degree programme (Alshahrani *et al.*, 2018; Avelino *et al.*, 2019; Croasdel *et al.*, 2011; Kuechler *et al.*, 2009; Zhang, 2007). Women are also more strongly influenced by future career prospects, the importance of professional qualifications and job security (Snyder and Slauson, 2014; Tsagala and Kordaki, 2005). However, some studies have shown that the influential motivational factors are almost identical for both genders. These include personal interest, the desire to make a contribution to society, one's own abilities and future career prospects (Malik and Al-Emran, 2018; Rajala *et al.*, 2023; Tsagala and Kordaki, 2005; Zhang, 2007). The perception of CS-oriented degree programmes differs between the genders, with some studies identifying a negative perception among women (Kuechler *et al.*, 2009; Rajala *et al.*, 2023; Zhang, 2007), whereas others found that women are not influenced by the fact that these programmes are considered too difficult or male-dominated (Croasdel *et al.*, 2011).

These findings emphasise that despite many similarities in the influencing factors between the genders, there are also significant differences. These differences are particularly evident in the perception of CS-oriented degree programmes and in external influences. This makes it clear that deeply rooted gender-specific role models and socialisation continue to play a central role in the choice of degree course (Zhang, 2007).

Another stream of research focuses on gender-specific deterrent effects and barriers that affect women in their choice of study. For several years, research has been investigating the question of why women are less frequently represented in STEM fields in general and what measures can be taken to counteract this, as systematised and summarised by Ihlen (2019) and Jeanrenaud (2020) in the German context and by Kahn and Ginther (2017) in the US context, for example. There is also an intensive examination of these issues specifically for the subject of computer science (Black *et al.*, 2011; Cheryan *et al.*, 2015; Dryburgh, 2000; Kim *et al.*, 2011; Master *et al.*, 2016). Such studies find that stereotypical ideas about gender-specific abilities (Cheryan *et al.*, 2015; Ihlen, 2019; Master *et al.*, 2016), but also stereotypical ideas about the people, work and values in the field of study (Cheryan *et al.*, 2015; Master *et al.*, 2016) are often causes for the underrepresentation of women. However, the interplay of a large number of direct and indirect influencing factors makes causal research complex and study results are sometimes contradictory or ambiguous (Dryburgh, 2000; Ihlen, 2019).

Measures often address the causal influencing factors (Ihlen, 2019; Jeanrenaud, 2020). In addition, the important role of female role models is often emphasised (Black *et al.*, 2011; Dryburgh, 2000; Ihlen, 2019; Jeanrenaud, 2020). However, measuring the effectiveness of the measures is methodologically difficult on the one hand, but on the other hand is often not carried out systematically and consistently (Ihlen, 2019; Jeanrenaud, 2020).

Overall, extensive research has already been conducted internationally on CS-oriented degree programmes and the influencing factors have been examined in detail in many areas. Numerous studies are available that provide valuable insights, particularly for women and in gender comparison. However, no specific research could be identified on the factors influencing the choice of degree programme in B-Inf, either internationally or in German-speaking countries. In German-speaking countries, there are studies on the influencing factors for CS and CS-related degree programmes (e.g., [Antonitsch et al., 2007](#); [Engeser et al., 2008](#); [Reuß, 2023](#)), but only to a limited extent.

3. Design of the study

3.1 Research approach and sample

A quantitative research approach with a structured online questionnaire was chosen, which offers the advantage that data can be objectively collected and analysed. This enables a detailed analysis of statistical correlations in the data set ([Berger-Grabner, 2022](#)).

The target population of this study comprises current university students in Germany or alumni who have recently completed their studies. This definition of the target population includes two consciously made choices:

- (1) Firstly, we intentionally included students from non-B-Inf disciplines in the sample. The rationale behind this choice was to capture both, the perception of B-Inf students, as well as, the perspectives of those who opted *not* to pursue B-Inf. Although the sample was not limited to B-Inf students, the survey instrument and questions were specifically designed around B-Inf, ensuring that all participants provided responses relevant to the programme. This approach allows for a more comprehensive understanding of both the appeal and deterrents associated with B-Inf by integrating individuals who had been potential future B-Inf students in the past, but have decided to pursue a different path.
- (2) Secondly, this study deliberately surveyed university students and not school pupils, because although school pupils may be potential students of B-Inf, they may not yet have considered the choice of a degree programme sufficiently or at all ([Heine et al., 2007](#)). Students, on the contrary, have already gone through the selection process and made a conscious decision in favour of a degree course, often after intensive consideration of various study options. This approach is consistent with the methodology of other studies conducted in countries with an education system comparable to Germany. For example, [Acilar and Sæbø \(2021\)](#), [Kori et al. \(2016\)](#), [Rajala et al. \(2023\)](#) and [Säde et al. \(2019\)](#) also selected students as a target group to investigate the factors influencing the choice of a CS-oriented bachelor's degree programme.

Convenience sampling was used to collect the sample ([Creswell and Creswell, 2018](#)). This method is consistent with the sample generation procedure in other studies ([Acilar and Sæbø, 2021, 2022](#)). In addition to using the email distribution list from the authors' university, the survey was distributed via the authors' social media channels and personal networks. Students were also approached on campus and in lectures and asked to participate. To ensure sufficient participation of women, elements of a stratified sample were integrated ([Fowler, 2014](#)). Targeted attempts were made to motivate women to participate via social media and personal contact. In addition, students with business degree programmes were also specifically contacted via social media, as their group was not sufficiently represented in the sample. As B-Inf is a combination of business administration and computer science, business students may have been a potential target group for B-Inf as well. The composition of the final sample is shown in [Table 1](#).

Table 1. Sample by study programme and gender

Study programme	Gender	Quantity	% of total	Cumulative %
Other CS-oriented degree programme	Male	21	11.4	11.4
	Female	9	4.9	16.2
B-Inf	Male	41	22.2	38.4
	Female	22	11.9	50.3
Business administration degree programme	Male	13	7.0	57.3
	Female	13	7.0	64.3
Other study programme	Male	23	12.4	76.8
	Female	43	23.2	100.0

Source: Table by authors

3.2 Survey instrument

A questionnaire in German language was administered using Google Forms. It is made up of several sections containing specific questions on the perception of B-Inf, the importance of general influencing factors when choosing a Bachelor's degree programme and socio-demographic questions.

Based on the previous literature, 19 influencing factors were identified that can influence the decision in favour of or against a study programme. These factors were assessed both in terms of *perception in relation to B-Inf* and their *importance for the general choice of a bachelor's degree programme* using various items, as shown in [Table 2](#).

The rating was carried out using a symmetrical five-point Likert-type scale with a neutral option ([Joshi et al., 2015](#)) to offer participants sufficient choice and not to force anyone to give an opinion (Perception: Strongly disagree, Disagree, Neither/neutral, Agree, Strongly agree; Importance: Not at all important, Not important, Neutral, Important, Very important). In addition, an "I don't know" option was offered in each case to avoid bias. The five-point scale is most frequently used in social studies ([Tanujaya et al., 2022](#)) and is also consistent with the design of various studies, such as the studies by [Kori et al. \(2016\)](#) and [Li et al. \(2014\)](#).

A pre-test was conducted to estimate the duration of the survey and to recognise potential problems such as participant fatigue, which can lead to questionnaire abandonment ([Creswell and Creswell, 2018](#)). In addition, it was tested whether the technical implementation worked and whether the tool used was understandable for the respondents ([Fowler, 2014](#)). The pilot group consisted of six heterogeneous individuals.

3.3 Data analysis

The data collected was analysed using the R-based statistics software jamovi, both descriptively and using bivariate significance tests. Due to the interval scaled variables and the lack of normal distribution of the data, non-parametric statistical significance tests such as the Mann–Whitney U test and the Kruskal–Wallis test were used ([Field, 2013](#)). These tests do not assume a normal distribution of the data ([Moore et al., 2007](#)). They also reduce the effect of outliers in the data set ([Field, 2013](#)). Nevertheless, parametric tests, such as the T-test, were carried out additionally to corroborate the analysis.

3.4 Ethical considerations

An essential prerequisite for the ethical conduct of a survey is that participants are fully informed about what they are volunteering for ([Fowler, 2014](#)). Participants were provided

Table 2. Influencing factors and questionnaire items

No.	Perception (P)	Importance (I)
1	There are many and secure job opportunities for graduates of B-Inf	Availability and security of jobs after graduation
2	B-Inf graduates have good career opportunities	Good career opportunities
3	B-Inf graduates earn a good salary later on	A good/high salary
4	I would enjoy a job in IT	Enjoy your future job
5	In an IT job, you have enough social interaction	Social interaction at work
6	I could help others by studying B-Inf	Helping others/making a contribution to society
7	B-Inf interests me	Interest in the subject
8	I am interested in technologies and their applications	Interest in technology
9	Studying B-Inf would promote my personal development	Personal development
10	I already have previous knowledge and skills that will help me in the B-Inf degree programme	Prior knowledge and skills
11	A B-Inf degree programme is difficult and time-consuming	Perceived feasibility of the study programme (difficulty/time required)
12	The profession of information systems specialist is highly regarded	Reputation of the profession
13	Clichés about business IT specialists are true (e.g. nerds)	Reputation of the degree programme by subject area
14	The authors' university has a good reputation	Reputation of the college/university
15	The B-Inf study programme at the authors' university has a good reputation	Reputation of the degree programme at the college/university
16	I study at my college/university because I live nearby	Proximity of the college/university to my place of residence
17		Influence of the family
18		Influence of friends
19		Influence of former teachers and student counsellors

Source: Table by authors

with comprehensive information both by email and on the first page of the questionnaire. Furthermore, no personal data was collected that would allow participants to be identified, with the exception of the voluntary provision of an email address for participation in a prize draw of two gift cards worth €10 each. The email addresses collected were deleted after the winners had been determined and before the data was analysed (Fowler, 2014).

4. Empirical results

4.1 Perception of business informatics

Items *P4*, *P5*, *P7*, *P8*, *P9* and *P10* showed statistically significant differences in both tests. The data showed that men were more likely to think that they would enjoy a job in IT than women (*P4*, $p < 0.001$). In addition, men were more interested in B-Inf and technology in general (*P7* and *P8*, $p < 0.001$) and also believed that B-Inf would promote their personal development more (*P9*, $p < 0.05$) than women did. In addition, male participants perceived

the social interactions in an IT job to be more sufficient ($P5, p < 0.001$) and rated their own prior knowledge related to B-Inf higher ($P10, p < 0.001$) than women (see Table 3).

4.2 Importance of general influencing factors

The analysis of the importance of the factors influencing the choice of degree programme also revealed significant gender differences. Table 4 shows the statistically significant items by gender.

Female students placed more value on the availability and security of jobs ($I1$) and also considered a contribution to society ($I6$) to be more important for their study decision than male students did. Men, on the contrary, were more influenced by their interest in technology ($I8$) in their choice of degree programme. When interpreting the results, it should be noted that $I1$ could only be tested as statistically significant using the Mann–Whitney U test. In addition, there was no homogeneity of variance for $I8$ using the T -test, which is a violation of the necessary requirements for T -tests. Nevertheless, the Mann–Whitney U test, which makes no assumption about the variances of the data, was statistically significant.

5. Discussion

Tables 5 and 6 summarise the statistically significant results. < and > indicate which group rated the corresponding item higher.

The analysis shows that male students rate the items in the *perceptions of Business Informatics* category ($P4$ – $P10$) higher than their female counterparts. In particular, male students rated their interest in technological topics and B-Inf higher than female students. Their assessment of their own prior knowledge and skills for a B-Inf degree programme is also significantly higher. In contrast, women attach greater importance to factors $I1$ and $I6$.

Table 3. Significant differences by gender in the perception of B-Inf

Statistical measure	Gender	P4	P5	P7	P8	P9	P10
Mean	Male	3.42	3.19	3.46	4.04	3.44	3.23
	Female	2.49	2.72	2.36	3.18	3.04	2.33
Median	Male	3	3	4	4	4	3
	Female	2	3	2	3	3	2
Standard deviation	Male	1.33	1.03	1.36	1.15	1.22	1.35
	Female	1.35	1.06	1.37	1.25	1.17	1.22

Source: Table by authors

Table 4. Significant differences by gender in the importance of influencing factors

Statistical measure	Gender	I1	I6	I8
Mean	Male	4.12	3.37	4.06
	Female	4.36	3.85	3.48
Median	Male	4	3	4
	Female	5	4	4
Standard deviation	Male	0.916	1.02	1.06
	Female	0.905	1.05	1.22

Source: Table by authors

Table 5. Summary of the statistically significant items in the category perceptions of business informatics

Item	Gender
Enjoy an IT job (P4)	M > F
Sufficient social interaction in IT job (P5)	M > F
B-Inf interests me (P7)	M > F
Interest in technology (P8)	M > F
Promotion of personal development (P9)	M > F
Prior knowledge and skills (P10)	M > F

Source: Table by authors

Table 6. Summary of the statistically significant items in the category importance of the factors influencing the choice of bachelor's programme

Item	Gender
Availability and security of jobs (I1)	M < F
Helping others/making a contribution to society (I6)	M < F
Interest in technology (I8)	M > F

Source: Table by authors

This shows that women are more focussed on career security and the social benefits of studying when choosing a degree programme. These results are consistent with the trend identified in the literature, which also found that women prioritise security-related factors in particular more than men (Snyder and Slauson, 2014; Tsagala and Kordaki, 2005).

At the same time, the studies by Malik and Al-Emran (2018) and Tsagala and Kordaki (2005) found that both personal interest and career prospects are important for both genders. These findings correlate with the results of the empirical study, which, however, identifies a different weighting of these influences. Men show a stronger interest in technology, which is reflected in the higher rating of the items *P8* (I am interested in technologies and their applications) and *I8* (Interest in technology.). Women, on the contrary, rated factor *I1* (availability and security of jobs after graduation) significantly higher.

Further similarities between this study and the previous research can be found in the study by Acilar and Sæbø (2021). The authors found that male participants rated the factors “Interesting work assignments”, “Personal interest in subject matter” and “Ease of study topics” significantly higher (Acilar and Sæbø, 2021). This is consistent with the results of this study, in which the items *P4* (I would enjoy a job in IT.) and *P7* (I am interested in B-Inf.) in particular were rated significantly higher by men. The difficulty of the degree programme cannot be significantly differentiated between the genders in the empirical study, but the prior knowledge and skills (*P10*) of men are rated significantly higher.

A notable difference between the results of the empirical study and the literature concerns external influencing factors such as family, friends, teachers and counsellors. Studies such as the one by Alshahrani *et al.* (2018), Avelino *et al.* (2019), Croasdel *et al.* (2011) Kuechler *et al.* (2009), Lenox *et al.* (2012), Tsagala and Kordaki (2005) and Zhang (2007) emphasised the influence of such external factors, especially on women. In the present study, however, no significant gender-specific differences can be identified in relation to these external factors.

The negative perceptions of the IT sector identified by Kuechler *et al.* (2009) can be partially confirmed by the empirical study, as women rate items *P5* (In an IT job you have sufficient social interaction) and *P9* (Studying B-Inf would promote my personal development) significantly lower than men.

In summary, it can be said that there are significant gender differences in the factors influencing the choice of degree programme. Men rate technological aspects and their own abilities more highly, whereas women give greater weight to practical considerations (e.g. availability of jobs) and social aspects. These differences are visible both in the literature and in the empirical study and offer important insights into gender-specific preferences, which can help to explain the comparatively low proportion of women in B-Inf (DESTATIS, 2023). The main reason for this is the technical orientation of the degree programme. In addition, women may prefer degree programmes from which they expect to make a greater contribution to society. This study also found that women are not significantly more influenced by external factors such as family when choosing a degree programme compared to previous findings.

6. Conclusion

6.1 Summary and contribution to knowledge

This research makes an important contribution to knowledge by investigating gender-specific differences in the factors influencing the choice of a bachelor's degree programme in B-Inf. While there are already extensive international studies on CS-oriented degree programmes, specific studies on B-Inf have so far been neglected. In German-speaking countries in particular, there are only a few studies on CS-oriented degree programmes, which makes this work particularly relevant. In general, it can be concluded that the effects for B-Inf in Germany seem to be similar to effects in the CS domain and that there seem to be few international differences. This also implies that the B-Inf discipline is perceived as rather technologically oriented as opposed to being business-related.

The results show significant gender differences, with men showing greater enthusiasm for technical aspects and also rating their own prior knowledge and skills higher. Women, on the contrary, prioritise job security and a contribution to society more highly.

6.2 Practical implications

The following practical implications can be drawn from the findings of this study. Universities should take into account the different motivations and priorities of the genders in their programmes and advice. Student counselling services and universities could, for example, focus more on career prospects and the social contribution of B-Inf to appeal specifically to women. For men, the technological focus and the application of technologies could be emphasised. In addition, the future career opportunities, job security and future salary could be more strongly promoted in favour of B-Inf. It would also be helpful to show what job profiles can be filled by future B-Inf graduates in their everyday working life.

With regard to motivating girls to study B-Inf, prior research suggests that it seems to be a promising approach to start directly with the girls (Jeanrenaud, 2020), but at the same time, other influencing actors such as high school teachers or vocational counsellors should also be addressed more strongly (Ihsen, 2019).

Specific activities for high school girls could include IT workshops that are designed to counteract stereotypical perceptions of computer science as a subject (Cheryan *et al.*, 2015; Master *et al.*, 2016) and arouse interest in technology. Such workshops could include virtual reality experience workshops to let girls interactively explore digital worlds and understand the technology behind the experience. Another idea could be AI-creative workshops that bring AI to life in a creative way. For example, generative AI can be used for creative activities,

accompanied by a discussion of the technical functionality and ethical implications. More technically oriented workshops could include beginner hackathons for playful experiences in programming, e.g. for creating their own mobile app or programming a robot.

The implementation of such measures should always be accompanied by an evaluation of their effectiveness. This could include a qualitative evaluation in the form of interviews, surveys and focus groups to record the individual experiences, perceptions and feelings of participants. Furthermore, quantitative effectiveness measurement such as recording student numbers before, during and after the implementation of the measures to quantify changes in the proportion of women are recommended.

Increasing female participation in CS-oriented programmes holds significant long-term benefits, both for the economy and society at large. A more gender-balanced representation can lead to greater diversity of thought, which enhances creativity and innovation in the development of information systems. Moreover, attracting more female talent can contribute to solving the ongoing IT skills shortage. Finally, greater inclusion of women in the profession fosters a more equitable workforce, which can encourage other women to pursue careers in technology as well.

6.3 Limitations and future research

As every research, this work may have a number of limitations. A significant limitation of this study lies in the survey of the sample, as it is not representative and therefore the generalisability of the results is limited. It would therefore make sense to conduct a representative study with a larger sample to substantiate the results.

Moreover, the study does not explain why men and women have these different preferences, which may, for example, be rooted in stereotypes about the discipline or gender roles. Therefore, a qualitative research approach could help to better understand the deeper psychological or social causes of the phenomena. Interviews with female students or pupils, for example, or focus groups for in-depth discussion and interpretation of the results of this study would be suitable for this purpose.

Finally, future research could benefit from longitudinal studies that track young people's perceptions and decisions over time, providing deeper insights into how gender-specific factors evolve throughout their academic and professional journeys.

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