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INTRODUCTION TO S.T.E.A.M (SCIENCE, TECHNOLOGY, ENGINEERING, ARTS AND MATHEMATICS) – COURSE DESIGN AND IMPLEMENTATION

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Introduction to S.T.E.A.M (Science, Technology, Engineering, Arts, and Mathematics) – Course Design and Implementation

Synopsis:

This session will provide participants the opportunity to engage in a dialogue related to the planning, organization and delivery of an undergraduate STEAM course designed for first-year students. We will engage in a conversation of the processes that underlie how individuals become lifelong STEAM learners, STEAM practitioners and STEAM researchers as well as the structures and mechanisms that lead to achieving these outcomes.

Introduction to STEAM (Science, Technology, Engineering, Arts, and Mathematics) – Course Design, Organization and Implementation

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Introduction to STEAM (Science, Technology, Engineering, Arts, and Mathematics) – *Course Design, Organization and Implementation*

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"Even though I build buildings and I pursue my architecture, I pursue it as an artist. I deliberately keep a tiny studio. I don't want to be an architectural firm. I want to remain an artist."
-Maya Lin

Abstract

The purpose of this paper is to provide readers the opportunity to see the planning, organization and delivery of an undergraduate course in the area of STEAM (Science, Technology, Engineering, Arts, and Mathematics). This course for is designed for students to thoughtfully engage in the interdisciplinary nature of STEAM.

In the course students develop skills related to intersections between these content areas, and the construction and application of STEAM models for cross-disciplinary dialogue, inquiry, and problem solving. The discussion fits in the discipline of SCIENCE and contributes to the continued efforts in the science community to engage and create opportunities for interdisciplinary study for student work and research.

Our journey…

This discussion will provide ideas and activities for educators who want to construct more equitable, more meaningful, and livelier educational experiences in preparing every student to succeed in a diverse and interdependent world. The paper addresses, through the "lens" of STEAM, the critical need to examine the foundations of how curriculum design and instruction evolve, and how we address learning to learn in preparation for a lifetime of change in the 21st century.

As a result, I will identify specific competencies of mastery of knowledge and skills, and how to improve learning, making the curriculum more relevant, and instruction concentrated more on creative and real-world problem solving.

Two essential questions guided the design and organization of the course:

1. What is the nature of the relationship between STEM and STEAM in the areas of art and science?
2. What type of activities increase student engagement, raise motivation, focus on relevant issues, and, most importantly develop critical thinking and problem-solving in an innovative and creative manner?

I have instructed this course over a three-year period and enjoyed the opportunity to engage students in a thoughtful and thought-provoking journey as we ponder and discuss the limitless opportunities related to research design and development. This creative and innovative approach has yielded a wealth of ideas, conversations and dialogues, knowledge and understanding and experiences of STEAM discovery and utility, and embracing the diversity of voices and opinions in a respectful and informed manner.

Weaving a tapestry of innovation, imagination, creativity and thought

Simply stated STEAM is an initiative to add Art and Design to the national agenda of *STEM* (Science, Technology, Engineering, Math) education and research --- *STEM* + Art = *STEAM* (RISD, 2013) At TED 2002, Mae Jemison, a doctor, dancer, engineer, and the first African American woman in space, said, "The difference between science and the arts is not that they are different sides of the same coin… or even different parts of the same continuum, but rather, they are manifestations of the same thing. The arts and sciences are avatars of human creativity" (TED, 2002).

Schools nationwide are eschewing a wide variety of "arts" programs (Visual, Performing, Fine, Language, and the Liberal Arts) to instead focus on teach-to-the-test courses catered to math and reading. The problem here is that a narrow focus on testing reinforces narrow-minded thinking. Young Americans are being educated out of creativity (Pomeroy, 2012). In an interview, John Maeda (2013), then President of the Rhode Island School of Design, also discussed this issue by stating,

> "*I remain convinced that artists and designers will be the innovators of this century, and that the problem-solving, the fearlessness and the critical thinking and making skills that I see every day are what is needed to keep our country competitive. Designers and artists create objects, devices and services that are more engaging, more efficient, more desirable and ultimately, more human."*

One of the main objectives of both art and science is discovery. Integrating arts-related skills and activities into the course is one very effective way to enhance student interest and achievement. By integrating arts-related activities into STEAM subjects this approach offers many cerebral advantages. Artistic activities engage the brain and improve cognitive, visual, and spatial processing. (Sousa & Pilecki, 2013)

Therefore, the curriculum should equip the students to "talk back" to the world. Who makes decisions and who is left out? Who benefits and who suffers? What is required to make change? In addressing these and other questions, it important to change one's perspective if you are going to change the outcome. Through hands-on and experiential learning, as well as project-based assignments and research critiques, students should have opportunities to question scientific, social and global realities. In this regard, student work must move outside the classroom walls, so that learning and research are linked to real world problems. (Cole, 2008))

The E.D.G.E. Program at Thomas College

The creation of the "*Introduction to STEAM*" course is part of Thomas College's EDGE **(Engage, Develop, Guide, Empower)** Program which is designed to assist students in building success in college. The program consists of a one-week intensive program (scheduled the week before the regular fall semester) for first-year students, including a college-level course, student development activities and college management workshops, followed by individualized academic coaching throughout the fall semester (**Figure 1**). The instructional design model of **EDGE** is illustrated as follows:

Figure 1.

As stated in the **EDGE Program** description, "The **EDGE Program** is an opportunity for students to jump-start their transitions to Thomas College. This free program equips students with the tools they need to tackle academic coursework, manage the transition into their new roles as college students, navigate campus resources, prepare for internship and career opportunities, and much more" (Thomas College Catalogue and Website).

One measure of a successful education program is one that delivers a curriculum that promotes critical thought, reflection, and collaboration (Wiles, J. & Bondi, J. 1998). As a result, the program fosters essential competencies related to knowledge of subject matter and student learning; formal and authentic assessment; democratic ideals; cultural diversity; recognition of individual student needs; and communication with students, the community, and other professionals. (Biffle, 2013)

During the school year, the **EDGE Program** is an important source of support for students. EDGE helps students manage their time, set goals, learn the ropes, and take on new challenges through Connect Program activities and management workshops. One-on-one academic coaching through the Student Success Center helps students to stay on track in classes, take advantage of resources at Thomas, and overcome obstacles to personal and academic success.

Course Overview - *Introduction to STEAM*

As stated previously, this course for is designed for students to thoughtfully engage in the interdisciplinary nature of STEAM (Science, Technology, Engineering, Arts, and Mathematics). Students develop skills related to intersections between these content areas, and the construction and application of STEAM models for cross-disciplinary dialogue, inquiry, and problem solving.
This also includes research, as well as the knowledge and understanding, and application of the structures and mechanisms that lead to achieving these outcomes. The goal is to foster creativity and innovation that comes with merging the viewpoint of a scientist with that of an artist or designer.

Main Topics Covered in the Course

The Introduction to STEAM course is a curricular and instructional approach that informs and guides quantitative and qualitative studies related to the nexus between STEM and STEAM. When I began designing the course regarding the integration of math and science with the arts, I realized that there was a need for an interdisciplinary curricular approach that addressed the scientific, geographical, anthropological, social and historic elements of how community spaces are shaped and transformed into meaningful places. From this view the following topics were identified as being part of the course:

- How to improve learning, making the curriculum more relevant, and instruction concentrated more on creative and real-world problem solving related to the work and experiences of scientists, artists and mathematicians.

- Using the concept of divergent thinking that generates several ideas about possible ways to solve a problem, often by breaking it down into its components and looking for new insights into the problem.
- Identifying what type of activities increase student engagement, raise motivation, focus on relevant issues, and, most importantly, develop creativity. PBL integrates knowing and doing. Students learn knowledge and elements of the core curriculum, but also apply what they know to solve authentic problems and produce results that matter. PBL students take advantage of digital tools to produce high quality, collaborative products.

One of the course pre-readings is Michio Kaku's "*The Future if the Mind,*" which provides a marvelous array of thoughtful and thought-provoking examinations and conversations as we explore and discover the many dimensions of design and conceptual thinking. In addition, students are required to research and write short essays on the "10 Guests" (identified and discussed in further in the section) featured during the course of our discussions, dialogues and activities.

Course Objectives

In this course, students will:

- Develop 21st century skills that are needed in order to live successfully as a member of the global community in an increasingly complex and technologically driven world. These skills include creativity, problem solving, critical thinking, communication, self-direction, initiative, and collaboration.
- Be able to further develop artistic and scientific skills and have the ability to do the following:
  -Draw on curiosity and imagination
  -Observe accurately
  -Perceive an object in a different form
  -Construct meaning and express one's observations accurately
  -Work effectively with others
  -Think spatially (How does an object appear when I rotate it in my head?)
  -Perceive kinesthetically (How does it move?)
- Provide students with a hands-on PBL (Project Based Learning) experience by integrating S.T.E.A.M. skills in order to produce an authentic artifact or artifacts.
- Understand how arts and STEM learning intersect and support each other by demonstrating the important differences in these two domains of human activity. (Figure 2)

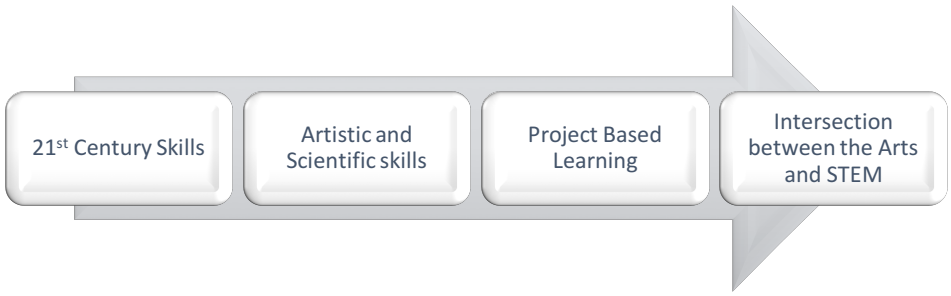

Figure 2

***Introduction to STEAM* - Course Design and Organization**

To say that this course design wasn't a challenge would not be at all accurate. First and foremost, designing an intensive course that is instructed over the period of one week has a number of built-in challenges and issues --- both curricular and instructional. Secondly, this is not for everyone (that is the week long intensive course teaching assignment) --- you either have the willingness to do this or not… simply not everyone's "cup of tea."

However, once one gets over the initial "shock of agreeing" to teach in this unique situation, you simply begin the process of organizing thoughts around what can be accomplished and at the end of the day what you want your students to know at the end of the course. In other words, you do what good teachers do --- plan for success and don't sweat the little stuff. As an introductory course this give you much latitude in that there is no "end game" per se--- only the foundation for more conversations, opportunities and dialogues to continue, and with any luck what students have learned can be applied in other courses.

The course design and organization were developed over a two-month period of time with many visits to several well known universities in an effort ascertain just what might work. The critically important elements were taking the five areas of STEAM (science, technology, engineering, art, and mathematics) and having each embedded in their "own day." In this way the organization of activities, projects, discussions, field research trips, etc., could be created in innovative and creative ways ---- dynamic, fluid, and fun! As Walter Isaacson (2014) states in his book the *The Innovators*, "given the environment and circumstances students can learn to find a common balance to trading ideas and exchanging information." This course provides a platform for intellectual as well as cognitive development in a wide variety of activities and projects.

STEAM Framework

A Guide for Interdisciplinary Teaching Across Content and Disciplines

Figure 3

The STEAM Framework can be best understood in **Figure 3** – a diagram that illustrates the nature of the relationship between content, disciplines, interdisciplinary and multidisciplinary instructional approaches, problem-based inquiry and research, and life-long holistic-learning habits of mind. The terms associated with the framework are "defined" in the following manner:

- **Lifelong learning** – Interdisciplinary, Multidisciplinary and Holistic/Lifelong Learning
- **Project/Problem-based inquiry and research –** Integrates knowing and doing.
- **Interdisciplinary/Multidisciplinary** – using the terms problem-focused process, sharing, and working together and in the case of STEAM organized in an integrated curricular instructional deign format
- **Discipline Specific** – Science, Technology, Engineering, Arts, Mathematics

- **Content Specific** - refers to the facts, concepts, theories, and principles that are taught and learned, rather than to related skills

The additional help and assistance of the E.D.G.E. Program staff (as discussed above) is essential to the overall success of the students and course. Everything else was thoughtfully planned and attention to detail (no matter how big or small) taken into consideration. Student evaluation and assessment are built-in throughout the course and once again use a wide variety of measures in evaluating student performance (a sample of these is presented later).

These are first-year students and self-selected in being in the course (*as per EDGE requirements*). This could present many challenges and issues, but I take the view that all of my students are talented and gifted and it is up to me to bring out their gifts. Working through a 9 to 10-hour day can be daunting, but given the right organizational planning can also be a wonderful opportunity. All the "intensive courses" meet graduation requirements as well, so students can use the experience as part of their academic program. What follows is how all these things were done and continue to be changed and tweaked where appropriate.

Course Organization, Content, and Schedule

The student day is a long 9-10 hour day with ample breaks, meals and "reflective meditation". The course begins with a whole class deep breathing exercises and simple kinesthetic movements to oxygenate the brain---an informed and knowledgeable class is *intensive, attentive and engaged!* The following information is an outline of the daily "sessions" that are divided into "day" and "evening" activities, workshops, tutoring sessions, etc.

Sample of the Day Session

- Mini Lecture Presentations, dialogues and discussions with related in-class activities
- Small/ Large Group Discussion
- Student Team Lab Design Time
- Film, documentary and artifact review
- Article reviews, research exploration
- Research Journal and note taking
- Possible Field Outings and required activities associated with this site

Sample of the Evening Session

- Problem-solving activity
- Student Team Lab Design Time
- Research Journal and note taking
- Article, research exploration
- Workshop sessions (E.D.G.E.)
- Planning/Project Design and Development
- Daily Journal Reflection Writing

The next part of the daily schedule is a discussion of the day's upcoming events, reviewing material from the previous day's experiences, and introducing our "invited guests. "Our *Invited Guests*," (creative visionaries who are part of the daily discussions and activities) were selected as a result of their diverse backgrounds and experiences in the context of a STEAM interdisciplinary curricular design and approach. This is an eclectic and highly skilled group of individuals that have made significant contributions to the fields of science, technology, engineering arts and mathematics --- and the world.

In my opinion, they all use the elements of STEAM in unique and dynamic ways as part of their extraordinary talents, skills and work. On a side note ---most of the students in the course have never heard of many of these "guests," so that presented an opportunity to further develop their knowledge and understanding of "secrets of genius."

The following mini sessions (designate "MS") are the "topics" during the course. Two "guests) and their specific topics are highlighted each day that compare and contrast various ideas and approaches associated with their work. The following are examples of what is currently done in the course --- realizing that in a different context and /or instructional strategy these topics and descriptions may change. An example of the weekly schedule and guest topics.

Day 1 Science:
George Washington Carver and Nikola Tesla – MS 1: Foundations of Cognition, Knowledge and Understanding

Day 2 Technology:
Margaret Bourke White – MS 2: *"*Stories Without Words – A Day in the Life"
Michelangelo – MS 3: "Sensing Place: Inquiry, discovery and exploration"

Day 3 - Engineering
Leonardo da Vinci - MS 4 - *"*Understanding Place and Space"
Jacques Yves Cousteau - MS 5: "Designing New Ocean Systems and Communities"

Day 4 - Arts*:*
Maya Lin - MS 6: *"*Modern Art and Cultural Diversity – Keeping it real"
Frank Lloyd Wright - MS 7: "A Dialogue in Arts and Architecture"

Day 5 - Mathematics*:*
Countess Ada Lovelace- MS 8:" Poetical Science and Notes on the Analytical Engine"
Sir Isaac Newton - MS 9: "How to Process, Analyze, and Visualize Information/Data"

A Summary of the Weekly Schedule

The next part of the discussion is how the week is planned and organized. **Table 1** provides a detailed overview of the weekly schedule. The planning and organization of the course is critical to understand because of the "one week" format of instruction and related activities. Students are able to "see" how the week is constructed and organized, what the daily activities and projects are in relationship to "our guests", and the timeframe for their participation in numerous experiences.

Because this is the "first college course" many of the students will have experienced there are several areas of having "a successful college start" that are identified and addressed during the week. These include, but are not limited to, time management, knowledge and understanding of the culture and history of the college, coping with the stress and challenges of leaving home for the first time, learning how to "pace oneself" during the course of their college education, and making positive choices in regards to personal decisions and relationships. Every effort for student success is built into the course --- building a sense of community is at the foundation of our "journey."

The Weekly Schedule at a Glance

Day 1 - Science	**Today's Guests**: ***Nikola Tesla and George Washington Carver***
Morning (9-12)	**Welcome and Introductions** *Our journey… S.T.E.A.M.* ***Explorers, Voyagers, and Thinkers – Weaving A Tapestry of Creativity, Innovation and Ideas*** **MS 1**: ***Foundations of Cognition, knowledge and understanding***
Afternoon (1:30-4:30)	**MS 1**: ***Foundations of Cognition (continued)***
Evening (6-8:30)	Design Center Work (with tutors)
Evening (8:30-9:45)	Group Sessions
Day 2 - Technology	**Today's Guests**: ***Michelangelo and Margaret Bourke White***
Morning (9-12)	**MS 2**: ***Stories without words – A day in the life*** -**Field Outing to Waterville downtown**
Afternoon (1-4:00)	**MS 3**: Sensing Place: Inquiry, discovery and exploration -**Field Outing to Colby Museum of Art**
Evening (6-8:30)	Design Center Work (with tutors)
Evening (8:30-9:45)	Group Sessions
Day 3- Engineering	**Today's Guests**: ***Leonardo da Vinci and Jacques Yves Cousteau***
Morning (9-12)	**MS 4**: Understanding Place and Space
Afternoon (1:30-4:30)	**MS 5:** Designing New Ocean Systems and Communities
Evening (6-8:30)	Design Center Work (with tutors)
Evening (8:30-9:45)	Group Sessions
Day 4 – Arts	**Today's Guests**: ***Maya Lin and Frank Lloyd Wright***
Morning (9-12)	**MS 6**: Modern Art and Cultural Diversity – Keeping it real -**Field Outing to L.C. Bates Museum**
Afternoon (1:30-4:30)	**MS 7**: A Dialogue in Arts and Architecture
Evening (6-8:30)	Design Center Work (with tutors)
Evening (8:30-9:45)	Group Sessions
Day 5 - Mathematics	**Today's Guests**: ***Countess Ada Lovelace and Sir Isaac Newton***
Morning (9-12)	**MS 8**: ***Poetic Science*** *and Notes on the Analytical Engine*
Afternoon (1:30-4:30)	**MS 8:** *How to Process, Analyze, and Visualize Information/Data*
Evening (6:00-7:15)	Final Design/Project Preparations
Evening (7:20-8:30)	Project Gallery Display and Celebration
Evening (8:30-9:45)	Group Sessions

Table 1

Field Research Outings

The field research outings are an integral part of the course activities and projects that are planned around major questions and themes. These include research assignments that are completed *in the classroom and the field.* Field Sites where we conduct our research include the ***Maine Maritime Museum, Colby College Art Museum****, and/or the* ***State of Maine Museum and Archives***. Mission statements from these three sites are provided as a background description for their diverse roles in providing educational research opportunities and experiences related to STEAM.

> "*The Maine Maritime Museum celebrates Maine's maritime heritage and culture in order to educate the community and a worldwide audience about the important role of Maine in regional and global maritime activities*."

> "*The Colby College Art Museum is a teaching and collecting museum that provides an extensive collection exhibits that are dedicated to the preservation, display, and interpretation of the visual arts*."

> "*The State of Maine Museum and Archives builds and maintains systematic collections regarding Maine's pre-history, history, and natural science. Its goal is to promote public awareness of Maine's natural resources and historical richness*."

These sites are selected because they provide multiple opportunities for discovery and exploration of STEAM concepts and practice. The pace and number of assignments is designed carefully and keeping in mind that student assessment and evaluation can be both summative and formative. Drawing upon and using information from field outing sites, all students complete activities and research projects that demonstrate proficiency and application of knowledge, as well as a deeper understanding of STEAM applications.

Student Assessment and Evaluation

STEAM is a model of collaboration, interdisciplinary study, and instruction (**Figure 4**). The world is connected in so many ways that this allows for the ability to work together and to solve problems across multiple disciplinary fields. In this view, thinking skills, research, imagination, craftsmanship and innovation cross all disciplines. It would be difficult to look at the works of Da Vinci and not appreciate the shear volume of his ideas associated with all of the STEAM disciplines (RISD, 2013).

The course uses the PBL (problem-based learning) approach. The goals of PBL are to help students develop flexible knowledge, effective problem solving skills, self-directed learning, effective collaboration skills and intrinsic motivation (Torp & Sage, 1998))

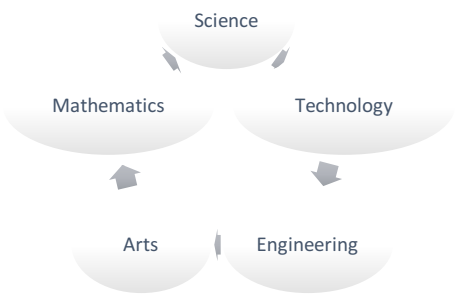

Figure 4

Daily Areas of Student Assessment and Evaluation

The organization and structure of the daily course activities are illustrated in **Table 2**. Each day a series of activities are scheduled with a designation of whether or not these are "team" or "individually" designed and/or produced. As a result, students are assessed and evaluated on various projects and activities (23 in all) related to course goals and objectives.

	Day 1	**Who**
1	Designing and Building Experience	Team
2	Using basic electricity	Team
3	Challenge Question/Problem Solving Experience #1	Team
4	Journal Entry #1	Individual
	Day 2	
5	**Field Outing**: ***Waterville community*** Using space, place and perspective	Individual
6	**Field Outing**: ***Colby College Art Museum*** - A journey in Art, Sculpture and Photography	Individual
7	The creative self – in which direction are you headed?	Individual
8	Challenge Question/Problem Solving Experience #2	Team
9	Journal Entry #2	Individual
	Day 3	
10	Student Portfolio Work	Individual
11	Design, construction, and analysis #1	TEAM
12	Challenge Question/Problem Solving Experience #3	Team
13	Journal Entry #3	Individual
	Day 4	
14	**Field Outing: Maine Maritime Museum** – application and interpretation in experiential learning	TEAM
15	Design, construction, and analysis #2	Individual or TEAM
16	Design, construction, and analysis #3	TEAM
17	Challenge Question/Problem Solving Experience #4	Team
18	Journal Entry #4	Individual
	Day 5	
19	Physics Research Challenge #1- Scientific Method and Analysis	TEAM
20	Physics Research Challenge #2 Scientific Method and Analysis	TEAM
21	Challenge Question/Problem Solving Experience #5	Team
22	Journal Entry #5	Individual
23	Final Exhibit Presentation and Gallery Walk (all students)	Individual and TEAM

Daily Areas of Student Assessment and Evaluation
Table 2

Student voices… *their journey and reflections*

I have taught this course over a three-year period and enjoyed the opportunity to engage students in a thoughtful and thought-provoking journey as we ponder and discuss the limitless opportunities related to STEAM research design and development. This creative and innovative approach has yielded a wealth of ideas, conversations and dialogues, knowledge and understanding and experiences of STEAM discovery and utility, and embracing the diversity of voices and opinions in a respectful and informed manner.

A brief summary of student course evaluation comments (*from 2013-15*) are as follows:

"I enjoyed working in groups and going on field trips, I also enjoyed the hands-on work and how knowledgeable my instructor was…"

"enjoyed the course…all the hands-on activities and group work, field trips and movies"

"…everything…everything about all five subjects (STEAM) was the perfect organization of ideas…"

"the hands-on aspects of the course, bringing the students back in time to when major people (our daily guests) lived…"

"… the teacher, team building, and subjects…"

"…all the field trips and projects. Everything is really interactive, and easy and fun to learn things."

"…Journaling…have not done this since the 5th grade and was the best way to learn…"

"…all of it (course activities and readings) …it's all very useful knowledge we should be learning"

"I would keep everything about this course…it's amazing!"

"…instructor's compassion for what he teaches and his history. He can combine them and tell us a lesson he learned, and he encourages us to follow our dreams."

"I liked everything about the course…"

Seventy-five, first-year students from 11 academic disciplines have taken the course. What I have gathered from the student responses is that I have been able offer an innovative and creative introductory STEAM educational experience that is organized as a thoughtful and engaging learning community. Students have learned the value and importance of teamwork, as well as individual contributions in working on any discussion, project, task, or research assignment. As a result, instructional goals regarding the integration of educational and scientific theories (STEM to STEAM), philosophies, concepts and ideas, methods and applications, and "*realia"* into a tapestry of life-long learning opportunities have exceeded my expectations.

Conclusions

In his 1939 book, *The Saber-Tooth Curriculum,* Harold Benjamin (aka J. Abner Pediwell) sketched a parable of stagnate curriculum reform. The book is a metaphorical and historical account of the development of an educational system. This paper addresses, through the "lens" of Pediwell and many others, the critical need to examine the foundations of how curriculum and instruction evolve as related to STEAM, and how we address "*learning to learn*" in preparation for a lifetime of change in the 21st century (Biffle, 2013).

The Saber-Tooth Curriculum recounts how a Paleolithic school curriculum became obsolete when the Ice Age came. The new conditions demanded a different curriculum to be taught to the community so it might survive and prosper. However, all attempts to introduce relevant skills into the curriculum met with stern opposition. "But that wouldn't be education", the elders of the tribe argued when the subjects were suggested that would enable the tribe to cope with living in the snowy wastes. The inevitable result was that the tribe did not survive (Benjamin, 1939)! Through his satire, Pediwell argued for the idea of learning to learn (or at least flexible and transferable Neolithic skills) as an important dimension of any curriculum.

This paper develops the argument that our curriculum, as basically taught today, is a saber-tooth curriculum. Because the curriculum was established in the 19th century, and although times have changed dramatically, the fundamental and sacred aspects of the 19th century curriculum remain with us today (Biffle, 2013) We must accept the need to learn new work, as well as technical and instructional skills in order to develop appropriate practices.

A well integrated STEAM experience teaches us that a curriculum should preserve the past, but not be limited by it. Integral to curricular and teaching success are experiences that exemplify the design and organization of a "*360-degree curricular focus*" that engages, informs, and creates an environment in which students discuss the principles of integrated STEAM ideas and strategies (Biffle, 2013).
By using these particular approaches and strategies, education programs and schools could re-focus on the development of collaborative, inclusive and creative STEAM initiatives.

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