

**CODE/MOE/UOIT Makerspaces Project**

**Lesson Plan: Grade 3 Science & Mathematics - Strong and Stable Structures:**

**Holiday Ornament using Tinkercad**

|  |  |
| --- | --- |
| **Lesson Objective & Big Ideas:**  Students will work in partners to create a design on Tinkercad that could be printed out on the 3D printer that would show that a structure has both form and function and that structures need to be strong and stable to be useful.  **Overall Science and Technology Expectations**  -investigate strong and stable structures to determine how their design and materials enable them to perform their load-bearing function;  -demonstrate an understanding of the concepts of ***structure***, ***strength***, and ***stability*** and the factors that affect them.  **Science and Technology Specific Expectations:**  2.4 use technological problem-solving skills and knowledge acquired from previous investigations to design and build a strong and stable structure that serves a purpose  2.6 use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences for different purposes  3.1 define a structure as a supporting framework with a definite size, shape, and purpose, that holds a load  3.2 identify structures in a natural environment and in **built** environment  3.4 identify the stability of a structure as its ability to maintain balance and stay fixed in one spot  **Mathematics Expectation - 3D Geometry**    * construct rectangular prisms (e.g., using given paper nets; using Polydrons), and describe geometric properties (i.e., number and shape of faces, number of edges, number of vertices) of the prisms | |
| **Learning Goals:**  “We are learning to use Tinkercad to design and print a 3-D Christmas ornament that would be suitable to hang on Christmas tree. “ | **Success Criteria:**  Co-construct success criteria for the ornament that could look like this:   1. holiday design 2. reasonable size e.g. a maximum of 50 mm (5cm) length by 50 mm height by 50 mm depth 3. able to be printed by the printer without collapsing (strong and stable structure) 4. has a feature on it that allows the ornament to be hung on a Christmas tree |
| **Lesson Overview:**  Students will design, create and 3D print a Christmas tree ornament.  Background: Students will have had background lessons on creating strong and stable structures (e.g. cardboard towers).  Students also will have lessons and experience in completing STEAM station journals for previous Maker projects. | |
| **Materials and Technology:**  3D printer  smartboard with computer  laptops or Chromebooks (iPads do not support Tinkercad software) 1 per pair  [STEAM Booklet](https://drive.google.com/open?id=0B3efwwTYD18ebENRLVFaa2ZwWms)  <https://www.tinkercad.com/> Tinkercad online software  [Tinkercad introduction video](https://youtu.be/uIkeUXiybs4) | |
| **Student Accommodations/Modifications:**   * **students may need accommodations for reading instructions in software** * **assistance with technology depending on background experience using computers** * **scribing in maker journals/ digital journals** | **Lesson will be differentiated by:**   * **Product, specifically: type of ornament as it relates to religious backgrounds (secular rather than Christmas themed).** |
| **MINDS ON: Getting Started: 30 minutes** | |
|  |  |
| Students bring in a variety of their favourite Christmas tree ornaments to begin this lesson.  Have students in groups of about 4 discuss and list the qualities of a good Christmas ornament.  Inform them that they will be designing their own Christmas ornaments on Tinkercad and then they will be printed on the 3-D printer.  Show the Tinkercad Instruction Video on the Smart board.  [**3D Design & Printing Tinkercad Walk-Through**](https://youtu.be/uIkeUXiybs4)  <https://youtu.be/uIkeUXiybs4>  Ask students how they might need to adjust their qualities of a good ornament in order for it to be able to be successfully printed out on the printer (e.g., wider base to support printing from the bottom up, not too large as a 5 cm X 5 cm X 5 cm ornament takes approximately 1 hour to print, interesting, but not too complex that would cause the ornament to collapse while printing due to hollow areas).  Develop with the class criteria for the Christmas tree ornament. (See example above). | |
| **ACTION: Working on it 2-60 minute periods minimum** | |
|  |  |
| Students will work in partners to draw a sketch of what their design will look like in the maker booklet.  Circulate to check on designs. Question students on how their designs meet the co-constructed criteria. Provide descriptive feedback.  Encourage to re-work design as necessary.  Once students have planned their ornament, log into <https://www.tinkercad.com/> and begin designing.  Tip: Students who have Google Drive accounts are able to log in through Google and do not require a separate account. Go to “sign in” and then click on “more providers”.  1 period will likely be needed to explore the Tinkercad software. While the 2nd period students will hone their skills and complete their project. Assessment may be done in the form of anecdotal notes, a rubric or a checklist.  As students work on their Tinkercad ornament, they should jot down notes in their STEAM journal to keep “lab notes” about problems they had to solve. | |
| **CONSOLIDATION: Reflecting and Connecting** | |
|  |  |
| After the end of the first “Working On it” period, discuss some of the problems that students jotted in their journals. Discuss how they went about solving these problems.  Ask students how they will continue the next period to improve their designs toward completion.  Continue project until completion. Students share their .stl file to their Google Drive and share with the teacher to upload to 3-D printer software for viewing or printing.  If time and resources do not allow for printing everyone’s project, have students screen shot various views of their ornament to 2D print off.  Students reflect on their success or failure in their STEAM journal.  Example of Grade 3 “Reindeer Barn” ornament: | |

