A novel approach to STEM education: What if we’re all right?

The idea of STEM education seems to be making more and more waves in the academic world lately. As with any discussion regarding change to the status quo, strong opinions on both sides have emerged. With such polarized positions, the task to create common ground could be a daunting one. Perhaps, common ground doesn't need to be created at all. What if the common ground has always been there? Not only at the root of STEM but perhaps even as an agreed upon principle of all those who have chosen to be educators?

What is STEM education? According to Wyatt Dalton of Pearson Accelerated. Com says, it can simply be defined as a "teaching philosophy " that integrates Science, Technology, Engineering, and Math "together into a single, cross-disciplinary program". The acronym STEM was reportedly first used in 2001 by the U.S. National Science Foundation in this source. The article continues by stating that in the early 2000’s, reports came out stating that the students in the United States were not as proficient in the STEM subjects as those of other competing countries. This fear has been a driving force in the development of educational programs across the United States in mathematics and science as well as engineering and technology for many decades.

Some argue the roots of STEM education go back all the way to the middle of the cold war. In this argument, a key moment in the space race, the beginnings of STEM can be traced to the launch of Sputnik in 1957. In his article, Alvin Powell suggests that the launch of Sputnik helped highlight the need for better education in the fields of science and mathematics in the United States. This heightened understanding and the urgency created by our need to compete in the global race for technological advancement would go on to create the first of many math and science schools. These schools would later prove to be the foundation for the new philosophy of STEM education.

So, what sets STEM apart from other forms of education? How is it different from traditional education? Simply put it's the philosophy. In a tedx talk posted March 11th, 2014, nationally recognized educator, Robert Stephenson lays out his point of view on this new teaching philosophy. In his presentation, he explained how the philosophy of STEM focuses on the innate desire for children to think "outside the box" to problem solve. And that when you give them a task with minimal rules and no concrete model to follow, they will become engaged and persevere in search of a solution. STEM fosters the child’s imagination and desire to learn. This coupled with another aspect of STEM, community integration, where businesses engage with the schools and students encourages the students even more.

STEM education is thought to be the solution for the U.S. to become more competitive in this global Market. STEM philosophy has shown signs of flexibility. There is much to be explored about STEM. Scholars have considered incorporating Arts into the STEM model "STEAM". Some suggest adding Reading. "STREAM". This open-ended philosophy of integrating Science, Technology, Engineering, and Mathematics and possibly other subjects is what’s making STEM sought out as potentially the next teaching philosophy of the 21st century. Perhaps STEM will be the future of education not only in the U.S. but worldwide.

STEM can mean different things to different people depending on one's perspective. The view of STEM can range from a hardline stance of being the only chance for our country's economic survival to the opposite end of the spectrum being unnaturally and unnecessarily forced upon a society. In my analysis of three articles written on STEM you will begin to see some examples of individual perspective being displayed through the writings from three different authors.

In the first article entitled, “Why we need more young people in STEM- and how we can do it", the author argues that the economy of STEM is advancing faster than there are people perusing STEM careers. In the beginning of the article, he paints a grim view of our future, using numerous emotional arguments to drive his point. He attempts to create fear by saying that the statistics are "incredibly worrying". He uses statements of urgency, saying as early as 2024 America stands to see "a deficit of 1.1 million STEM jobs". He then attempts to create a sense of ownership and team by suggesting that we all have a "Duty" to not only encourage but to inspire the next generation to pursue STEM careers. He ends his opening argument with a statement of impending doom. He suggests that if we fail at our task to encourage and inspire that "all the progress made in innovation could falter'.

At this point the author seems to transition from a position of fear to one of encouragement and inclusiveness explaining how different sectors of the community all can participate in the task of encouraging more STEM involvement. Whether it's parents, friends, schools, businesses, or government, we all need to come together and play our part. The author finalizes his argument with another appeal to fear and urgency by restating his opinion that if we don't succeed in producing a larger STEM workforce, our progress will "splutter and stall".

The second article "why STEAM is so important to 21st century education" by Joseph Latham PhD, continues support for the need of STEM education. He also introduces one of the more modern augmentations of STEM, STEAM. Here he suggests the importance of incorporating the arts to STEM. He argues that STEAM isn't just adding a subject to STEM. STEAM adds a dynamic focus on creating a more diverse student with more creativity and better communication skills than those studying under the STEM system.

Throughout this article, the author doesn't make strong emotional appeals as did the author of the "Hays" article, rather he stays on a more intellectual theme. He uses facts and figures as the bases of his arguments and once explained moves on. He doesn't take a strong personal stance on the STEAM approach vs STEM. This becomes apparent as the article progresses and the reader sees the author using STEM and STEAM as relatively two interchangeable disciplines. Another major difference between this article and the "Hays" article is the willingness of the author to recognize that education In STEM or STEAM can be beneficial to students choosing non-STEM/STEAM career paths.

The third article entitled "stop pushing STEM" by Dana Albert makes an extreme departure from both the more pro STEM “Hays" article and even the more open and inclusive "USD" article. In this article Dana Albert expresses his strong opinion that the focus on STEM education is misplaced.

He starts off with a very strong emotionally charged argument, pointing out what he sees as hypocrisy from current elected officials. He questions if they think of themselves as "special". He asks if they believe they can have careers outside of STEM while deeming the next generation "doomed" if they don't go into STEM jobs. After that heated introduction the author transitions into a more fact driven format. He lays out piece by piece his argument why STEM education is no more needed now than it has been in the past and in the projected future. He uses charts and logic-based arguments to show that differences in income between STEM and non-STEM jobs are not as large as others have argued. He then pivots away from his more factual approach to one more appeal to the readers emotional side by suggesting that by pushing all children into STEM doesn't consider the individual child's personality and interests. He equates forcing a child who doesn't have the aptitude, personality, or desire for STEM to be unnatural like forcing a cat to accept a leash.

Each of these three authors used emotional argumentation to one degree or another to direct their readers. In doing so they helped demonstrate that each person has a unique understanding of the world around them. It is this uniqueness that creates such diverse opinions on a subject. This one in particular: STEM education.

So where do we go from here? If STEM can mean so many different things to so many people, how can we possibly find common ground? And just exactly how does one incorporate the myriad of opinions from such a diverse pool? I believe that perhaps the solution is already in each person’s understanding. The authors just never mention it. It's there in the emotional hardline response of the Hays article, where Alistair Cox's fearfully argues that the world of STEM is moving faster than we are creating STEM workers. You can also find it in the less emotional charged writings of Joseph Latham PhD. in the USD article where he argues in a more even tone but strongly advocates to significantly change STEM to a more arts centered program STEAM. Lastly, I argue that even in the completely opposite argument of Dana Albert where he suggests that STEM is not needed to the degree some are pushing, the solution does reside as well.

If you look at all three of these arguments, one common theme arises from each. This being the authors collective desire to create the best education for the next generation. Whether it's to fill an ominous gap in the STEM workforce, to create better communicators across all the STEM disciplines, or to simply encourage each child to pursue their own individual educational path, they all center on the child's education.

In the definition of STEM taken from the beginning of this paper, Wyatt Dalton of Pearson accelerated.com states that STEM is “A teaching philosophy " that integrates Science, Technology, Engineering, and Math "together into a single, cross-disciplinary program". If you couple this definition with our three author’s common goal, you can begin to see just how intertwined these authors are. They all share the actual Philosophy of STEM. Yes, in their own ways, but it's there in all three arguments. Even Dana Albert express STEM philosophy while actively making an argument against the overuse of STEM education when he focuses on how every student possesses different personalities, interests, and aptitudes. It is that very understanding of the individual that helps form this foundation of STEM.

In the Tedx talk presentation mentioned earlier in this paper posted March 11th, 2014, Robert Stephenson does an exemplary job at expanding on how this philosophy, when applied in the classroom, can help to foster a child's creativity and desire to learn and problem solve. This way of teaching could assist a child in discovering an interest in the hard Sciences and other aspects of STEM. Even if STEM isn't ultimately that child's educational outcome, the experience in STEM education could have far reaching positive effects in creating a more rounded and potentially qualified member of the work force, regardless of which employment path that child takes. In his article, Dana Albert mentions he studied STEM curriculum after entering the workforce and has worked in the tech world his whole career. He says this was a direct result of taking an aptitude test at his first job. This makes me wonder. If he had an aptitude all along for technology, and I would argue a personality as well, then perhaps had he been educated in STEM and introduced to computers under the STEM philosophy, he would have then, early on, discovered an interest as well. This in no way negates his argument. It simply underlines how using STEM philosophies early on in a child’s education could help direct a child to discover a potential educational interest.

I believe if we all embrace this philosophy and use the open-ended instructional methods of STEM, there would be common ground found and no longer a reason to argue against, but perhaps a reason to argue for adding the arts to make STEAM or reading to make STREAM, or even another acronym not yet imagined. It is this philosophy of integrating subjects, encouraging children to think outside the box, and focusing more on, as Dana Albert mentions, a child's aptitude, personalities, and interests, that could be the glue that binds us all together. As we have surmised, it could even spark a student’s interest in the STEM core subjects; an interest the student otherwise may never have discovered.

I further believe that it's this philosophy that not only binds these authors together but will bind the future of education and STEM, not only with us in the United States, but to a greater extent, the Global educational community. How amazing is it, that within such widely varying points of view there can exist such a strongly agreed upon principle?

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| **Project Portion** | **Ideal Criteria** | **Overall Feedback** |
| Introduction | * Engaging * Shows importance of question * Indicates major parts and content |  |
| Background | * Uses credible, neutral sources * Effectively and sufficiently explains essential information * Written objectively in own words * Well organized and focused paragraphs with transitions * Minimal error |  |
| Analysis | * Smooth transition from background * Summarizes accurately and in own words two opposing answers and one objective answer to the question * Recognizes bias * Reasonable observations about how all sources make their arguments impactful * Well-organized and focused paragraphs with transitions * Minimal error |  |
| Response | * Smooth transition from analysis * Incorporates strong points from sources * Draws a reasonable and well-supported conclusion, answering the question * Provides satisfying conclusion to the project * Good transitions between focused paragraphs * Minimal error |  |