

Addressing Challenges to Building Effective STEM Programming in Elementary Grades

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Keva Planks. Magformers. Scratch. Sound familiar? If so, then you most likely teach or have a child in elementary school. STEM has been all the rage for the last few years and it ranges from anything to everything involving science, technology, engineering, and math (with the occasional art; commonly referred to as STEAM). Schools, public libraries, community centers, and camps are all looking for ways to create and/or incorporate STEM programs into their repertoire. They may bring in some sort of STEM coordinator or a surplus of STEM themed items, which to kids basically look like toys. But what is it about STEM toys that have kids so interested? For one thing, they are interactive and hands on. They spark creativity and curiosity all at the same time! Some activities require building, or coding, or testing, or even “failing forward” where students learn from their errors and continue to persevere.

As an elementary educator for the past 14 years, I witnessed the emergence of STEM in various classrooms and different districts in two different states. I have observed students grow ideas, concepts, and confidence when involved in STEM lessons. They discovered ways to push their thinking and make real life connections. I have taught five different grade levels and continue to experience how teaching STEM at the elementary level is challenging. While math and English Language Arts receive ample instructional time and resources as subjects evaluated by mandated testing, many aspects of STEM instruction are not given the same amount of attention in the curriculum or school day. I have found success in addressing these challenges to implementing STEM through teacher collaboration and administrative support; knowing it is difficult to achieve success on your own.

Some of the specific barriers facing elementary teachers include time constraints and readily accessible effective STEM resources. Education leadership organizations like the National Science Teachers Association and the National Study of Science and Mathematics Education point out that science instruction (including STEM) may receive less instruction daily, if not weekly. How can we find more time for STEM? Time constraints limit teachers from planning, conducting, and reflecting on science instruction including STEM. Furthermore, these limitations add to the challenge of finding relevant and effective STEM resources and opportunities for exploration in the classroom. According to Education Week, 100kin10 Coalition addresses this issue specifically stating that, “Teachers often don't have sufficient access or funding to quality STEM curriculum. They also rarely have opportunities to collaborate with STEM experts in the classroom and many elementary teachers feel anxious about teaching STEM subjects.” These are very real concerns not only regarding the lack of

instructional resources, but also the opportunity to collaborate with colleagues and administrators to co-create STEM units grade or district wide.

When I started teaching in my district, I quickly noticed their commitment to STEM education. My district has found a manageable solution that has helped address one roadblock: specifically focusing on teacher voice and time. With supportive leadership, teachers are given an opportunity to co-create STEM units for the entire district. Over the last five years, they have employed teachers in the district (along with the district STEM coordinator) to create STEM specific units for each grade level across the six elementary schools in the district. Each year, they add a new six-day grade specific STEM program that will be co-taught with the STEM coordinator and as the years progress, the classroom teacher transitions into the role of the primary STEM teacher and the STEM coordinator teaches fewer days each year. It started with Roller Coaster Physics in fourth grade then followed with Windmill Design in fifth grade, Scratch coding in sixth grade, Seed Dispersal in third grade, and currently developing programs for grades one and two. These units are created in part through resources that are already available on the internet and modified for our district specifically with the resources included and reproduced. This worked well because teachers were given paid time over the summer to plan units and then lead professional development throughout the school year for teachers in each grade level.

In recent years, I have participated in curriculum writing for different types of STEM units. The district I am currently in has spent countless hours finding ways to develop grade specific STEM units for all students. The unit highlights a specific topic that is class wide and lasts for about four to five days straight for an hour to two hours a day. Each unit focuses on an essential question and builds each day using discussion techniques such as a “chime” (an ongoing conversation between students that builds off their own ideas or the ideas of their classmates), a connection wall, and/or group problem solving. Then try different solutions toward the unit challenge until they succeed (with teacher assistance of course). We also focus on a class Makerspace that meets for an hour to an hour and a half (total of six hours) over a one to two week span. The students absolutely look forward to these STEM weeks all year long. They are completely engaged and challenge themselves. Unfortunately, once it ends, the students do not have consistent STEM instruction in the classroom (if at all).

This has been a great first step in assisting teachers to incorporate a STEM unit into their curriculum. Teachers were able to co-teach with the STEM coordinator and be exposed to new concepts and lessons. They were provided with professional development and resources prior to implementation. These resources were provided in paper and digital form to provide teachers with opportunities to modify or differentiate any of the materials. Students were given time to imagine, create, and explore hands-on discovery and experimentation. They were continuously curious and eager to learn with

every lesson. Overall, teachers and students were excited and not anxious to approach scientific methods and science engineering practices.

The chance to build units was a great start, but the challenges of time constraints still hindered progress. Our students wanted more STEM experiences and I felt we could expand on our prior efforts. What if there was something short, simple, and manageable teachers could turnkey in their classrooms? Would you be willing to incorporate such creativity and curiosity into your classroom? I know for many teachers, one of the greatest challenges we face is time constraints. Time to plan, time to prepare, and time students spend exploring. Although we have time constraints, we see the joy of learning through the STEM lens and we want to create this more often. We want to be able to provide this type of thinking without overwhelming teachers to add more to their already busy planning periods.

Naturally, the philosophy behind a STEM curriculum involves hands-on, student-centered based learning. While focusing on innovation and application, students are encouraged to take risks and gain confidence through their learning. Teachers across the world would probably agree this is a fantastic approach, however, it may not be that simple to implement on a daily basis. Or is it? Teachers can sometimes feel overwhelmed with the ongoing demands of ever changing curricula, schedules, professional development, differentiation for all, and teacher obligations within the school and the community. Questions come to mind regarding the details. Where do we find STEM activities? Who creates grade level appropriate materials? When do we find time to complete these interactive lessons? How do we get more than one week of STEM? What is a solution for a more consistent approach?

According to Chelle Hendershot, a veteran educator and public speaker on education, teachers should find ways to combine their subjects and incorporate a bigger problem or question that could be solved in more than one way. On her website, Beneylu.com, another suggestion would be to change the vocabulary in your teaching to use the words: design, model, experiment, trial and error. Further literature suggests teachers could take professional development classes that focus on everyday STEM and using materials and unit ideas for STEM coordinators. While other experts listed suggestions for activities through links on their website. Almost all of the literature agrees that elementary teachers have “plenty on their plates,” but can make small changes to the way they teach lessons.

When brainstorming what a specific plan would be, I thought about convenience. I thought about what could be done for more STEM and more consistency. I knew other teachers felt the same way. After surveying colleagues at my school, it was absolutely evident that every teacher who participated agreed that if STEM materials were already prepared for them, they would incorporate consistent time for students to explore STEM in the elementary classroom. I found a resource that bridges the gap from one unit to a more consistent implementation for student engagement while supporting other

teachers. It started when I searched for a pre-made resource that would be helpful for my colleagues and me. Something that would require little planning and student engagement. It was a weekly “newspaper” for teachers to use in their classroom called *The Daily STEM*. It is filled with news, puzzles, and much more to engage kids with STEM through literacy. Bingo! Pre-made, short, simple, accessible. This didn’t require a subscription, or a login, or an email. I was able to choose from different issues and the students could differentiate which issue they thought was most interesting. The combination of student choice and STEM was a winner! Not only did the students love it, but the teachers did as well. This really was something that, after careful searching, I was able to implement quickly and share out to colleagues.

After printing *The Daily STEM* newspaper articles, I laminated them so they could be used over and over again for different students. I found that the best time for the students to engage in STEM learning was a learning period that is unique to the elementary school I teach in. Everyday at the same time, my students have a set time called, “X-Period” and it has been part of the district since I attended elementary school here. It is a built in time of day (different times for different grades) when students receive various services for reading instruction, math instruction, music instruction involving instruments, speech, occupational therapy, physical therapy, and small group instruction. As time went on, I realized it was a good idea to not stick exclusively to this time as some of the students who excel in STEM the most were out of the classroom at that time. Each article has some similar headings that stay consistent from issue to issue. Some examples include: *STEM in the News*, *STEM Challenge*, *Mystery Photo*, *The Quote*, and *The Puzzle*. The headings that vary include a section titled, *STEM+* and it varies between history, inventions, art, superheroes, agriculture etc.. Some of the headings that are not always in the issue include: *Geeky Fashion* (funny science expressions on shirts), *STEM Book*, *STEM Movie*, and *Seasonal STEM* (the seasons, back to school, holidays, etc.). Not only is the organized layout easy to follow, but also has pictures, visuals, and diagrams.

After trying this in my school with a few other teachers, the students really seemed motivated to read more and try the challenges. Most students were optimistic to see what the challenges were going to be or what the answer to the puzzle was from the week before. For teachers, having *The Daily STEM* already available was an easy go to. At times, the articles were jumping off points for student-generated questions and additional challenges. Students were also able to compare answers with other groups who had worked on that article previously (as some students were moving a little slower than others). After speaking to colleagues, we all felt like we were slowly, but more consistently, finding ways to challenge students in a more manageable way. It is definitely a process that is evolving.

I think sometimes as educators we feel new “hot topics” need to be wrapped in a bow and look fancy. After reading the research and adding *The Daily STEM* to our

classrooms, we found it's better to take it slow and make small changes. The fact remains the same, incorporating STEM into the elementary classroom on a consistent basis is hard, but it is possible with the help of tricks that are already out there and not reinventing the wheel.

For more information on some of the suggestions on how to integrate STEM into your classroom on a daily basis, please visit the following websites:

<http://dailystem.com/>

<https://www.weareteachers.com/stem-its-elementary/>

<https://beneylu.com/pssst/en/stem-classroom/>