EDU501511

Teaching Collaboratively with Autodesk Fusion 360

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Learning Objectives

- Learn how to assign and manage student access to your individual or group data while keeping it private.
- Learn how to evaluate student progress in projects and offer feedback anytime from virtually any connected device.
- Learn about documenting the design process in real time directly in the design file.
- Learn to recognize file reservation status in a group project.
- Learn how to quickly archive last term's course and prepare to start fresh with a new set of students.

Description

From its early days, Autodesk Fusion 360 software has included ever-improving tools for working collaboratively on decentralized teams. With an eye toward education and a few extra capabilities added just for the education space, Autodesk Fusion 360 is ready to become a central part of the process of teaching design, engineering, and manufacturing.

These tools are not usually the focus when discussing Autodesk Fusion 360 for the classroom, but they are the critical elements that make Autodesk Fusion 360 the best solution for your classroom. In this session, you'll see these communication and collaboration tools in use as we look at the process for creating, managing, and completing a class. We'll explore the tools that teachers will find most useful for conducting their classes in today's dynamic environment to ensure you can keep offering the best instruction, regardless of where you or your students are working.

Speakers

Thom is a Platinum level Autodesk Certified Instructor, Author, and Lecturer on CAD and related technologies, Thom has been using 3D CAD for over thirty years. Thom has worked as a solutions engineer and consultant for commercial and education interests at Autodesk, his own company; Concepts and Design and now Team D3 as a Business Development Manager for Learning and Education. He has held multiple certifications in Autodesk AutoCAD, Inventor, and Fusion 360.

Dan is a Senior Technical Program Manager at Autodesk in the Education group, where he helps schools implement Fusion 360. Dan is a nationally recognized instructor, a longtime speaker at Autodesk University and many other education events and is a guest speaker at many universities. Before joining Autodesk, Dan worked at an Autodesk reseller where he provided CAD solutions and training to clients for 19 years. He has also authored 25 books on Autodesk 3D mechanical design software.

Introduction

Fusion 360 is a tremendous design, engineering, simulation and manufacturing suite and I think its interface lends itself particularly well for new learners. However, the process of teaching Fusion 360 requires the use of curriculum, grading platforms, course descriptions, physical locations, and technology to present the lessons to just begin naming what is needed to teach.

In this course we will focus on elements of Fusion 360 that will benefit the teacher and the teaching process rather than the tools that will be the subjects of the lessons that you deliver. Time permitting in the live course we will also come back to some feature level elements that can help the learning process and help you assist students as well.

Objectives review

Learn how to assign and manage student access to your individual or group data while keeping it private

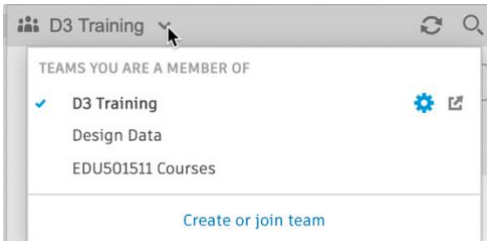
Fusion 360's cloud data offers educators and students far more than just simplified access to their own data. The Fusion Team environment is the foundation of true collaboration with you and your students and opens workflows for your students and even outside advisors to work in sync with one another.

Leveraging the Folder Level Permissions to apply roles for students and other collaborators to specific folders is the key to securing the work that you and your students do. This level of security unlocks the real potential for cloud data in a classroom environment. The process is still evolving but is already incredibly useful using the Autodesk ID that your students will need to use Fusion 360 to connect them to your class or classes. Below is a link to an important whitepaper but the overall concept is really very simple and can be summarized.

Connecting members to a Team

Anyone who did not create a Fusion Team must be invited to it. The invitation can be sent from the *Admin* tools under the profile of any administrator for the Team. The invitation itself is set to the e-mail of the person you want to invite. For them to actively edit data in the team that e-mail must be associated with an Autodesk ID. The invitation is sent and if the e-mail is not recognized as associated with an Autodesk ID information on how to get an ID will be included in the e-mail.

Once a user has accepted the invitation to a Fusion Team they still might not be able to see the team after starting Fusion 360. If they were using Fusion 360 previous to the invitation, they would have been working in their own Team or perhaps another Team they were invited to. To access the data in any team they need to use the *Team Selector* Pulldown in the upper-left corner of the Data Panel.



Team Selector

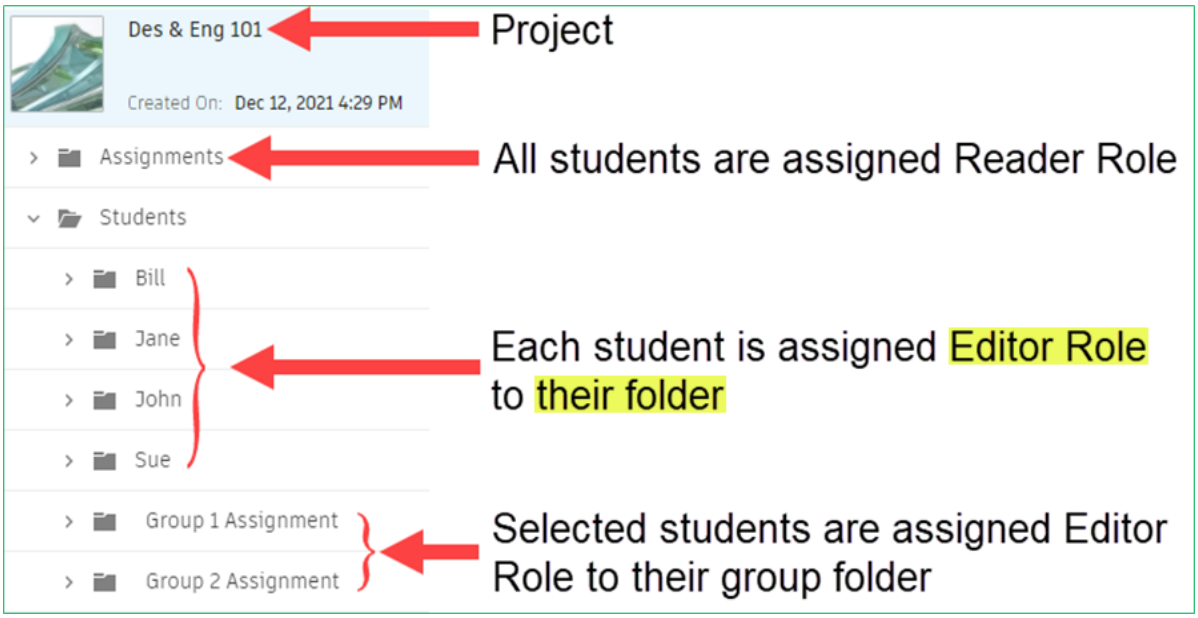
A Fusion Team might be thought of as a Filing Cabinet. That cabinet will have information organized within it. The initial invitation to a Fusion Team is akin to giving some access to the room with the Filing cabinets in it, but simply being able to under the room will not help them understand what to do. They'll need to accept the invitation and be given a role within the team to begin to find what they need.

Projects and Folders

A Project in the Fusion Team might be looked at as a Drawer in the Filing Cabinet. All of the Projects can be seen by people in the Team with the appropriate Team Role; either Administrator or Team Member (see below) or by Project Contributors given access to select Projects. Unless someone invited to the Team has been invited as a Project Contributor to every project, they will not be able to see them all.

For teachers with an Education entitlement there are four different types of Projects. What this class will focus on is the Folder-Level project. At the time of this writing this type of Project can only be created by users with Education entitlement, other users only have three (Open, Closed, and Secret). The other types of Project can be created from the Fusion Team, but creating a new Project from the Fusion 360 Data Panel will automatically create a Folder-Level project.

Folders contain the individual design files or any other type of file. These can (not surprisingly) be looked as the file folders in drawer contain the individual files uploaded or created by the end users. Essentially any type of file can be stored in a Folder so class instructions, CAD data of any format, images, and even videos are examples of things that might be stored there. All of those files can be accessed from the web client and possibly even the Fusion 360 mobile app.



Recommended Project/Class structure

Team and Folder Roles

A Team Role is a high-level control on what a user can do in the team. Fusion Team Administrators should give users the lowest level of access necessary for the end user to get their work done. Team Administrator and Team Member roles receive a high degree of access within the Fusion Team. For students a Team Role of *Project Contributor* is recommended as they're only able to see Project that they have Folder Role in and even then it's the Folder Role that determines what they're able to do.

A Folder Role grants specific access or usage rights to a folder and all of it subfolders. This is why a Folder role should be given at the lowest level necessary as well. If you have a 'Student Folder' with a sub-folder for an individual student, focus your Role assignment on that sub-folder. Otherwise if you give a student an *Editor* role on the 'Student' folder, they will be an editor in all of the folders you are expecting other students to put work into.

Here are some examples of the Fusion Team and Folder Role, what type of user that might be assigned that role, and what that role can do withing the Fusion Team:

Fusion Team Roles and Capabilities		
Team Role	**Who they are**	**Example of Capabilities**
Team Administrator	Instructor or Admin	Manages the Fusion Team and has complete access to Projects, Folders, and Files
Team Member	Faculty or Assistant	Can view; open and closed projects, and create legacy projects (selectable)
Project Contributor	Student	Only view projects they are invited into

Project Folder Roles and Capabilities		
Team Role	**Who they are**	**Example of Capabilities**
Viewer	Mentor, outside advisor	Can only view, post and read comments on the Fusion Team portal
Reader	Student (non-editing)	Viewer role + can open files in Fusion 360, but cannot save the files to this folder
Editor	Student	Reader role + within Fusion 360 or Fusion Team can edit, upload, rename, move, delete files, and create subfolders under the folder the Editor role is set
Manager	Instructor, TA	Edit role + can manage members and control their access levels
Administrator	Instructor, Admin	Manager role + they can permanently delete files on Fusion Team

Getting started with Fusion Team for Education whitepaper

Autodesk has produced a great whitepaper that will be updated for your reference. So, rather than writing a guide to walk you through setting up for Fusion Team for use in your classroom, we will instead provide a link to that resource so you can always get the latest information on the technology and its features for managing the data of you and your students.

https://autode.sk/3RAIZut

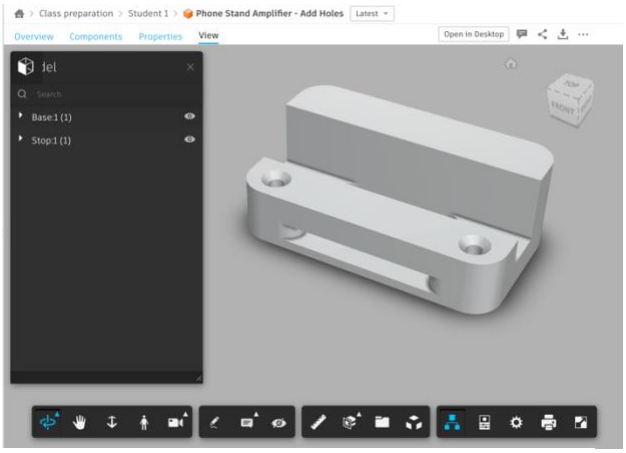
Learn how to evaluate student progress in projects and offer feedback anytime from virtually any connected device.

The cloud data presents a great opportunity to give your students feedback. The Fusion Team is accessible from virtually any web connected device. As an Administrator of your Fusion Team, you can view any of the data that has been posted.

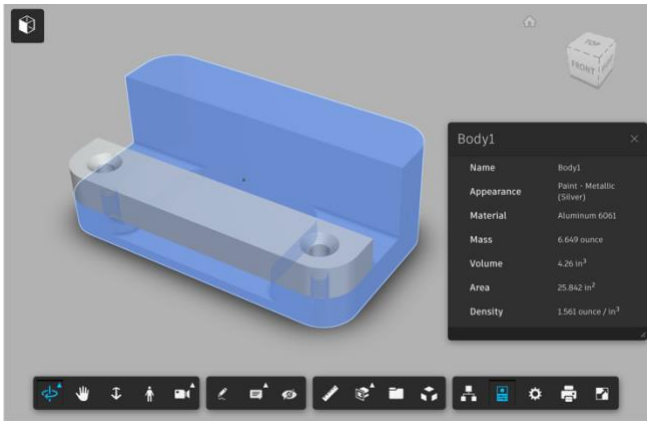
The viewing tools in Fusion Team include tools for reviewing properties, seeing the model structure, measuring features, and commenting on the data.

Model Structure

The structure of the model can be viewed from the Fusion Team via the Fusion 360 app on Android or iOS or a Web Browser. It's possible to see what components or bodies are in the model. You can also click and drag components or bodies apart or even "explode" the design to see how it's built using a simple slide bar that appears. This can be great for interrogating a student's work and understanding what their original ideas entail.



Model structure in Fusion Team Viewer



Properties of the selected component in viewer

Model Properties and measurement

After opening the Properties dialog, you can select components and have their volume, mass, and other properties. This can be a very quick way of to assess whether further interrogation of an assignment is needed. It's highly unlikely that a student could miss a model value on a design assignment and get the correct model properties. If you find an error, you can use the measurement tools find the errant features even if everything appears correct. You can choose other unit types for the measurement to suit your needs as well.

Accessing the data outside of the Team

Fusion 360 can share a link to the design from the file itself. This direct link allows the recipient to view the model outside of Fusion team and do the same type of interrogation as within the team. Options such as allowing the model to be downloaded or a password to be used to view the file are available as well.

Another similar workflow is for students to share the URL for the model from Fusion Team in the web browser which will require access to the Fusion Team. Having students post the link or the URL as a grade submission saves a lot of the data handling typically associated with posting models to a class management system.

Learn about documenting the design process in real time directly in the design file

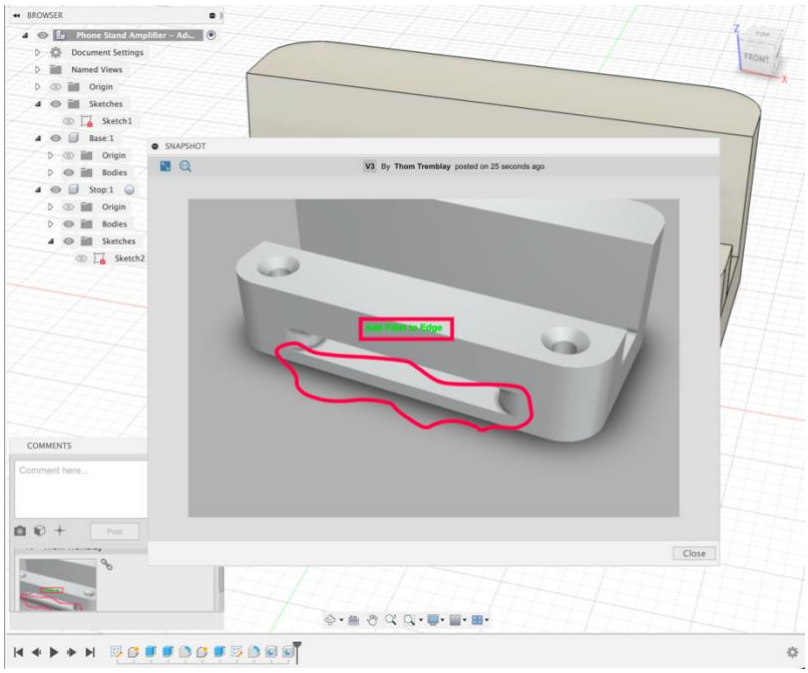
Every time Fusion 360 saves a design it creates a new version. The history of versions of the files is tracked in Fusion 360 along with the username time and date. This makes it easy to see how students are progressing on their work. It is also a useful feature for group projects to see if all the members of a group are participating in the development process.

When the design is saved it prompts the user for a "Version Description". I recommend having students leave a specific version description to create a running record of the development of the design that can be reviewed at any time. Different versions of the file can even be viewed in 3D in the Fusion Team web client to explore the progress more deeply.

An older version of a design can also be opened if the student realizes a choice they made might not be the only solution. Once the older version is open it can be saved as a new file with no connection to the original or it can be saved as the latest version of the design superseding (but not removing) the work that was done between the old version and the former current version.

Markup and Comments

In the Fusion Team or a shared link a reviewer can use markup tools to highlight parts of the model. These markups will appear in the design file itself in the Comments window in the lower-left corner of the design window. The user, time, and date will be recorded with the markup along with a comment number.



Markup from Fusion Team viewed in Fusion 360 comments

In return the student can create comments in Fusion 360 capturing the entire screen or associating the comment to a specific face or point. All these comments can also be viewed in the Fusion Team. All together these markups, version descriptions, and comments build a history of the student's work or the work of an entire team that requires minimal effort but gives students and teachers great insight into the evolution of a project.

When further review is needed

As an Administrator (other roles allow this as well) you can also download student design data to your local computer or open it directly in Fusion 360 if it is installed on the computer you are viewing on. This can be done without having to ask the student to do anything additional making it easy to dig more deeply into their exact development process.

Learn to recognize file reservation status in a group project

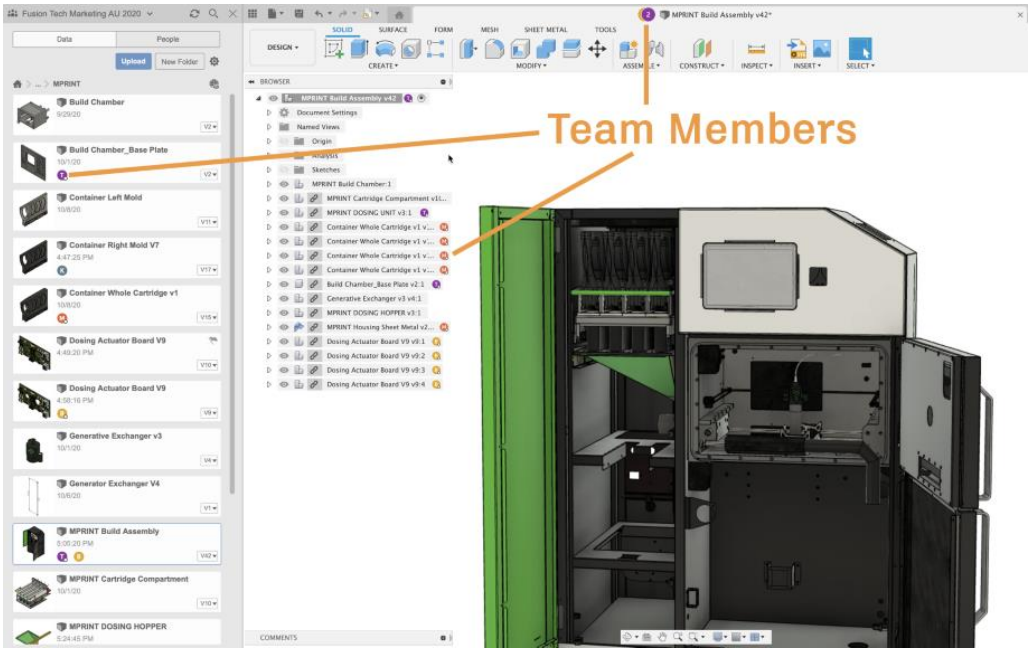
For the last many decades manufacturing companies have spent small fortunes to be able to manage data workflows for teams of engineers working on the same project. Even with the appropriate resources, implementing these solutions in an education environment would be challenging at best.

The native workflow of Fusion 360 is to have multiple bodies or components (with bodies contained in them) in the same file to represent multiple parts in an assembly. This is different than the normal process with other Gen 1 parametric modeling systems that use separate part and assembly files. It can greatly simplify exploring a model and developing a design especially for students. However, Fusion 360 can also work with files linked into a design file. This is often referred to as a “Distributed Design” and it is ideal for designs with a large number of components or for working with a group of other designers. To make this workflow even better for a group situation, Fusion 360 does automatic Design reservation to protect users from overwriting work others are doing and to be able to quickly see if another user is making changes.

NOTE: Design reservation will not be a selectable option under the Admin tab of Fusion Team until you’ve invited at least one more user to your team.

Reserving data

Opening a design file will automatically display an avatar with the first initial of your username in the Fusion 360 Data Panel and in Fusion Team. Anyone working with a view of the folder you’re working in will be able to see that you have opened the file. Simply opening a file DOES NOT reserve that file to you for editing.



File open and Reservation status shown in Fusion 360 interface

In a folder as many users as have Reader level or higher roles on the folder containing the design can have it opened at the same time. As more users open the file, more avatars will be stacked up in the display. If you're viewing the design in Fusion 360, those avatars will also be displayed at the top of the tab.

In a design file with multiple distributed data files linked to it, avatars will be displayed in the browser on files that people have opened. This gives a great view of how the group is working on various components of the design.

To reserve the file for editing a user needs only to be the first person that makes a change to the file. The person that begins actively editing will have a small dot added to their avatar. At this point others can continue to view the data, include the file in other files and even explore their own edits which they will not be able to save to the same file, but can use Save As to create a new design.

If a user wants to be able to freely experiment with changes with a design without limiting the ability for others to continue working and not create a parallel file, you can open a file, right-click and select 'Read-Only For Me' from the context menu. Any change you make cannot be saved. If the user makes a discovery that they decide they want to keep, they can use Save As or at the top of the design window select 'Make Savable'.

Edit in Place

Using distributed data give you extended capacity and flexibility, but you can still modify components external to the design from within the design. This makes it easy to develop external components while see how the change affects the rest of the design.

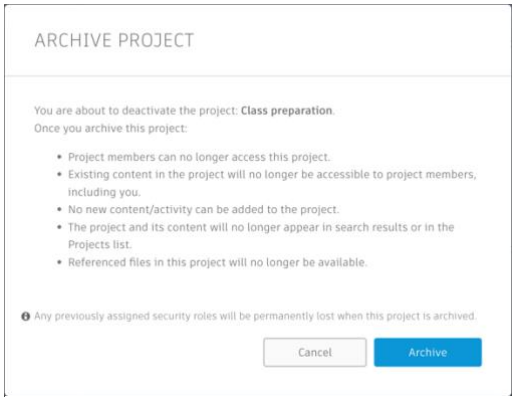
To modify the external components simply hover over the component in the browser and select the Pencil icon that appears. The user can also right-click on the component and select 'Edit In Place' to activate the component in the window and place it's features in the timeline. At this point the edits made will be as though the user had opened the sources file. Saves will be executed on that file.

Learn how to quickly archive last term's course and prepare to start fresh with a new set of students.

At the end of a term, it is best to not delete the contents of a class project. It is better to remove reuse any files that need to be available in a future term and to then archive the project to semi-permanently remove the data from the Fusion Team.

Copy or Move Data

Data files that need to live on from term to term can quickly be copied or moved from a current project to a new project that will take its place by selecting the files in the Data Panel or in the Fusion Team and using *Copy to* or *Move to* options to navigate to their new location. Copying the data is recommended so that any archive would still have the previous data should something need to be recovered or compared.



Project Archive confirmation dialog

Archiving a project

The Archive function for Projects takes the Project and all its contents “offline” for users and anyone that is not an administrator for that Fusion Team. When a Project is archived, the roles assigned to folders are removed and users who previously had access to the project will lose that access. However, the data is not lost. All the files and folder structure are removed from access by anyone.

Should anyone need access the data in the future, an administrator an Restore a project. The project will reappear in the Fusion 360 Data Panel and the Fusion Team for those who are able to see projects. The roles previously applied to folders will NOT be restored. If a student needs a file that they created in the past an Administrator or Manager will need to download or copy that data to a location the student can access it.

Deactivate a Member of the Team

As members of the team no longer need access they can be Deactivated. Under the Admin tools a list of users can be found under Members and Roles. Selecting a user, you can choose to Deactivate them and confirm the task. This will remove the user from being able to access the Fusion Team. Deactivating a user will not delete them from the Fusion Team.

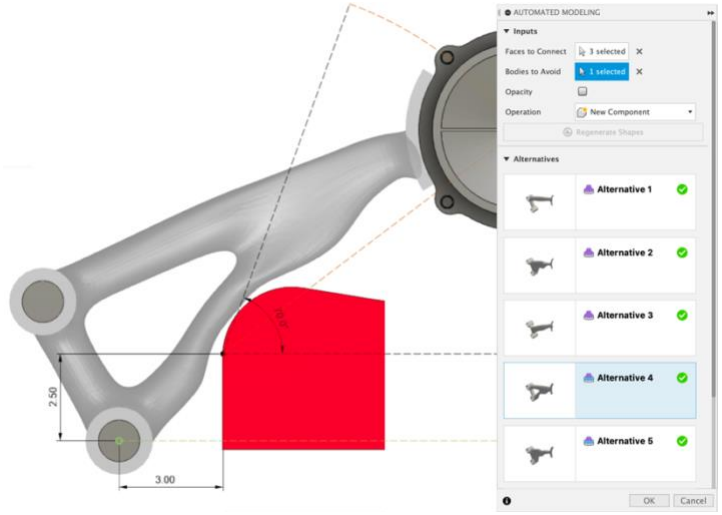
A member of the team that has been Deactivated can be reactivated. Their Team Role will be restored but their Folder Roles will not be restored. This makes it possible to bring students back into the Fusion Team without having to issue a new invitation.

Additional features and workflows that are helpful in an education setting

In addition to the subjects covered in the course specific to conducting the class Fusion 360 has a lot of features, options, and workflows that are valuable additions to lectures and to have in mind to assist students.

Automated Modeling

This tool can be used to create a set of geometric suggestions between selected faces and can include bodies to avoid inspiring users to consider alternative approaches to creating components. These suggestions are presented in a list that can be quickly displayed in the model and generated as a Body or a Component.



Automated Modeling results display

File History and Promoting a version

A new version is created with each file save. There is an option (recommended) to add a note with each save. Any existing version of the file can be opened as a read-only file and the open file can be saved as the latest version of the file. Changing the Latest version does not remove previous versions so if the user changes their mind, they're able to use the process again.

Learning Panel – Interactive Help

The Learning Panel can be displayed at any time by selecting 'Show Learning Panel' under the help icon. It will display the active "tab" that is being used and show the help associated with the active tool and each time a new tool is selected the learning panel updates with content for the new active tool. Additional information can be accessed by switching from *step-by-step* help to *Learn more*.

Share Link options

Share Link

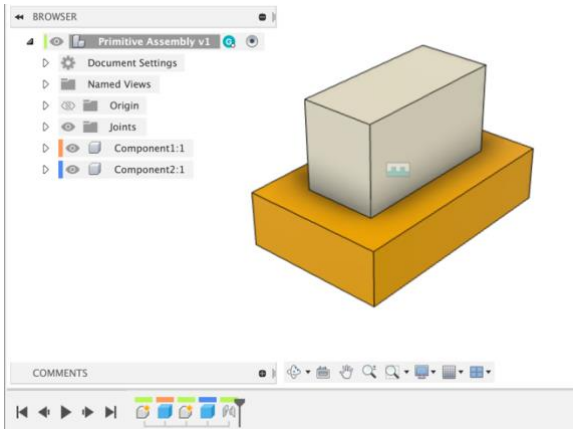
Under the File pull-down you can select *Share>Link* to generate a URL that will take the recipient to the model. You can choose whether to allow download of the CAD data and also choose if you want to require a password to view the file. Anyone receiving the link will be able to view the model even if they do not have Fusion 360 or an Autodesk ID.

Web version of Fusion 360

Teachers and Students with education entitlement can run Fusion 360 through the Google Chrome web browser. Go to fusion.online.autodesk.com and enter your Autodesk ID Username and Password. Fusion 360 will load, function like the desktop version, and the user will have access to their cloud data.

Component Color Swatch

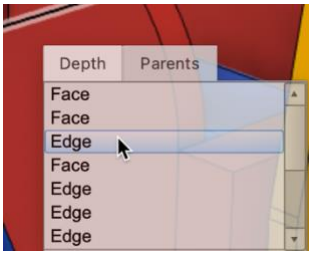
This option is available through the gear icon in the lower right of the screen. After selecting the Component Color Swatch tool, a color will appear next to each component in the browser and the same color will be shown over the features in the timeline associated with the component. This can be a great way to help students understand how these relationships and to see the value of activating components to limit the timeline.



Component Color Swatch in Browser and Timeline

Select other/Face Cycling

While in a command or if a user wants to select objects before starting a tool they can always orbit to select addition edges, faces, or profiles. However, this is not always convenient and the object that is needed might be obscured from any direction.



Moving your mouse point over the object you want to select (even if it's behind multiple layers obstruction), clicking and holding the mouse button will generate a list of entities that can be selected. Releasing the mouse button, you can move down the list and the options will highlight until you find and click on the option you want. This can be repeated as many times as necessary in a command.

Selection cycling

Selection Priority and Filters

To make it easier to select elements for editing in complex designs, Fusion 360 has a wide selection of filters that can be enable or disabled. There are high level filters for only allowing selection of Components, Bodies, Faces, or Edges and there are options for very specific entity types. In a list of checkboxes, you can choose to only be ablet o choose Decals, Mesh Faces, or T-Spline bodies to name just a few. Using the 'Select All' checkbox at the top you can more quickly enable or disable the entire list and then choose only the ones desired.

The Select Panel in Fusion 360 has other options for selection input (Window, Freeform, Paint), and priority functions that are practicing and learning to recognize as students can choose them and then be caught off guard by the change in behavior of Fusion 360.

Change rotation point

The rotation point for a model is what the model pivots around while using the Orbit tools. This point can be easily changed be click the mouse wheel while holding the shift key once then resuming Orbit by clicking and holding the mouse wheel. This can be done accidentally and can be frustrating when people aren't aware of the option to change that rotation point.

The rotation point can normally be restored to the center of the model by releasing the shift key and double-clicking the mouse wheel to do a "Zoom All".

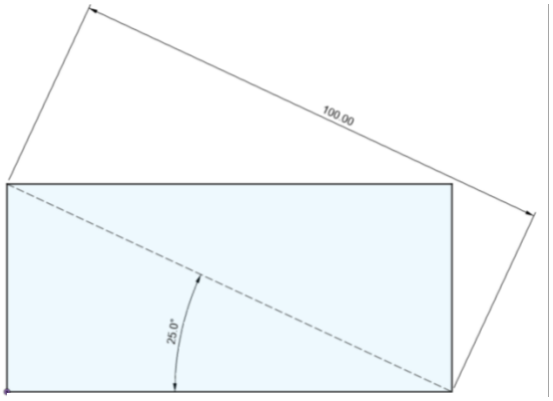
Draw a tangent arc in the Line tool

After completing a line segment, the user can move their mouse to the endpoint of that segment, click and hold the button and drag an arch tangent to that segment. This is why the icon for the line tool also has a tangent arc on it.

Use Construction Geometry to capture design intent

Construction geometry is a useful tool for working out the geometry of a sketch. If a sketch needs to fit around an object whose profile isn't needed for the resulting feature or is more easily controlled using a different geometric solution, that geometry can be incorporated without having to work around those profiles to create 3D. Any geometry that is "switched" to Construction Geometry in the sketch will be invisible in the profile(s) used to generate a 3D feature. You can switch on construction geometry in the Sketch Palette before sketching or any normal geometry can be selected and toggled to construction using the icon in the Sketch Palette or by using the 'X' keyboard shortcut

In the example on the right an angled line whose length and angle is used to determine the size of the rectangle, but there is only one profile in the sketch because the line is a Construction line.



Controlling a sketch with a construction line

Reorder features to add a Component

The end of the timeline can be moved to insert features or sketches into a component at an earlier point in time than the model has progressed to. The action is like "feature rollback" in older 3D CAD systems.

This capability can also be used to repair larger issues with the design. It's not uncommon to begin modeling what will be an assembly of components and forget to create a component at the beginning of the process. If a user begins creating a sketch and features before realizing they should've created a component, they can move the end of the beginning of the timeline and create the component they needed. This will create an empty component and by default, activate it. The user can then activate the top level of the design and move the timeline marker back to the end of the list of features or at least to the end of the features associated with this new component. The model will be restored, and the sketch and features will still be associated with the top level.

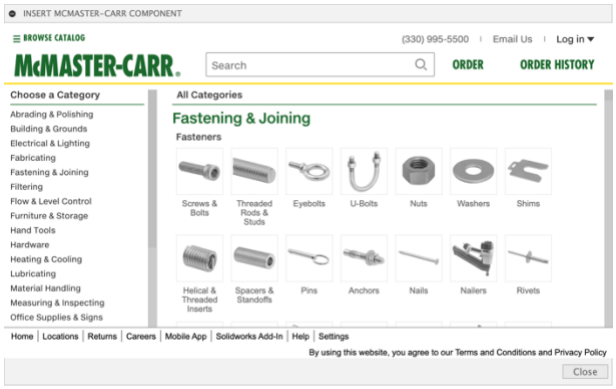
If the sketch has only been used to create features associated with one component, it can be dragged onto the new component and it and all of the features related to it will be moved into the new component. If relationships have been created beyond across components and sometimes across bodies, the sketch might not be allowed to be moved to the new component. In that case you can drag the body of the model to the new component. This will give a result similar to using the 'Create Component from Bodies' tool.

Joint Origins

Joints are created in Fusion 360 by creating relationships between Joint Origins. In that workflow and the As-built Joint these Joint Origins are created in the process of creating the Joint. However, you can add a Joint Origin to a component at any time. If a component needs to be repeatedly located in a location or orientation that requires offsetting the joint origin or changing the angle, it can be located in advance and saved with the component. They can even be associated with 2D geometry.

Standard Components

A valuable lesson is the use of standard, purchased components in designs. Modeling items like fasteners or metal shapes invites error and creating non-standard sizes.



Downloading components from the McMaster-Carr library found in the *Insert* panel makes it easy to be sure that the purchased components needed in a design are correct. By filtering these components by standard, size, material, and other criteria students also learn that even components of the same type do not come in every possible size. Once the correct component is found students can search for the *CAD* icon associated with the part number for the component and download it directly into the design by selecting it as a 3D STEP file. Some threaded fasteners can be downloaded without threads to save resources.

In conclusion

It has been the goal of the presenters of this class to inspire you to use Fusion 360 and Fusion team not just as subject for your courses, but as a platform to assist in delivering those courses. The integrated data management and collaboration tools are easy enough to use in virtually any level of education and help students understand how working as a team is critical to the design process. In reality many manufacturing companies are still working without the level of collaboration available to you and your students. We wish you and your students great success.

We would also like to recommend that you connect to others to share your experiences and learn from theirs. A great place to do this is the Autodesk Fusion 360 Educators forum. Here is a link: https://forums.autodesk.com/t5/fusion-360-educators/bd-p/6145