CanYou? A mobile application to increase the interest in technical areas among the underrepresented girls.

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ABSTRACT

Within both education and work forces at companies in the area of science, technology, engineering and mathematics (STEM) there is an underrepresentation of females. The reasons are several, lack of role models, gender stereotyping, girls also tend to underestimate themselves and even if they have an interest in the area they have another first choice option. We have worked with a design concept, a mobile application called CanYou?, to enhance girls interest in STEM fields and tutor them with easy practical examples which show the possibilities of technology. The main aim is to inspire. The only thing needed to change an opinion is an opportunity, which is what we are creating with this application regarding their interest in the STEM field. The design concept provides a platform with fun social tasks where the user can challenge their friends, work on interesting projects, and increase their skills.

Author Keywords

Responsible design, Youth, Challenges, Inspire, Interaction, Girls in STEM

INTRODUCTION

Girls are underrepresented in fields such as science, technology, engineering and mathematics (STEM) according to a research conducted by 'A girl scout research institute' [6]. The research presents that 74 percent of teen girls in America are interested in the field of STEM, but only 13 percent has it as a first choice to work within any of the areas. Today technology is dominating much of our daily lives and Companies in Silicon Valley *are thought to hold some of the greatest minds and innovators of our time [4]*. Even though girls are interested in puzzle and problem solving [5] still according to a report in 2011 made by the U.S. department of Commerce [7], only one in seven engineers is female. In companies there is a lack of diversity, e.g. only 27 percent of computer related jobs are held by a woman. According to Robert E. Moritz [8] the result of a project is best when there are diverse people working together. The team should include a mix between different genders, backgrounds, ethnicities and ages. Moritz explains that diverse teams give the best thinking which generates the best actions and the best results, it is the winning recipe. It is therefore important to try to achieve diversity in those areas where it is lacking today e.g. in STEM fields.

The best way to address the problem is to start by motivating young girls to participate in STEM related activities and inspire them to continue with pursuing a degree in a technical field. According to Brotman and Moore [12] the science curriculum and pedagogy need to change so that the experiences, interests and learning styles of girls can be recognized in the classroom. In order to effectively engage girls in science, they have to see that the subject is relevant to their everyday life and to be able to participate in group work and practical experiments [13]. Research has shown that girls participating in single sex classrooms (only with girls) tend to have a better performance, both overall, as well as in science related subjects specifically [14]. This fact shows that gender inequality, misconceptions about how girls compare to their male classmates and sometimes harassment is present as early as in the school environment.

PRE-STUDY

Related work

The urge to achieve diversity and increase the amount of females in STEM areas is a huge focus among countries around the world and there are multiple projects and organizations working to reach this goal. 'National girls collaborative project' was founded in the U.S. with the aim to *bring together organizations throughout the country that are committed to inform and encourage girls to pursue careers in science, technology, engineering, and mathematics[2]*. The organization also aims to i*ncrease the number of women of color and minorities in STEM fields [2]* by offering educational opportunities. A similar project is carried out in Europe where 'European schoolnet' organizes different initiatives in collaboration with several countries. Together they are trying to fight the trend of a declining interest in science studies and related professions, when at the same time there is a rising demand on technical skills. Until 2020 there are several goals, including setting up science centers, creating partnerships between schools and companies, providing particular guidance to encourage youth girls to choose scientific careers [11].

Interviews

While we were trying to formulate our concept, and in order to get a deeper insight of what young girls think about when participating in STEM activities, we conducted a short interview. The interviewee was a 14 years old girl at the first class of the secondary school. When asked about

her favorite courses at school she replied that, among other things, she likes algebra which shows that there is an initial interest in the STEM area.
We presented her with different scenarios of activities such as creating technologically enhanced fashion accessories and building different artifacts and she showed that she was interested and would participate in such activities. She described herself as crafty and said that she enjoys "building things".
At school they only have an informatics course and another technology related one that is mostly theoretical and only has a hands on project at the end of the year. It was obvious from her responses that although she likes to participate in tech projects, she doesn't have enough encouragement and inspiration from her school curriculum. She also replied that she would be even more motivated to participate if there was a competition between schools or classmates rather than working for herself.
Finally when she was asked if she would consider being an engineer her reply was "no because I don't like what an engineer does" which shows that there might be a misconception regarding what an engineer actually is and does.
At the early stages we also discussed the topic with some of our female classmates. They explained the problems they were facing when they were at school trying to engage in STEM related activities. The solutions to these existing problems was that they were following blogs and tech related websites, and in the end they gave their opinion on what they would like to have in school to support STEM activities.

OUR IDEA

To change the fact that girls today are underrepresented in education within the technological areas we developed an application built on the concept that everything needed to change an opinion is an opportunity. One of the problems to solve is that people tend to avoid tasks they think they would not like or consider hard without giving it a try. We think that this could be overcome with an innovative and thoughtful design. The thought is to approach the target group in a new way. By introducing an application which from first sight is not related to physics or math, we think a first try could be achieved which could be enough to make students reevaluate their judgement.
The application will provide do-it-yourself tasks for the user to complete, to challenge someone else or both. The tasks are of a crafting character and within the area of STEM, although not in an obvious way. The tasks are designed to encourage the user through detailed instructions to do something that from first sight could seem difficult but in fact is very easy when following the instructions. Similar to painting by numbers, without any guidance the task would seem impossible but by breaking it down to parts it becomes easy.
One of the main focuses in the application is that it has to be easy to use and self-explaining. Since the aim is to give the user an interest in STEM areas, any potential difficulties might instead contribute to the opinion of STEM areas being difficult. The second focus is to make it fun and worthy spending time on. The user should feel an urge to revisit the app after the first use. The app must therefore contribute with something more than only enjoy ability, it has to offer the possibility to further exploration in addition to social elements. The tasks distributed in the app are updated within a 7 day interval, however not all of them at the same day, i.e. one task might be updated on Monday and the other on Tuesday, to give the user the possibility of something new to explore every day. The user could also challenge one of their friends to do the same task, which gives a motivating and social aspect to the application. The friends are retrieved from the user's Facebook account.
The problem with similar applications and web sites is that although they don't have a specific target group, the majority of the users are male. In order to make sure that both girls and boys will be motivated to use the app, we added the competing element. Each user competes for their school. For each completed challenge, a point is added to the overall school score and the users can see how their school compares to the others. The user could also see a record of how many points he or she individually has collected.
Initially we explored the idea of our design to be solely addressed to girls, however we very soon rejected this concept. Our aim is to promote equality and collaboration between the two genders. Isolating girls might have led to an increased number of inspired girls but it would not have promoted the app as equal and open to everyone. Also the notion that girls need something special since they are not as good as their male classmates might have been another negative way to view the application. By challenging other users, the tasks create a topic to discuss among friends, therefore anyone interested needs to be part of the target group.

Design

The home screen is designed in the form of an inspirational grid that includes all the ongoing challenges for the current week (Figure 1a). By selecting one of them the user can see the challenge screen (Figure 1b) which presents a short inspirational video on how the final result will look like, the possible uses etc. There are also step-by-step instructions on how to complete the challenge, and a submit form where the users can submit pictures, video and text description of the final result and the whole process they followed. Finally the user can press the dare icon to dare their friends to complete this specific challenge.
When the user submits a solution, he or she has access to every other submitted solution for this challenge. The submitted solutions also become visible through the archive after the week is over and new challenges have started.

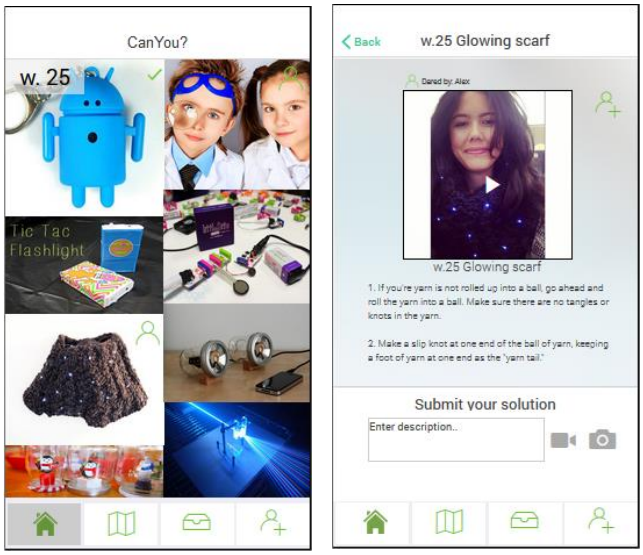

Figure 1. a) Home Screen, b) Challenge screen.

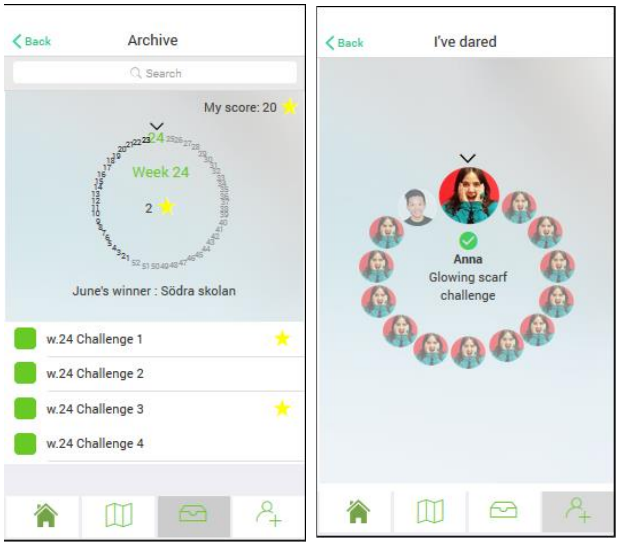

Figure 2. a) Archive Screen, b) Dare screen.

This element of our design aims to work as a tutorial database in order to help students improve their skills and encourage them to try challenges they thought were too difficult for them. In the archive the users can go through all the past weeks, see the submitted solutions to all the challenges, and see their personal score and the winning school of the month (Figure 2a). The challenges they completed themselves are marked with a star.

In the dare screen the user can see all the friends he or she has dared for the current week's challenges (Figure 2b). In both the dare and the archive screen we introduced a playful way of interaction. The weeks of the year for the archive as well as the friends for the dare screen resemble a spinning wheel. The upper top part is the spot for the current selected one and the users can spin the circle to select another person instead and see more information about that friend. The same applies for the weeks in the archive screen.

Finally there is a map of the city with all the schools participating in the competition (Figure 3). The user's school is marked green and the score of the schools is visible on the map all the times. By clicking on any of the schools, its name appears. The reason we chose a map instead of a ranking list is that we think this is a more interesting way of interaction since the users can navigate through the city and see how they compare with the rest of the schools.

Figure 3. Map

Evaluation

When a first version of the design was completed, we tested it by asking two users to complete some predefined tasks using the app. The aim of the tasks was to guide the users through the different screens of the app and test whether the interaction was simple and self-explanatory. The initial intention was to test it with teenagers but this was not possible. The first two test users were male of age 20-30. Their feedback helped us to identify several usability issues such as buttons that were not very salient and icons that didn't provide useful insight. The spinning wheel interaction seemed to be clear to grasp without any guidance.

After these areas were improved, we conducted one more test with a female age 20-30 using the same tasks as before. She found the idea interesting especially for finding inspiration for tech projects. She pointed out that a similar concept could work for adults as well that are interested in technology or want to improve their skills. After some minor adjustments, we had the final design of the application that appears in the pictures above.

CONCLUSION

Engaging more women to work in the STEM fields is vital. We are witnessing fast paced changes in the fields of science and technology and a more diverse perspective is required today more than ever. The key to achieve this goal is by motivating girls early in their lives to pursue a degree and later a career in such topics. With CanYou? more girls can be motivated to participate in activities that will inspire them to become scientist or engineers.

It is important for the girls to understand that they are as smart and capable to succeed in the STEM fields as their male classmates, and the best way to achieve it is through recreational activities and healthy competition. CanYou? gives girls the opportunity to participate in activities that are not considered traditionally female. Our goal is to spark their interest and we trust them to set their goals and achieve them.

The application has potential to work in collaboration with schools. Science professors can propose the projects and even provide the material needed to complete them. Another way to continue with the project is by collaborating with scientists and engineers that can work as role models, propose interesting tasks and provide help when it is needed.

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