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Exploring the Effects of the Hedy User Interface on the Development of CS Interest in Girls: a Study Design

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ABSTRACT

Women are underrepresented in Computer Science (CS). Closing the gender gap in CS benefits the economy, gender equality and society. However, girls have low CS interest while interest energizes learning and guides career trajectories. We explore the effects of the user interface of Hedy, a graduate language which teaches the syntax of Python, on the development of CS interest in girls.

KEYWORDS

gender, programming language, user interface, interest

1 INTRODUCTION

Women are underrepresented in the field of Computer Science (CS) [6]. Closing the gender gap in CS benefits the economy, gender equality and society: more filled CS vacancies, women having access to well-paid jobs, and more innovative products. However, girls are less stimulated to gain experience and to develop their interests in CS [7, 9]. Interest, however, is a motivational process that energizes learning and guides academic and career trajectories [3].

To develop interest, children need to learn about and interact with CS which is often via programming. Previous programming experience is correlated with the CS career orientation of primary school students [1] and is the best predictor of persistence in female CS college students [10]. It is important that programming environments support the interest development of a variety of students.

One of the programming environments used by children to learn to program is Hedy. Hedy is a graduate language which teaches the syntax of Python [4]. In the first level of Hedy there are no syntactic elements such as brackets or indentation and while children move through the levels more syntax and commands are added.

In this research, we explore the strengths as well as opportunities of the user interface (UI) of Hedy. Therefore, we consult University students that follow the course Digital Interfaces as part of their Industrial Design bachelor's degree.

2 BACKGROUND

Interest describes (a) situational interest which is engagement with some content in a particular moment, and (b) individual interest which is the motivation to continue to seek opportunities to engage with that content over time [3, 8]. Based on these types of interest, Hidi and Renninger [5] created the four-phase model of interest development. The model defines four phases: triggered situational interest, maintained situational interest, emerging individual interest and well-developed individual interest. In the first two phases, the situation triggers interest. After repeated experiences with meaningful tasks, interest can develop into the latter two phases [3]. To stimulate the development of interest, Harackiewicz et al. [3] discuss four interventions:

> **Structural features.** Triggering situational interest by introducing novelty, complexity, surprise and incongruity.
> **Context personalization.** Triggering situational interest by leveraging students existing individual interests.
> **Problem based instruction.** Triggering and maintaining situational interest by introducing a problem that highlights a lack of knowledge and motivates the search for answers.
> **Utility-value.** Triggering and maintaining situational and individual interest by students actively generating connections between the topic and their lives.

Durik and Harackiewicz [2] used structural features to develop math interest. They added colour, varied fonts and vivid pictures to math tasks. This enhanced the situational interest of students who were low in individual interest. However, the intervention had a negative effect on students who had a more developed interest in math. Therefore it is important to balance structural features.

Within our research, we aim at using structural features and the visual aspect of the programming environment to develop the interest of girls in CS.

3 METHOD

To our knowledge, limited work is done on the effects of programming environment UIs on interest development. We suggest the following steps to design and test an adjusted UI:

(1) Collect feedback from design experts: what can we change to make Hedy more attractive to children and girls specifically
(2) Combine literature on UI design with the feedback from the experts to develop a concept for an adjusted UI of Hedy

(3) Test the concept among the target group with a survey containing the current version of Hedy as well as the adjusted version (method inspired by [6])

(4) Adjust UI based on feedback from the survey and implement it into Hedy

(5) Measure interest-related behaviour before and after the introduction of the new design

This research focuses on the first step. We collect feedback on the UI of Hedy by consulting University students that follow the course Digital Interfaces as part of their Industrial Design bachelor's degree. We collect insights through a survey with mostly open-answer questions. We ask them about the strengths of the UI, what we could change to increase children's interest in CS, whether they perceive Hedy targeted at a specific gender and if there is anything we could change when targeting girls.

So far, four students responded. They all indicated to never heard about Hedy before and they all have Python experience. Below we share their opinions and suggestions. Both the questions and given answers are translated from Dutch.

4 FIRST RESULTS

We asked the participants what (design) aspects of Hedy they experience as positive. According to one of the participants, there is a clear distinction between coding area and assignments. Another participant mentions the clear distinction between different assignments. It is also mentioned that the emphasis on terms makes it easier to remember them. Several remarks are made about the buttons. One of the participants notes that the button to copy code is useful and has a clear purpose. Another participant mentions that there are many buttons on a single page and you need to click on them to understand what they are doing. Two of the participants wonder what the button with the ladybug is doing. One of these participants shares that 'the design of Hedy looks child-friendly. However, it is not always clear what you are supposed to do: where should you type the code? What is the ladybug for? What is the meaning of the different colours above the assignments?'.

The participants have a couple of suggestions for increasing children's interest in programming through Hedy. One of the participants suggests a fun reoccurring character 'who guides you and helps you as a friend through the levels'. Another participant mentions that Hedy has a school-like appearance, which we may like to change. It is also suggested to give children the opportunity to change the graphics of the environment (with more options when reaching higher levels). Furthermore, one of the participants suggests replacing certain difficult words, such as 'commands' and 'concepts', with more neutral and accessible terms.

When asked whether they perceive Hedy for boys or girls with a Likert-type item, three of the participants indicate that they perceive Hedy as neutral while one participant perceives Hedy as slightly more for boys. One of the participants states 'I think it is neutral since it has different colours and not a certain look that I find more appropriate for a certain gender'. The participant who perceives Hedy as slightly more for boys mentions that the appearance is quite blue which is a colour that is associated more quickly with boys. This participant also mentions that programming 'is more likely to be associated with boys than with girls'.

We also asked the participants what we can change if we focus on the interesting development of girls. A participant suggests making the context of the assignments more for girls but also notices that 'I do like the fact that the assignments are so neutral and that the contexts are recognizable to everyone'. Two participants mentioned the use of colour: using neutral colours that are appreciated by all genders as well as making the environment more colourful. One of the participants also mentions using a different font: 'use a nicer neater written font. The somewhat thicker and less tidy fonts are more suitable for boys than for girls'.

5 CONCLUSION AND DISCUSSION

In this research, we explore whether we can adjust the UI of Hedy to increase girls' CS interest. The first results show that Hedy is perceived as quite neutral. However, we could adjust Hedy by making it more evident how to use the environment, by adding a character that guides the user, and by using different colours and fonts.

To continue this research, we should collect more expert opinions. Thereafter, we can combine these with literature to make a concept for an adjusted Hedy which we can test. Next to UIs, we are interested in the personalization of assignments and making connections to real life as ways of increasing CS interest in girls who use Hedy. Other future work that is of interest is analysing more programming languages and environments, such as Scratch or code.org, on gender inclusiveness and their impact on interest development. Through this and future work, we want to create more awareness that programming environments can impact interest development. Moreover, this work can result in recommendations for creating more gender-inclusive CS education. When our CS education develops CS interest in a more diverse group of students, we take a step forward in closing the gender gap.

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