Investigating the Role of Computing Education for Informed Usage Decision-Making

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ABSTRACT

Every person is confronted with multiple usage decisions, especially in the context of digital systems. The challenge for computing education is to enable students to make these decisions in an "informed" manner, which is considered a key competence needed to become a responsible citizen. As a first step within our research project, we report an attempt, inspired by healthcare research, to measure informed usage decisions by calculating a score indicating the "informedness" of a decision. We evaluate and discuss our method based on a first findings from a field test with 28 students.

CCS CONCEPTS

• **Social and professional topics → K-12 education**.

KEYWORDS

Citizenship Education, Computing Education

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1 INTRODUCTION

Users of digital systems are confronted with usage decisions on a daily basis, e.g., when accepting cookie banners, choosing an app from the app store, or when deciding on AI tools to use. Making a goal-oriented decision in such situations is considered a key competence for digitally responsible citizens, for instance within the DigiComp Framework [11] or the Dagstuhl triangle [2]. For such a decision, various aspects have to be taken into account.

Besides ease of use, whether it suits the purpose or user basis, aspects such as privacy, code of conduct, lock-in effects, and many more might influence the usage decision. Goal-oriented decision making also relates to the much broader field of democracy education in Germany [7] or decision education in the US [4], as democratic values like freedom, human rights, and justice play an important role in this context.

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We consider such a goal- and value-oriented decision an *informed usage decision*. In line with [1, 9], to make an informed usage decision, one must choose an available option after evaluating relevant aspects of different alternatives according to the decision-maker's goals and values. For informed usage decisions in digital systems, computing competencies are needed to adequately consider (1) what aspects might be relevant, (2) assess and evaluate them for different available alternatives, and (3) weigh the alternatives against each other [2]. For example, to decide on a messenger to use, the decision maker must first identify relevant aspects that are or should be important to them. These can be, e.g. privacy, availability, existing user basis, multi-device compatibility, or transparency. The decision maker needs to identify technical properties influencing these aspects, and evaluate all systems that fulfill these constraints. In the context of messengers, computing concepts such as basic concepts of encryption, but also architectural structure (centralized vs. decentralized), open source, or data collection are important for an informed usage decision. While other "informed" decisions, such as consumption decisions of physical products, are discussed commonly in K-12 education, the decisions on digital systems are less present. Sometimes, the privacy properties of software, like a messenger, are discussed. However, other important values like freedom, democracy, and human rights are lacking completely[3].

With our research, we want to investigate the role of computing education in informed usage decisions on digital systems. Thus, we aim to analyze what CS competencies are necessary for making informed usage decisions, how the students apply these competencies, and how to foster informed decision-making in K-12 education. To this end, we need to be able to grasp, assess, and measure informed usage decisions. In this poster, we present a first attempt at measuring informed usage decisions for the exemplary case of instant messengers.

2 RELATED WORK

In education and pedagogy, little research focuses directly on assessing informed decision-making. Instead, most existing research targets pedagogic tools, like learning analytics [12], that help to gather knowledge for teachers to make informed decisions or investigate the knowledge used in informed decision-making of teachers [8]. Within the domain of computing education, Gebhardt et al. [5] discussed the influence of the (de-) centralization of power on messengers and proposed a teaching concept to teach (de-) centralization and the underlying values to students. In their work, they discovered, that despite being educated on (de-) centralization directly before, the students took only privacy into account when recommending a messenger. The majority of research on informed decision-making comes from the field of healthcare. Studies in this

field investigate and measure the patient's decision-making on available treatments. This is most commonly done using a questionnaire to investigate values, knowledge, and intentions. From these aspects, a measure for informed decision-making is constructed [6]. While some studies classify choices as *informed* or *uninformed* [9], others vote for a continuous, instead of a binary scale [6].

Furthermore, the acceptance of a specific technology depends, according to the technology acceptance model [10], largely on the perceived usefulness and ease of use of the technology. These factors then influence the attitude and behavioral intention to use the technology. In the technology acceptance model, social pressure, experience, image, and multiple measures are stated for effectiveness as factors for perceived usefulness. The authors observe that the amount of experience of a person decreases the influence of social pressure on the acceptance and usage of a technology.

3 MEASURING INFORMED DECISION-MAKING

To assess the "informedness" of a decision, we adapt an approach from healthcare research as described above. Hence, we developed a questionnaire with repeating subsections for each messenger the participant uses, as each used messenger represents a usage decision on its own. In these subsections, we use elements and items from the technology acceptance model (see section 2): We first ask participants to rate statements on aspects about each messenger on a 6-level Likert scale. These aspects were compiled from the literature and expert interviews and include, besides others, privacy and whether they enjoy the functionalities of the messenger. Additionally, we asked the students how likely they will use the messenger in the future and how often they use the messenger. We collect the general importance of aspects in messengers. For example, for each messenger, students should rate the statement "I can reach all my friends and family through this messenger", which then aligned with the general value of "existing user-basis". From these items we (1) derived the knowledge about each messenger and (2) constructed a score capturing how well the perceived properties of a messenger fits what the students deem important. The score was then weight with the usage intention, how likely they will use the messenger in the future. As recommended for informed usage decisions, we did not aim for a binary classification whether or not a usage decision is *informed*. Instead, we try to measure the level of *informedness*. To get a first idea of the *informedness* of a decision, we compare the participants' results to a random selection of answers, to have a base line for what to consider informed.

Fieldtesting. The developed methodology was then tested in two classes, year 10 (with elective CS subject with related topics such as internet and cryptography) and 11 (without elective CS subject), at a high school in Baden-Württemberg with 14 students in each class. We use the different groups to investigate the possible influence of prior cs knowledge on the decision. Looking at the results, our data indicates some major false assumptions on specific messengers among students. For example, when using the messenger "Telegram", students thought that messages are always encrypted and only people within the chat can read the messages. Comparing both classes, we observed that there was only a slight, but no significant difference based on prior CS knowledge. Regarding the influence of values, we discovered, that how well a messenger fits the attitudes of the students does not have an influence on the usage intention for this messenger. We also observed that the students performed significantly worse than if they had randomly answered the questionnaire. However, we noticed a reoccurring pattern of rating all values of messengers as similarly important.

Discussion. These results show the difficulty of measuring "how well a messenger fits the students' attitudes" with the approach derived from similar work on "informed decisions" in healthcare. First of all, we could not measure differentiated the importance of aspects, which should be measured in the future using direct ranking methods. Furthermore, we presumably overlooked aspects that are important for students, as we limited aspects to a predefined set. In future, relevant aspects should be directly specified by the students.

4 CONCLUSION AND FUTURE WORK

The results of the first field test of our methodology provide us with helpful insights into the pitfalls of measuring attitudes and values in the context of informed decision-making, showing that a mixed-methods approach seems more purposeful.

In our future work, we aim at refining our approach to investigate informed usage decision-making. To this end, we are especially interested in the existing mental-model of students and experts of messengers. These results will then be used to investigate relevant CS competences for informed decision-making.

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