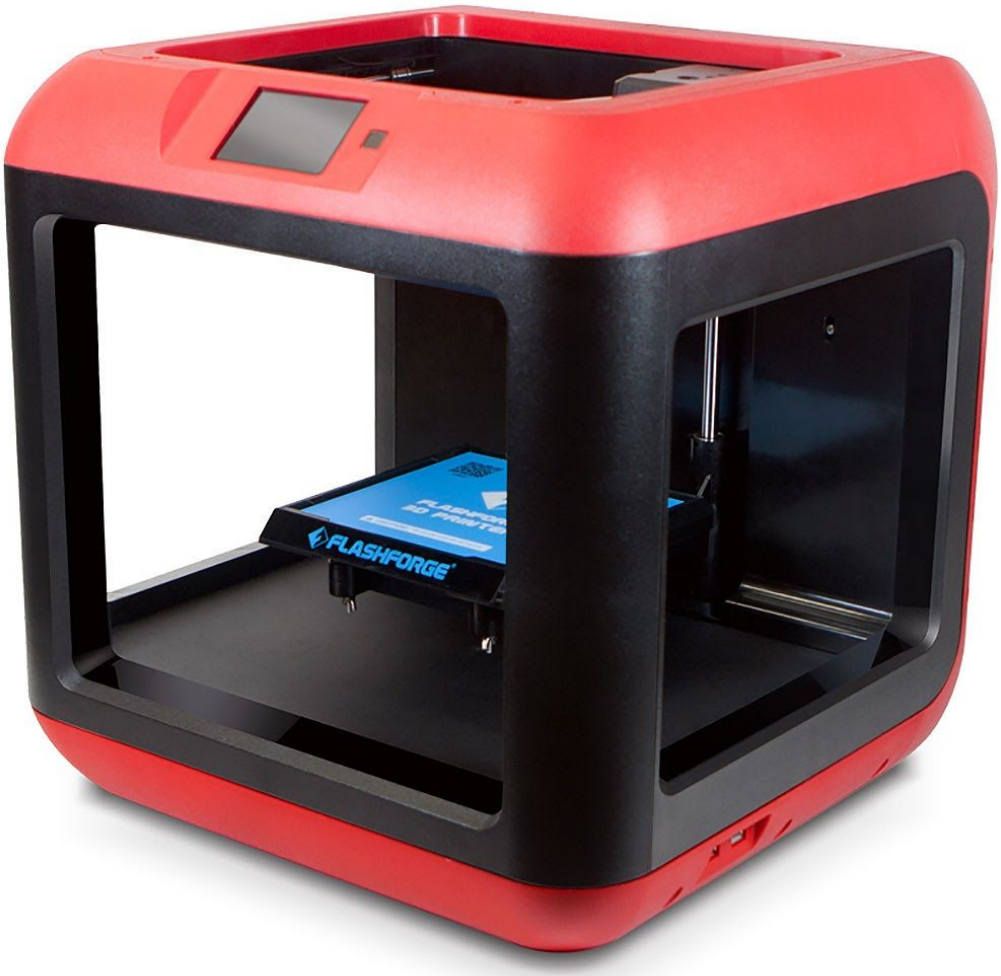
LSA

LIFETIME SKILLS ACADEMY

3D MODELLING AND PRINTING
CAD and 3D Printing



LSA PROGRAMMING
3D Printing Lesson Plan Step-by-Step

Instructor Master System:
What does it mean to be a coach at LSA?

LSA coach means that you have a genuine desire to help students become amazing future leaders in our technological world.

The following below would need to be added to each lesson plan below.
LSA programming is unique because we show students the end product and we track their progress uniquely through our 5 Star Development system.

Step 1: Equipment:

- Mini-projectors (if needed)
- Computers (if not provided)
- Mice
- Charging Station
- Power bars
- Extension cord for the projector

Step 2: Before-class preparation

- In tinkercad make a folder so that kids from that class can save their creations in
- The folder should be marked with the location and date for the class

Step 3: Set up:

- **Arrival Time**: 20 minutes early
- Set up your main computer and projector
- Set up children's computers
- Login into tinkercad, make sure to use the classes folder in tinkercad
- Ensure mice are plugged in

*Check with schools about empty rooms at end of school day to set up early
**First Class bring in guide sheets and PDF
**First Class bring in the 3D Printer

- Print 1 batmarang per child

Cheat Sheets or Guide Sheets

- Each class is going to have guides and lesson plans
- Concepts
- Hotkeys, assistance

Step 4: Introduction:

- Introduce the concept and the importance of what they are going to learn. Let them know that as students in the Lifetime Skills Academy they are expected to be the best of the best and to be growing leaders in all of their pursuits.
- **Attendance:** Take attendance before and each time you move as a class into any new space.

Step 5: LSA Money Intro:

- Introduce LSA money and concepts
- The prizes can be redeemed on the last 2 days of class

Step 5: 5-Star Development System - get them excited about systems based learning

Show the 5 Star Development System Report Card online and let them know that this is what they will be judged on. *Priming students to get excited about performing, improving and getting to the next level.* Students that complete all levels will get a certificate through the MySkills Training platform.

Step 6: Inspire, inspire with the end concept
Show the end product or the product that you are going to build during that lesson

Step 7:
Class Execution of the Lesson Plan
Lesson Plan:

- Basic learning per class
    - Techniques
    - Concepts
    - Link to lesson plan videos

***Coaching Point* - Show Demo Example**: Show an example using a projector and a video of something that you are going to show them that day. *We are priming them to be excited for the programs that they are going to do.*

Step 8: Take Down

- Login/logout of the computers
- Have the students assist you in putting all the computers away

Step 9: Marketing Materials

- Hand out marketing materials and ensure that they go home with a lesson plan

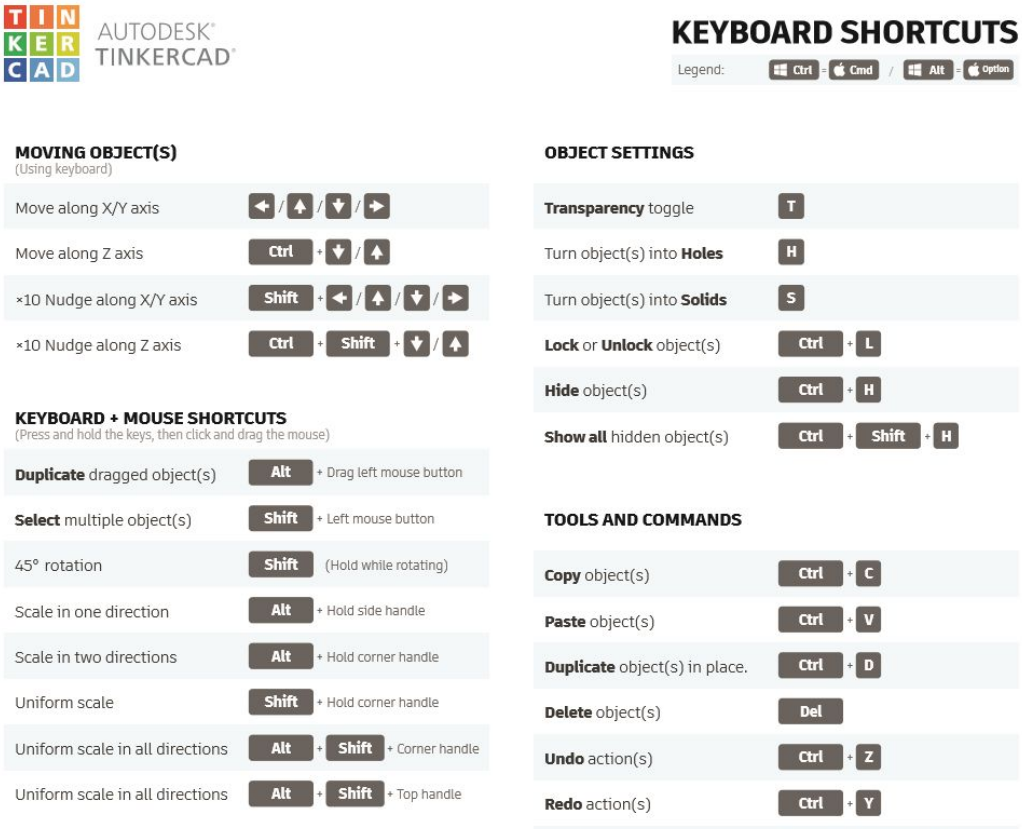
3D Printing Progress Report

Beginner (Star)	Build Shapes	Modify Shapes	Interact - Grouping and Aligning	Concept
Actions - Description	Create basic shapes	Change basic shapes	Able to make basic shapes interact my grouping and aligning	Understand the concept and use of computer aided design
Intermediate (Shooting Star)	**Create Polyshapes**	**Design Skills - Workplane and Text**	**Combining transparent and solid structures to create different objects**	**Importing 2D Image and Utilizing it in 3D Format**
Parts	Group 3+ basic shapes as one piece	Able to use workplane and text	Able to use multiple solids and holes to create a part	Importing any 2D image and using it in 3D models
Advanced (Super Star)	**Make a Unique Model**	**Stucture with Interior**	**Creating Landscape/Scene**	**Multi-Assembly Design**
Assembly	Creating a unique model for the parts collection	Make a stucture with defined inteior	Use many parts to assemble a landscape or scence	Creating a whole object through multiple different parts
Very Advanced (MegaStar)	**Preparing for Printing**	**Support**	**Creating**	**Creating useful structures**
	Able to understand printing software	Build utilizing supports	Able to combine complex shapes	Utilizing knowledge to create useful everyday objects

Step 1: Students Access TinkerCad.com to use all designs
www.tinkercad.com
Tinkercad is a free online web-based browser that saves all designs. *All projects are saved automatically.* Students can access their designs and continue to Tinker, here!

Username: info@lsacademy.ca
Password: lsacademy2019

BackupUsername:
Password:



LESSON PLANS

Below is a table of contents of every skill that the students will learn in 3D Printing.

Lesson Plan 1: Skill basics
(https://www.tinkercad.com/learn/project-gallery;collectionId=OPC41AJJKIKDWDV)

a) Place it
b) View it
c) Move it
d) Rotate it
e) Size it
f) Group it
g) Align it

2) **Name Tag**
(https://www.tinkercad.com/learn/overview/O0XHVHMIXGFO1D6;collectionId=O2C1PXBIQ2KHCOD)

3) **Dice**
(https://www.tinkercad.com/learn/overview/OMPFUS5IYC6JRMP;collectionId=O2C1PXBIQ2KHCOD)

4) **Customized Cup / or plant holder**
https://www.youtube.com/watch?v=HeTqjwfGJgU&t=134s

5) **Creating a Stamp and Branding**
Skills

1. Importing 2D object
2. Converting 2D object into a SVG
3. Utilizing Parts collection
4. Combining shapes into a stamp
5. Aligning for print

6) **House** (2 classes one on building itself basic building with 1 room, 2nd making a house with internal rooms - can add furniture if wanted, try for 2 story house, with different floor plans)
(https://www.tinkercad.com/learn/overview/OG2TEUVIQFHI7DT;collectionId=OY5L5E8IRXTI47Z)

7) **Landscape/scene**
Creating a mini-city. Utilizing houses to make a mini-city.

8) **Vehicle**
(https://www.tinkercad.com/learn/overview/OJ7NTHAIRXTO6B2;collectionId=OY5L5E8IRXTI47Z)
(https://www.tinkercad.com/learn/overview/OIU0ZY1IRXTXIP3;collectionId=OY5L5E8IRXTI47Z)

9) **Game Piece**
(https://www.tinkercad.com/learn/overview/O698ZZXIXGFTSXU;collectionId=O2C1PXBIQ2KHCOD)

10) **Person**
(https://www.tinkercad.com/learn/overview/OYZGQIIJ2UPCSCZ;collectionId=OY5L5E8IRXTI47Z)

11**) How to Print Using FlashForge Finder**
Skills

1. Downloading file for printing
2. Uploading onto Flashforge Finder Software
3. Scaling / Sizing on Flashforge Finder Software
4. Supports / TroubleShooting for Printing
5. How to feed the the plastic into the feeder

Lesson 1: **Skill basics**

Step 1: Bring in the 3D printer and show them the printer and print batarangs for them.
Step 2: Introduce 3D printing, what it is, what materials are used, what type of printers exist
Step 3: Introduce Tinkercad as the software, explain what CAD (computer aided design) is
Step 4: introduce the concepts of design, such as aesthetic shape, practical geometry, and the idea of designing for purpose and use, and how math is used to optimize these processes
Step 5: logging onto tinkercad.

End objective: The end result of the first lesson is for the students to understand what 3D printing is, what software and hardware we will use for the class, and what they can expect to learn from the class.

What to print: Students are allowed to print 1 small creation. For grades 2-4, they are allowed only to print their nametag, for grades 5+, they can print another of their unique creations.

Skills learned: how to log on, how to operate the basic tinkercad functions

Videos to Watch :

- Flashforge finder printing
    - https://www.youtube.com/watch?v=zhijztSuCPI
- Flashforge finder review and use
    - https://www.youtube.com/watch?v=xbfZVz6CM5E
- Uses of CAD in real world
    - https://www.youtube.com/watch?v=bi92OVyGIro
- CAD in use creating a tank
    - https://www.youtube.com/watch?v=uHhA8ZmR9EY

Lesson 2: Dice

Steps

1. Gets the students logged on to tinkercad
2. Make sure they all have mice
3. Make sure they know which is the left side and which is the right side of the mouse
4. Bring them to the dice lesson (https://www.tinkercad.com/learn/overview/OMPFUS5IYC6JRMP;collectionId=O2C1PXBIQ2KHCOD)
5. Help students as they progress through the lesson
6. If or when students are done the dice, expand onto 20 (or any number sided die they wish to make, maybe weighted dice) sided die or next lesson

End objection: the child should end up with a die to which they could play games with.

Skills learned: the students should gain proficiency in viewing the object from many different angles. The students should also gain perfecency in making new workplanes, knowing how to add shapes onto existing objects, how holes are used, and how objects can be grouped together.

Videos to watch:

- Step by step creation
    - https://www.youtube.com/watch?v=-WSayXHWcRo

The end result of the lesson should be that students are comfortable with moving around an object, creating workplanes on the objects, and grouping objects.

Lesson 3: Name Tag

Steps

1. Get students logged on
2. Go to the tag lesson on thinkercad (https://www.tinkercad.com/learn/overview/O0XHVHMIXGFO1D6;collectionId=O2C1PXBIQ2KHCOD)
3. Help students make their tag
4. When students finish the tag, allow them to make their own from scratch,

Skills: the student should learn about how to use the text function, and scaling to get objects to fit on to areas. Students should learn about

Videos to watch:

- Name tag, with open back area
    - https://www.youtube.com/watch?v=7XS9DHu1-74
- Name tag with stamped hole
    - https://www.youtube.com/watch?v=Cw2o0RbitRE

Lesson 4: cup/pot

Steps:

1. Get students logged on
2. Go to tinkercad and have the kids start a new project
3. The requirements for the cup is a flat bottom, and a hollowed out inner area with no holes
4. The first step is to have the kids decide on the shape they want to use
5. Next the shaped needs to be scaled to what is wanted
6. Next the students need to duplicate they cup shape, which is done by selecting the shape then pressing Ctrl+D
7. Next the student will have to move the copy of the shape out so the 2 are no longer overlapping.
8. Student needs to scale down the copy, they will need to hold shift as they shrink the object to get it to get smaller at the same rate as the other dimensions
9. The student will need to turn this smaller copy into a hole, leave it for now
10. The student if wanted can make a handel, they can make any they want, but the handel must be used to hold the cup
11. Simplest handel will be a ring, the students will need to turn the ring to be vertical, and align it with the top and side of the cup, do not group yet
12. Once the handel is in place deselected it
13. Next select the cup, and the smaller copy that is now a hole
14. Students will likely have to be told that to select the 2 they will need to click on the objects while holding Ctrl
15. Once selected align the 2 cups centering in width, and depth frame. And aligning to top in the vertical plane and group
16. Now group
17. Once done the students can add decorations to the cup
18. Students that get through it quickly are suggested to follow the video about adding curved writing

Skills: the students should gain practice with the use of the align and grouping tools. The main takeaway is an understanding of negative geometry, and how holes can be used.

Videos to watch:

- Basic cup
    - https://www.youtube.com/watch?v=uvCKrB5uIcE
- Basic cup with handel
    - https://www.youtube.com/watch?v=xChXCrVJxas
- Basic cup with writing
    - https://www.youtube.com/watch?v=nLPJwkWxJvU
- Advanced curved flat writing
    - This one has a lot of steps but yields a very nice cup
    - This one has a lot of work with negative geometry
        - https://www.youtube.com/watch?v=HeTqjwfGJgU

Lesson 5: Stamp and branding

Steps

1. Get students logged in
2. Start a new tinkercad project
3. Have the students find an image they would like to use
4. The requirement for the image is that it must be able to be change into a monochrom format, aka it must be able to be turned into black and white, no grey or any other color allowed. Note try to get them to save the pic as a Jpeg format
5. Once they have found an image they would like to use, they need to go to (https://www.online-convert.com/) where they will convert the file into a SVG format
6. From there they need to save the SVG file to the desktop
7. Then going back to tinkercad they must click on import, which is above the workplane tool
8. Once the image has been loaded in, they need to design the stamp base itself. Any shape can be used but the stamp base must be as large as the image itself
    a. If they want to make a lining shape for there stamp base they will have to make the stamp shape, then shrink it using the shift button, then change its height to be the same as their shape they imported and set it as a hole. Then they must align the stamp and the slightly smaller stamp hole and group it this will make the outline shape for the stamp
9. Once the stamp base and stamp image have been group, they need to make the handel, suggest they use the puller shape from the shape generator all section

Skills: The students should gain experience in changing file formats, learning about file formats, and how they can use out of tinkercad resources and how to add them to tinkercad. They will also gain experience with how to design functional objects.

Videos to watch:

- How to turn 2d images into 3d objects
    - https://www.youtube.com/watch?v=FkBjRDVeI5E
- How to make a stamp
    - https://www.youtube.com/watch?v=-mot47HKrFI

Lesson 6: making a game piece

Steps

1. Get students logged on to tinkercad
2. Start a new project
3. Bring the kids to the Chess Pawn lesson (https://www.tinkercad.com/learn/overview/O698ZZXIXGFTSXU;collectionId=O2C1PXBIQ2KHCOD)
4. Help the students make their pawn
5. When they finish they may try to decorate it more, or try making other pieces for a chess set

Skills: The focus of this class is about making rinal pieces from much simpler parts, and how complex shapes are more a combination of much more simpler shapes

Videos to watch:

- Making a chess set from start
    - https://www.youtube.com/watch?v=fkhuHTF9tqo
- Making a custom chess set
    - https://www.youtube.com/watch?v=xM0x1PY7QO4
- Making game pieces
    - https://www.youtube.com/watch?v=YmMAhF2_w0c

Lesson 7:making a person, or superhero suit

Steps

1. Get students logged on
2. Start a new project
3. Get students to the create your future (https://www.tinkercad.com/learn/overview/OCKYHQEJ2QEZ0AM;collectionId=OY5L5E8IRXTI47Z) self, or create your superhero suit (https://www.tinkercad.com/learn/overview/OYZGQIIJ2UPCSCZ;collectionId=OY5L5E8IRXTI47Z)
4. After they finish the lesson they can continue to decorate and work on their model

Skills: the focus of this class is to continue the work on understanding how to build up something, while making the models more complex

Lesson 8-9: building a house

Steps

1. Get students logged on
2. Start new project
3. Get the students to follow the build a tinkercad house project (https://www.tinkercad.com/learn/overview/OG2TEUVIQFHI7DT;collectionId=OY5L5E8IRXTI47Z)
4. After the students may continue to expand and decorate their house
5. The 2nd class the student should be encouraged to expand on the house
    a. The main targets are
        i. Internal rooms
        ii. Stairs
        iii. 2nd floor
        iv. Interior furniture
    b. Try to see if they can make a floor schematic for their house

Skills: the focus of this lesson to to expand on working on intier shapes and for them to gain some expertise on how cad is used in the real world, by seeing how interior schematics are made.

Lesson 10: making a vehicle

Steps:

1. Get students logged on
2. Start a new project
3. There are a few options for this
    a. Best boat
        i. https://www.tinkercad.com/learn/overview/OHEOOINJ7QGENIP;collectionId=OY5L5E8IRXTI47Z
    b. Balloon Powered Car
        i. https://www.tinkercad.com/learn/overview/OIU0ZY1IRXTXIP3;collectionId=OY5L5E8IRXTI47Z
    c. Space Station
        i. https://www.tinkercad.com/learn/overview/OJ7NTHAIRXTO6B2;collectionId=OY5L5E8IRXTI47Z
    d. Designing Sea Craft
        i. https://www.tinkercad.com/learn/overview/OGGLXOCIRXTM0OB;collectionId=OY5L5E8IRXTI47Z
    e. car/bus/truck, etc of their own making

Skills: the focus of this build should be tolerances. What we are looking for is for pieces to be added to the object, such that care is taken to make sure the parts fit together well. Wheels fit into wheel wells, engines fit on wings, etc.

Lesson 11-12:making a landscape

Steps

1. Get students logged on
2. Start new project
3. The project is mostly open ended, so they can create any scene or landsacpe
4. Project does need to have a few things
    a. Building
    b. Vehicle
    c. Person
    d. Objects

Skills: the focus of this project is to get the kids to make something large deduce what parts they need and then combine them to make the end product. There should be considerations give to sizes, scopes, and scales of the objects in relation to each other. So houses would need to be able to fit the people, same with the vehicle

Overall goals:

The overall goals of this program is to introduce to the children what CAD is and how it is used.

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4 by 3 skills beginners intimidate, advanced
3 stars , (with help, with little help, without help)

Basic level > actions (everything in lesson 1)

> build = learn how to create basic shapes, and the functions of their menu options

> modify = learn how to modify basic shapes by using the menu functions and the point functions to change the size and shape

> interact = learn how to interact with shapes and have shapes interact together by grouping multiple shapes and by aligning shapes with each other using the group and aligning functions

> concepts = understands the basic concept of CAD

For the lessons this would be lesson 1

Intermediate > parts (start with cup and game piece, then name tag, then dice)

> create: learn how to group multiple shapes together to create a new part

> design: learn how to use the work plane and writing tools to design new parts

> spatial reasoning: learn how to imagine reason multiple solids and holes objects to create an entirely new object

>parts design +understands the concept of making a part of a whole

For this lesson dice and name tag would be the min, also the basic house, also any type of game piece model

Advanced > assembly (start with superhero, vehicle, then landscape/scene)

> greater than the whole: learn how to use multiple parts to create a more complex object

>interior design: create an object that uses multiply parts to make distinct interior feature for a model

>see it: use different parts and models to create a landscape or scene

> assembly design = understands the concept of making a whole from different parts

For this lesson on house with interior, or vehicle with interior . lesson on person, lesson on landscape or scene