

## 3D Printing Induction- Modeling and Printing a Keyring

<b>Date:</b>	<b>Class/Group:</b>	<b>Time:</b> <b>Room: Fabrication Lab</b>
<b>Topic: 3D Printing Induction</b>		
<p><b>Specific Objectives/Learning Goals:</b></p> <ul style="list-style-type: none"> <li>- The intention of the 3D induction is to enable participants to become familiar with the practical use and basic theory behind the use of the UP 3d printer.</li> </ul> <p><b>Learning Outcome:</b></p> <ul style="list-style-type: none"> <li>- Create 3d model in Tinkercad.</li> <li>- Become confident with terminology around the machine</li> <li>- Become familiar with the safety procedures in the workshop and with the use of the machine.</li> <li>- Successfully print the 3D model.</li> </ul>		
<p><b>Prior Learning:</b></p> <ul style="list-style-type: none"> <li>- <b>No prior learning required</b></li> <li>- Experience with the use of tinkercad or other 3d modeling software is advantageous</li> </ul>	<p><b>Resources/Materials required:</b></p> <ul style="list-style-type: none"> <li>- <b>Secure a HOT WORK PERMIT</b></li> <li>- 10 pens</li> <li>- 10 laptops</li> <li>- 10 USB sticks with files for lesson</li> <li>- 4 working UP 3d printers</li> <li>- TV + facilitators laptop</li> <li>- 10 print outs of of the 3d printing induction paperwork</li> <li>- Sample prints.</li> <li>- Extra printed copies of the power-point for inductees to seek answers for their paperwork.</li> <li>- Kit to repair the 3d printers</li> <li>- Spare spools of UP ABS</li> </ul>	
<b>Lesson Steps</b>		
<b>Time:</b>	<b>Procedure</b>	<b>Comment</b>
00.00	<p><b>1. Pre-Lesson</b></p> <p><b>Secure a HOT WORK PERMIT</b></p> <p>Prepare Television + Computer link up at the front of the class.</p> <p>Open the 3D printing pdf induction.</p> <p>Ensure each participant has a laptop, USB stick with appropriate 3d modeling files</p> <p><b>2. Introduction/Motivation</b></p> <ul style="list-style-type: none"> <li>-Introduce the inductees to yourself. Give participants a brief background on your experience with 3D printing.</li> <li>- House keeping- Toilets + Fire evacuation.</li> <li>- Take participants on a brief tour of the space to familiarise them with the Fab Lab and the facilities available to inductees. Make the last machine that you visit the 3D printers</li> </ul>	<p><i>Visit the ESO's in the facilities department near the museum and pick up a hot work permit for the duration of the induction 38407243</i></p> <p><i>The password the facilitator laptop is facilitator.</i></p>

00.10	<p><b>3. Facilitator Input</b></p> <p><b>4. Stand around the machine and show a few prototypes</b></p> <ul style="list-style-type: none"> <li>- Give an overview of the project you will create on the 3D printer today.</li> <li>- Give a brief overview of the machine.</li> <li>-Limitations of size, materials and speed of printing.</li> <li>-Uses for the machine- repairing broken product parts + prototyping 3D concepts.</li> </ul> <p>Prepare participants for the machines to break + explain they are temperamental.</p> <p><b>5. Class Discussion</b></p> <p>Answer any question and get inductees to sit at a laptop.</p>	
00.15	<p><b>6. Facilitator Input + Activity- Tinkercad Introduction</b></p> <ul style="list-style-type: none"> <li>- Get inductees to sign up for a tinkercad account.</li> <li>- If there are delays with logins, encourage participants to start off by undertaking some of the tutorials in tinkercad.</li> <li>- Create a new design</li> <li>- Show participants how to navigate the space + the 3d model</li> <li>- Adjust the grid size to fit the 3d printer bed size 140 mm x 140 mm</li> <li>- Place some geometry into the grid, play with adjusting the dimensions of the piece through the placement of the ruler over the piece.</li> <li>- Play with the nodes, showing how you can scale the model + shift it off the bed.</li> <li>- Place multiple shapes together overlapping one another. Group the shapes together.</li> <li>- Scale the geometry to fit inside of a box and place this model over the shape. Click on the 'hole' to create a negative impression on the model.</li> <li>- Draw another piece of geometry and play with importing text, re-orientating it onto the front face of the piece and embossing the work 2 mm.</li> </ul>	<p><i>The password the bank of laptops and the 3D printer laptops is edgeuser.</i></p> <p><i>Use the whiteboard to write up the tinkercad web address.</i>  <a href="http://www.tinkercad.com">www.tinkercad.com</a>  <a href="https://www.tinkercad.com">https://www.tinkercad.com</a></p>
00.30	<ul style="list-style-type: none"> <li>- Ask Participants to design a key ring with dimensions around 25x 50x 10mm (models significantly larger</li> </ul>	

<p>00:45</p>	<p>than this will not get printed in the allocated time)</p> <ul style="list-style-type: none"> <li>- Encourage participants to be a little creative (within reason) eg Emboss the piece with your initials or make a ball inside a cube.</li> <li>- Save your work in the program and then demonstrate how to download the work for 3D printing.</li> </ul> <p><b>7. Facilitator Input</b></p> <p>Show the pdf presentation on the UP 3D printer.</p> <p>Cover the following information-</p> <ul style="list-style-type: none"> <li>- ABS vs PLA</li> <li>- FDM printing vs SLS</li> <li>- Orientation of your model for strength.</li> <li>- Infill of your model. Time vs strength.</li> <li>- Rafts</li> <li>- Support structures.</li> </ul> <p><b>The anatomy of the printer-</b></p> <ul style="list-style-type: none"> <li>- Outline the key parts of the 3d printer.</li> </ul>	
<p>01:00</p>	<p><b>How to go about printing</b></p> <ul style="list-style-type: none"> <li>- Intializing the printer.</li> <li>- Extruding the filament.</li> <li>- Loading the printing bed</li> <li>- Printing- check your print, but ensure the chamber remains warm.</li> <li>- Removing the print safely from the printing bed</li> <li>- Ways to remove the support structure and raft from your model.</li> </ul>	<p><i>Bring 3D printing paperwork and pen</i></p>
<p>01:10</p>	<p><b>Problems that can arise with your print</b></p> <ul style="list-style-type: none"> <li>-Jammed filament spool</li> <li>- Printing lifting off the bed</li> <li>- Dust on the filament clogging the printing head</li> <li>- Slumping and deformities in your model.</li> <li>- extrusion of plastic stops.</li> </ul>	

<p>1.20</p>	<p><b>8. Inductee Activity</b></p> <ul style="list-style-type: none"> <li>- Allow two participants to start printing, working as a pair. Use the workflow worksheet as a guide to step participants through the printing process.</li> <li>- For the pair that are unable to print, get them to work through the induction paper work.</li> <li>- Get participants to use the 3D printer job log to log their print job and to document any faults that arise with the machine.</li> </ul> <p><b>9. Feedback</b></p> <ul style="list-style-type: none"> <li>- Using the powerpoint (need to add some slides)</li> <li>- Work through the answers for the induction paperwork and get participants to peer mark the inductees worksheets.</li> </ul> <p><b>10. Conclusion</b></p> <ul style="list-style-type: none"> <li>- Thank participants and encourage them to come back with their personal projects soon.</li> <li>- Demonstrate and explain how they would make an online booking in one week when the paperwork has been processed.</li> <li>- Explain the 2 hour book limit per day and courtesy call for cancelled bookings. If you are printing at the end of the day ensure that the print fits into our opening hours.</li> <li>- Explain that the raft and model will be weighed in the future and you are charged 15 cents a gram.</li> <li>-</li> </ul> <p><b>11. Pack Up-</b></p> <ul style="list-style-type: none"> <li>-Ensure that the inductees paper work is complete, signed by the facilitator, peer and participant. Leave this paperwork for Phil to process.</li> <li>- Generally tidy up the space.</li> <li>- Thoroughly clean the laser cutter.</li> <li>- Leave a note or send an email on any problems you experienced with inductees or equipment in the space.</li> <li>- Check out at reception and let them know you have</li> </ul>	<p><i>-Turn on the extraction fan. Located in the science lab area. Labeled exhaust fan.</i></p> <p><i>Perhaps have a few copies of the printed induction powerpoint available for inductees to find answers</i></p> <p><i>-Be proactive as the facilitator to cycle participants through the printing.</i></p> <p><i><a href="http://edgeqld.org.au/3d-printer-job-log/">http://edgeqld.org.au/3d-printer-job-log/</a></i></p> <p><i><a href="http://edgeqld.org.au">http://edgeqld.org.au</a></i></p> <p><i>-Resources Tab</i> <i>-Make a Booking</i></p> <p><i><a href="mailto:Mick.byrne@slq.qld.gov.au">Mick.byrne@slq.qld.gov.au</a></i></p> <p><i>phil.gullberg@slq.qld.gov.au</i></p>
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	<p>completed your induction if your are the last person to use The Fab Lab</p> <ul style="list-style-type: none"><li>- Return the Hot Work Permit.</li></ul>	
<b>Evaluation of Inductees Learning + problems experienced with equipment:</b>		
<b>Self-Evaluation/Reflection:</b>		