HOW MIDDLE SCHOOL STEAM TEACHERS CAN COLLABORATE WITH TEACHERS OF OTHER SUBJECTS

Are you a middle school STEAM teacher? If so, you'll know that if we want to provide our students with a true STEAM experience, it's important to promote collaboration between different subject areas. That means teaching multi-disciplinary lessons which cover different areas of the curriculum, rounding out students' learning outcomes and breaking down the barriers which exist between different subject areas.

The challenges middle school educators face

Teaching middle school students means teaching children when they're at a very delicate yet crucial moment in their learning path. The skills educators need to teach this age group are different from earlier years, as slowly but surely, you need to move from simplicity in a specific context to critical thinking and higher complexity problems. We have to ask students to justify their opinions and have longer debates in class. In most subjects, educators also have to help students develop new soft skills, such as problem-solving, collaboration and communication, that are harder to master.

How can these challenges be overcome?

Co-hosting classes across subject areas

Many studies made over the last few decades have proved the importance of co-hosting a class with another teacher. In 2004, a comprehensive article called '*Challenges Facing the American Middle School*' by Juvonen et al. focused on how crucial it is to see the same student in a different classroom context. Educators can get a more extended and comprehensive analysis of student needs and perhaps notice more weaknesses or strengths, making them easier to address together with colleagues.

A STEAM course, such as the _Arduino Student Kit_, presents the perfect interdisciplinary framework to plan and practise common teaching time. The goal of an interdisciplinary team of educators is to facilitate abstract thinking and connect prevailing patterns that emerge on the same topic from two parallel subjects.

AN EXAMPLE OF TEACHING STEAM AND HISTORY

When you teach history to students aged 11+, there's more focus on linking events and examining why things happened in the way they did, rather than simple focusing on one single event or one person, as we do for younger years. Students are taught how to think critically, challenge assumptions, and examine the 'why' rather than the 'what'. So how can STEAM and history educators integrate their lessons together for a truly cross-curricular learning experience?

Using the Arduino Student Kit in a cross-disciplinary way
If you teach a STEAM subject, use (or want to use) Arduino kits and want to integrate your students' work into another subject area, this is how to start planning classes together with your history colleagues.

In each lesson contained in both the _Arduino Student Kit_ and the _Education Starter Kit_, we introduce topics related to the history of technology in a section called the 'Invention Spotlight'. We bring in the history aspect to help students understand how we got to now in terms of technological development, so they can see the process inventors and eventually adopters went through to make the technology mainstream.

Step 1: Identify course intersections & linking points
The big change that brought Europe and then North America to modernize manufacturing, the _Industrial Revolution_, is an anchor between science and history.

We suggest introducing this topic in a very different way: starting with the inventions that made it possible!

Concrete concept   **Abstraction**

Inventions	→	Period of social and economic change that transformed society and economy

Step 2: Coordinate

- Check with your colleagues when they are planning to teach that topic. We know that calendars change frequently, but there should be a rough plan!

- Between you, choose a specific angle to tackle from a historical point of view. As mentioned, you could focus on the Industrial Revolution, and in the Student Kit there are several chapters we could use as linking points.

  Here some examples for inspiration from the Student Kit:

  Communication devices
  Lesson 4 - Dimmer Switch - Telephone
  Lesson 9 - Light wave radar - Wifi

  Production chain
  Lesson 2 - Electricity Basics - Automation
  Lesson 6 - Sports Robots - Electric Motors

  You could choose the progress of communication devices from the Industrial Revolution to the modern day as your specific topic area, or you could also take the angle of advancements in the production chain.

Step 3: Brief your colleague

Brief your history colleague on the previous Arduino class content you've worked through with your students. Show them the chapters and the platform, so they can familiarize themselves with the content.

It's important they feel comfortable and are 100% on board, and this will make a great example for your students of a true and full cross-subject collaboration. Show them that different subject areas don't have boundaries and even their history teacher can code and use electronics!

We'd also encourage you to adapt and add extra information as needed. Feel free to make extra slides or create your own content to add on top of what's included in the Invention Spotlight.

Step 4: Schedule

Co-hosting the class is crucial. Find the best dates and times when you can both be present and still have the time to plan some exercises and fun activities to do together.

Plan enough time - remember this will be one unique topic but it will parallel what students are learning in their different classes. The class should have an harmonious flow, and students should not perceive one topic versus another, rather, they should perceive it as one unique teaching experience.

Step 5: Enhance students' critical thinking skills by creating customized exercises
Plan some exercises that make your students really reflect. Cause and effect is an important concept in both history and programming, and you can create many different exercises based just on that. Some of these exercises can be done in class, but some could be assigned as extra work to reflect on and complete alone.

Step 6: Boost creativity
When planning these extra activities, instead of asking your students to create a brand new prototype, ask them to find inspiration on how to hack and beautify existing projects. Thinking about how they could improve an existing Arduino build is a good stimulus, and you might find that your students start to undertake autonomous research.

Pinterest is a gem of resources when it comes to teaching hacks!

Step 7: Have fun!
It can be intimidating for a lot of educators to step out of their comfort zone, their subject, and their classroom, but this is what makes it a fulfilling experience for both you and your students. Showing that we, as educators, don't fear new challenges but instead get inspired from them is one of the best STEAM teaching experiences we can provide!

INSPIRED? HERE'S WHAT YOU NEED TO GET STARTED WITH ARDUINO EDUCATION

Try our new Student Kit, designed for home learning and teaching remotely. It will help you get started quickly and easily with robotics, electronics, and coding. Furthermore a kit that will provide you content for several different subjects that can support cross-curricular collaboration between teachers.

To get the kit, you can *find your country's distributor*, or *buy it in our online store*.