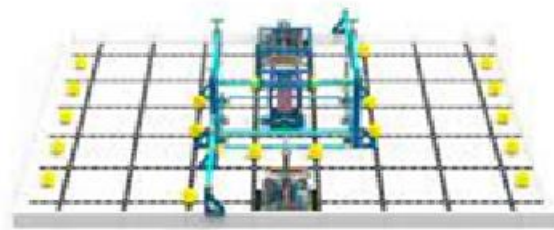# VIQC Elementary School – Career Readiness Online Challenge (172)

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Contents

Introduction

The scope of this documents is to explore existing and/or prospective career/companies, and discover similarities and differences in how the engineering design process differs or is the same as VEX Robotics. In our case, we have selected Apple Technology to compare their design process with the one we have been using to construct our robot.

What is process engineering design and why do you have it in STEM?

STEM stands for Science, Technology, Engineering and Mathematics and refers to any subjects which fall under these disciplines. The acronym originates from the US when companies experienced problems filling tech jobs in one of these sectors. STEM careers/companies will often have a process that they follow for engineering design projects, in its most basic form, it will resemble the diagram below.   The purpose of a design-process is *"to shape and guide your work and thoughts to improve the outcome."*1
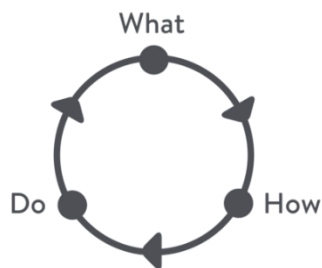

Figure 1. Basic of Process design. 2

Why Apple was selected

We chose Apple's design process for two reasons: it's an international company with a brand and logo transcending languages and cultures with empathetic, desirable products and features; secondly, Apple do truly innovate, they dare to dream and this is what sets them apart: they introduce market changing products which disrupt the market. Having said this, ideas are not enough: it's 1% inspiration and 99% perspiration or as Dr Rafiq Elmansy puts it, *"creativity is not enough to transform a design to a successful product; an innovative process needs to be implemented in order to achieve this goal."* 3 This report will explore this further in the remaining sections.

An Overview of VEX and Apple's design processes.

VEX IQ CHALLENGE

- Design Brief 📁
- Research
- Specification 📁
- Design
- Build
- Evaluate
- Improve

📁 Documentation

Apple

- Ideas 📁
- Product Start-up
- Prototyping (10-3-1)
- ANPP 📁
- Build
- Team Iteration (build, test, review)
- Monday Executive review day
- Product Launch
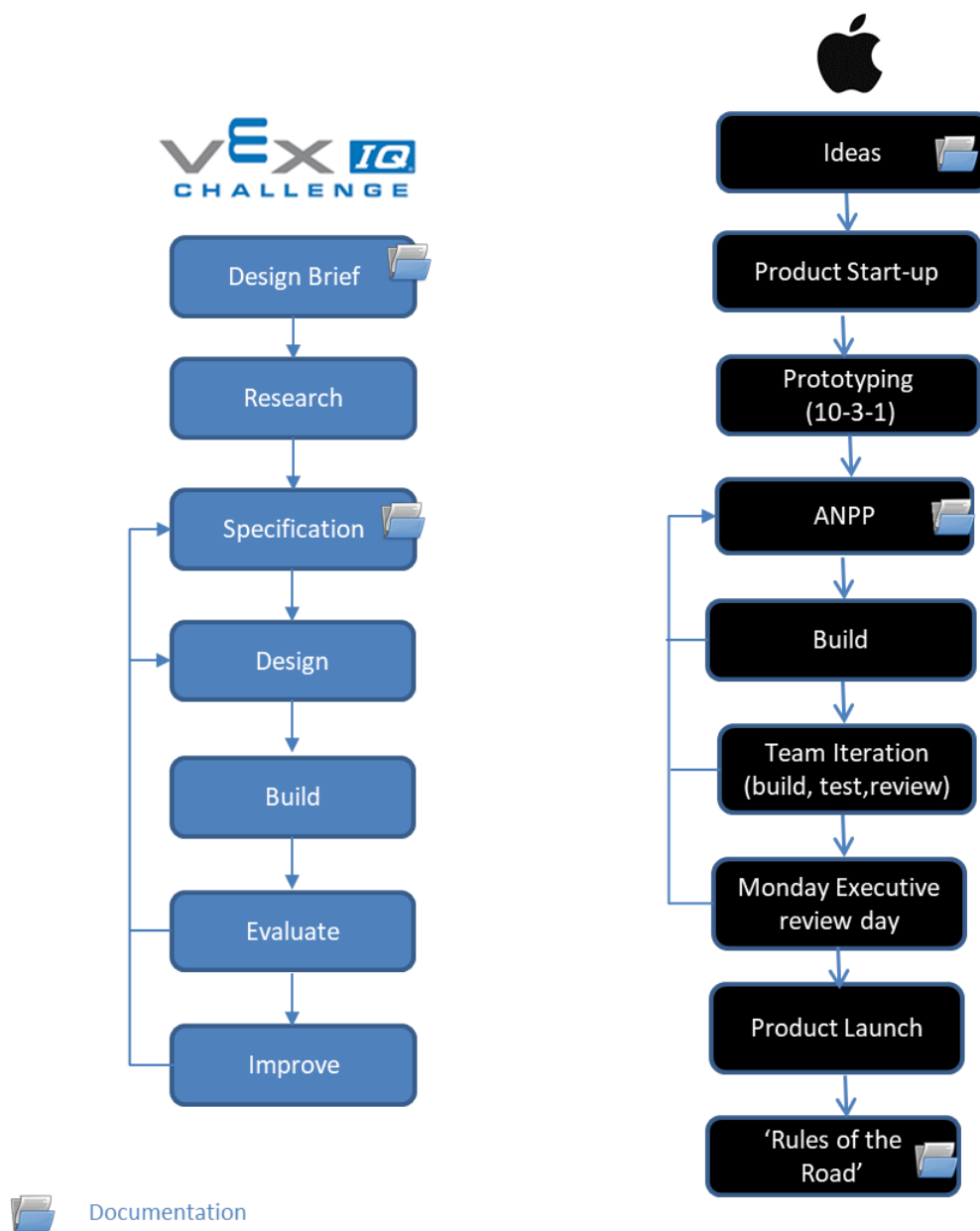- 'Rules of the Road' 📁

Figure 2: AS-IS VEX design process and Apple's design process

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Table 1: A closer look at the similarities and differences in VEX and Apple design processes

VEX Design Process Further information/examples of team usage.	VEX Process Heading	Apple Process Heading	Apple's Production Process and Framework. Further information on Apple process
		Ideas	Senior managers express interests in creating a new product with initial sketches. No complete or visual concept of the product exists at this time.
		Product Start-Up	Internal start-up phase where a team may opt to create their own reporting structures and work separately from Apple Business.
The design brief was provided from VEX IQ Game Manual released in summer 2021 and has various iterations and is the teams' authoritative guide. All teams are expected to keep up to date with this document.	Design Brief		
	Research		Undertaken as part of Start-up phase
During discussions we were able to deduce certain attributes the robot required.	Investigation & Specification		Product Start-up phase, but again, are not quite the same.
CAD and sketching. Our team sketched the robot in rough with different angles and viewpoints.	Design	Prototyping	Pixel-perfect prototypes or 10 to 3 to 1 - this stage is part of mock-ups and also a visual to the project/product. The name 10 to 3 to 1 is the way the prototype is selected. First, design team has complete freedom to explore 10 concept ideas, these are narrowed down to three finalists and then only one final product is selected to go forward.
Our build was modular in which we assemble the main components separately.	Build	Apple's New Product Process (ANPP)	Once prototype is selected, the ANPP is a document charting the process in detail and maps the various stages.
Peer-to-Peer Review undertaken on Monday Team and senior mentor review (senior student): ad-hoc	Evaluate	Monday review day with the executive team.	The Executive holds a meeting every week to examine every product the company has in the design phase.

Teacher and Team Rubber Band evaluation undertaken Wednesdays			Regular peer Design meetings take place to review the products for improvements.
Improve the robot by re-designing and building again.	**Improve**	**Iteration** **Testing the Product.**	Product is built-tested-and reviewed over and over again by the product engineering team.
	NA	**Packaging**	How the packaging is opened is tested for best consumer experience.
Present during tournament.	**Tournaments**	**Product Launch**	Commercial launch.
We had our first local competition in late November 2021 with a presence of 32 teams. We evaluate our Robot after each competition.	**This could be compared to evaluating after a big live tournament.**	**"Rules of the road"**	Evaluate the entire process and millstones – it's not the small review but the 'big' review.

Overview of similarities and differences between VEX and Apple design processes.
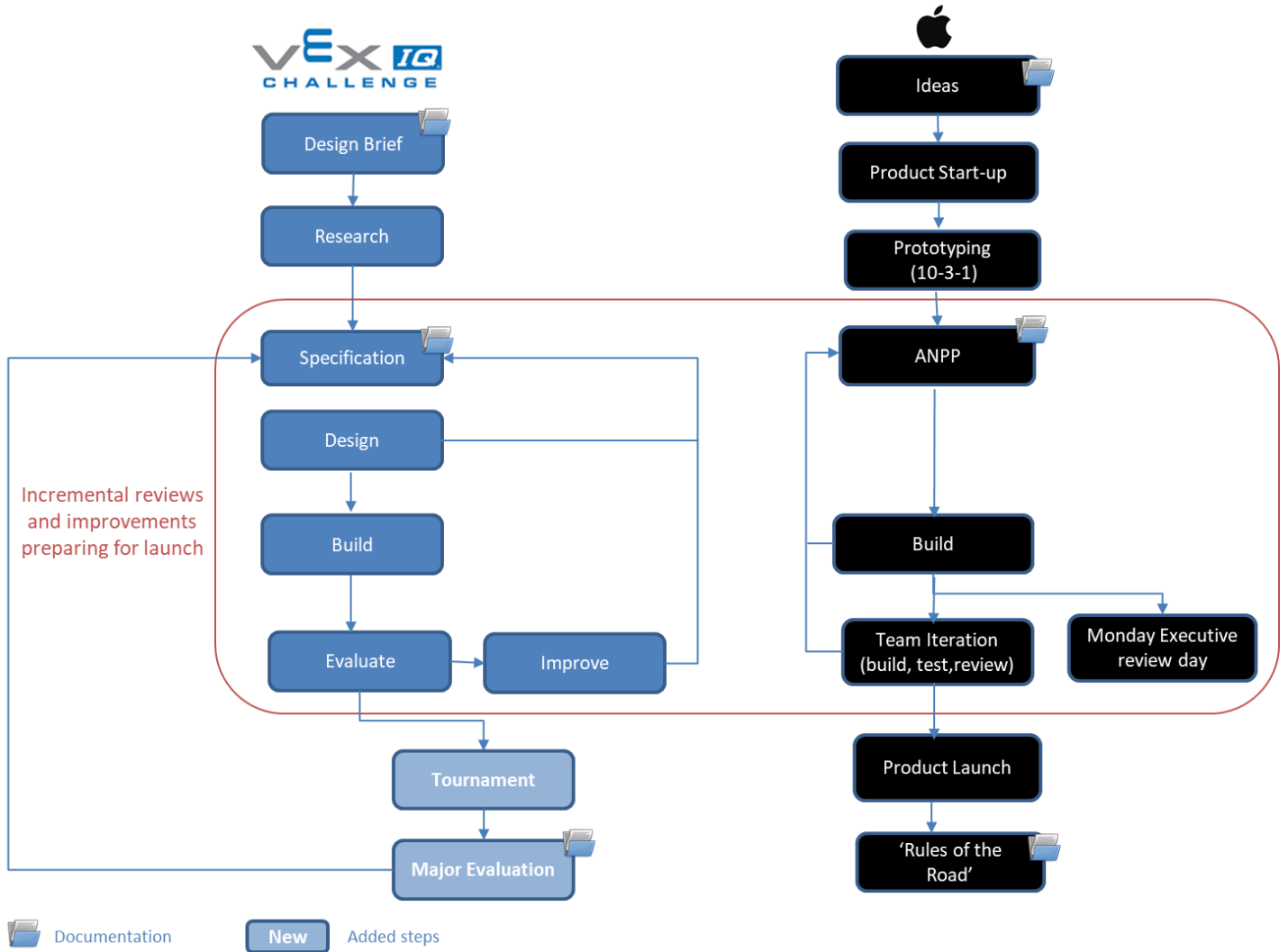

Figure 3: VEX design process slightly modified to sit side-by-side with Apple's design process, highlighting similarities and differences.

Figure 3 illustrates in a diagram the points discussed in table 1, summarising the similarities and differences between the two design processes.

How do Apple document the steps of a design process in the tasks of their job?

How Apple document the steps to design process is kept under close wraps. This is not surprising as it's Apple's intellectual property and should be kept under close guard.

How participating in VEX will prepare the team for a future in STEM-related career.

Although our team is from one school, the context and formation of how we came together as a group should be explored further: our first year at secondary/middle school was a stop-start experience with strict COVID restrictions curtailing our movements and being forced into national lockdown, remote-home learning via MS Teams. These measures were put in place to keep the nation safe. Our team was assimilated towards the latter stages of the school year, many relationships with peers being distant acquaintances. Meet-ups during the summer holidays were all virtual until the start of a new academic year.   As a team, initially, we did struggle but we strongly believe without the design process, there would have been an absence of a common structure, governing and guiding our meetings, allowing us to make mistakes, learning and moving on.

In a decade's time, when we are ready for the world of work, there is likely to be hybrid working and project teams may be geographically dispersed or possibly in the same city but opt to work remotely, project colleagues at first will be unfamiliar to us. The guide will be a design process and/or structures in place to ensure diversity of minds are able to come together, face-to-face or virtually, to solve problems and work towards meeting collective goals.

Conclusion

In summary, the VEX design process is an excellent foundation which we are being exposed to for careers in myriad of STEM subjects/careers and industries.

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