

Resources and Materials

Math and Equation Resources

Note: this document has been divided into tabs to make it easier to navigate and find what you are looking for. Use the tabs on the right to go to the section that interests you.

Resources and Materials

Courses

Indiana University - [Creating Accessible Digital STEM Materials](#)

California Community Colleges: [Public STEM Accessibility](#)

Videos

- [Accessible Equations](#) (3:28)
- [Why Make Accessible Math?](#) (4:46)
- [Accessibility clinic: A collaborative approach to maths accessibility](#) (1:06:52)
- [Students First! Accessibility for STEM \(Math\)](#) (59:29)
- [Math Accessibility Playlist](#) by the Accessibility Guy (7 videos - all ~ 3:00-6:00)
- [The Ripple Effect of Accessibility Updates in O365](#) (47:29)
- Inclusive Teaching – Math Accessibility @ Johns Hopkins
 - [Part 1 – Math as a Language](#) (44:44)
 - [Part 2 – Equation Creation Tools](#) (50:27)
 - [Slides for both workshops](#)

Accessible Equation Information and Resources

- [Accessible Equations and Mathematical Text at the University of York](#) (this is an excellent resource for equation info - I highly recommend checking it out)
- [Accessible Math Languages & Tools](#) - a spreadsheet breaking down languages and tools and how they interact with Canvas, Word, PowerPoint and PDFs
- [PCC's Math and Chemistry Accessibility Site](#)
- [Penn State's Equations: MathML, Images and LaTeX](#)
- [The Winning Equation: Access + Attitude = Success in Math and Science - DO-IT](#)
- [Digital Accessibility in STEM: Math](#)
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General STEM Resources

[STEM Focused Resources](#)

Math Books and Platforms

Books and Teaching Platforms

Accessible Math Books

- [Math - Open Stax](#)
 - [College Algebra 2e](#)
 - [Introductory Statistics 2e](#)
- [Bookshelves - Mathematics LibreTexts](#)
- [Nonscriptum](#)
- [Math in Pressbooks](#) note from this page- “Display LaTeX with MathJax”
 - NOTE: MathJax is not available on Pressbooks.com. All books published on Pressbook [Add Mathematical Notation – Pressbooks User Guide](#)s.com have the WP QuickLaTeX plugin enabled by default.

Book Creation

- [PreTeXt](#) - PreTeXt is an authoring and publishing system for authors of textbooks, course materials, research articles, and monographs, especially in STEM disciplines, with a strong focus on accessibility.

Worksheets

- [Digitally accessible math worksheets](#)

Math Teaching Platforms

- [MyOpenMath](#) - [Accessibility Information](#)
 - [MyOpenMath / WAMAP / IMathAS Accessibility](#)
- [WAMAP](#) - [Accessibility Information](#)
- [IMathAS](#) - [Accessibility Information](#)

Office 365 and PDFs

Documents

Office 365

- [Writing and presenting about math is easy and inclusive with Microsoft 365](#)
- [Make math inclusive for everyone with Microsoft 365](#)
- [Math Dictation - Math in Office](#)
- [The Ripple Effect of Math Accessibility Updates in M365](#)
- [Typing Math in Microsoft Word | University of Houston](#)
-

PDF Info

- [From LaTeX to accessible PDFs: Transforming math workflows in Microsoft 365?](#)
- [Exporting PDFs with math](#)
- [Best Practice Guide: Math in PDF](#)
- [Creating accessible PDFs in LaTeX | Overleaf docs](#)
-

Accessible Graphing Calculators

Accessible Graphing Calculators

- [Desmos](#)
- [Geogebra](#)
- [Geogebra Vs Desmos: Which should I use?](#)
-

Conversion Tools

General Overview

- [Guide to math formats, converters, and accessible speech](#)
- [University of Nevada, Reno's Making LaTeX Math Equations More Accessible](#)

Tutorials from Indiana University

- [Convert a LaTeX Document with Math to HTML / Canvas RCE](#)
- [Beamer Math Lecture to HTML \(styled\)](#)
- [How-to convert beamer .tex files into HTML using pandoc](#)
- [Convert LaTeX document or Beamer to EPUB using pandoc \(from HTML\)](#)
- [Converting Handwritten Notes to Canvas RCE Page](#)

Tool Suggestions from Experts

[MathML](#)

- Note: It is strongly recommended that you use MathML Version 3.0 rather than older versions.
- It's for HTML, not PDF, but you get better accessibility features from HTML. The actual spec is [Mathematical Markup Language \(MathML\) Version 3.0](#)
- In the WordToEPUB tool, MathML is supported. Some of the EPUB Reading Apps faithfully present MathML visually, and Assistive Technology, like Jaws and NVDA can also access the MathML. There is also an experimental feature in WordToEPUB That is LaTeX to EPUB, which is so cool, you would not believe it. This is the future for those professors in the Math department that are married to LaTeX. We at DAISY are working on an EPUB and MathML test file that looks at a range of MathML approaches, and we expect to make a set of recommendations to publishers in the next few months.
- Information on creating [MathML from LaTeX documents](#)
- It's difficult to impossible to embed MathML into a PDF
- [LaTeX and MathML – What Content Creators Need to Know](#)
- For a PDF: You will need to copy and paste the MathML code for each expression into a <formula> tag in the PDF. There is no automated method. Plus: Only NVDA+MathPlayer knows how to read the resulting file. So, common practice is to create the content in something much easier to produce and read, like Word+MathType or HTML+MathJax.
- The blind students that I work with at Stanford have a strong preference for Math ML.

- Journal of Science Education article: [The Accessibility of Mathematical Notation on the Web and Beyond](#)
- MathML is great for reading and navigating through Math content.
- From Penn State: [MathML and MathJax](#)

[MathML Cloud](#)

- MathML Cloud is a great tool to generate Alt text and convert one format to another.
- Math Cloud is Free.

[Pandoc](#)

- A Universal document converter - If you need to convert files from one markup format into another, pandoc is your swiss-army knife.
- Can convert LaTeX to Word or HTML5
- [Accessibility at Penn State | Pandoc Conversion Utility](#)

[Tex4ht](#)

- TeX4ht is a system for converting documents written in TeX/LaTeX/ConTeXt/etc. to HTML, various XML flavors, braille, etc., optionally using MathML

[MathKey](#)

- Generates MathML, Latex or Image
- Is for macOS and iOS
- Includes a browser component where the iOS device can send data easily to the computer.
- Is not always accurate, and depends on the quality of the drawing. It is a good place to get the MathML equation started though. Sometimes only a few things need to be adjusted in the code.

[MathType](#)

- Mathtype will allow you to convert LaTeX code into a LaTeX equation in word, and can be used with duxbury.
- Mathtype equations need mathtalk or export to HTML to be read aloud
- Can be used by screen readers
- Mathtype equations can't be automatically enlarged to (eg) 200%, so need to be manually enlarged, so they need accommodation for low vision students
- [How to use MathType in PowerPoint so that it is accessible to screen readers](#)
- [Symbols missing in equations converted from Word's equation editor to MathType](#)

MathJax

- MathJax Equation Enhancements - LaTeX equations can be entered in any Canvas text field, and MathJax is loaded if Canvas detects LaTeX equations on the page. ([Deploy Notes - 11/18](#))
- A Javascript package that can render equations that are written in many formats including Tex in the browser
- [Accessibility Features](#)
- [Demo of Tex in MathJax](#)
 - If you view the source of that page, (control+u) in Chrome, you will see the math equations surrounded by dollar signs. This will be very familiar to a math instructor who writes Tex. Also, if you look at line 10, you will see where MathJax is configured to look for the dollar signs and parse the math between them. I would strongly recommend using the above page as a template and having your instructor download and add their own math in that page.
- [Preparing Accessible Math Documents using MathJax](#)
- [SPSCC Pressbook Tutorial](#)

GrindEq

- Converts [LaTeX to Word](#) with an option to keep the equations in MathType format.
- It is one of the few conversion tools which has a MathType option. The MathType is important because it lets you export to content with MathML (unlike the native Microsoft Equation Editor). It does require the MathType plugin which works only on Windows/Mac Mojave.
- I would recommend using GrindEQ's LaTeX to Word utility to convert your LaTeX files into MS Word files with MS Word equations. This utility can also help with numerous custom LaTeX macros that may not be supported by Pandoc.

Central Access CAR tool

- Once you have Word/MathType with proper heading styles and good table structure, you can use the Central Access CAR tool to convert the Word to an HTML document with the MathType as needed.

Equatio

- Can scan images of equations and export either MathML or LaTeX.

- It is available for Windows/Mac but requires an institutional license. The cost is fairly reasonable though
- Will convert handwritten math equations to LaTeX
- Has a Chrome Extension
- EquatIO does make entering math equations easier for Google docs and Word, but it makes the equation an image and places alt text for a screenreader. TTS programs do not usually interact with alt tags, but R&W does in this instance. Users with screenreaders will be required to memorize the equation as it's read since they can't navigate through it. Editing your math equation in EquatIO takes a level of patience since you have to import the equation back into the math editor.
 - After recognizing an equation, Equatio has the ability to copy as mathML or LaTeX so it does do more than save an ALT text to be read. On tests of that process users have been able to paste the mathML into a web page and then use NVDA plus MathPlayer with Firefox to work through details of an equation.

[MathPix](#)

- EquatIO uses MathPix to do the OCR of equations. MathPix's Snip tool is even better suited for doing OCR of mathematics into LaTeX for remediation / AltMedia work. It's workflow is more efficient and it is quite a bit cheaper than EquatIO
- MathPix allows you to copy either MathML or LaTeX to your clipboard.
- Mathpix.com has been a phenomenal tool for making math accessible. Before MathPix, I used Wiris.com, but Mathpix...leaves me in awe. I have used MathPix heavily to make math content in libretexts.org textbooks accessible.

[Mathkicker.ai](#)

- It's built for math and handwritten and is in an early stage of production, but it could be something to keep an eye on that could work for science courses as well.
- The math conversions are similar to mathpix output, but it does the whole document at once

[WordtoEPUB](#)

- Free tool from Daisy Consortium for PC
- You can convert the MS Word file to EPUB. I would recommend sharing an EPUB, not another format, as MS Word on a phone is not ideal and there is potential for students to inadvertently edit the document.

- WordToEPUB will convert the math to MathML. (BTW WordToEPUB will soon allow you to convert LaTeX to MS Word and will also soon handle MathType, which it currently doesn't)
- You can also convert Word to HTML - it works well. You will need to enable it in Preferences > User Interface Options > select *Offer HTML Output* as it is not on by default.

[Indiana University Math Converter Tool](#)

- Tool from Indiana University

[Beamer to LTX Converter](#)

- Convert Beamer to Accessible PDF - Transform LaTeX Beamer-class slide decks into tagged, accessibility-focused PDF presentations without rebuilding years of course material from scratch.

Handwritten Notes

Handwritten Notes

Tools

These are some tools and resources that may help with converting handwritten notes to accessible formats

- [Comply AI](#) - developed by a UCLA Math student using Claude - is requesting feedback
- [Mathpix](#) - can convert handwritten notes - including chemical and atomic structures into accessible formats
- [Mathkicker](#) - free tool to convert complex math expressions and formulas, handwritten notes and images into Word or HTML
- [Image Accessibility Creator](#) - an AI driven image interpreter - it analyzes the image and not only reproduces the information, but also attempts to explain it.
- [Indiana University Math Converter Tool](#) - tool developed by IU - the markup languages of AsciiMath, LaTeX, and MathML can be converted by MathJax or MathCAT into speech text, making math content more accessible by interpreting the markup and generating written output.
- [Converting Handwritten Notes to Canvas RCE Page](#) - part of an Indiana University course - note: course is archived and no longer updated
- [ComplyAI](#) - Developed by an undergrad at UCLA specifically for math-heavy handwritten content like STEM lecture notes and problem sets. They plan to expand to the domains of chemistry, physics, art, and other subjects. (all math is in Typst):
- **AI Tools** - try using different AI tools (Chat GPT, Claude, Gemini et...) to convert your notes - different handwriting and styles produce different results so it is worth finding the one that works best with your handwriting.

Recommendations and Instructions

[Mathpix: Convert Handwritten and Printed Math](#) - Recommendations from the University of Maryland, Baltimore County on using Mathpix to digitize handwritten notes.

Authoring Tools

Authoring Tools

[PreTeXt](#) - PreTeXt is an authoring and publishing system for authors of textbooks, course materials, research articles, and monographs, especially in STEM disciplines, with a strong focus on accessibility.

[TikZ package - Overleaf, Online LaTeX Editor](#) - a complex and powerful tool to create graphic elements in LaTeX.

[Mathcha](#) - Online Mathematics Editor

LaTeX Info and Resources

LaTeX Resources

- **New:** [Generating Well-Tagged PDF from LaTeX](#)
- [Convert Beamer to Accessible PDF | Beamer to LTX Converter](#)
- [Digital Accessibility for LaTeX](#)
- [LaTeX Wikibook](#)
- Website: [Making LaTeX accessible](#)
- [Accessible LaTeX Documents | MathML, Tagged PDF, Alt Text & Screen Readers](#)
- [Underleaf](#) - convert Math to LaTeX
- [LaTeX Questions Answered](#)
- [LaTeX Tagged PDF -- A blueprint for a large project](#) - via [PDF Association](#)
- [LaTeX Tagging Project](#)
- [Accessible LaTeX](#)
- [Creating Accessible LaTeX Documents - LibGuides at MSU Libraries](#)
- [LaTeX Accessibility Guide | Engineering Technology Services \(ETS\)](#)
- [Accessible documents from LaTeX | UCL Digital Education team blog](#)
- [How to create accessible documents with LaTeX](#)
- [LaTeX - Digital Accessibility | University of South Carolina](#)
- [Math converter: Tools: Accessibility: Indiana University](#) - Convert AsciiMath, LaTeX or MathML to Speech Text
 - [Math converter instructions: Tools: Accessibility](#)
- [Creating Accessible LaTeX Documents - Subject Guides at Grand Valley State](#)
- Check out the [TeX forum on StackExchange](#) such as this one: [A guide on how to produce accessible PDF files?](#) which is where lots of TeXperts (yes, that's they're often called) hang out. They are a resourceful and helpful group as long as you follow StackExchange's [community standards for etiquette](#).

Information on LaTeX

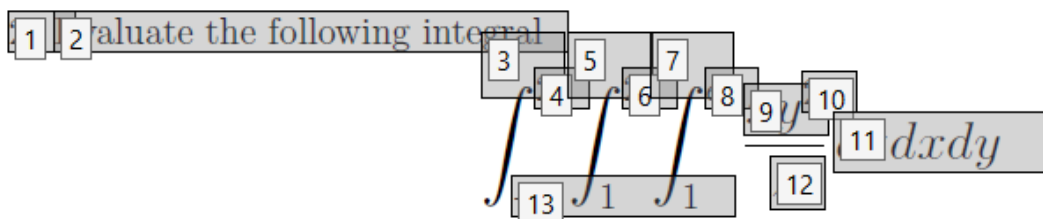
Because LaTeX is open source software, the first thing to know is that there are lots of different variants in the LaTeX family. The term “LaTeX” has been genericized; it could easily refer to the actual latex implementation or to any of several siblings/cousins like pdflatex or xelatex or ams-latex that have evolved over the years. Some options produce PDF output directly while others may produce DVI (DeVice Independent) or PS (PostScript) as intermediate formats before conversion to PDF. With so many options, you’ll first need to know the exact workflow the professor is using to produce the PDF output. (One bit of good news: If one workflow doesn’t produce the desired output, switching variants might bring us closer to where we want to be. But people can be zealots about their LaTeX configurations—it takes a lot of tuning to get things configured so that it “just works”—so tread lightly if making this suggestion.)

There is an [accessibility package](#) for LaTeX (and its siblings) with the stated purpose of producing structured and tagged PDFs. My next suggestion would be to have the professor add this package to a short PDF document with equations for you and then to check it for accessibility. I am not an expert on PDF accessibility at all, but depending on what you find, you can decide whether it might be more feasible to remediate the inaccessible PDF after generation rather than force LaTeX to produce accessible PDFs in the first place.

Testing Results LaTeX converted to a PDF

PDFs were not accessible for math equations

- Test Document was not OCRed or Tagged
- Once tagged, it still could not be read by NVDA at all
- Reading Order goes inline so it will not read the equation correctly



1 2 Find the mass and the center of mass of a thin rod with the following density function

$$\rho(x) = \begin{cases} 3 & \text{if } 0 \leq x \leq 2 \\ 4 + x & \text{if } 2 < x \leq 4 \end{cases}$$

Latex is great for reading and writing Math as a blind student.

Process and Process Discussions

Process and Process Discussions

[IMS Guidelines for Developing Accessible Learning Applications](#)

Your BEST and most accessible option is going to be creating Math in Microsoft Word with MathType, then publishing to MathML.

Here is the process we now use, and I think it could help. I have to give credit to Richard Orme from the Daisy Consortium for sharing this with me. This process isn't bulletproof by any means and some of the tools have clear limitations, but it works fairly well. We've been working on STEM accessibility for a few years and the more we learn the less we know, but if we keep pounding the stone eventually it will break; that's what we tell ourselves anyway.

1. LaTeX to Word with pandoc
2. Edit and clean up in Word with MathType
3. Create an EPUB with math as MathML (with LaTeX annotation) using WordToEPUB
4. Test the experience in EasyReader for Windows, Thorium (with MathJax switched on) and VitalSource Bookshelf

Funny, a couple friends and I were just talking about best math workflows recently. To the best of our collective knowledge, there is no one "best" option.

- Scientific notebook used to import into Duxbury, and is a LaTeX based WYSIWYG – It's been years, but I'm pretty sure you could insert LaTeX directly into it, though I had trouble importing other LaTeX documents into it. I don't even know if sci notebook still works for us, so I'll leave that for someone else to confirm.
- Mathtype will allow you to convert LaTeX code into a LaTeX equation in word, and can be used with duxbury.
- Mathtype equations need mathtalk or export to HTML to be read aloud, and to the best of my knowledge can't be read aloud without a screen reader.
- Mathtype equations can't be automatically enlarged to (eg) 200%, so need to be manually enlarged, so they need accommodation for low vision students
- Using built in Word equations, immersive reading tools will read equations. They aren't usable by students with a screen reader, but they're usable by a student who just wants it read aloud for audio reinforcement. You can't use them with Duxbury directly, but you can convert equations in mathtype.
- And in reality, math is non-linear, so reading it linearly (ie, listening to it spoken aloud) is an incredibly difficult way to learn math. For a blind student, you're going to want

physical braille which means Sci Notebook or Mathtype. For a student using audio reinforcement, word equations are more useful.

- Epub3 readers will read out loud more reliably, and I think the WordToEpub3 pipeline does convert Microsoft equations (I am not sure about mathtype)
- For most accessible, HTML & MathML < epub3.
- For least accessible, write it very small on a piece of paper while standing in front of it yelling about your favorite conspiracy theories.
- I'm partial to the hollow earth myself.

I would recommend using [GrindEQ's LaTeX to Word](#) utility to convert your LaTeX files into MS Word files with MS Word equations. This utility can also help with numerous custom LaTeX macros that may not be supported by Pandoc.

Then use [WordToEPUB](#) to convert the MS Word file to EPUB. I would recommend sharing an EPUB, not another format, as MS Word on a phone is not ideal and there is potential for students to inadvertently edit the document.

WordToEPUB will convert the math to MathML. (BTW WordToEPUB will soon allow you to convert LaTeX to MS Word and will also soon handle MathType, which it currently doesn't)

The best EPUB reading system for desktop in my opinion is [Thorium reader](#). For iOS, students can use Apple Books and on Android, [Gitden Reader](#) used to be the best for math.

There are a number of ways to convert LaTeX/TeX equations to MathML. Once in Math ML the equations can be placed into HTML or ePub documents which will permit the users to employ screen readers to interact with the math.

From an alternate media perspective, I think the easiest workflow for creating MathML-based content is to work within MS Word and use MathType to create the equations. Then, use the Export to MathPage option with the output as HTML+MathJax. This should function with all current screen-reader applications.

Math Equations in Canvas

At this time Canvas does not offer a great solution for hosting accessible Math. We hope that this changes at some point. Currently, all equations are entered as an image with alternate text. This does not offer students who use screen readers the best option.

One potential solution is to:

1. Create the math in Word with MathML (tools like MathType can help)

2. Export the Word document as an HTML file with MathJax enabled (MathType can also help here)
3. Post the HTML file in the Canvas Course or offer it as a downloadable file

We recently hosted an office hour on best practices for creating accessible math in a word document. You can find it on the [CCC Accessibility Center Presentations](#) page.

One thing you can do is use the HTML Editor in Canvas, which allows you to copy and paste in MathML for the math expressions. You can generate the MathML using MathType, or you can use some type of free online editor and then copy out the MathML code from there, for example <http://www.wiris.com/editor/demo/en/developers> or <https://mathmlcloud.org/>

You will need to copy the MathML code from the external source and then copy it into the HTML editor in Canvas in the appropriate spot where you want the equation to go. Then "Save and Publish" the page, at which point it should properly display the math expressions. I should point out though that if you first "Save" the page and then click on "Publish" it will cause the math expressions to be lost and replaced with annotation code from the original HTML content. If this happens, simply unpublish the page, pull up the HTML editor once again (without making any changes) and then click on "Save and Publish."

Since Canvas used MathJax to display MathML, any screen reader which can handle MathML should support it, such as JAWS, NVDA, ChromeVox or VoiceOver.

I've had stellar success creating screen reader accessible math materials with the **Central Access Reader**

Technical info and my favorite features:

- For input: MS Word docs with either Eq Editor or MathType (So, infyreader output works if you use infyreader).
- You can check the voicing of the file from within the application and make corrections back in word.
- There are several options for output, MP3 audio is great for anyone just getting started with screen readers.
- but the value is in it's Flex HTML export function which outputs a fully screen reader accessible HTML (single file, no messing around with a file and a folder) with embedded MathML equations. Students don't require any plug ins or software downloads. The files are fully accessible with the default browser/screen reader combos on just about every platform (I haven't tested android) but students have had no problems with these platforms apps:

Windows: JAWS & IE (Edge, Chrome, firefox also seem to work fine), NVDA should also work.
MAC (computers/iPhone/iPad): Voiceover & Safari (Or chrome or firefox)

I can't say enough about how Central Access Reader (CAR) has been a game changer. Students use the same technology and keyboard commands they use to read web pages. And the application is FREE. The only possible negative about CAR is that it hasn't been updated in a while, so at some point technology will leave it behind. The CAR interface isn't 100% accessible, but it can be used to create fully accessible math HTML pages. Small and easy to send via email. The output is also editable if you know HTML, web design. Here is the link to the Central Access Reader install for Windows (64-bit Windows only, and an older Mac version).

Central Access Reader: <https://www.cwu.edu/central-access/reader>

I also recommend the Central Access Toolbar. The tools and macros on this Word toolbar add in have sped up my workflows from Adult Ed and Dev. Math to Calculus 4.

Additional Comments

We are currently trialing a workflow in SensusAccess that automatically converts TEX/LATEX into accessible HTML5 with math as MATHML.

The Data Analytics instructor I worked with ultimately moved his content into PPT files, which handled the equations a bit better than the PDFs he started with.

There was a product I tried when it was in beta that worked pretty well for creating accessible math content in PDF's. It was years ago so I don't know where it stands now. LEAN Math and the contact is John Gardner <john.gardner@viewplus.com>

Screen reader and Math content has best iteration results when the content is formatted in MathML or Latex.

I use Central Access Reader, I get good results from both Equation Editor and Mathtype, check the output in CAR before saving to an HTML file with MathML, by saving the "FLEX" HTML option in car. Any hyperlinks in your document will need to be fixed in notepad, you can't use in-document links, so MS word table of contents won't work, use the CAR table of contents option for longer documents. The previous message mention space in Math equations, which cause the voiced "error" where ever they occur. I have been able to use either Equation Editor or MathType and even mixed in a document with usable results. Students have really liked the HTML output, it requires no plug ins or special software, they read it with default screen reader/browser combos on MAC, OR WIN OS, mobile devices. I send them both the HYML and

MS Word files if they need editing capabilities. With JAWS now able to read (in theory) equations in MS Word, and the new Equation Editor & Nemeth input/output for Braille displays (still needs some work, hard to set up, but it's a start, requires MS Word 365), things are finally looking like that holy grail of Braille access to MS Word equations, both reading and composing using Nemeth, will soon become a reality. I will be sad if CAR allowed to become obsolete, without anyone to support its upgrade to newer architecture. The Central Access Toolbar, another great tool from Central Access, already won't install into MS WORD 2019. A 😞 shame tools with such amazing functionality are allowed to wither without other tools that provide such nimble workflows to screen reader accessible MathML. (Save CAR, please!) Hope some of that info helps.

Community of Practice

STEM Community of Practice

[STEM Access Community of Practice - Welcome Newsletter](#)

[The STEM Access Exchange - Interest Form](#)