Emerging Trends in Educational Technology

Addendum to the 2016-2021 Archdiocese of Philadelphia Educational Technology Plan

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Table of Contents

Introduction

The Archdiocese of Philadelphia Office of Catholic Education seeks to further develop and promote the utilization of technology into the core curriculum for benefit of all students. To accompany the 2016-2021 Educational Technology Plan, published Summer 2016, this Emerging Trends in Education Technology addendum seeks to provide future guidance and information into the ever-changing, fast evolving world of educational technology in both the elementary and secondary school settings.

As a school community reviewing this vision document, it is important to consider that this is intended to develop knowledge on trends in the field. As a result, there are no implementation standards, goals, or timelines associated with these trends. First and foremost, schools should be seeking to fulfill the goals outlined in the 2016-2021 Educational Technology Plan. The Archdiocese of Philadelphia (AoP) Technology team is willing and able to help schools assess their current progress on those goals if assistance is requested. The 2016-2021 Educational Technology Plan seeks to make universal recommendations and goals, Archdiocesan wide, to improve the academic outcomes of all elementary and secondary students. In contrast, this vision-based document provides school communities with an opportunity to both examine and plan for the future of technology education in their school beyond goals outlined in the 2016-2021 Educational Technology Plan. Both the 2016-2021 Education Technology Plan and the Emerging Trends addendum were created with current best practices, the Archdiocese of Philadelphia Technology Curriculum Guidelines, and the ISTE Standards for Technology Integration in consideration. This Emerging Trends in Educational Technology addendum outlines several key trends for consideration by the school community. With stakeholders, administrators, faculty members and families, together schools should consider which of these trends may best fit the specific needs and goals of their individual school community.

These trends offer schools a variety of options and curricular connections to expand both the technological knowledge and content area integration for students. In this Addendum, school

communities will find implementation ideas, as well as, resources for further growth. As with both the Educational Technology Plan and this Emerging Trends in Educational Technology addendum, it is our goal to ensure that all Archdiocese of Philadelphia students receive a robust academic foundation, with faith as a compass, to guide their development into well-rounded, global citizens.

Trend 1: Makerspaces

The Makerspace movement is a blend of Inquiry Based and Project Based Learning, with an emphasis on Science, Technology, Religion, Engineering, Art, and Mathematics (STREAM). New tools and resources are introduced into the educational environment for students to discover, to create, and to explore. Commonly, students build objects that race or run an obstacle course, solve a challenge or perform actions that the students can control or programme.

Making a Makerspace In the Elementary and Secondary Settings

Imagine combining parts of an art room, with a sewing class, plus bit of a wood working studio and toss in some 3D printers and robots and this creative space starts to come into reality. What this complexity creates is a guarantee that each Makerspace will be a completely unique individual setting. The level of complexity and the components within each Makerspace varies wildly from site to site. Some Makerspaces might simply use traditional craft supplies (cups, straws and pipe cleaners) while others are designed around using large pieces of cardboard to build and create costumes and structures. Still others have 3D scanners and printers, microprocessors and robots that allow students to explore the worlds of technology and programming. Ultimately, each Makerspaces will provide an unique outlet for students to apply their best skills to create, to problem solve, and to innovate.

Often due to each school's specific needs, resources and curriculum objectives Makerspaces may lean more towards one specific area such as robotics or graphic design. As the resources or the needs of the school community change, the Makerspace evolves as well. The size and location of a Makerspace can vary from some bins in a corner of a classroom to or an entire room or open spaces filled with tools and resources. In an elementary setting, Makerspace concepts can easily be supported by existing inquiry based lessons in existing classrooms. As interest in Makerspace concepts and physical space becomes available, often programs can grow to include rooms where specialized equipment or furniture is located. In the secondary setting, often more complicated tools and machinery can be utilized by the students due to their advanced maturity. Similar to the elementary level, makerspace concepts can be integrated into existing inquiry based lessons within the traditional secondary class schedule. Regardless of the size of

the Makerspace, or what they are filled with, students are encouraged to be guided by their imagination as they play and create!

Trend 2: Augmented Reality and Virtual Reality

Augmented Reality (AR) and Virtual Reality (VR) have been integrated into classrooms as devices have become more mobile and advanced. Utilizing AR and VR can engage students, deepen content knowledge, and allow students to interact with curriculum in ways previously unimaginable.

Augmented Reality blends the real world with digital enhancements, creating an augmented reality. AR allows for our world to come alive! Many museums utilize AR through mobile apps. When a patron holds up the app to a piece of artwork or artifact, more information is given. This concept is shifting to make a strong presence in the classroom for its ability to strengthen curriculum connections. AR allows for teachers and students to unlock layers of information, while integrating as simply or complexly as the lesson requires.

Mobile devices, such as iOS or Android cell phones or tablets, are required for utilizing AR in the classroom. The integration of AR into the curriculum can vary depending on the experience needed to enhance the curriculum content. Apps such as Anatomy 4D are prebuilt for AR experiences. Alternatively, students can create their own custom AR experiences utilizing an app like Aurasma. Both integration techniques build upon students' prior knowledge to craft unique, engaging learning opportunities.

In contrast, Virtual Reality immerses teachers and students in a completely virtual world. Popular with gamers for many years, VR technology is now jumping into the classroom for its active learning style and content rich experience. Deeper learning is achieved when students are able to travel and explore locations, rather than simply reading a book. Educational technology companies, like Google and Nearpod, are already creating standards rich content for VR use in the classroom; a trend expected to continually grow over the next few years.

To utilize Virtual Reality in the classroom, students need both a smartphone and a VR viewer. These tools range in size and cost, allowing for budgeting flexibility within the school community. Often, only a single set of mobile devices and viewers are shared within the community. Alternatively, students

could be permitted to utilize personal mobile devices, along with a school purchased viewer like Google Cardboard, to experience VR simulations.

AR and VR Integration in the Elementary and Secondary Settings

AR and VR can be used in a variety of ways in the elementary classroom to enhance curricular objectives. For a robust AR experience, students can create their own AR enhancements using high quality apps such as Aurasma and Daqri. There are many tools that utilize premade AR experiences, such as AugThat, but always keep in mind that the deepest learning happens when students create, collaborate, interact, and share. To integrate, two standout ideas are the creation of interactive word walls or interactive multimedia book reports/reviews. These suggestions deepen the learning process while also engaging students.

Google Cardboard, or alternative VR goggles, and the use of the accompanying Google Expeditions creates a fantastic VR experiences for the elementary classroom. Specifically, Expeditions allows for teachers to guide students through immersive experiences around the world, giving students a first person point of view look. This extends 'field trips' to places students are unable to visit - a robust way to bring science, religion, and history alive!

At the high school level, students are prepared for more rigorous utilization of AR and VR in the classroom. AR apps such as Anatomy 4D and Elements 4D help students to redefine the learning space and to engage with the sciences in a unique way. An art show or gallery can be greatly enhanced when students utilize AR to create multimedia rich presentations connecting the art and artist. Many yearbooks are also beginning to tap in AR to build content such as videos, concert clips, and sports highlights into such a memorable item.

Google Expeditions can also be a high quality tool at the secondary level for virtual field trips; it can be enhanced through the use of student leaders, rather than teachers, to guide classmates' experiences.. This provides students with a different way to give a presentation on a historic or religious locale. At this level, students can also utilize VR for simulation experiences such as driving or flying, to transform passive learning into active learning.

Trend 3: STEAM and STREAM

STEAM is an educational framework focused on the balance and integration of **S**cience, **T**echnology, **E**ngineering, **A**rts, and **M**ath throughout the curriculum. Built upon the STEM movement in education, STEAM then came to recognize the Arts as an essential learning component for other disciplines. To develop globally minded 21st century learners, the STEAM framework promotes inquiry based learning, collaboration, creativity, and high level critical thinking skills. Thus, the end result is for students to grow as effective communicators and problem solvers, while also fulfilling all the rigors of a challenging curriculum.

In the STEAM approach, two or more disciplines or standards are combined to develop the interconnectivity of content areas. Additionally, standards can be taught through opposing content areas; for example, utilizing the arts as a means to enhance skills in mathematics. At the heart of this approach is robust inquiry based learning techniques. Inquiry based learning aims to help students problem solve and innovate in unique ways.

In 2014, the National Catholic Education Association (NCEA) recognized the addition of the "R" for religion, transforming the framework from STEAM to STREAM. This approach recognizes the essential place and role of our Catholic faith throughout the entirety of our curriculum. The interdisciplinary approach of STEAM with the infusion of religion helps our students make connections with and through our faith. The STREAM approach to creative classroom instruction promotes both academic rigor and relevance within a values-based framework.

STEAM and STREAM Integration in the Elementary and Secondary Settings

When planning for STREAM instruction in the classroom, teachers should consider a few factors. First, these lesson and activities should be interdisciplinary, combining several content areas or standards into a rigorous learning experience. Teachers should also consider the utilization of "The Four C's" (Communication, Collaboration, Creativity, Critical thinking) as a framework for this inquiry based learning.

At the elementary level, fusing math and art, or science and religion, are fantastic places to begin utilizing a more STREAM based approach. No specific specialized equipment is necessary for this style of instruction; any classroom materials or school technology can be adapted and utilized. This allows for easy integration of this trend without additional resources required for the school community to begin. However, many quality programs, such as the LEGO robotics, exist and can be recommended to support STREAM based education. Finally, STREAM education lends itself to the backwards design planning framework, with a emphasis on addressing real world problems.

Secondary teachers, when planning for STREAM instruction, should consider many of the same factors as elementary teachers. Backwards planning, interdisciplinary focus on standards, and utilization of key collaboration and communication are all essential components to effective STREAM planning.

At the secondary level, both the rigor and relevance of STREAM lessons can be greatly amplified through connections to real world situations. Students can focus their inquiry on solving problems, while utilizing knowledge from multiple content areas. Secondary schools are uniquely situated for this because of the specialized content areas, technology resources available, and potential connections to the surrounding community. A deep, engaging learning experience can be created when departments collaborate, thus modeling the same collaboration encouraged with students.

Computer Lab, Reimagined

As schools move towards a 1-1 student to device ratio, the question often arises as to what should be done with the traditional computer lab space. The computer lab is a unique classroom. Often they contain numerous electrical outlets well spaced throughout the room. Data access ports are also often located throughout the space. Given all the power and date outlets these rooms are perfect locations for Makerspaces or Innovation Lounges allowing space for school news studios, audio/video editing suites, and green screens locations where once before there was not room or appropriate infrastructure access.

The furniture often found in a traditional computer lab space is unique and should be evaluated to determine if it still meets the changing needs of the 21st century students. Typical computer rooms often have long narrow tables arranged around the perimeter of the room, with the center filled in with additional rows of computers. Reconfiguring or replacing the existing furniture, and redesigning the overall layout of the space can more easily realize natural opportunities for students to work in pairs or small groups.

The New Media Consortium (NMC) is a community of hundreds of leading universities, colleges, museums, and research centers. In the 2017 NMC Horizon Report they identify that the mobility and the flexibility of classroom spaces and furniture is paramount. "Educational settings are increasingly designed to support project based interactions with attention to greater mobility, flexibility, and multiple device usage." These mobile active learning spaces allow teachers and students to instantly create spaces that address their present needs for collaboration and workflow, without creating future restrictions. The layout of the space should not be a barrier to collaboration and learning. Studies have shown that the layout and flexibility of a space can directly improve students' engagement, collaboration and increase overall student achievement.

In addition to redesigning the physical space, schools may also use this opportunity to acquire and run specialized computer programs on a small number of computer workstations. Some examples may including installing specialized software for Art, Computer-Aided Design and Drafting (CADD), animation or software for professional business applications such as the Microsoft Office Suite. Often

these programs may require expensive licenses, or advanced hardware to run at peak performance. For these reasons it is often not financially feasible or necessary to purchase a copy of this software for every computer in the school. In the 'Computer Lab, Reimagined' these cutting edge programs can instead be placed on a few computers to provide for the needs of multiple groups of students.

Some specialized computer programs that may be of interest:

- Art - Mudbox, Mol
- Image Editing - Photoshop, Dreamweaver, Corel, Serif, Xara
- CADD programs - AutoCAD, Blender, TurboCAD
- A/V editing - Final Cut, iMovie, Corel, Adobe Premiere
- 3D animation software - Autodesk, Cinema 4D
- Full versions of MS Office Suite

Conclusion

As our students are called to be faith-filled global citizens, educators today must heed the call to expand professional and educational horizons. When utilizing the 2016-2021 Educational Technology Plan goals, along with the future vision planning guidance provided by this Emerging Trends in Educational Technology addendum, schools will make strides in developing future-ready programs for the success of all students. When combining our faith, robust curriculum, and the right technology for a school community, we as educators help grow the next generation of leaders and saints.

Resources for Further Exploration / Works Cited

Trend 1: Makerspaces

- *The Maker Movement: A Learning Revolution* (from ISTE, Web Resource, 2014)
- *Maker Ed.org* (Maker Ed, Web Resource, 2017)
- *Designing a School Makerspace* (from Edutopia, Web Resource, 2013)
- *Starting a School Makerspace from Scratch* (from Edutopia, Web Resource, 2015)
- *Resources for Creating a Makerspace* (from Makerspace Lab, Web Resource, 2017)
- *Makedo* (Makedo, Web Resource, 2017)
- *Making a Makerspace: Creating Self-Sustaining Recess/Lunch-Time Visits* (from Elementary Ed Tech, Web Resource, 2014)
- *Creativity Lab* (from the Lighthouse Community Charter School, Web Resource, 2017)
- *8 Questions To Ask Before Creating a Makerspace* (from ISTE.org, Web Resource, 2016)

Trend 2: AR and VR

- *When Virtual Reality Meets Education* (from Tech Crunch, Web Resource 2016)
- *12 Ways to Use Google Cardboard in the Classroom* (from Ditch That Textbook, Web Resource, 2016)
- *How to Transform Your Classroom with Augmented Reality* (from EdSurge, Web Resource, 2015)
- *The Educational Potential of Augmented Reality* (from School Library Journal, Web Resources, 2016)
- *32 Augmented Reality Apps for the Classroom* (from Teach Thought and EdShelf, Web Resource, 2016)

Trend 3: STEM, STEAM, STREAM

- *From STEM to STEAM: Using Brain Compatible Strategies to Integrate the Arts* (by David Sousa and Tom Pilecki, Professional Publication, 2013)
- *Catholic Schools Add 'R' for Religion to Turn STEAM into STREAM* (from Education Week, Web resource, 2015)
- *Steam Edu* (Website, 2015)
- *The How's and Why's of Going 'Full STEAM Ahead' in the Classroom* (from EdSurge, Web Resource, 2015)
- *60 Apps to Teach STEAM in the Classroom* (from We Are Teachers, Web Resource, 2014)

Trend 4: Computer Lab, Reimagined

- *How Flexible Learning Spaces Improve Active Learning* (from eSchool News, Web Resource, 2016)
- *How to Make Your Classroom a Thinking Space* (from Edutopia, Web Resource, 2013)
- *Creating Flexible Classrooms for Personalized Learning* (from The Tarrant Institute for Innovative Education, Web Resource, 2016)
- *NMC Horizon Report > 2017 Higher Education Edition* (from The New Media Consortium, Web Resource, 2017)
- *NMC Horizon Report > 2016 K-12 Edition* (from The New Media Consortium, Web Resource, 2016)
- *3 Ways Colleges Can Reconfigure Computer Labs* (from Ed Tech Magazine, Web Resource, 2013)
- *12 Tips For Building an Innovation Space* (from National Center for Engineering Pathways to Innovation, Web Resource, 2015)