From the beginning of the project we outlined a scrum[1] approach to development, using agile[2] methodology as we thought adaptability would be vital, considering that this was our first major project of this nature and so we had no real idea as to what to expect. This flexibility has worked extremely well for us, as it has allowed us to deal with unexpected problems, challenges, and changes that came about as part of the project. Although we have changed some of the finer details in terms of how we work, the fundamentals have remained the same.

While our scrum structure has stayed mostly the same throughout the development of the project, one of the changes we made was the number of times we meet every week. We initially decided to have 2 group meetings a week, and while this mostly worked during the term, it proved untenable during periods such as the Christmas holidays and during periods of intense work for other assessments. As such, it sometimes fluctuated to less than 2 meetings a week, and occasionally none at all. In terms of development methods, we mostly stayed the same in terms of using scrum, which worked very well throughout the entirety of the project. This was as back when we did not know how to exactly configure a project of this nature, it allowed us to quickly switch around to do whatever necessary task there was.

Despite the risks within the project starting quite high given our uncertainty and lack of knowledge, as we became more comfortable with the nature of our assignments, the project, and other team members, risks fell greatly. This was largely due to us gaining practical knowledge as to what worked and what didn't in terms of development methods. So, while we did briefly consider the Waterfall method in assessment 3 as a possible development method, sticking with the scrum method made more sense in terms of our comfort with it, as introducing a new development method could introduce new risks.

In a similar vein, the software tools we used to make our project have stayed mostly the same throughout. Once we started using tools and how to use them, it was generally easier to stick with them due to us developing our understanding rather than switch to something new and relearn. In terms of the tools we have been working with the entire time: Google Drive has been used to as a way to store and edit joint documents, Facebook Messenger has been vital in allowing communication, Libgdx has been the framework for games we have been building, and Github has been invaluable in terms of managing code within a team setting. These have all been in constant use, as there has always been a need for their functions. However, there are a couple of tools, such as Trello and Discord, that have only seen sporadic use. Trello is a visual task management app that the team we took over from in assessment 3 used. We briefly gave it a try, but though we liked the visual aspect we thought it would be too much work to switch all our documents and primary means of organisation over to it. Discord, likewise, we attempted to use briefly in the holidays as a means to host video calls but it was a hassle to arrange them as all group members were busy with personal work. Additionally, Facebook Messenger seemed perfectly fine for communication as it allowed messages to spread out and didn't require as much of a time commitment.

Throughout our project our management and structure has obviously changed - due to us having little experience with projects such as these, as well as working in a team of people whom we did not know. As a result of this, our initial methods were adapted as we grew as a team and understood the strongest attributes in order to exploit these and complete the project to the highest standard.

To begin with, we decided on weekly meetings in order to have week long sprints in which we would do our allocated work, but we found this to be ineffective as if work was not completed and then it would overflow into the next sprint. We then moved towards 3 meetings per week in order to consistently meet and assure that work was completed, although we found this to be too much as often multiple people would not have worked towards the project between meetings as it was too short of a time frame. As a result, we decided on 2 meetings per week (Monday and Friday) to have 5 day long sprints, which followed our software development model [3], with the weekend to complete any overflowed work from the sprint.

We found that the role of Scrum master was more effective when spread across all members of the group - this meant that all members were looking at the Scrum frequently and were aware of everyone's current work. Other than this, we kept management and structure consistent throughout the course of the project, as we discussed our strong and weak points in our initial meetings meaning that we had a strong idea which member would be suitable for each role. We decided on a Meeting Chair in order to lead discussions rather than having a Project Manager as it was a relatively small project with few members - we found this extremely effective as all members were seen as equally important.

Changes to requirements and risks impacted our management and structure throughout the course of the project. As discussed by B. W. Boehm [4], it is important to prioritise risks and discuss the likeliness of them impacting the project. We found that during breaks from University, as well as during exam periods, the likeliness of some risks impacting the project had increased. As a result, 2 members of the group had to temporarily take on roles of project managers in order to ensure that members still focused on the project despite other commitments. A requirements change in assessment 4 resulted in no change to our management as we were already comfortable with how our team was working at this stage, and we decided that our previous experience in the past assessments proved we were able to adapt to new requirements easily following our management methods.

Our final management and structure was built from experience in software development and was perfected for our team over the course of the project. In the end, we had 3 members of the group focused on code development and 2 members focused on documentation of the project, the final member of the group acted as a supervisor of the project and worked on all parts of the project in order to ensure a suitable overall standard of work, as well as developing our website in order to make it presentable to our customer. We decided that our structure as a team should allow for all members of the group to be seen as equal, rather than giving one member a management role - this allows for all members to have an equal say in decisions, rather than putting more pressure on a manager.

Citations

[1] K. Schwaber and J. Sutherland, The Scrum Guide (2016)
https://scrumguides.org/docs/scrumguide/v2016/2016-Scrum-Guide-US.pdf#zoom=100
[2] K. Beck, Manifesto for Agile Software Development (2001) http://agilemanifesto.org/
[3] J. Highsmith, A Cockburn, *Agile software development: The business innovation* (2001)
https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=947100
[4] B. W. Boehm, *Software risk management: principles and practices* (1991)
https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=62930