Broaden Your Experience: Developing a Prototype Game to Teach Bioinformatics in the Classroom

High school classrooms are full of girls with incredible potential in computer science, who don't choose the study in university due to stereotypes, societal expectations or gaps in high school curriculums, among other reasons.

The big picture aim of this project is to appeal to these girls by showing them the capabilities of computer science in the context of biology, with the hope that this subject, which is considered more "socially acceptable" and is generally more targeted toward women, will make the content more approachable, engaging, and attractive to them.

Specifically, my objective was to come up with a short game to introduce the concept of gene clustering in bioinformatics, highlighting the importance of using computers, and giving the students a taste of the algorithms that are used for it. The topic of clustering appealed to me when it was offered as an option, because it is, in my opinion, quite a logical and intuitive concept, as well as very widely used in the field of bioinformatics. Additionally, it extends naturally into other concepts in computer science like classification, machine learning or data analysis.

Table: Breakdown of time spent

Activity	Time spent (h)
Meetings (introduction and feedback)	2.5
Brainstorming	3
Making initial "paper version" of the game	4
Making initial (terminal) code	5
Writing application code	32
Making instructions	3
Testing and getting feedback	4
Writing report	4
Total	*57.5*

At the start of the project, I had a couple of meetings with Jasmijn and the team to introduce the project and define the specific case I would work on. Around that time, I

brainstormed a few important aspects I wanted the game to include, as well as specific ideas, which I pitched to the team.

My initial plan was to develop a concept for the game, including some schematics of what I was imagining, and the text to accompany them. I spent some time refining my ideas from the brainstorming and crystallizing them into a concrete idea for the game. However, the “paper version” of the game didn’t quite convey what I wanted, so I decided to make a prototype application.

The concept for the game was a window where short DNA sequences appear in blocks, and fall into the game area. The students can then drag and drop them into one of 4 different boxes. By putting sequences into the same box, they create a cluster. As the sequences spawn faster, the game becomes more difficult, so the length of the sequences and the speed at which they appear can be used to tune the difficulty for different age groups.

I started by developing code for the core functionality, which allowed me to create a very basic terminal-based version of the idea. However, the lack of visuals greatly detract from the experience of the game, as there is no drag and dropping, and no speed at which sequences spawn.

Hence, I then worked on the visuals. This took some time, as I am not very familiar with building user interfaces in python, but I eventually completed a version of the application. It has an introductory window where users choose an age group to adjust the difficulty level, followed by a window explaining the concept of clustering. Then, the actual game is implemented, and lastly there is a final explanation window that underlines the importance of programming for clustering and briefly explains one of the algorithms used.

Once the application was finished, I did some initial testing by having my high school-aged brother play and tell me his thoughts. I also had some feedback from Jasmijn, and after making the appropriate adjustments, further tested it with four more high schoolers and a recent high school graduate. I recorded their feedback and compiled it in my repository.

This project was very rewarding, and I enjoyed it a lot. I had never built an application, or worked on user interfaces in python by myself, so that was a valuable learning experience in that sense. I also enjoyed the process of user testing the application, and found the small

interviews I conducted to be very insightful and helpful. I believe my project would have benefitted from more communication with the team on my part, which would have probably made the final product more tailored to their needs. In the future, I will work on establishing clear expectations, planning collaboratively and checking in often throughout the project.