STEAM MINDED WV

Progress Report: A Comprehensive Approach to WV STEM Education

July 2019

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Introduction

PURPOSE

The purpose of this progress report is to describe A Comprehensive Approach to STEM Education in West Virginia and the ongoing progress and initial recommendations of the of the STEM workgroups.

STEM DEFINITION

STEM is an acronym for the transdisciplinary integration of the four disciplines of Science, Technology, Engineering, and Mathematics. STEM education places a priority on the study of science and math with purposeful integration of technology and the engineering design process. STEM education is an opportunity for students to collaboratively solve engaging and relevant problems using innovation and creativity. The engineering design process allows students to identify problems, design possible solutions, test and evaluate those solutions until the best solution is discovered. STEM in the classroom engages students in real-world situations and allows students to experience solution-finding for problems that are relevant to today's world.

HISTORY

In December 2017, Governor Jim Justice issued a proclamation instructing the West Virginia Department of Education (WVDE) to establish the West Virginia Advisory Council for a Comprehensive Approach to STEM Education. The Advisory Council's purpose is to ensure STEM work across the state is coordinated, connected, and inclusive. In February 2018, WVDE convened a joint meeting of the Advisory Council workgroups to build a shared understanding of the vision, mission, and goals; refine workgroup activities and outputs; and develop work plans to achieve goals. In May 2019, the Advisory Council workgroups completed their work, and submitted a report to WVDE detailing recommendations to promote STEM in West Virginia. STEM-minded WV is the culmination of the Advisory Council workgroup's recommendations.

VISION

Current and future job opportunities in West Virginia demand a workforce with strong STEM competencies to fulfill them. The WVDE and the Comprehensive Approach to STEM Advisory Council laid the groundwork for a statewide system of STEM support that prepares and inspires generations of learners to become leaders who meet the challenges of the state's emerging economy and contribute to the global society through innovation, collaboration, and creative problem-solving.

MISSION

Our mission for STEM is to provide a system of support that: 1) instills enthusiasm, interest, and engagement in STEM through personalized learning; 2) promotes transdisciplinary STEM literacy across the curriculum; and 3) provides equitable access to STEM experiences, majors, and career pathways.

GOALS

Using technology and other tools and supports, WVDE will:

» Improve student engagement, preparation, and achievement in STEM;

» Build educator capacity in STEM through credentialing and professional learning;

» Increase workforce readiness through coding and computer science to support STEM learning; and

» Increase stakeholder awareness and participation in STEM by facilitating collaborative STEM initiatives.

OUTCOMES

Through collaborative, cross-organization work* in five key areas including workforce development, computer science, STEM learning in and across disciplines (early and elementary), STEM learning in and across disciplines (middle and secondary), and community engagement, the Comprehensive Approach to STEM Advisory Council seeks to ensure that WV:

» Graduates students from high school with increased STEM competencies necessary for college and careers, such as those associated with computer science;

» Has educators with the confidence, knowledge, and skills to create engaging STEM learning environments; and

» Provides collaborative STEM initiatives with stakeholders that will result in the alignment of educational opportunities to business and industry needs to meet economic demands.
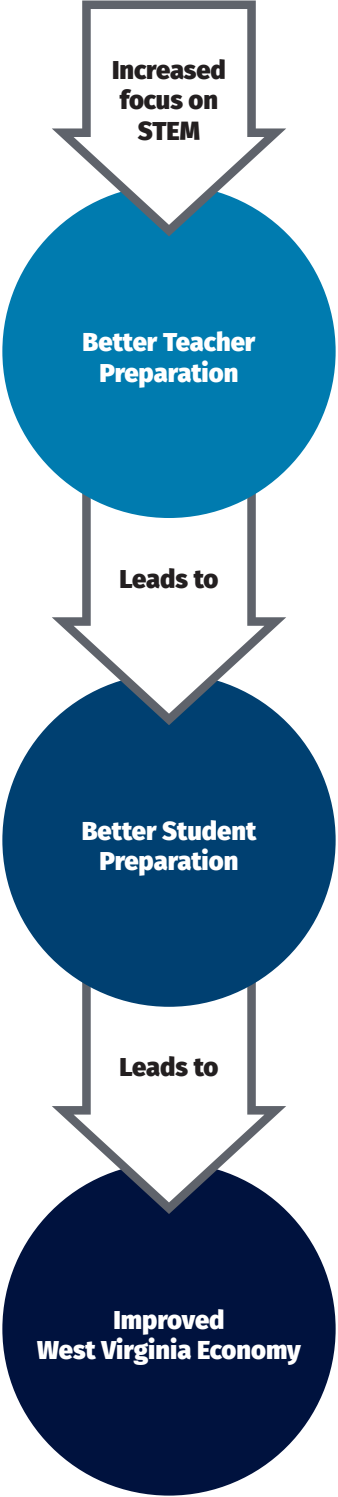
PROGRESS REPORT

This progress report includes a summary of the specific recommendations for STEM education from each of the five work groups provided to the West Virginia Department of Education.

See Special Thanks information for organizations comprising the West Virginia Advisory Council for A Comprehensive Approach to STEM Education.

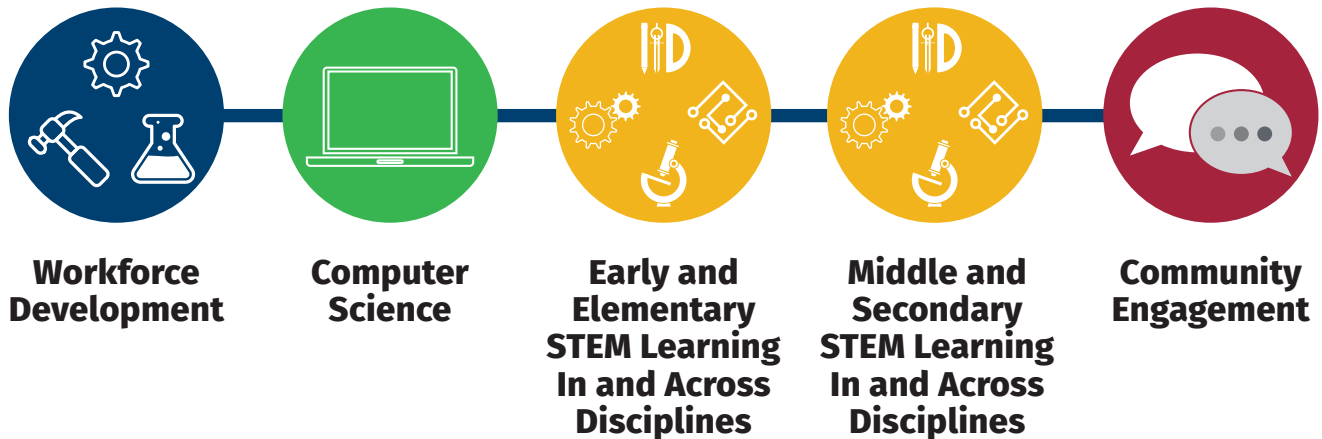# Theory of Action

A theory of action is a hypothesis for how an initiative might operate to achieve its goal. It is a chain of reasoning usually reflected in logical "If...then..." statements that explicitly connect the actions to the desired results.

Increased focus on STEM

Better Teacher Preparation

Leads to

Better Student Preparation

Leads to

Improved West Virginia Economy

The Process for Developing a Comprehensive Approach to STEM Education

Through collaborative, cross-organization work, workgroups with expertise and experience in five key areas are creating a state system of STEM support:

Workforce Development — **Computer Science** — **Early and Elementary STEM Learning In and Across Disciplines** — **Middle and Secondary STEM Learning In and Across Disciplines** — **Community Engagement**

WORKGROUP GOALS

» Workforce Development — Increase workforce readiness in STEM fields

» Computer Science — Improve educator capacity and student engagement, preparation, enrollment, and achievement in computer science

» Early and Elementary — Improve educator capacity in STEM through credentialing and professional learning and increased student engagement, preparation, and achievement in STEM

» Middle and Secondary — Improve educator capacity in STEM through credentialing and professional learning and increased student engagement, preparation, and achievement in STEM

» Community Engagement — Increase awareness of the Comprehensive Approach to STEM Education and successfully communicate it to various stakeholders statewide

EXPECTED OUTCOMES

» Students will graduate from high school with increased STEM competencies necessary for college and careers, such as those associated with computer science;

» Educators will have the confidence, knowledge, and skills to create engaging STEM learning environments; and

» Collaboration with stakeholders will result in the alignment of educational opportunities to business and industry needs to meet economic demands.

Workforce Development

Increase workforce readiness in STEM fields

Lawrence J. Malone, Malone Consulting and Strategies
Timothy Elliott, WVDE

RECOMMENDATIONS FOR WVDE

>> Develop additional STEM options for students beyond those offered through CTE

>> Explore IT networking, coding, and cybersecurity courses for dual credit

>> Increase the number of STEM-related CTE courses awarding high school credit

OTHER CONSIDERATIONS AS RECOMMENDATIONS AND OUTPUTS:

>> Adopt digital literacy standards

>> Explore ways to increase real-world/experiential STEM learning for all students

>> Ensure work-ready educators through increased partnerships with colleges of education

>> Enhance educators' capabilities to provide instruction on "soft skills"

>> Work with Workforce WV to develop training programs and activities related to STEM careers

>> Expand virtual learning tools and resources to increase access in small, rural counties

>> Provide ongoing "career awareness" opportunities for parents and students

>> Identify workforce needs and available jobs

>> Increase innovative approaches to address shortage of math and science educators

>> Develop additional entrepreneurship courses

Computer Science

Improve educator capacity and student engagement, preparation, enrollment, and achievement in computer science

Terry Lashley, Appalachia Regional Comprehensive Center
Ashley Walther, Appalachia Regional Comprehensive Center

RECOMMENDATIONS FOR WVDE

» Develop central clearinghouse/website for all computer science professional learning opportunities for educators

» Establish full certification and teacher endorsements for computer science

» Identify WVDE staff who will be responsible for coordinating Professional Learning Opportunities

» Identify STEM/computer science point-of-contact at each county in WV

» Identify curricular pathways and guidelines for CS

» Provide at least one certified or endorsed computer science teacher in all middle/high schools in WV

» Update and adopt Computer Science and Technology Standards

» Increase participation in computer science professional learning opportunities

» Increase development of new computer science training, professional learning opportunities, and recommendations for future training/opportunities

» Increase development of computer science credentialing and certification programs for educators

STEM Learning In and Across Disciplines (Early & Elementary)

Improve educator capacity in STEM through credentialing and professional learning and student engagement, preparation, and achievement in STEM

Margaret Kursey, Berkeley County Schools
Leah Sparks, Kanawha County Schools

RECOMMENDATIONS FOR WVDE

›› Explore developmentally appropriate STEM school models

›› Clarify and promote the importance of the integration of STEM-focused concepts, versus teaching STEM in isolation, during the early and elementary grades of pre-k through 5.

›› Develop additional professional learning opportunities that focus on developmentally appropriate STEM integration in grades pre-k through 5

›› Utilize the West Virginia Early and Elementary Learning Programmatic Implementation Guides for grades pre-k/k; grades 1/2; and grades 3/4/5 as a mechanism to provide and promote concrete examples of how to integrate STEM-focused concepts into the classroom

›› Discuss the development of developmentally appropriate STEM-focused resources (potentially including an early and elementary-focused STEM integration rubric) as part of the WVDE's Taskforce on a Comprehensive Approach to Early and Elementary Learning for Grades Pre-K through Five

STEM Learning In and Across Disciplines (Middle & Secondary)

Improve educator capacity in STEM through connecting professional learning among the STEM disciplines to focus on big ideas in the standards, student engagement, preparation, and achievement in STEM

Lori Whitt, WVDE
Joanna Burt-Kinderman, Pocahontas County Schools

RECOMMENDATIONS FOR WVDE

>> Develop a process, a rubric, and an implementation graphic to designate model STEM schools

>> Develop a tool to ensure that STEM activities claiming to address math and science should do so with integrity to the grade-levels content and math, science, and engineering practices

>> Develop a tool that ensures that learning activities integrate grade-level content standards with the standards for Mathematical Habits of Mind, as well as the science & engineering practice standards

>> Develop a tool that ensures that technology is in service to the content and practice standards

>> Focus on "reasoning" practices which are common to standards in all three content areas (Math, Science/Engineering, ELA)

>> Focus on discussion and transfer between content domains maximizing the impact on improving STEM teaching and learning

>> Focus on productive discussion and well-structured talk which provide the groundwork for robust learning which produces long-term benefits in critical thinking skills and achievement

>> Invest in professional development focused on improving these practices at the classroom level

Community Engagement

Increase awareness of the Comprehensive Approach to STEM Education and successfully communicate it to various stakeholders.

Sarah Sayko, Appalachia Regional Comprehensive Center
Janelle Sperry, West Virginia Parent Teacher Association

RECOMMENDATIONS FOR WVDE

» Design a repository/website for STEM-related opportunities

» Create and share a STEM glossary of STEM-related vocabulary

» Develop criteria for STEM Champions, including components and examples of Individuals or organizations that promote STEM learning within their local setting

» Develop a STEM communication and outreach campaign

Frequently Asked Questions

What is a Comprehensive Approach to STEM Education?
A comprehensive approach to STEM education encompasses rigorous instruction of the individual disciplines of science, technology, engineering and mathematics, as well as the use of integrative, inquiry-based approaches such as project-based and problem-based learning.

Why is a Comprehensive Approach to STEM Education important?
A comprehensive approach to STEM education is important because it incorporates all core instruction areas and includes input and supports from various workforce industries, disciplines, and core instruction. Focusing on these areas of skills and knowledge is essential for student success, because these fields are deeply intertwined in the real world, and in how students learn most effectively.

Who benefits from a Comprehensive Approach to STEM Education?
Many people benefit from a Comprehensive Approach to STEM Education. These include students, educators, parents and caregivers, higher education, business and industry, government and military, civic and faith-based organizations, and others who want to ensure West Virginia students graduate with the skills and qualifications needed to fulfill future workforce demands in West Virginia and beyond.

What does a statewide system of STEM support look like?
An effective statewide system of STEM support involves many individuals and organizations across the state who work together to provide the necessary conditions, information, and resources to enable communities to 1) instill enthusiasm, interest, and engagement in STEM through personalized learning; 2) promote interdisciplinary STEM literacy across the curriculum; and 3) provide equitable access to STEM experiences, majors, and career pathways.

What does transdisciplinary STEM literacy mean?
Transdisciplinary STEM literacy is the ability to apply rigorous academic concepts from science, technology, engineering, and mathematics to solve real-world problems that cannot be solved using a single discipline.

What constitutes workforce development?
For the WV Comprehensive Approach to STEM Education, workforce development centers upon an assessment of workforce needs to promote the STEM-focused skills needed for current and future job opportunities; an assessment of emerging sectors and workforce needs; data-based decision making for programming and policy revisions; and mapping out an effective STEM career pathways strategy.

What constitutes computer science?
For the WV Comprehensive Approach to STEM Education, computer science centers upon a review of current technology and computer science standards and programs of study, a review of current requirements related to computer science; the skills and professional learning opportunities educators need to effectively teach computer science concepts; and pathways that lead to advanced credentials in computer science.

Special Thanks

As stated in Governor Justice's Proclamation, the Advisory Council will foster collaboration among STEM advocates across the state. The Advisory Council will also be inclusive of businesses that have a vested interest in STEM education and insight into workforce needs that provide a unique perspective and can provide future opportunities for students. Each of these Advisory Council members are champions for STEM education and students will benefit from their efforts, especially when those efforts are coordinated. WVDE would like to give special thanks to the representatives of the following organizations who comprise the STEM Advisory Council:

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STEM LEARNING IN AND ACROSS EARLY & ELEMENTARY LEARNING

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