Looking for a Major in Computing? Technical Knowledge versus Broader Social Values in Computing Majors

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ABSTRACT

Introduction. The importance of computing education is growing as technology becomes more prevalent in society. Universities must train students to meet the demand for experts in the field. However, the number of students pursuing a degree in computing remains low, and diversity in both education and industry is still far from being achieved [2, 5, 11]. One possible reason is the perceived misalignment between the values of young people [8] and those associated with computing. Therefore, how universities promote themselves, as well as the messages they deliver when engaging with prospective students, are all crucial factors to consider.

We examined the descriptions of computing majors provided to potential students on the official websites of four European universities. We focused on the descriptions of bachelor's and master's degrees, as well as the titles and learning outcomes of compulsory courses. We tokenized and lemmatized the documents. Next, we analyzed the word frequency count and the relative document frequency of each lemma. Lemmas were finally divided into educational, social, and technical lemmas.

Findings show that while descriptions of computing majors acknowledge the link between computing and society, the presentation of compulsory curricula does not. This suggests that universities may prioritize preparing students for specific technical tasks over helping them in understanding the broader social context in which their work will be used. Additionally, it implies that how universities present computing may not align with the values of prospective students, potentially limiting diversity and inclusion in the field.

Our exploratory paper contributes to computing education in several ways. First, it examines of how universities present computing majors to prospective students, providing valuable insight into how universities communicate about the field. This information can be used to refocus and tune in to society's and individuals' needs. Second, the paper highlights how much emphasis universities place on social aspects of computing in their curricula. As Generation Z students have a stronger sense of purpose and a desire to make a positive difference in society [8, 9, 12], they may be more drawn to computing majors that are clearly connected to social issues. By paying attention to how they present themselves and their courses, universities can work to increase diversity and inclusion in computing. Finally, following the described methodology, we produced an initial lexicon of highly representative lemmas that can be used in future studies to broaden the scope of analysis and include a larger sample of universities.

Methodology. The high demand for computing professionals, combined with the field's lack of diversity, necessitates an understanding of what universities can do better to attract and include more young people. When it comes to forming aspirations, institutions' messages are critical in providing prospective students with career information [6, 7]. Focusing on the social embeddedness of computing can create a bridge between computing and students' values, while respecting and reflecting technology's role in society.

In this study, we examine the descriptions and programs of computing majors at four European universities. Our goal is to understand which topics universities focus on to describe their majors and present their curricula on their websites, and consequently picture how computing could be perceived by prospective students. We will specifically address the following research questions:

(1) **RQ1**: Do computing majors present computing as a field that has an impact on society?
(2) **RQ2**: What could students expect to learn from the courses by reading their learning outcomes and their titles?
(3) **RQ3**: Is there alignment between students' values and the values proposed by the universities?

Discussion. In this study, we looked for references to social-related topics in the descriptions of computing majors, as well as courses' learning outcomes and titles. We were particularly interested in determining whether computing majors present computing as socially embedded (RQ1), what prospective students can expect to learn based on curricula (RQ2), and whether there is a match between social values of teenagers and values proposed by the university (RQ3).

womENcourage, September 20–22 2023, Trondheim, Norway

ACM ISBN 978-x-xxxx-xxxx-x/YY/MM…$15.00
https://doi.org/XXXXXXX.XXXXXXX

Majors present computing as a field that has an impact on society. This is consistent with the acknowledged social component of computing and its disciplines [1, 4]. However, while social references can be found in the texts, they primarily focus on the technical aspects of the field. Social lemmas have a low presence in the whole vocabulary and a low frequency, suggesting a general reference to society rather than a specific and in-depth one. Differences among the four universities were also observed. University 1, which is bigger and has higher gender balance and impact rankings, scores highly in all the results. Interestingly, university 3, which has the opposite characteristics, has the lowest values overall. University 2, which offers more non-computing majors and has lower gender diversity than university 1, shows slightly lower values. University 4, which is high in gender diversity but low in all the other characteristics, shows the highest values in the relative document frequency, but low values in variety of social terms in the vocabulary and in their frequency. However, this discrepancy could be due to its small contribution to the corpus. One possible explanation for these differences may be found in the characteristics of the universities.

Table 1: Vocabulary composition of majors' descriptions according to categories.

Percentages of unique lemmas					
	Corpus	**Univ 1**	**Univ 2**	**Univ 3**	**Univ 4**
E	P = 0.43	P = 0.44	P = 0.47	P = 0.49	P = 0.37
S	P = 0.10	P = 0.12	P = 0.09	P = 0.03	P = 0.06
T	P = 0.47	P = 0.45	P = 0.44	P = 0.48	P = 0.58
Percentages of categories on total frequencies					
	Corpus	**Univ 1**	**Univ 2**	**Univ 3**	**Univ 4**
E	P = 0.44	P = 0.49	P = 0.41	P = 0.39	P = 0.35
S	P = 0.07	P = 0.08	P = 0.06	P = 0.02	P = 0.06
T	P = 0.49	P = 0.43	P = 0.53	P = 0.58	P = 0.59

Conclusion. As we live in a world that is rapidly changing and becoming increasingly reliant on technology, it is crucial that the next generation of computing professionals understand the connection of their work with society. They need to be able to see beyond the technical aspects and be able to understand how their work will impact individuals, groups and the society as a whole. To do this, the curriculum and its presentation must be re-evaluated to include a more diverse range of course offerings that encompasses the social and ethical implications of computing. This will help students to understand the *why* behind what they are learning, and not just the *what* and *how*. Moreover, as the Gen Z is deeply involved in social causes [8, 9, 12] and values alignment between their career motivations and what their career has to offer [3], it is crucial to incorporate the social value of computing into the presentation of curricula. This will assist students in seeing the potential of their skills to make a positive impact in the world, and align their career goals with their personal values. Lastly, by shifting how they present the curricula of computing disciplines, universities can help fostering inclusion, especially from a gender point of view. Because of its presentation as a mainly technical field, computing is commonly masculine-typed and consequently women are discouraged at taking part in it [10]. This is why it's important that institutions pay attention to how they present themselves through their websites, which are reliable sources of information that are essential to depict computing to prospective students [7].

This study is part of a larger effort proposed and realized by EUGAIN, a Horizon Europe-sponsored COST Action, whose purpose is to create a European network that enhances gender balance and diversity in the field of computing.

CCS CONCEPTS

• **Social and professional topics** → **Computing education programs**; *Gender*; *Adolescents.*

KEYWORDS

gender balance, DEI, computing, intervention, generation Z

ACM Reference Format:
Irene Zanardi, Serena Versino, Karolina Bolesta, Anna Szlavi, and Monica Landoni. 2018. Looking for a Major in Computing? Technical Knowledge versus Broader Social Values in Computing Majors. In *Proceedings of 10th ACM Celebration of Women in Computing womENcourage (womENcourage).* ACM, New York, NY, USA, 2 pages. https://doi.org/XXXXXXX.XXXXXXX

ACKNOWLEDGMENTS

This project was partially supported by COST Action CA19122 - EUGAIN (European Network for Gender Balance in Informatics).

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