Inverted User Stories and Topic-Centered Classification as ideas for embedding ethics into computer science education

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Abstract. In this poster, we consider ethical issues in computer science education. Informatics concepts raise social and thus ethical issues when transferred to an application context. We offer a methodical way of integrating ethical learning into computer science education while maintaining the distinct conceptions of computer science education, including methodology.

Keywords: informatics and society · ethical learning · multiple perspectives · user stories

1 Initial situation

This poster aims to integrate aspects of ethical learning into computer science (CS) while maintaining the specific characteristics of computer science education (CSE). Integrating ethics into CSE will pose the challenge of using methods and conceptions of neighboring disciplines, on the one hand, and not letting CSE itself become only an ethics class, on the other hand. The research question is: How can CSE integrate ethical learning while retaining its distinct conceptions, including its methodology? In the German-speaking community, this kind of question is discussed in the topic area "Informatics and Society", which is also referred to as "Informatics, People and Society", depending on the publication [7,8]. According to our research, this rather constitutes a cluster of subject areas that has only been perceived as a collective term until now. We focus and on the subfield that raises ethical issues when computer science concepts are placed in an application context.

2 Related Work

As early as 1972, Nielsen marks a starting point, which is continued by Johnson 1994 and Martin 1997 [1–3]. A more recent approach is being tested at Harvard [5] and a cross-sectional study is conducted by Fiesler et al. in 2020 [6]. It is widely recongnized that these topics should be worked on from within CS itself and should be spread at various levels of education, even if prior work often focused on academical courses. We would like to concentrate (also in the course of the expansion of CS as a compulsory subject in Germany) on school teaching in the secondary level I.

3 Methodical Design

In order to integrate ethical education into CS learning, we transfer computer science concepts into an application context and focus on genuine informatics competencies. Therefore, our proposal is a four-phase theme-centered instructional design: In the first phase *informatics procedure*, students learn the technological aspects and informatics basics of the subject area and apply them practically. Up to this point, it does not differ from existing teaching concepts. Our example scenario describes a restaurant where a person receives a transmitter and can sit down at any table. When the food is ready, a waiter brings it to the right table. The students' task is to make the LED on the Calliope board [9] light up in three different colors, depending on the signal strength. The localization of the group of guests can be read from the LED colors of the individual Calliopes in the room. In the implementation of their solution, the students are given an idea of the technical implementation of localization using radio signals (see Fig. 1). In accordance with the communicative and cooperative character of CS [7,8], in

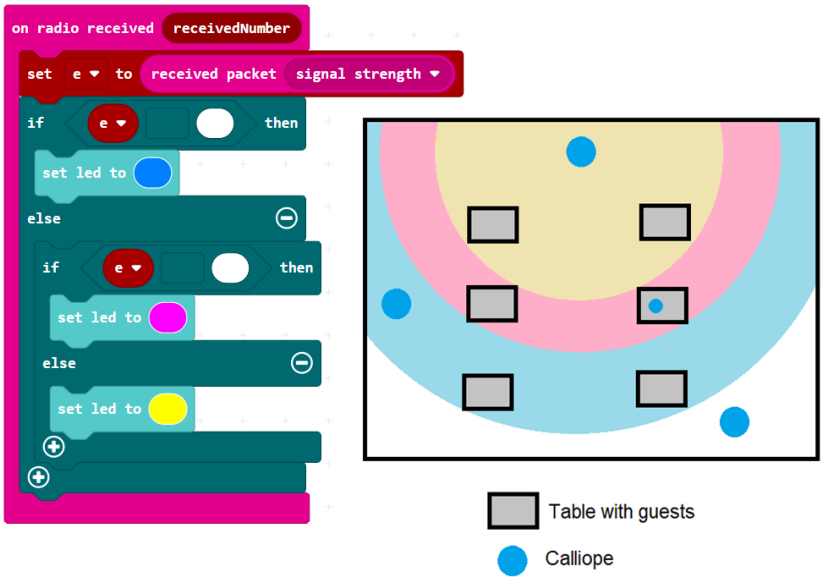

Fig. 1. Algorithmic implementation of the localization.

the second stage, *use in narrative context*, the teacher presents a narratively designed and contextualized challenge situation that is directly related to the core topic and is challenging due to the open-ended story. In the example scenario: The situation that is outlined by the teacher is the story of the 16-year-old girl, who argues with her parents, packs a suitcase and travels by train to a distant

friend without telling anyone. But the students learned principles of locating the girl's smartphone... In the third part, *narrative design of multi perspectives as inverted user stories*, students are challenged: They continue the open end of the story, creatively developing it from a given or a self-selected perspective and taking into account special interests of the taken perspective. We call it *Inverted User Story*, which represents an as concrete application as possible of the technology or CS topic learned at the beginning. The narratives constructed in the learning process needs by no means to reflect the personal stance of individual students – a position taken on a trial basis can and should also be valued in CS classes. For example: One could tell the story from the point of view of the parents who are worried about their daughter. Perhaps also because she is dependent on medication... Another could tell the story from the point of view of the girl who wants to contact her parents later, but first needs distance... The inverted variant chosen by us represents a novel approach for the use in lessons, as it transports particular social perspectives – here, explicitly ethical viewpoints – in the established user story format. The learning path described here culminates in the fourth and final phase, *topic centered classification and relation determination on a sphere*, in the mutual presentation of the student products and the grounded relationship on the sphere. In our example: The location on the sphere serves to secure the inverted user stories. Each student or group tells their story and chooses a direction of their flag in relation to the other stories (see Fig. 2). This visualizes that there are different well-founded views on the ethical question. Our proposal aims at promoting the students' compe-

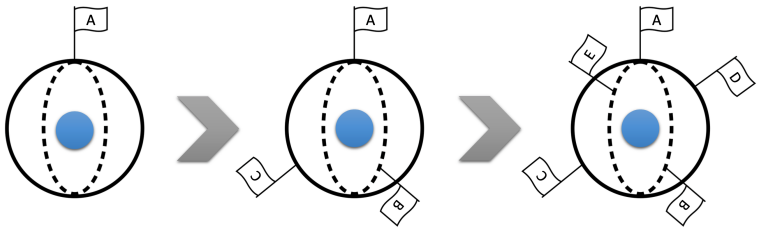

Fig. 2. Sphere in progress.

tence to introduce their arguments into discourses in a well-founded way and at the same time to respond to the contributions of their interlocutors [4]. The aim of the teaching-learning scenario presented here is a "change of perspective from the living environment towards technologically sound, propaedeutic investigation" [7], which illuminates the aspects of ethical education inherent in CS. The narratives constructed helps relieve teachers from having to fully present and complete all possible positions, because the method also works with selected positions and assigns teachers a primarily moderating function. The present approach follows a genuine informatics-based learning process, as stories are created and the creative aspect of informatics is emphasized.

4 Conclusion

We have offered a methodical way of integrating ethical learning into computer science education while maintaining the distinct conceptions of computer science education, including methodology. The four-step process allows the learning path to be experienced symbolically and haptically: 1. *informatics procedure* students discover an informatics concept, 2. *use in narrative context* the teacher takes the concept into an application context by starting an unfinished story, 3. *narrative design of multi perspectives as inverted user stories* learners continue to develop the story from a particular point of view, 4. *topic centered classification and relation determination on a sphere* students visualize their points of view and classify their contribution in relation to others. We continue researching other subsets of the broad field of "Informatics and Society" for further methodological conceptions.

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