STEAM

WVDE TECHNICAL ASSISTANCE CENTER

at West Virginia University

2021-2022 Year in Review

Year One Annual Report

Year One At-A-Glance

February-July 2022

OUR IMPACT

WEST VIRGINIA STEAM TECHNICAL ASSISTANCE CENTER

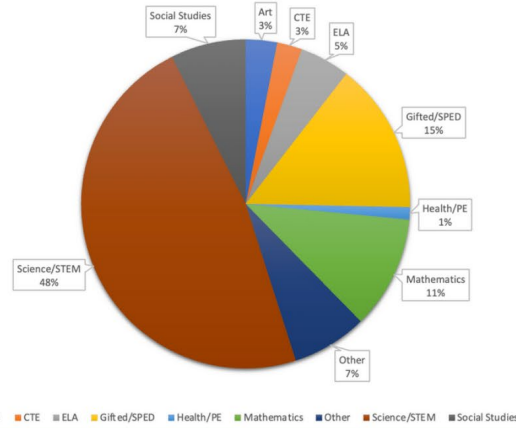Helping educators and students fall in love with STEAM experiences.

Participating Teachers by Content Area

- Art 3%
- Social Studies 7%
- CTE 3%
- ELA 5%
- Gifted/SPED 15%
- Health/PE 1%
- Mathematics 11%
- Other 7%
- Science/STEM 48%

Legend: ■ Art ■ CTE ■ ELA ■ Gifted/SPED ■ Health/PE ■ Mathematics ■ Other ■ Science/STEM ■ Social Studies

12,365
STUDENTS IN GRADES 6-8

20,325
MILES TRAVELED BY SPECIALISTS

225
TEACHERS FROM
9
DIFFERENT CONTENT AREAS

109
SCHOOLS

49
COUNTIES

3
ENGAGING IMMERSIONS

Projectile Launcher (41%)
Hydraulic Claw (34%)
Wiggle Bots (25%)

84%
OF TEACHERS OBSERVED A SIGNIFICANT INCREASE IN STUDENT ENGAGEMENT

TESTIMONIALS

"Almost all students were engaged for the entire class period. Student engagement was increased, and as a result, there were no discipline issues. Students were excited to work on this activity."

"Some of my students who don't usually participate much in writing and discussion-based activities were eager to participate in this activity. I could tell that several groups were proud of their work, and that's always a great feeling."

"The student engagement was great, the instructions were simple to follow, and the students were problem-solving, troubleshooting, collaborating, and thinking critically. In addition, they were implementing the scientific method and were completing all these tasks while having fun."

STEAM WVDE TECHNICAL ASSISTANCE CENTER at West Virginia University

West Virginia DEPARTMENT OF EDUCATION

WVPEC

WEST VIRGINIA PUBLIC TEACHERS COLLABORATIVE

WestVirginiaUniversity

Introduction:

The WVDE/WVU STEAM Technical Assistance Center (STEAM TAC) at West Virginia University was established as a collective vision of the West Virginia Department of Education (WVDE), West Virginia University (WVU), and the West Virginia Public Education Collaborative (WVPEC). The STEAM TAC strives to enhance STEAM educational opportunities and career pathways among West Virginia middle and high school students.

Our Mission:

- To provide modeling, training, curricula, and resources that empower West Virginia teachers to incorporate the best pedagogical STEAM practices into their classroom teaching.
- To create or acquire educational assets that provide students with the STEAM skillsets and mindsets required for career and college readiness.
- To build relationships with WV educators to promote the STEAM-centered classroom.
- To build relationships with STEAM-focused programs in the state to amplify their work and create pathways to STEAM experiences for teachers, students, and families.

Our Approach:

- To model STEAM learning best practices while leading hands-on lessons with teachers and students simultaneously in the classroom setting.
- To focus on WV Career exploration and pathways.
- To emphasize design thinking to solve a real-world challenge.
- To provide teachers with:
    - Standards-based instruction
    - Follow-up lesson extensions focusing on cross-curricular topics
    - Free educational materials
    - Resources to help guide STEAM learning beyond the initial visit
    - Inclusive programming designed to accommodate all learners
    - networking opportunities among participating teachers through a strong STEAM educator professional learning community (PLC)

Year 1 Goals:

- Hire and onboard a team of four STEAM Teaching Specialists and identify a workspace.
- Identify topics of focus for grades 6-8 to:
    - be in alignment with the WV College- and Career-Readiness Standards for Science, Mathematics, Computer Science (CS) and Technology, Career Technical Education (CTE), and the Arts.
    - have associated hands-on activities, real-life applications, career exploration, reflection, enrichment, and extension opportunities with engineering design as well as the Standards for Student Success for Grades K-12.
- Develop and distribute a county survey in collaboration with the WVDE for state science, math, CTE, CS, and art teachers for grades 6-8 to:
    - to determine best practices and appropriate strategies to improve West Virginia STEAM education efforts for Grades 6-8.

- o engage middle school classrooms through STEAM immersion activities and provide resources, modeling, and training to teachers and students.
- Develop training and resources that demonstrate the best pedagogical STEAM practices using critical skillsets and mindsets in collaboration with the West Virginia Department of Education (WVDE).
- Develop a marketing plan to share vision, goals, message, potential, outreach, and partnerships with county school systems.
- Provide educators with ongoing support, including teacher-friendly "kits" containing materials for incorporation into future classroom lessons.
- Provide students and educators with hands-on, in-person learning experiences based on real-world applications.
- Build and grow connections and cooperative relationships with West Virginia county school systems.
- Enhance opportunities for students to connect with career and technical education, career exploration, and STEAM fields of interest.
- Implement a data-driven plan of evaluation to assess progress with the development and implementation of the program, as well as outcomes and impacts with stakeholders.
- Join a coalition of STEAM-focused partners from industry, government, academia, and the nonprofit sector to amplify their work while building connections with teachers, students, and families.
- Work with the WVDE to assure sustainability of the STEAM TAC.

We are pleased to provide you with a report on the initial work completed on the project. Year one accomplishments included: determining the initial goals and outcomes of the project, filling critical staffing needs, addressing essential logistical requirements for the program, designing curricula for classroom STEAM immersions, procuring necessary materials and equipment, and meeting with key stakeholders such as school administrators, teachers, and members of the West Virginia Department of Education to determine if the initial focus was appropriately aligned to meet their needs.

Year One Activity:

A. Staffing and Personnel:

Acquiring personnel for the project included the following tasks: assessing personnel needs, writing job descriptions, soliciting applications for STEAM TAC Specialists, interviewing, hiring, and onboarding four WV-certified STEAM educators for Specialist positions. Recruitment and interviews began in August 2021. Three specialist positions were initially filled in September 2021.

Although we continued to take applications, we did not immediately fill the fourth position due to a lack of highly qualified candidates. We continued to market the position in the following months, and a second round of interviews took place in January 2022. The addition of the fourth specialist was beneficial due to the full calendar of school visits and the fact that the existing staff could not reach all interested schools. Moreover, our team needed an experienced high school educator on board before the summer to assist with the development of high school STEAM curriculum. Our fourth specialist joined the staff in April 2022. A full list of the STEAM TAC staff can be found below. Please also refer to **Appendix A** to learn more about our new team members.

- **Donna Hoylman Peduto**, Executive Director of West Virginia Public Education Collaborative (WVPEC)
- **Jennifer Schwertfeger**, STEAM TAC Program Manager

- **Dr. Jennifer Robertson-Honecker**, STEAM TAC WVU Liaison, STEMCARE Director, Associate Professor
- **Melissa Bane**, STEAM TAC Specialist (joined September 2021)
- **Angela McDaniel**, STEAM TAC Specialist (joined September 2021)
- **Clifford Sullivan**, STEAM TAC Specialist (joined September 2021)
- **Anna Tucker**, STEAM TAC Specialist (joined April 2022)

In addition, the program is overseen by Robert "Joey" Wiseman, the director of the WVDE Office of Teaching and Learning, Middle and Secondary Services, and Erika Klose, coordinator for STEAM, Science, Computer Science, and GIS.

Staff onboarding took place on the West Virginia University (WVU) campus in Morgantown, WV, and at the West Virginia Department of Education (WVDE) in Charleston, WV. The specialists were trained in the policies and procedures for both WVU and the WVDE and met with each of the WVDE Teaching and Learning coordinators for Middle and Secondary Services.

While at WVU, the specialists also toured the campus and met with WVU Provost, Dr. Maryanne Reed, and faculty members from a wide variety of disciplines. This included visits to the Creative Arts Center, the Statler College of Engineering, the Davis College of Agriculture and Natural Resources, the WVU LaunchLab, the Media Innovation Center, the Art Museum of WVU, and others. The meetings were meant to stimulate future collaborations to develop curriculum and educator resources and have already resulted in several exciting partnerships.

B. Program Logistics and Curriculum Development

Much of the first three months, September through November in 2021, were spent familiarizing the new personnel with STEAM TAC protocol and identifying priority programming for the middle school launch. Planning included: determining the best methods for delivering the immersions, testing various products to use during the lessons and distribute to schools, developing curricula for the immersions and follow-up lessons, and procuring all the needed equipment and materials to lead the immersions.

A survey was developed in collaboration with WVDE county administrators to help us determine which strategies could most improve West Virginia STEAM education efforts. Using the responses and conversations with the WVDE, we concluded that the lesson methodology should involve both students and teachers. The immersion planning included a professional learning model known as *Embedded Professional Development* [1, 2]. During school visits, the STEAM specialists would guide *Classroom Immersions* where they embed themselves into the classroom environment, leading the lessons with youth while working alongside participating teachers. In this way, the specialists modeled best practices for the participating teachers while also helping them build self-confidence in incorporating hands-on engineering design projects into their lessons.

The initial focus of the work was to create classroom immersion experiences that used engineering design, and project-based learning and modeled the STEAM-minded approach to teaching and learning. In addition, it was crucial that the lessons demonstrate cross-curricular concepts and career cluster connections while providing middle school students with hands-on opportunities to improve STEAM skillsets and mindsets.

During fall 2021, we tested a variety of pre-developed, design-based learning curricula. Given that the specialists would be working with five to seven classes per day and visiting three to four schools each week, much time was

spent determining program logistics and designing a manageable teaching plan. To ensure success, the chosen lessons and materials needed to meet the following criteria:

- Engaging, hands-on experiences that encourage student problem-solving and creativity
- Student success can be achieved in as little as 40 minutes
- Easy incorporation of real-world relevancy, cross-curricular applications, and career cluster integration
- Projects allow for group work to encourage collaboration and teamwork
- Easily stored and transported to and from schools
- Prep and turnover time is minimal
- Available in bulk at a reasonable price
- Bonus: kit materials can be easily augmented for follow-up lessons

The STEAM TAC team ultimately chose to use prepackaged engineering design kits developed by TeacherGeek. TeacherGeek kits offered several unique advantages over those from other companies.

- Lessons are focused on a fun challenge
- Include go-to guides that offer multiple build examples which achieve the same goal but also leave room for student creativity
- Most builds can be completed in 20 minutes, leaving room for lesson introduction, project testing and iteration, and reflection
- Materials are prepackaged with all needed materials and student instructions (extra parts included)
- In bulk, each kit costs under $6
- Kit materials allow each project to be disassembled and redesigned multiple times
- Students gain hands-on experience with tools like screwdrivers, hammers, and multi-cutters
- Teacher created US company

Three kits were chosen for the initial focus, each centering on a particular middle school grade. The STEAM TAC team developed a coordinating curriculum for each immersion and follow-up extension lessons that teachers could lead after the visit. Each lesson included standards-aligned content covering various subjects (i.e., math, social studies, art, ELA) and centered around a challenge that introduced several career clusters. The immersions are briefly described below.

Hydraulic Claw: (Grade Focus: 8th)
- Challenge: Students construct claws for a person with a disability and test their designs in an engaging competition that mimics a real-life problem
- Key Topics: energy transfer, fluid mechanics, one-variable equations and inequalities, the role of an active citizen, and the effects of technological advances on West Virginia
- Career Cluster Integration: Health Science, Human Services, Business Management and Administration, Finance

Projectile Launcher: (Grade Focus: 7th)
- Challenge: Demonstrates how projectile motion relates to carnival games, sports, and other parts of life
- Key Topics: accuracy, precision, data collection, potential and kinetic energy, and engineering design
- Career Cluster Integration: Transportation, Distribution, and Logistics; Law, Public Safety, Corrections, and Security; Government and Public Administration

Wiggle Bot: (Grade Focus: 6th)
- Challenge: Students work in groups to design and build a bot that creates art using basic wave concepts, electricity, vibrational energy, and creative design thinking
- Key Topics: electricity, circuits, vibrations, waves, the center of gravity, statistics, and probability
- Career Cluster Integration: Arts, Construction, STEM, Manufacturing

C. Communications, Marketing, and Outreach

Other early logistical efforts included working with the WVDE and WVU to develop a co-branded STEAM TAC logo, joint messaging, and a website. The initiative included members of both organizations' communications and branding teams. Katie Farmer, Communications Director and Marketing Strategist for the Office of the Provost, Christy Day, WVDE Director of Communications, staff from WVDE, and WVU University Relations worked together on logo design, website development, promotional materials, and a plan for social media.

The website is live here https://steamtac.wvu.edu/ and offers our mission, an opening video, descriptions of available classroom immersions, and introductions to each team member. The website also serves as a means for teachers and schools to schedule an immersion visit through a link to a Qualtrics registration survey. It continues to be a hub for pertinent information, reach numbers, and upcoming events.

D. Content Delivery

Official Announcement and Kickoff Events

To celebrate the establishment of the STEAM TAC, the group received official recognition from the West Virginia Board of Education (WVBE) on Wednesday, December 8, 2022, in Charleston, WV.

The ceremony to launch the STEAM TAC was held on Thursday, December 9, 2022, at Mountaineer Middle School in Morgantown, WV. Mountaineer Middle School hosted local and state officials and education leaders for the STEAM TAC's grand opening ceremony in Morgantown. Simultaneously, the center's new STEAM specialists joined West Virginia Department of Education staff and WVU Extension agents to visit four middle schools in Logan, McDowell, Mingo, and Wyoming counties to demonstrate interactive STEAM activities and underscore the STEAM TAC's statewide reach.

COSI (Center of Science and Industry) joined West Virginia's STEAM Celebration Day and participated in the opening ceremony by performing the famous "elephant toothpaste" science experiment. WV Superintendent of Schools, Clayton Burch, WVU Provost and Vice President for Academic Affairs, Maryanne Reed, West Virginia Delegates, Evan Hansen, Joe Statler and Danielle Walker, in addition to COSI's President and CEO, Dr. Frederic Bertley, performed the science demonstration together for the students at Mountaineer Middle School, showcasing that science is fun and accessible. COSI also distributed 2,000 Learning Lunchbox STEAM energy kits to students and families across 22 schools in 6 counties, selected in collaboration with the WVDE.

Middle School STEAM Immersions

During the visit, each teacher receives a classroom set of kits, tool sets, and a tote containing any construction materials needed to creatively complete, test, and modify the builds. All materials are provided free of charge and remain in classrooms for further use.

During the 2022 spring semester, an astounding 11,950 middle school students from 96 schools within 47 counties participated in our program. A complete list of participating schools and counties is located in **Appendix B** at the end of this report.

The STEAM TAC also participated in Remake Learning Day events, Family STEAM/Technology Nights in several counties, the WV Science and Engineering Fair, and WV Social Studies Fair, in addition to the WV Science and Math Teachers' Conferences. These were unique occasions to showcase the broad range of learning opportunities the STEAM TAC can offer.

Summer School Programming

The STEAM TAC continued middle school outreach by participating in the WVDE Summer SOLE (Student Opportunities for Learning and Engagement) Program providing interactive, challenging, and engaging in-person STEAM learning experiences for students and teachers. STEAM immersions were made available to all West Virginia public schools serving 6-8 grade students beginning in June and running through late July 2022.

TeacherGeek kits and tool sets were ordered for participating county school systems for school distribution. 685 Projectile Launcher and Hydraulic Claw TeacherGeek kits, 150 tool sets, and 30 STEAM "Wonder Boxes" filled with construction materials were provided free of charge and delivered directly to participating county administrators in the weeks before the start of summer school programs. All STEAM learning materials remained with participating educators for summer classroom use, for students to take home, or for classroom applications in the fall.

With our goal to increase students' learning gains and lower teacher stress and preparation time, specialists provided pre-visit planning support to participating summer educators. The virtual meeting sessions were used to review the immersion experience, resources, lesson plans, and lesson extension opportunities. All lessons included accommodations, modifications, and enrichment.

Our staff offered flexible scheduling with one, two, multiple-day, or full summer programming options. Presentations were customized due to the varied school schedules and themes. The specialists and management staff visited 11 counties, served 33 schools, and impacted an additional 625 students. A complete list of participating schools and counties is located in **Appendix B** at the end of this report.

The summer learning atmosphere was fun and upbeat, with students and teachers from multiple schools meeting in one central location within counties. Our curriculum served as a conduit for developing skills, including cooperation and communication for all involved. On post-visit surveys, specialists reported high teacher and student engagement levels, with many participants requesting return visits during the upcoming school year.

Outcomes and Impacts

Data on each immersion was collected using multiple methods:

1. Teachers or school administrators completed an online registration to request an immersion.
2. Teachers or school administrators communicated with the STEAM TAC Specialists before the visit to estimate the number of students that would participate, and the type of immersion offered.
3. STEAM TAC Specialists completed a post-immersion survey directly following the event (discussed in Section A).

4. Teachers who participated directly in the classroom immersion were asked to complete a post-immersion survey (discussed in Section B).

The information presented in the following two sections represents the post-immersion survey data submitted by the STEAM TAC Specialists or participating teachers. In summary, specialists traveled over 18,500 miles and worked with 11,950 middle school students from 96 schools within 47 counties during the 2022 spring semester. An additional 625 students representing 33 schools in 11 counties were served during the summer months. Approximately 6,000 TeacherGeek kits were distributed to participating classrooms during the spring and summer. A complete list of participating schools and counties to date can be found in **Appendix B** at the end of this report.

A. Impact Numbers and Demographic Data

Following each classroom immersion, STEAM TAC specialists completed a post-immersion survey that collected information on the number of participating students, as well as demographic data on the immersion experience (immersion type, grades taught, number of participating teachers, and the content area of the participating teacher(s)). Similar demographic information was asked in the participating teacher post-immersion survey (discussed in Section B). However, since not all teachers completed the post-immersion survey, the demographic data shown in Charts 1-3 is from the specialist survey.

Most participating teachers (48%) were science or STEM content area educators. Gifted/SPED and mathematics were the next most prevalent content areas (15% and 11%, respectively). Immersions were well distributed across all three grade levels (31% to 34%).

Figure 1. Counties with schools that participated in spring and summer classroom immersions. Note that McDowell, Mingo, Logan, and Wyoming also received COSI Energy kits for all 6th graders in their counties in December '21. We are currently working to recruit schools for fall classroom immersions.
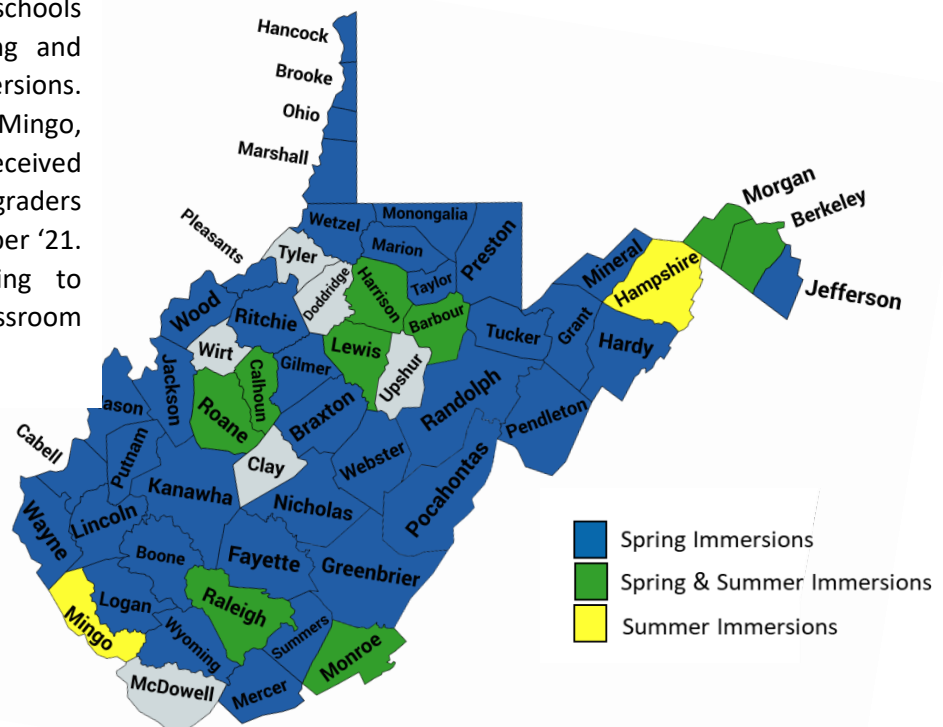
Chart 1. Distribution of participating teacher subject areas. Note that teachers could represent multiple content areas.
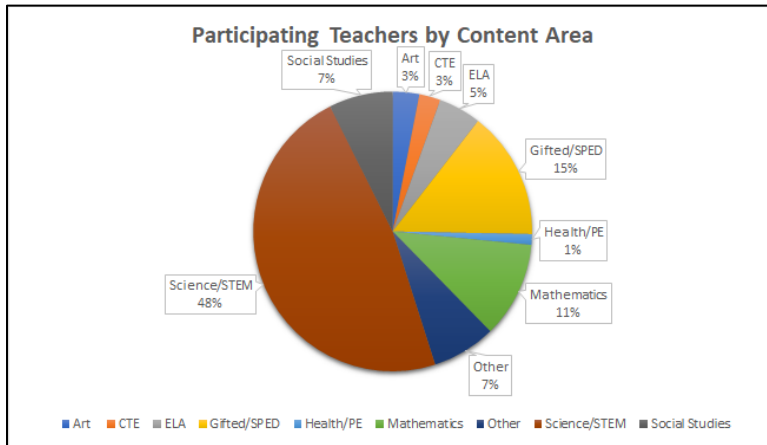

Participating Teachers by Content Area

Chart 2. Percent distribution by grade level. Note that many immersions had multiple grades participating.

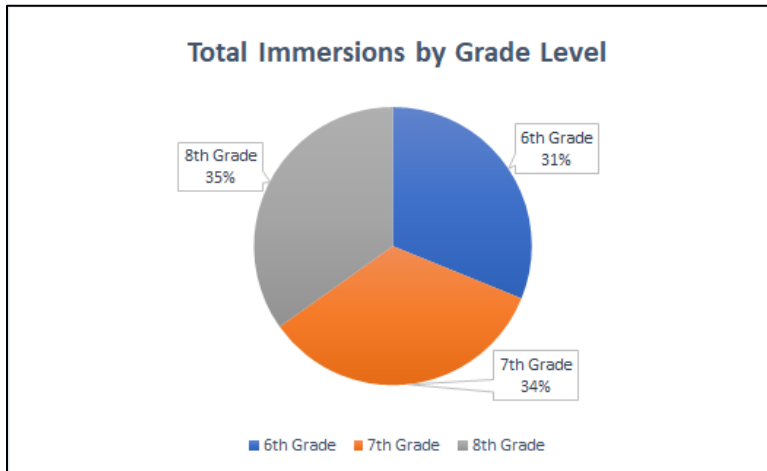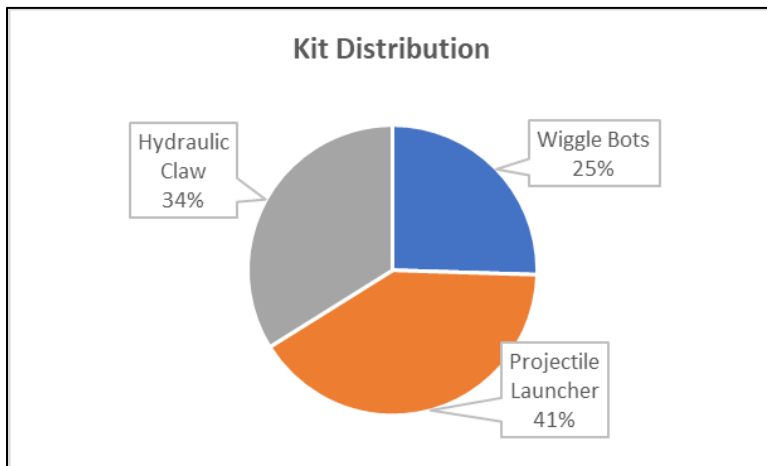Total Immersions by Grade Level

Chart 3. Percent distribution by immersion type.

Kit Distribution

B. Educator Feedback

Following each classroom immersion, host teachers were asked to complete a participating teacher post-immersion survey. The survey tool, shown in **Appendix C**, uses a combination of open-ended and Likert-style questions to determine the program's impact. To date, ninety-three teachers representing thirty-four West Virginia counties have completed the survey. Results are displayed on the following pages.

All teachers reported that using design-based learning increased their students' engagement (Chart 4). Teachers also answered overwhelmingly (89.2-100%) in the positive (Strongly Agree/Agree or Very Likely/Somewhat Likely) to each of the statements in Tables 1 and 2. In particular, 97.8% of teachers (N = 91) responded that they were "Very Likely" to request a future visit from the STEM TAC. The remaining two teachers said they were "Somewhat Likely," and no teachers said they were "Not Likely" to request a visit.

Chart 4. Responses from participating teachers on changes in student engagement. 100% of teachers responded that student engagement increased significantly (84%) or some (16%) during the immersion.
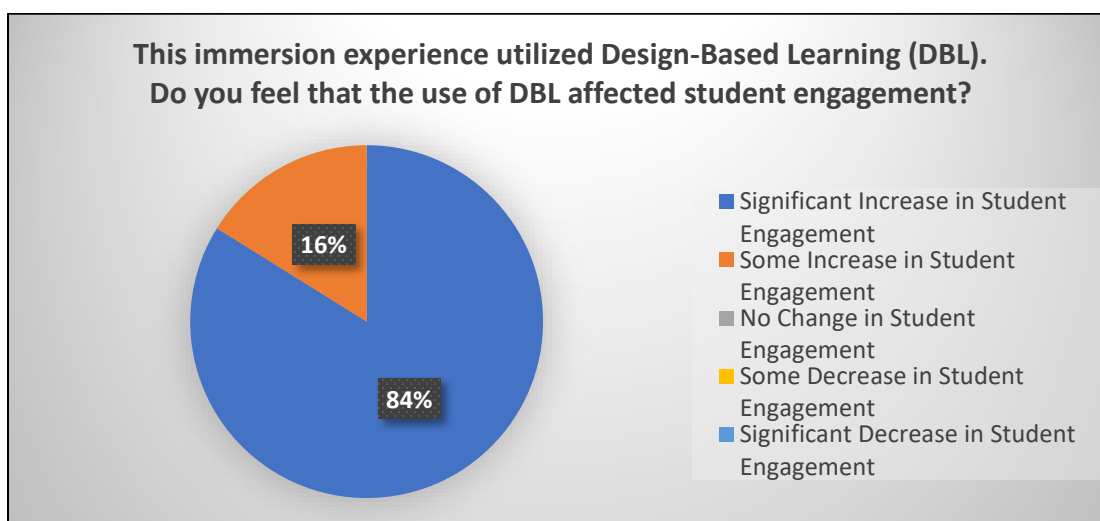

Table 1. Participating teachers were asked to evaluate their immersion experience. % Positive measures responses to "Strongly Agree" and "Agree."

Read each sentence below and then mark the corresponding response that shows how much you agree with each sentence.	Strongly Agree	Agree	Disagree	Strongly Disagree	N	% Positive
The immersion promoted an atmosphere conducive to learning.	83	4	0	6	93	93.5%
The information was presented at an age-appropriate level.	84	3	0	6	93	93.5%
The immersion provided opportunities for the students to think critically.	82	5	0	6	93	93.5%
The immersion provided information on career pathways.	65	18	2	8	93	89.2%
The immersion kept students engaged.	83	3	0	6	92	93.5%
I believe experiences such as this can help students become more confident in STEAM topics.	80	4	0	7	91	92.3%
Overall, I really liked the immersion experience.	83	3	0	7	93	92.5%

Table 2. Several self-efficacy and behavior change questions were also included. % Positive measures responses to "Very Likely" and "Somewhat Likely." 100% of teachers responded that they would likely request another visit from the STEAM TAC in the future, Very Likely (97.8%) and Somewhat Likely (2.1%).

As a result of your participation in this immersion experience, how likely are you to do the following in the future?	Very Likely	Somewhat Likely	Not Likely	N	% Positive
Try one or more of the extension lessons using the provided kits and materials.	84	9	0	93	100.0%
Work with a fellow teacher to offer interdisciplinary extension lessons (ELA, social studies, etc.) using the provided kits and materials.	56	34	3	93	96.8%
Lead other design-based learning lessons with your students.	75	18	0	93	100.0%
Request another visit from the STEAM TAC in the future.	91	2	0	93	100.0%
Participate in a STEAM TAC Professional Learning Community.	51	39	3	93	96.8%

When reviewing the data, six teachers answered "Strongly Disagree" to all the questions in Table 1. However, these same teachers answered "Very Likely" to all questions in Table 2 and provided highly positive comments to the open-ended questions. Thus, we postulate that these six teachers chose "Strongly Disagree" by accident. If true, this would increase each of the % Positive response rates in Table 1 by nearly 6.5%.

Participating teachers were also asked several open-ended questions about their classroom immersion experience.

1. Did you observe any changes in student behavior or unique insights from students as a result of participating in this immersion experience? Please describe below.
2. What did you like best about the immersion experience?
3. What changes would most improve the immersion experience?

The comments were overwhelmingly positive. A selection is displayed below. For question 3, the most common suggestions for improvement included: providing multi-day events so students could spend more time on the projects, providing enough kits for each student to work independently, and more time to focus on career clusters. Below is a selection of participating teacher comments on questions 1 and 2.

- "They had to work in groups which is always something they need to work on with social development. It also engaged most of them, which is no small endeavor."
- "Students were highly engaged and interested in the lesson. Extension activities were an excellent addition."
- "Success of lower ability students and the joy I could see in their faces."
- "The best part about this immersion was the flexibility with designing the hydraulic claw and the collaboration among students for a common goal."
- "I have a few students in each of my six classes that are habitually off task or not engaged. ALL my students were involved and on task for this task."
- "Almost all students were engaged for the entire class period. Student engagement was increased, and as a result there were no discipline issues. Students were excited to work on this activity."

- "The student engagement was great, the instructions were simple to follow, the students were problem-solving, troubleshooting, collaborating, and thinking critically. In addition, they were implementing the scientific method, and were completing all these tasks while having fun."
- "Some of my students who don't usually participate much in writing and discussion-based activities were eager to participate in this activity. I could tell that several groups were proud of their work, and that's always a great feeling."

Developing Partnerships with STEAM-Focused Organizations

Established Partnerships

The Education Alliance – AmeriCorps Mentors Program:

The STEAM TAC collaborated with Emily Pratt, Education Alliance, to build a partnership with the WV AmeriCorps Mentors Program. During classroom visits, AmeriCorps teacher mentors joined our specialists in classrooms to experience best STEAM teaching and learning practices. TEAMS meetings were held before the visits with the AmeriCorps Mentors and their directors to discuss expectations and logistics. Participating counties included Cabell, Logan, and Pleasants.

COSI (Center of Science and Industry):

The STEAM TAC made an in-person visit to the COSI campus in October 2021. Our team was met by Stephen White and his staff, who proposed partnership possibilities for short and long-term curriculum options. As noted earlier, COSI assisted with the official launch of STEAM TAC. Discussions regarding the use of COSI Hyperloop Kits have been tabled.

NASA IV&V Facility:

As our materials purchasing continues, we foresee the need to utilize the IV&V space for storage and kit dispersal. We continue the exploration of curriculum and partnership collaboration opportunities with IV&V and Fairmont University Education Resource Center (ERC) staff. COVID protocols remained in place until March 2022, restricting building use.

WVU Science Adventure School (SAS):

Several in-person meetings with SAS took place during Spring 2022, including specialists' on-site visits to the Summit Bechtel Reserve. Greg Corio, Ali Jeny, and Andrew Hoover discussed SAS STEAM outreach programming for WV sixth-grade students. Potential ideas for partnerships were discussed, including STEAM TAC specialists attending SAS events in Fall 2022 to reach counties yet to host the STEAM TAC. We received SAS STEAM lesson plans to review to consider areas of programming coordination and potential collaboration.

Vantage Ventures:

The STEAM TAC staff made an in-person visit to Vantage Ventures offices in Morgantown in June 2022. Our goal for the visit was to educate our specialists and raise awareness of classroom teachers about future West Virginia careers, ensuring they are comfortable sharing these opportunities with their students. Some professions presented by the entrepreneurs included software engineering, data scientists, technology-enhanced musicians,

and systems engineering. Following a tour of their facilities, entrepreneurs discussed ideas for STEAM collaboration. Sara Billers led the conversation that included topics surrounding "careers of the future" and entrepreneurship. The STEAM TAC plans to highlight these inspiring entrepreneurs in our career exploration curriculum by adding personalized videos and potential classroom visits (in-person or virtual) by these experts.

Potential Partnerships

NYSF- National Youth Science Foundation:

NYSF desires to establish a partnership with the STEAM TAC to secure funding for their programming that aligns with our charge. Ryan Haupt, Director of STEM Programming, is composing a proposal for STEAM partnership opportunities. He joined our specialist, Angie McDaniel, during a STEAM TAC visit to Tucker County Middle School in May 2022 to experience our immersions firsthand. Discussions focused on alignment of curriculum and programming (present and future) and developing professional learning opportunities for STEAM educators. Ideas include the potential use of the NYSF Center in Davis, WV, for professional learning events, including their makerspace and lab facilities, funding NYSF Summer STEAM Camp programming, makerspace development for WV schools and STEAM Learning Lab events. The NYSF Foundation's primary goal is to reduce participation barriers to STEAM learning for all students. These barriers include financial struggles, lack of availability and transportation from rural areas.

Civil Air Patrol Aerospace STEM Programming:

Civil Air Patrol's Aerospace Education STEM Kit program officials reached out to partner with the STEAM TAC to increase awareness of and provide funding for the program's offerings to STEAM educators in West Virginia. The Aerospace Education Member (AEM) program is for K-12 formal and informal educators at schools, youth organizations, museums, and libraries. There is a one-time $35 fee with free annual renewal. This STEM kit program provides participating educators with equipment and resources for hands-on, inquiry-based learning, including free aerospace/STEM lesson plans, activities, textbooks, products, and programs to use in any classroom, after-school, or enrichment program. An in-person meeting is scheduled for August 4, 2022 at Yeager Airport in Charleston, WV, to review their kit options and discuss potential funding to cover the one-time fee for educators.

WVU Faculty Partners:

To date, three members of the WVU faculty have agreed to join our cohort of STEAM educational experts. These include Dr. Heather Harris, Educational Programs Manager from the Art Museum of West Virginia University, Dr. Kaken Dey, Assistant Professor from the Statler College of Engineering and leader of the Connected and Automated Transportation Systems Lab at WVU, and David Smith, Associate Professor from the WVU Reed College of Media. Their content expertise will significantly strengthen our STEAM offerings. In addition, Heather and David plan to incorporate STEAM TAC curriculum into Fall 2022 courses and ask their students to design and develop extension lessons that coordinate with our immersion experiences.

We will continue to recruit additional faculty partners in year two. Additional areas of focus will include robotics, agriculture, ecotourism, sports science, and geology.

Recruitment continues throughout the state for STEAM teacher leaders and up-and-coming star educators to join the STEAM TAC. Currently, two STEAM teacher experts have agreed to assist. Diana Aston, a special education teacher of self-contained students from Marshall County, supported us during the visit to the WV Schools of the Deaf and Blind. Mrs. Aston is severely hearing impaired, and her recommendations for lesson approach prove to be a valuable asset. High school mathematics educator Mr. Adam Wolfe, Kanawha County, joined our team and will begin pilot testing our immersions this fall.

Year One Summary and Plans for Year Two:

Year one of the WVDE-WVU STEAM TAC was used to build infrastructure for the program and launch outreach efforts throughout the spring and summer. Additionally, hiring personnel and identifying priority programming consumed much of the first four months. Year one was overwhelmingly successful, with specialists reaching 12,365 students and 225 teachers from 109 schools within 49 counties during the spring and summer of 2022.

As we enter year two, we look forward to continuing and growing our programmatic outreach. Furthermore, we will initiate a concerted outreach effort to engage schools and corporate partners more deeply and further develop assessment and evaluation tools. In addition, we are also actively working to establish a team of collaborating faculty and teachers using the stipends built into the current funding. See **Appendix D** for the Memorandum of Understanding for WV certified master STEAM educators.

In addition, we have also identified several state and nationally recognized STEAM organizations to distribute the allotted subcontracting funds. This will allow us to expand our reach and leverage existing outreach efforts for the K-12 pipeline. The goal behind this additional effort is to capitalize on existing programming currently being undertaken within the state to amplify our efforts and the goals of this program.

Sources:

https://www.tandfonline.com/doi/abs/10.1080/13664530.2015.1011346

https://docs.lib.purdue.edu/jpeer/vol2/iss2/2/

Appendix A: STEAM TAC Staff

Donna Peduto currently serves as Director of the West Virginia Public Education Collaborative. Ms. Peduto recently served as Director of Operations for the West Virginia Board of Education. She was a key liaison to the WVBE members and executive leadership, the Governor's Office, chairs of the legislative education committees, as well as other leaders and organizations around the state. Earlier in her career, Ms. Peduto also served as director of the Learning Lab Network Sites for the Stupski Foundation and as the director of K-12 Initiatives at the EdVenture Group. Ms. Peduto is a member of the National Association of State Boards of Education Executives serving as President of the National School in 2016, a board member of the Regional Education Lab, a member of the Association for Supervision and Curriculum Development and was inducted into the June Harless Hall of Fame in May 2016. Ms. Peduto is a graduate of West Virginia University with both a Bachelor of Science in Elementary Education and a Master of Arts in Reading.

Jennifer Schwertfeger is a former life science educator and has served as Science Coordinator for the West Virginia Department of Education, Office of Teaching and Learning, Middle and Secondary Services. Schwertfeger earned a Bachelor of Science degree in Biology from West Liberty University and a Master of Arts degree in Science Education from West Virginia University. Through her STEAM-based lesson approach, she promotes the importance for students to recognize their connection to learning starting on a personal level and broadening their scope of understanding to their community and world. Schwertfeger served as the 2020 West Virginia Teacher of the Year.

Dr. Jen Robertson-Honecker is an associate professor and STEM Specialist for WVU Extension Service's 4-H Youth Development program. Jen's work brings science programming to youth and educators in rural communities through camp programs, events, and in-school and out-of-school-time activities across the state. With a Ph.D. in analytical chemistry and a background in both collegiate and public-school teaching, Jen uses her real-world knowledge to create relatable, effective curricula for youth. In 2018 and 2019, she led the WVU Extension team that worked with National 4-H and Google to write the National Youth Science Day challenges, Code Your World and Game Changers which reached more than 500,000 youth across the country

Melissa Bane is a STEAM education expert who served West Virginia public schools for eleven years. She is a graduate of West Liberty University with a BA in Elementary Education and certification in Mathematics, grades 5-9. Melissa began her career as a kindergarten teacher followed by STEAM instruction for grades 5-8 where she developed and implemented hands-on, engineering-design student lessons and teaching practices. In addition, her passion for STEAM education inspired her to develop and operate a functioning Makerspace that became a model for fellow educators to follow.

Angela McDaniel is a former West Virginia science and Project Lead the Way teacher of 27 years. She is recognized as a National Board Certified-Renewed educator and winner of the Presidential Award for Excellence in Math and Science Teaching. Angie is certified as a STEM educator, a teacher mentor for WVDE and Kagan Instruction, and as an instructional coach. Angela is a graduate of Alderson Broaddus with a Bachelor of Science degree in Secondary Science Education and a Master of Arts degree in STEM Education from the American College of Education.

Cliff Sullivan has 14 years of teaching experience in West Virginia public schools and New York City. Cliff is a Technology Integration Specialist who has served on multiple leadership and STEAM committees for curriculum

development and implementation. He holds certifications in Vex Robotics, Minecraft Education, and various Computer Science programs and is one of three Code.Org Computer Science Fundamentals facilitators for West Virginia. Cliff designed and created a Makerspace that serves as a career exploration lab where students become problem solvers through the engineering design process. Cliff holds a Bachelor of Fine Arts degree in Computer Animation from the Institute of Art, Design, and Technology (Tampa) and a Master of Studies degree in Early Childhood Education from Fordham University in addition to an Administration Certification from Marshall University.

Anna Tucker has nine years of experience teaching mathematics in West Virginia public schools. She is a graduate of West Virginia University with a Bachelor of Arts degree in Mathematics and a Master of Arts degree in Secondary Education. Her passion for STEAM learning inspired her to develop STEAM projects and lessons that seamlessly integrated into her 9-12th grade mathematics classroom. In addition, Anna designed 8th-grade STEAM curriculum for the West Virginia Governor's School of Math and Science that incorporated computer science programming languages and music.

Appendix B:

Alphabetical List of Participating WV Schools - Spring Semester 2022

Aurora School	Marlinton Middle School
Baileysville Middle School	Meadow Bridge Elementary School
Barboursville Middle School	Meadow Bridge High School
Board of Children	Monongah Middle School
Braxton Middle School	Moundsville Middle School
Bridgeport Middle School	Mountain Ridge Middle
Brooke Middle School	Mountain View Middle School
Bruceton Mills Middle School	Mountaineer Middle School (Mon)
Buffalo Middle School	Mountaineer Middle School (Harrison)
Calhoun Middle School	Musselman Middle School
Cameron Middle/High School	New Haven Elementary School
Chandler Academy	New Martinsville Elementary School
Chapmanville Middle School	New Martinsville Middle School
Charles Town Middle School	Oak Glen Middle School
Dunbar Middle School	Oak Hill Middle School
Duval PK-8 School	Paden City Elementary School
East Bank Middle School	Paden City High School
East Hardy Early Middle School	Park Middle School
East Preston Middle School	Paw Paw Middle School
Eastern Greenbrier Middle School	Paw Paw High School
Elkins Middle School	Pendleton County Middle School
Elkview Middle School	Peterstown Middle School
Frankfort Middle School	Philippi Middle School
Geary Middle School	Pikeview Middle School
Gilmer Middle School	Pleasants County Middle School
Hacker Valley Middle School	Poca Middle School
Hannan Jr/Sr High School	Point Pleasant Jr/Sr High School
Harpers Ferry Middle School	Ravenswood Middle School
Harts PK-8 School	Ripley Middle School
Hayes Middle School	Road Branch Middle
Hendon Consolidated Middle School	Robert Bland Middle School
Huff Consolidated Middle School	Shady Spring Middle School
Huntington East Middle School	Shepherdstown Middle School
Huntington Middle School	Sherman Junior High School
Jackson Middle School	Sherrard Middle School
John Adams Middle School	Short Line School
Kasson Elementary/Middle School	South Charleston Middle School
Keyser Middle School	Spencer Middle School
Logan Middle School	Summers County Middle School
Long Drain School	Summersville Middle School
Man Middle School	Suncrest Middle School
Mannington Middle School	Taylor County Middle School

Triadelphia Middle School

Tucker Valley Middle School

Tygarts Valley Middle School

Union Educational Complex

Warm Springs Middle School

Warwood Middle School

Washington Irving Middle School

Weir Middle School

West Preston Middle School

Westwood Middle School

Wildwood Middle School

Winfield Middle School

List of Participating WV Counties – Spring Semester 2022

Barbour	Greenbrier	Marion	Pendleton	Taylor
Berkeley	Hancock	Marshall	Pleasants	Tucker
Boone	Hardy	Mason	Pocahontas	Wayne
Braxton	Harrison	Mercer	Preston	Webster
Brooke	Jackson	Mineral	Putnam	Wetzel
Cabell	Jefferson	Monongalia	Raleigh	Wood
Calhoun	Kanawha	Monroe	Randolph	Wyoming
Fayette	Lewis	Morgan	Ritchie	
Gilmer	Lincoln	Nicholas	Roane	
Grant	Logan	Ohio	Summers	

Alphabetical List of Participating WV Schools - Summer 2022

Beckley-Stratton Middle School

Belington Middle School

Bridgeport Middle School

Burch PreK-8

Calhoun Middle School/High School

Geary Elementary/Middle School

Gilbert PreK-8

Hedgesville Middle School

Independence Middle School

Kasson Elementary/Middle School

Kermit PreK-8

Leading Creek Elementary (6)

Lenore PreK-8

Lincoln Middle School

Matewan PreK-8

Mountain View Elementary/ Middle School

North Martinsburg Middle School

Park Middle School

Paw Paw Elementary (6)

Paw Paw High School (7-8)

Peterstown Middle School

Philippi Middle School

Robert Bland Middle School (7-8)

Shady Spring Middle School

South Harrison Middle School

South Martinsburg Middle School

Spencer Middle School

Spring Mills Middle School

Walton Elementary/ Middle School

Warm Springs Middle School

Washington Irving Middle School

West Virginia Schools for the Deaf and Blind

Williamson PreK-8

List of Participating WV Counties – Summer 2022

Barbour	Harrison	Mingo	Raleigh
Berkeley	Hampshire	Monroe	Roane
Calhoun	Lewis	Morgan	

Appendix C: Post Visit WVDE-WVU Participating Teacher Immersion Survey

The purpose of this survey is to evaluate the STEAM Immersion Experience that was taught in your classroom by the WVDE/WVU STEAM TAC Specialist. Thank you in advance for taking the time to fill out this evaluation. Your honest feedback will help us make the programs we offer across West Virginia better and more effective for both students and educators.

In which WV County did the immersion experience take place?

Which immersion lesson did the STEAM TAC Specialist lead in your classroom?

○ Wiggle Bot

○ Projectile Launcher

○ Hydraulic Claw

What grade(s) were the youth that participated in the immersion experience? Check all that apply.

☐ 6th

☐ 7th

☐ 8th

Which classes participated in the immersion experience? Check all that apply.

☐ Science/STEM

☐ Mathematics

☐ Social Studies

☐ ELA

☐ Gifted or Special Education

☐ Other _____

Directions: Read each sentence below and then mark the corresponding response that shows how much you agree with each sentence.

	Strongly Disagree	Disagree	Agree	Strongly Agree
The immersion promoted an atmosphere conducive to learning.	○	○	○	○
The information was presented at an age appropriate level.	○	○	○	○
The immersion provided opportunities for the students to think critically.	○	○	○	○
The immersion provided information on career pathways.	○	○	○	○
The immersion kept students engaged.	○	○	○	○
I believe experiences such as this can help students become more confident in STEAM topics.	○	○	○	○
Overall, I really liked the immersion experience.	○	○	○	○

This immersion experience utilized Design-Based Learning (DBL). Do you feel that the use of DBL affected student engagement?

○ Significant Increase in Student Engagement

○ Some Increase in Student Engagement

○ No Change in Student Engagement

○ Some Decrease in Student Engagement

○ Significant Decrease in Student Engagement

Did you observe any changes in student behavior or unique insights from students as a result of participating in this immersion experience? Please describe below.

_____

_____

As a result of your participation in this immersion experience, how likely are you to do the following in the future?

	Not Likely	Somewhat Likely	Very Likely
Try one or more of the extension lessons using the provided kits and materials.	○	○	○
Work with a fellow teacher to offer interdisciplinary extension lesson (ELA, social studies, etc.) using the provided kits and materials.	○	○	○
Lead other design-based learning lessons with your students.	○	○	○
Request another visit from the STEAM TAC in the future.	○	○	○
Participate in a STEAM TAC Professional Learning Community.	○	○	○

What did you like best about the immersion experience?

_____

_____

_____

What changes would most improve the immersion experience?

_____

_____

_____

Memorandum of Understanding
between **WVDE/WVU STEAM TAC**

and

_____, **STEAM educator**

Background

West Virginia University's STEAM Technical Assistance Center (TAC), launched in January 2022, is committed to helping educators and students fall in love with STEAM experiences so West Virginia's next generation can hone essential mindsets and skillsets for success.

Our master STEAM TAC specialists work directly with teachers and students in their classrooms through hands-on, interactive STEAM experiences known as immersions. Specialists model lesson delivery and ensure educators are just as engaged and involved as the students. Free standards-focused instruction, lesson plans, educational materials, and resources are provided to help guide STEAM learning in classes year-round to prepare students for college and STEAM-based careers. In addition, our specialists can provide follow-up classroom visits or personalized educator assistance as requested, including resources, professional collaboration and learning opportunities.

Each classroom immersion is designed as a three-part experience that includes a pre-visit presentation, an in-person, hands-on, engineering design-based STEAM lesson, and a post-visit follow-up with supplemental lesson plans and networking opportunities for participating STEAM TAC classroom teachers. All immersions are tailored to grade level and personalized for the school's local community.

Our program will support educators and students in grades 6-8 throughout the 2022-2023 academic year and aims to expand the program to all middle and high school students in grades 6-10, with a strong focus on science, mathematics, and computer science content areas.

Purpose

This Memorandum of Agreement (MOU) establishes the guidelines for collaboration between the STEAM TAC and select master STEAM educators to promote STEAM learning throughout the State of West Virginia. Our goal is to target experienced STEAM educators who are current classroom teachers in the content areas of science, mathematics, technology/computer science, career and technical (CTE), and the arts.

Agreement:

Responsibilities STEAM TAC:

The **STEAM TAC** will identify and invite WV educators who are experienced in the STEAM approach to learning to work alongside the STEAM TAC administration, staff, and participating classroom teachers to carry out our goals as set forth by the West Virginia Department of Education (WVDE) and West Virginia University (WVU).

The STEAM TAC will:

- maintain the TEAMS STEAM TAC Professional Learning Community (PLC) page for ongoing communication among participants.
- serve as a communication liaison among stakeholders.
- provide scheduled dates of events and meetings in advance to stakeholders.

- provide lesson plans and materials for master educators for review or classroom piloting.
- examine feedback and make appropriate changes to the curriculum.

Responsibilities of Master STEAM Educator:

As a Master STEAM Educator, you will be a valuable resource to provide the STEAM TAC with insights and ideas to improve our hands-on immersion lessons, making them more comprehensive, inclusive, and equitable for all students.

The Master Educator will:

- participate in bi-monthly virtual meetings with the STEAM TAC staff.
- create engineering design lessons incorporating computer science skills (i.e., programming, data analysis).
- lend content area expertise to high school STEAM immersion experiences.
- pilot test of new curricula with students.
- serve as a consultant for additional STEAM-related projects.
- agree not to sell or promote STEAM TAC lessons for personal profit.
- agree to a photography release for STEAM TAC press and social media promotion.
- agree to maintain confidentiality surrounding the planning, communications, and work of the STEAM TAC and its stakeholders.

Meetings and Reporting

To accomplish the purpose and objective outlined in this agreement, partners will meet at least two times per month for the purposes of program planning and monitoring and evaluating outcomes with STEAM TAC administration, staff, or participating educators, with additional meetings scheduled if necessary.

Duration of Term of Memorandum and Termination Process

This memorandum shall commence on September 1, 2022 and shall continue for a period of one calendar year. This memorandum may be terminated by either party giving the other party by written notice.

Financial Considerations

A stipend of $2000 will be offered to the Master STEAM Educator to be paid out in two installments of $1000 each on December 15 and June 15. If any expenditures are required by the participating educator, they must be reviewed and approved by the STEAM TAC administration. The STEAM TAC will approve and order any requested materials or supplies and then shipped to the participating educator.

Photography Release

As a STEAM TAC Master Educator, I, _____, consent to the use of my image for photography and video creations produced by the STEAM TAC, WVU or WVDE.

Due to student privacy considerations, I agree not to share or post any photographs or videos I have taken during STEAM TAC school immersion visits.

Signatures

This MOU is at will and may be modified with the mutual consent of the authorized individuals of the STEAM TAC and _____. Once signed by authorized officials of both groups, this MOU will begin [Month Day, Year] and remain in effect until [Month Day, Year].