MODELING AND PROTOTYPING FOR THE PRODUCT DESIGNERS

An internship project report
Submitted in Partial fulfillment of the requirements for the award of the Degree of Bachelor of science in mathematics

Submitted by

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Accredited at 'A+' Grade by NAAC (CGPA 3.27)

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March - 2021

CERTIFICATE

This is to certify that the internship project work entitled " **MODELING AND PROTOTYPING FOR THE PRODUCT DESIGNERS"** is a bonafied record work done by **I. JERINA (18BM7455)** submitted in partial fulfillment of the requirements for the award of the Degree of BACHELOR OF SCIENCE IN MATHEMATICS at Sri G.V.G Visalakshi College for Women (Autonomous), udumalpet during the academic year 2020-2021.

Signature of the guide **Signature of the HOD**

E-CERTIFICATE


This certificate recognizes that

Jerina Ibrahim

has successfully completed all required learning materials in the following course:

Modeling and Prototyping for Product Designers

Certificate of Completion

Date:
03/14/2021

AUTODESK.
Design Academy

Introduction

The internship training program was organised by “Autodesk” it is an American multinational software corporation that makes software products and services for architecture,engineering,construction,manufacturing,media,education and entertainment industries. This is one of the E-Learning Content. Author **Alex Lobos** teaches about how to create innovative, attractive, functional designs, develop various design concepts, modelling and prototyping for product designers within Fusion 360.

In this course, we will be able to:

1. Gain insight into a design process for product development
2. learn key features in Fusion 360
3. modify and improve existing models
4. generate photo-realistic renderings and 3D print models.

DIGITAL TOOL

AUTODESK.

Author **Alex Lobos** gave training under the titles,

1. The design process
2. Modelling the shoe
3. Green materials choice
4. Creating additional shoe parts
5. Life cycle assessment
6. Friction
7. Energy of materials
8. Editing the existing shoe model
9. Sharing our final shoe model

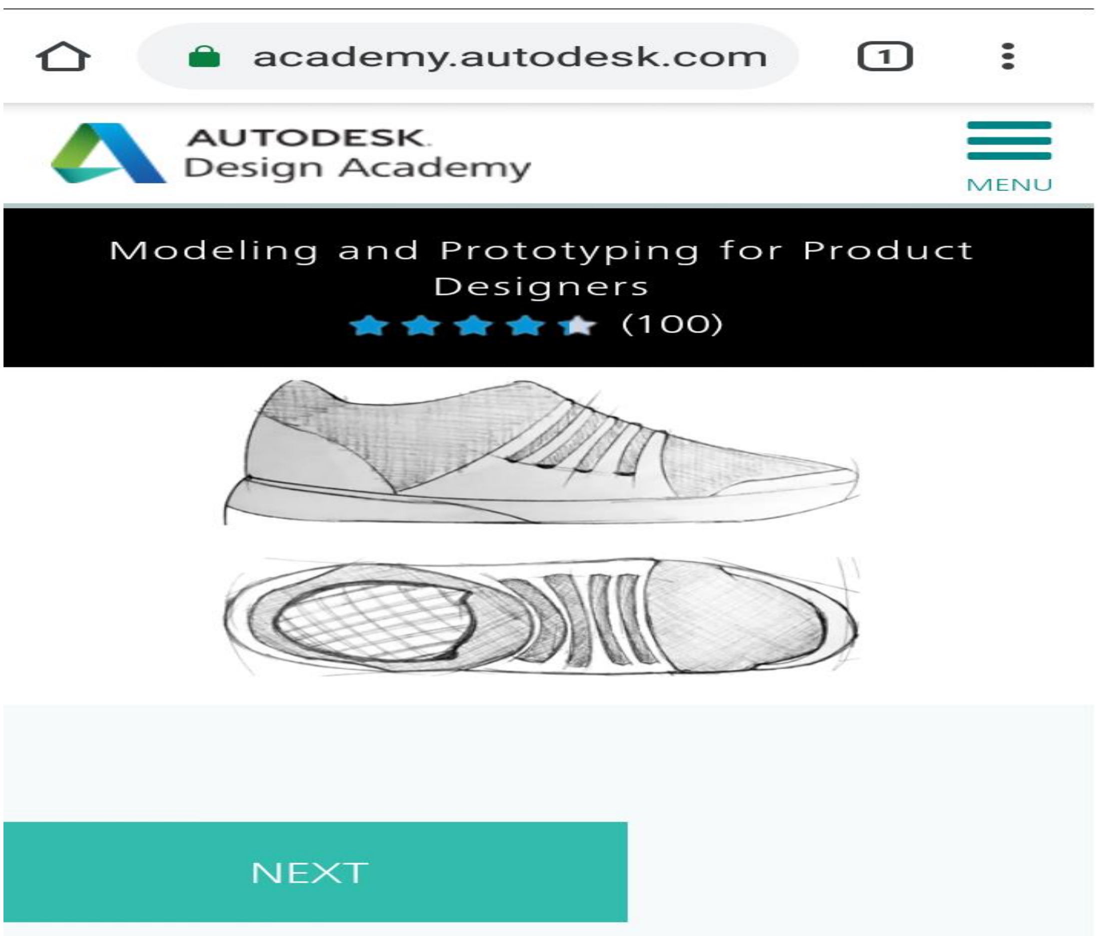
Software Package : Fusion 360

Introduction about the fusion 360

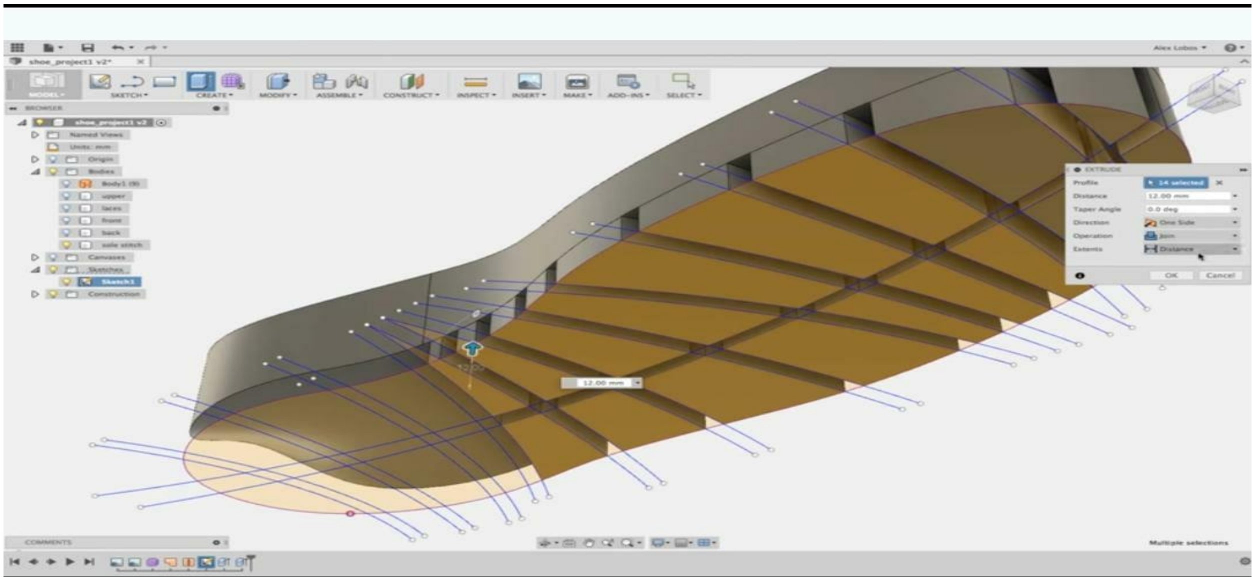
Fusion 360 helps students and educators to prepare for the future design. Which connects the entire product development process into the one cloud based platform. Minimum 8GB RAM is required in order to run fusion 360.it is used in aerospace industry. It is also used in:

- 3D modelling features
- Electronics
- Generative design
- Documentation
- Collaboration

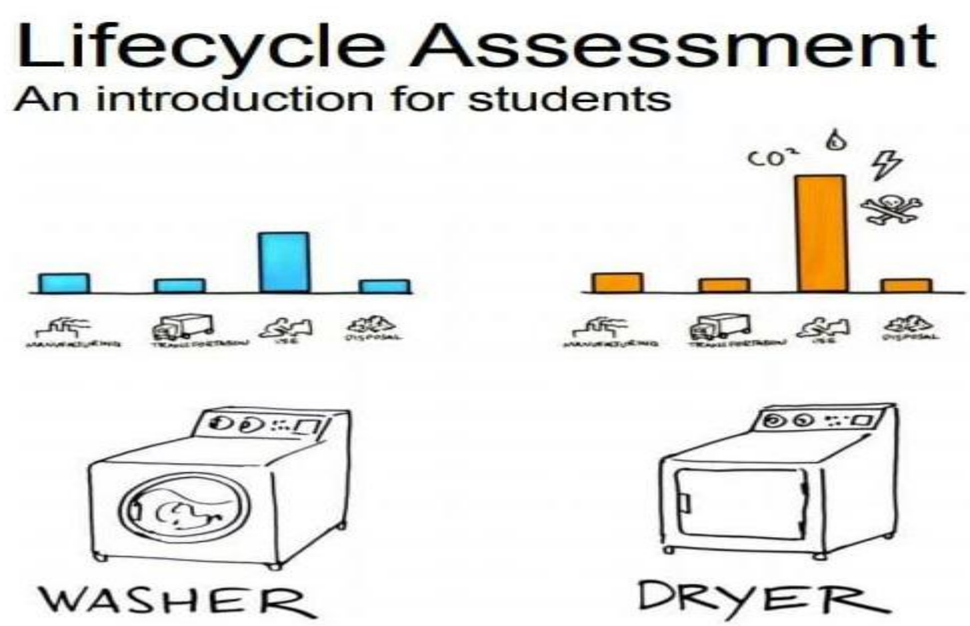
Modelling the shoe:



Create the opening for inserting the foot in the shoe and make copies of the body for modelling additional parts and save the file as the new projects.



Life cycle Assessment



Lifecycle assessment (LCA) is a method to quantify the environmental impacts of a product or service, such as greenhouse gas emissions, water pollution, land use, toxins. and more. These impacts can be measured for any or all phases of a product's lifecycle, including manufacturing, distribution, use, and disposal. LCA can be used for many purposes, from helping inform the early stages of the design process to providing detailed data for environmental reporting. The depth and breadth of analysis can vary greatly, take care to match the sophistication of the analysis to its intended purpose. A rough assessment can take less than an hour, while a full assessment performed international standards may take hundreds of hours. Many methodologies and software tools are available for LCA, and these should also be matched to the intended purpose.

Uses of Lifecycle Assessment

The most common uses for LCA are internal decision making and external reporting. For internal decision making, LCA is useful to identify the product's biggest environmental impacts and to provide a benchmark for further analysis. Both of these are useful for guiding product development and are best performed early in the design process. While more detailed analyses always provide deeper understanding, they may not always be time and cost-effective.

For external reporting, LCA is useful to prove that a product environmentally preferable to its competitors or to verify that the impacts of the product meet governmental or third party standards. Both of these uses require that lifecycle assessment be as accurate as possible, using standardized methodologies and boundaries.

Scope and Boundaries

There are direct impacts, such as resource use and waste during manufacturing. But there are also many indirect factors, such as emissions of the power plant that generated electricity for the factory; impacts from mining and refining of raw materials, transportation energy use during the product's life, and the product's end of life.

The more factors you include, the more complete our assessment will be, but the more time and money it will require. Also, when we include factors that are out of your direct control, such as supplier and user behavior, your results will be less certain and precise.

Boundaries define what your assessment will include, both in terms of lifecycle stage and what's considered within each stage. For lifecycle stage, some analyses (called "gate to gate") only consider impacts from manufacturing Some consider impacts from material extraction until the final product leaves your factory ("cradle to gate"). Others consider impacts until the end of a product's life ("the grave"). The most widely useful assessments use "cradle to grave boundaries, including all stages of your product's lifecycle, from resource extraction to end of life.

Materials and Processing

To determine the impacts of your product, all your product's components and how they were processed This includes knowing, for example, not only what kind of plastic was used for a certain part. but the mass of that part and whether it was formed by injection molding., extrusion, or other process. For assemblies from suppliers, you may need to get information from them disassemble a unit and weigh its parts, or estimate in other ways. Ohen there will be some materials or processes in your product's lifecyde that you do not have data for. In this case, you often have to use the data available and estimate the best item or combination of items as a substitute. It is good practice to run multiple analyses with different substitution to see how sensitive the results are to your assumptions.

Transportation

Transportation of finished goods and component parts should be factored in as well. Oten design engineers won't know these figures with certainty, so you may want to try several ahematives to see how much it changes the results. Average transportation impacts from mines to material factones are already included in the material properties data of some databases

Energy and Resource Use During Life

Energy use during the products life must be estimated, as well as other resource use (water, paper, or other materials. You can do this by estimating both the usage pratile and the Metime of the product, and multiplying them. (For instance, a laptop might use 25 W ot power for eight hours per day for four years, for a total lifetime energy use of 292 KWh.) Because there can be a high degree of uncertainty in these estimates, be sure to fun multiple analyses with different estimates to see how sensitive the results are to your assumptions

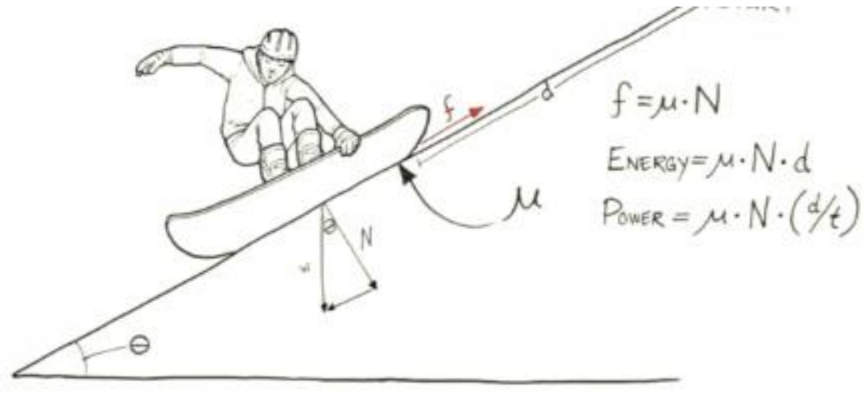
The process of performing an LCA is generally as follows

1. Determine system boundaries
2. Determine product trend functional unit.
3. Gather inventory
    a. Materials
    b. Manufacturing processes
    c. Transportation
    d. Energy and other
    e. End of life

4. Compute in cotton with several variations)

5. interpret results

Reducing Friction



Friction will occur at any place where two surfaces come into contact with each other. Friction can cause energy losses that create unwanted heat, deformation, and wear. This can reduce the lifetime and increase the cost of the products you design.

However, friction also helps us move around. Consider how our tires grip the road. With a thorough understanding of how friction works, engineers can create designs that reduce friction and resulting energy losses, while maintaining the benefits of friction when it's helpful

Mechanical Friction Basics

Friction forces oppose the direction of motion and can vary greatly based on the ma terials in contact, temperature, pressure, and whether the objects are stationary or moving.

The coefficient of friction, u, determines the friction force and is derived experimentally. The higher this number, the greater the resistance.

There are a variety of strategies to minimize u and reduce unwanted friction These include switching materials, using lubricants, adding wheels, and even preventing objects from touching using magnetics and acoustics, Reducing friction is studied in-depth in the engineering field of tribology.

Embodied Energy of Materials

A materials embodied energy is the energy that must be used to extract, transport, and process the material. For a product that doesn't require energy during use, like a chair, the material's embodied energy is often the biggest source of carbon footprint and environmental impact.

A great way to reduce embodied energy is to specify recycled materials for your designs. For example, using recycled aluminum can out embodied energy by 90%. If you're using recyclable materials, you'll also want to design your product to ensure the materials can be recovered at the products end of life. For more information, see the video on Disassembly and Recycling.

Health Impacts of Materials

Materials can sometimes also have negative health impacts, and some materials are regulated for this reason. For example electronics sold in Europe need to meet the Restriction of Hazardous Substances Directive (ROHS). You can avoid health impacts by avoiding toxins, clearly labeling them when they are used, and designing in product safeguards like child.

Conduct life cycle assessment (LCA) on your design to dive into more detailed analysis that can help inform material choice.

While more time consuming. LCA USually includes more nuanced data on variables like ozone layer depletion, air pollution, water acidification and eutrophication, land use, ecotoxicity, and carcinogens. To learn more, see our Primer on LCA. the Okala Guide, and Sustainable Minds.Every pound of material that you save in your product saves much more waste and material upstream. Material Inputs and Ecological Rucksacks are closely related concepts that provide a tangible short-hand for understanding this larger ecological impact of the products and materials around us and can help understand the importance of lightweighting.

An item's Material Input (MI) is the total quantity (in kg) of materials moved from nature to create a product or service For example, you have to dig up and dispose of about seven kilogram of material to make one kilogram of virgin steel. The Ecological Rucksack is the Material Input minus the actual weight of the product and highlights the hidden material flow.These figures are based on a We cycle approach from the "cradle" to the point when the product is ready for use They seek to quantify matenal inputs derived from raw materiais use (including minerals, fuels, and biomass), earth movement, water, and air.

This concept originated with Friedrich Schmidt-Elonk from the Wuppertal Institute for Climate, Environment and Energy in Germany.

Basic Material Input Data:

Industrial products often carry rucksacks that are about 30 tirnes their own weight So only about 5% of the non-renewable natural material disturbed in the ecosphere actually ends up in a technically useful form.

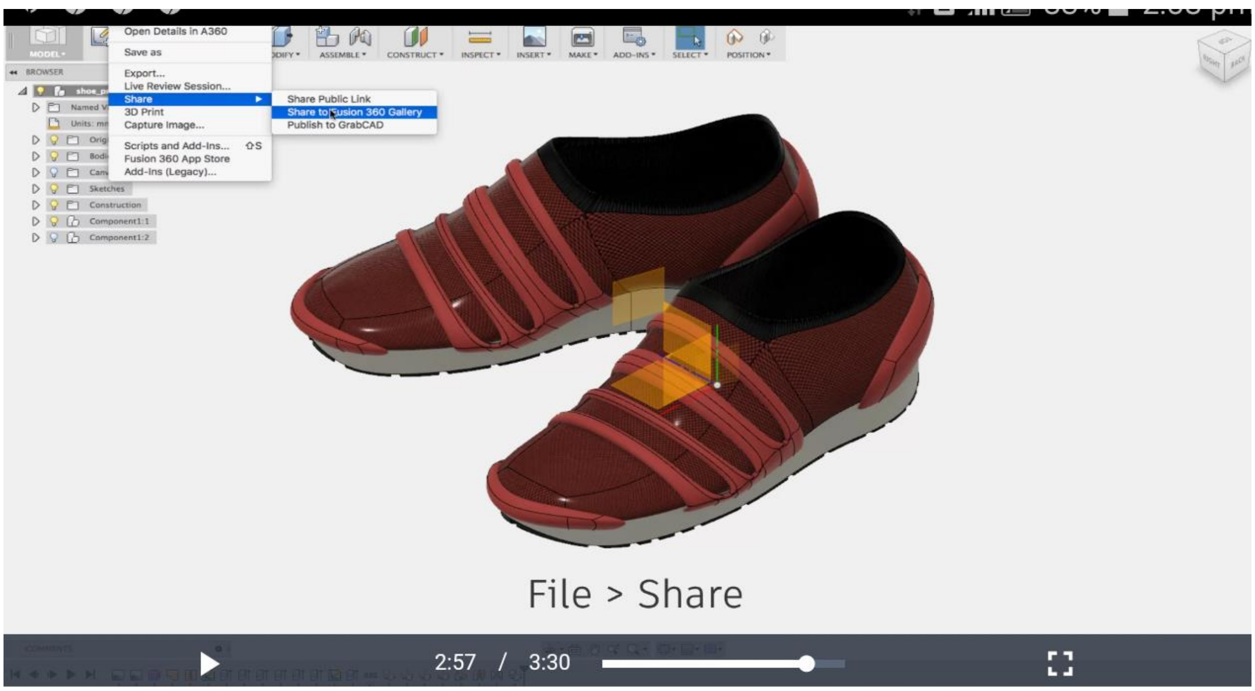
For example, the ecological rucksack of a personal computer is about 200 kg per kg of product (Schmidt-Bleek, Manstein, & Gerhard, June 1999). The table below contains Material Input factors for some common raw materials used in industrial products

Using Material Input Data:

To calculate the Material Input of your product, multiply the mass of each material you use by its Material Input factor, and then sum these values

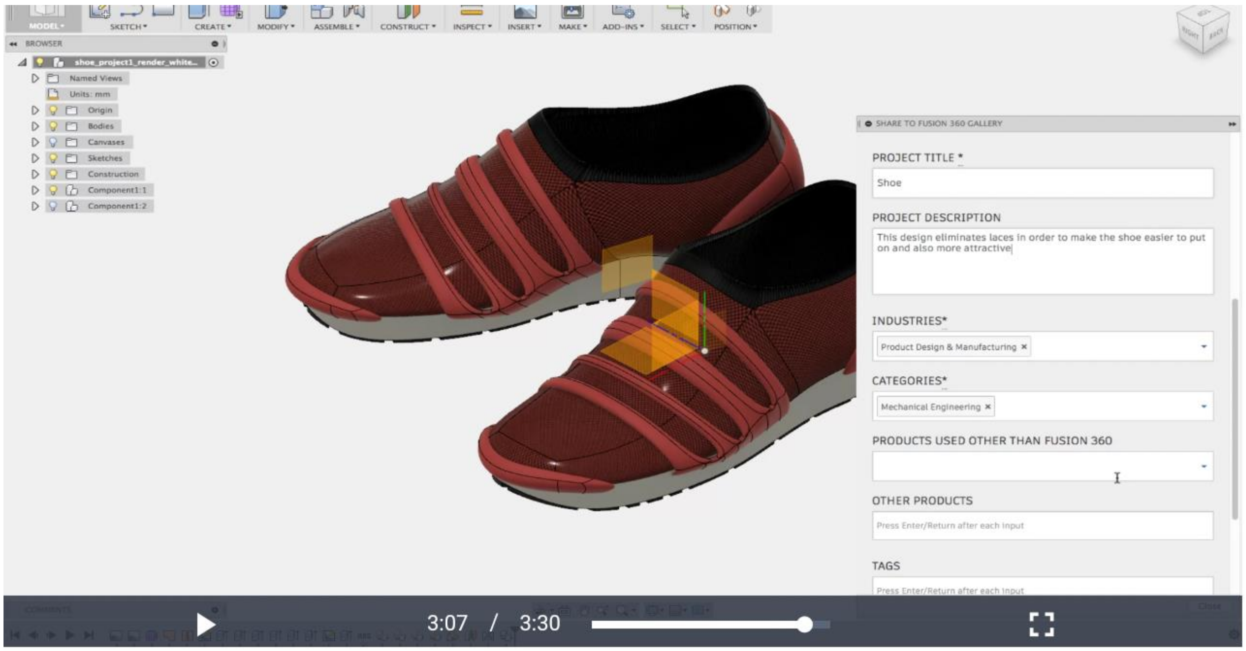
Considering the Material Input per Service Unit (MIPS = M/S) is a good way to compare the resource consumption of different solutions that produce the name service. The metric you use for the service unit (S) depends on your product, but could be hours used or distance traveled. To improve the resource productivity of the solution, you can either increase its service lifetime of reduce its material input.

Sharing our final shoe design



Using Fusion 360 software, we share the final shoe design.

If we want to change any design, we make changes like changing colour, model etc…after doing the changes, click the share button to share our design. And select the share to Fusion 360 Gallery.



At next, type the project title, project descriptions, industries, categories, and other details required.

Finally we make the shoe model perfectly.

Quiz

Checkpoint questions were provided to check our understandability of the concepts and to increase the real life application. the quiz answers were checked an the correct answers were provided for our reference.

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MENU

Modeling and Prototyping for Product Designers
(100)

Vhat is the key function of Design?

Choose one

- Make cool products
- Solve unmet user needs (selected)

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MENU

Modeling and Prototyping for Product Designers
(100)

Select the tools from the list below for identifying user needs. (select all that apply)

Choose all that apply

- [x] Observe users
- [x] Interview users
- [ ] Test products first-hand

Modeling and Prototyping for Product Designers

★★★★★ (101)

elect the tools from the list below for identifying user needs. (select all that apply)

Choose all that apply

- [ ] Observe users
- [ ] Interview users
- [x] Test products first-hand

BACK NEXT LEAVE BLANK

Modeling and Prototyping for Product Designers

★★★★★ (101)

Early sketches focus on quantity in order to explore multiple directions.

Choose one

- (•) True
- ( ) False

BACK NEXT LEAVE BLANK

Conclusion

The internship was very useful to learn new things practically. It provides a path to achieve several of our learning goals. This internship programme was not one sided, but it was a way of sharing knowledge, ideas and opinions.