GNG 1103F
Group 11

Project Deliverable C:
Design Criteria and Target Specifications

The purpose of this deliverable is to define the design criteria of the product, based on the client's interpreted needs. These needs will help the design team produce a virtual reality software that will allow students to learn organic chemistry in a more interactive manner.

Design criteria produce a detailed description of what the product needs to be (also known as the product's characteristics). The design criteria will be grouped into the following categories:

- Functional requirements
  - Characteristics that affect the operation of the product
  - Set up time and speed are examples of functional requirements
- Non-functional requirements
  - Characteristics that do not affect the performance of the product
  - Colour and product-life are examples of non-functional attributes
- Constraints
  - Important considerations that must be taken into account
  - Cost and weight are examples of constraints for the product

The client's interpreted needs were determined in Deliverable B. Once the raw data from the first client meeting was collected, the needs were collected and interpreted in the table below. The needs were also given relative importance to provide the design team with some more guidance on the more significant client needs. These needs will be used to determine the design criteria for the virtual reality software.

Need	Need Description	Importance
1	Students and teachers with minimal virtual reality experience can use the product	5
2	Students can learn organic chemistry effectively with the system	5
3	Through visualization and interaction with the software, the students can better comprehend the topic	5

4	Product uses and displays scientifically-accurate material (eg. reaction rates)	4
5	System immerses students in the reaction, to help them understand all the components of a reaction	4
6	Focuses on speed of reaction and proportionality	4
7	Students can physically interact with the system	3
8	Software has various metrics to track students' progress	4
9	System can communicate with the student, to provide assistance	3
10	System is cost effective for teachers and students	3
11	System does not take long to set up	2

For some design criteria, metrics will be used to help during the benchmarking process. Metrics are measurable attributes that can be compared across several products. The benchmarking process is when similar products are compared to determine which is the best product. This information will then be implemented into the design team's virtual reality product. The goal of benchmarking is to determine what the competition is doing, and how to innovate upon their ideas.

Below is a table with the interpreted client needs, along with their respective design criteria. These criteria are design aspects that will be taken into account when addressing the specific needs. Design criteria with measurable units, for example (lb), are metrics that will be used during the benchmarking process. Note that there are very few metrics when describing a software, as it does not many measurable properties that could be analysed.

Need	Need Description	Design Criteria
1	Students and teachers with minimal virtual reality experience can use the product	- Simple controls - In-software help - Time needed to set up reaction (s)

2	Students can learn organic chemistry effectively with the system	- Interactive - Accurate description of reactions
3	Through visualization and interaction with the software, the students can better comprehend the topic	- Strong visual tools - The program runs smoothly with minimal delays
4	Product uses and displays scientifically-accurate material (like reaction rates)	- Follows chemical laws
5	System immerses students in the reaction, to help them understand all the components of a reaction	- Interactive - Establish in-game rewards to affirm student's knowledge
6	Focuses on speed of reaction and proportionality	- Accurate display of chemical laws - Can manipulate point of reactions
7	Students can physically interact with the system	- Physically interactive
8	Software has various metrics to track students' progress	- Teaches in steps/modules
9	System can communicate with the student, to provide assistance	- In program guide - Ability to guide students through operations
10	System is cost effective for teachers and students	- Cost ($)

With these design criteria, it becomes quite clear what attributes need to be considered when making this product. The design criteria outlined above correlate directly to the needs of the client; this ensures that all the issues that the client presented to the design team are addressed.

As previously stated, the design criteria will be grouped into the following categories: functional, non-functional, and constraints. This will allow the design team to clearly understand the impact that certain design criteria have on the product. For example, the set up time for the software directly impacts the product's function, whereas cost has minimal influence on the program' s performance.

Functional Criteria	Non-Functional Criteria	Constraints
- Simple controls - In-software help - Ability to guide students through interactions - Teaches in steps/levels - In-program guide - Immerses students in the reaction - Follows chemical laws	- Accurate description of reactions - Establish in-game rewards to affirm student's knowledge - Have various metrics to track students' progress - Strong program optimization, can run on different devices - Provides assistance instantly upon request	- Cost ($) - Set up time (s) - Physically interactive - Run smoothly without bugs - Strong visual tools

As previously mentioned, benchmarking (seeing what the competition) is doing will allow the design team to take advantage of the competition's shortcomings. By researching the competition, the design team can focus on the needs that other products do not address. For this particular case, the virtual reality software will be designed to adhere to needs that most other products do not consider.

Also in this graph, the best competition will be determined by using the relative importance of the design criteria. The product with the greatest subtotal after calculation has the best technical specifications.

The best product for a specific design criteria will be scored as such:

- 3 points (green)
- 2 points (yellow)
- 1 point (red)

Product specifications	**Importance**	**Odyssey (Wavefunction)**	**VisChem (VisChem)**	**Biochemistry Frontiers (The Chinese University of Hong Kong)**
Cost ($)	3	500/student	No cost	No cost
Set up time (s)	2	30	15	5
Physically interactive	3	Click and drag (when dynamics are paused)	Click the mouse to enlarge the picture or play animations and videos	Click the next button to see the next step or choose the answer to the multiple choice
Immersive in reactions	4	Yes	Limited	No
In-software help	5	Online FAQ section	None	Yes
Displays accurate dynamics	4	Only when non-physically interactive	Yes	Yes
TOTAL		47	44	49

After completing the benchmarking, it is clear that the design team's plans to immerse students in the reaction greatly distinguish our software from the competition. It is also clear that the cost of the product can not be unreasonable, since other products are free and effectively teach organic chemistry to students.

Lastly, target specifications are used to compare our product to the given benchmark products of the competition. In comparing our product with *Biochemistry Frontiers*, it appears that our software will be competitive, even ahead, of this product. Despite not being able to surpass *Biochemistry Frontiers'* superb startup time, our product plans to be better in all areas, especially in immersing the students in the reaction. Based on this information, the target specification for our product will be any score greater than 50.