Curriculum analysis: stemscopes curriculum

Curriculum Analysis

Effective curriculum is the backbone of any effective school instructional policy. In order for administrators to properly assess and gauge the effectiveness of any specific curriculum, it is important for administrators to have dialog with the educators that will be implementing the curriculum. The book Curriculum Leadership: Readings for Developing Quality Educational Programs provides evidence of this when it states " successful curriculum leaders build collaborative teams of educators who are committed to working together to increase student learning" (Parkay, et al. 2014, pg. 2). It is vital for curriculum leaders to build buy in from the educators into the process. Leaders cannot expect the students to buy into the curriculum program if the educators do not. This is why it is important not to push a new curriculum onto teachers who do not have the proper and appropriate background knowledge and research related to the curriculum. Curriculum can and has been defined in a number of ways but one way of defining it is

" curriculum is all of the educative experiences learners have in an educational program, the purpose of which is to achieve broad goals and related specific objectives that have been developed within a framework of theory and research, past and present professional practice, and the changing needs of society" (Parkay, et al. 2014, pg. 3).

For the purpose of this analysis, the Accelerate Learning Inc. curriculum known as STEMscopes, will be studying and analyzed. This curriculum is currently employed in the Black County School System which I teach at in the fields of Science. This is strictly a digital science curriculum that enables

and promotes 21 st century skills such as communication, critical thinking, problem solving and creativity by using the 5E model. Inquiry, self-learning and other 21 st century skills are at the forefront of the curriculum as well as the new Georgia Standards of Excellence in Science. This analysis will consist of an in depth look at nine aspects of the curriculum which are: goals, alignment with standards, learner expectations, pacing, embedded literacy, embedded information and technology literacy, teaching strategies, learning activities, assessments and resources.

Goals

Goals of the curriculum are clearly stated on the homepage under Mission as well as on the features for each program provided. Goals for the curriculum are split up between three programs, a State Aligned Standards program, Next Generation Science Standards program, as well as an Early Explorer program that was designed to support students ages three through five. The Early Explorer goal is stated as " thoughtfully designed by PreK teachers with the busy PreK teacher in mind, Early Explorer was built from the ground up to Head Start and state guidelines to prepare PreK students for science in Kindergarten." The goals for the Next Generation Science Standards program states that their desire is to " unravel the standards into digestible modules for your K-12 students. From hands-on, inquiry-based investigations to rigorous CER assessments, STEMscopes NGSS takes the guesswork out of teaching the NGSS." Finally, the State Aligned Standards program goal is, " engaging for students, easy for teachers, and affordable for schools, STEMscopes State Edition is rooted in the scientifically proven 5E model with acceleration and intervention." The curriculum states that STEMscopes is a

digital science solution for students, to provide them with the necessary 21 st century skills. State Aligned Standards program is based on state standards including the Georgia Standards of Excellence. The program is research based and has had continuous input from expert teachers. STEMscopes is a curriculum that has the unique ability to effectively evolve based on new and upcoming best teaching practices. Every curriculum program is supported by STEMcoach, which is a professional development compilation that enables teachers to share best strategic practices, and professional development in the field. Goals are easily accessible on the website for the curriculum and explicit in detail on the goal and purpose for each program. Curriculum exhibits and provides goals for students to analyze social forces, such as the environment as well as problem solving issues within the Project Based Learning applications and 21 st Century Skills. Curriculum also provides the curriculum in Spanish in grades k-5 but does not provide translated curriculum for students in higher grades.

Alignment with Standards

The STEMscopes curriculum is divided up by the three programs stated in the previous section. These programs are divided based on what particular standards and guidelines they address and align with. The Early Explorer program is based on a scaffolding learning approach for students ages three through five. This program incorporates Head Start guidelines, state and national PreK and Kindergarten guidelines as well as methods to best prepare students for NGSS Kindergarten standards. This program enhances the student’s ability to get a jump-start on science concepts for all learning styles. According to the curriculum, “ STEMscopes NGSS is an all-in-one

STEM solution for the NGSS and developed for over three years. STEMscopes NGSS is rooted in the 5E model, a research-based instructional method that effectively connect the three dimensions of the Next Generation Science Standards: Disciplinary Core Ideas, Science and Engineering practices, and Crosscutting Connections".

STEMscopes State Aligned Standards Program has science curriculum for each grade level, K-8, that is aligned to every standard in the Georgia Standards of Excellence, as well as high school Physical Science, Chemistry, Biology and Physics GSE standards. The curriculum is aligned where students use an inquiry based learning style using the 5E model: engage, explore, explain, elaborate, and evaluate, as well as intervention and accelerate. The curriculum for both the State Aligned Standards program and the NGSS program provides a variety of methods to assess student achievement including, multiple choice assessments, open-ended response assessments, claim-evidence-reasoning assessment, and writing prompts which are consistent with current state and national assessment formats.

Learner Expectations

Learner expectations state explicitly what the students should know for each unit and compiling those key concepts will ultimately provide details for what students should be able to know by the end of the grade, course or program. Learner expectations in the Black County School District states that it is their mission to " educate, inspire, challenge, and support students to be productive citizens prepared to compete globally" as well as their vision states that " Black County Schools will be regarded as the innovative model

for excellence as a teaching and learning community”. Inspiring, challenging and supporting students is what the 5E model of the curriculum endorses the most. Students are challenged with analyzing a phenomenon, inspired by authentic experiences and supported with a variety of activities and strategies to best serve the students throughout learning process. STEMscopes also encourages innovation within the curriculum with students contemplating possible creative solutions to problems, exploring new ideas and creating original products to show mastery of the content.

Learner expectations are included and organized by the use of the Georgia Storyline Units within the State Aligned Standards program. This is a systematic approach to scaffolding learning within the units as well as across same subject matters or cross-curricular knowledge. Bloom’s taxonomy is used and layered within each and every unit. Students observe phenomenon and make inferences based on prior remembered knowledge. Students then summarize important information, and demonstrate understanding of facts and ideas. Students make use of technology to gather information and graphic organizers to organize their thinking. Hands on activities or labs also enable students to begin solving the problems of the phenomenon. Next, students begin applying research and information to task and continuing to attempt to problem solve by applying the acquired knowledge. Students will take information apart and explore relationships and systems. Students learn explanations of content through reading comprehension, multimedia visuals or other hands on activities. Next, with guidance, students will identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge. Students plan what

they want to find out and include how they will go about finding it out, what they will observe and what they think they may find out. This is evident in the Next Step Inquiry activities in the Evaluate section. Here students make inferences and find evidence to support generalizations and propose alternative solutions. Students suggest ways to plan and conduct investigations to find answers to questions. Students can also elaborate on the content through cross curricular ideas in math, social studies, art, engineering, etc. Finally, student achievement is evaluated through selected type assessments, constructed response or performance tasks. Once data has been gathered from evaluations, students are either grouped together in order to provide intervention or acceleration materials.

Pacing

The complexities of the concepts and key understanding evolve from grade to grade. Concepts start very simple in Kindergarten with phenomena examples on the concept of Motion as follows, “ If one baseball bumps into another baseball and sends it rolling, will the second baseball travel in a straight line or a zig-zag?” This is the same principle knowledge of the concept, Motion, that high school students are required to learn but in a simplistic form. In fourth grade based on the same content knowledge of Motion, these students are asked to ponder “ how do balanced and unbalanced forces affect objects?” The depth of knowledge in the question has increased dramatically from Kindergarten to Fourth grade. In eighth grade, also based on the same content, students are presented with the phenomena question, “ how can constant velocity be shown on a graph?”. Finally, in high school Physics students should discuss and investigate “

which surface provides the least amount of friction: sand, mud, concrete, or dry soil?". This scaffolding style of questioning is age appropriate per grade level.

Big ideas and concepts are clearly addressed at the beginning of each unit and lesson. These are stated at " Key Concepts" and " Fundamental Questions". Each unit is set up as a " Georgia Storyline" which includes the 5E model with a culminating, project based learning experience. Also, remedial interventions are available within each unit as well as accelerated projects. Like the layered level of phenomenon, the complexities of the concepts and key understanding evolve from grade to grade depending on age appropriate cognitive levels.

Embedded Literacy

Students are presented with phenomena either by visuals, such as pictures or videos, real life visuals, or topical questions to begin each unit. Students work in groups to share ideas and listen to other ideas to formulate a hypothesis based on gathered prior knowledge. Students also make connections across content areas during the Elaborate section, Intervention section and Accelerate section of the unit with resources in Math Connections, Reading Science, Next Step Inquiry (typically relating to social issues), Art, Engineering and Career Connections.

Nonfiction texts are found in the Evaluation sectio of the curriculum in the form of, Argue: Claim-Evidence-Reasoning assessments. Student are presented with a nonfiction story relating to the content and the students are asked to read, analyze the scenario, state a claim, provide evidence for that

claim and connect claim to evidence with contextual reasoning. Fiction texts are integrated into the curriculum through the STEMscopedia articles in the Explain section, and Reading Science articles in the Elaborate section. Non-print materials are incorporated within the curriculum with Content Connection videos, Science Rock videos, and PhET simulations. The curriculum does not provide varied readability levels for each grade level. But, since the Georgia Standards of Excellence are tiered in Science every few years, teachers could pull literacy and reading over the same content from lower or higher grades to meet the needs of each student's Lexile level.

Embedded Information and Technological Literacy skills

The use of information and technology to support and relate information, media and technology across all content areas improve the teaching and learning processes is embedded at each grade level. Students have the ability to access all materials that the teacher releases online through the application. This includes videos, reading articles, Next Step Inquiry activities, Picture Vocabulary, assessments and virtual labs such as PhET simulations. According to one source, " training students to learn from videos in the same way that they learn from teachers, books, and other sources" (Parkay, et al. 2014, pg. 372) can be effective when differentiating. Students are also given the opportunities to create media literacy during the evaluation and accelerate sections. Students can do this by creating videos, songs or recorded performances that provide evidence of effective 21 st century skills and mastery of the desired content knowledge.

Teaching Strategies

Each step of the 5E process has teacher instructions and prompts for the teachers to read, analyze and use where they see fit. Curriculum for each unit or concept also includes the standards alignments, standards unwrapped, which include actions that the students should be able to complete, content students should learn, implications for instruction as well as common misconceptions, teacher background knowledge, materials list and answer keys. The implications for instruction gives the teacher differentiation strategies for students who struggle with the desired learning outcomes and extension opportunities for those who show mastery of the content. The Intervention section of the curriculum process provides advanced graphic organizers and activities for lower level learners. The Acceleration section of the process gives the higher level learning students opportunities for engineering and art projects to extend the learning.

The curriculum suggests throughout the process if the instruction should be whole group, small group, or independently completed. The curriculum also provides instruction and resources to teach proper safety procedures as well as it provides safety posters and resources for further instruction on this topic. Since this is an inquiry based learning curriculum, students continuously have the opportunity to choose between tasks in the Engage section during class discussions or debates on the phenomenon presented and in the Explore section, during labs and hands on activities. The students also have options of a variety of learning avenues in the Elaborate section, specifically the Next Step Inquiry activities, where students choose what they want to research and complete investigations relating to the content at hand. Finally, students have the opportunity to choose between a variety of

assessment formats in the Evaluate section, as well as the Intervention and Acceleration sections, where students have the ability to often create a product to show mastery.

Another example for how the 5E model of learning lends itself in multiple capacities is the fact that since there are so many options and pathways for students to learn the content and topics, the students can often pick the learning style that fits them best and what they are most comfortable with. Students of all backgrounds can learn through inquiry since it is an elaborate process that exposes students to a variety of strategies. Some of those strategies include self-reflections, peer discussions, hands on exploration, reading, writing, and use of multimedia, cross curricular activities or Next Step Inquiry activities for students to investigate a related topic of their choice to elaborate on the content, constructed response assessments, selection type assessments or performance task assessments. Students are also exposed to a variety of strategies after the achievement has been evaluated. A variety of activities, graphic organizers or reading comprehension articles are used to intervene and remediate as well as creating products to accelerate the learning process. The curriculum currently provides units in Spanish, but only for grades k-5 and no other language for other ELL students.

Learning Activities

The 5E model of: engage, explore, explain, elaborate and evaluate, promotes sequenced activities that build on prior knowledge that target the learner expectations. Within each section of the 5E model, higher order thinking and

problem solving is promoted. Students should think of big ideas relating to the initial phenomena, analyze and think critically on the observance at hand as well as formulate hypothesis' for potential solutions to the problem in the engagement section. Students should continue to think critically, analyze, and problem solve the initial phenomena in the explore, explain, elaborate and evaluate sections with performance tasks, literacy, art, multimedia, etc. throughout the process.

The 5E model encourages both group and individual activities and projects all the way through the process. Students should engage in debates, and discussions. Students should also explore with authentic experiences, both individually and in groups, as well as manipulate simulations. Students should role play, be provided demonstrations and show proper modeling during the explain section. Students should have debates, discussions, performances and authentic experiences by elaborating on the phenomena through cross-curricular connections. Lastly, students should be evaluated by individual and group projects, and other authentic assessments such as performances and creating products that display mastery on the content.

Since the 5E model gauges' student's prior knowledge from the start in the observance of the phenomenon, differentiation of content can easily be modified early on in the process. Students are also experiencing the content through a variety of instructional strategies that promotes diversifying learning styles and multiple intelligences. Student interest in the content is elaborated during the Next Step Inquiry activities where students propose questions they ponder related to the content and complete appropriate research to find possible solutions.

The curriculum also promotes authentic avenues of learning both in and outside of the classroom by allowing students to discuss and debate possible solutions and reasoning based on prior knowledge that the students bring with them to the discussions. Also, the Career Connections features enables the students to related the content to applications outside of the school in a variety of careers. STEMscopes curriculum is the science curriculum to enhance 21 st century skills that are much needed in many career today. Like it has been stated, students are continuously having meaningful and productive discussions on the phenomena as well as formulating initial solutions and reasoning's in relation to the phenomena which promotes critically thinking and problem solving skills that are essential in the 21 st century. Students proceed through the sections, self-adjusting and modifying their original hypothesis based on new or relevant information gathered in the process.

The curriculum also has a feature that allows the lessons, activities and assignments to be accessed by students online whenever the teacher decides to release the particular section. The curriculum also promotes the use of online simulations that the students can manipulate that will provide them more in depth knowledge on the phenomenon. Creativity is a must for students in our ever changing society and this particular curriculum puts creativity as one of its core skills throughout the learning process, from the engagement of the phenomena presented, to the products to be created to show mastery in the evaluation or Accelerate section.

Assessments

Since this curriculum provides such a diverse amount of ways for students to show their understanding and mastery of the content, student assessments come in a variety of avenues throughout the process in order to drive further instruction. Assessments at each section are congruent and aligned with the content the students are actually engaging in. The assessment for the engagement section may be informally completed based on discussions or debates on possible solutions or reasoning's. Assessments for the exploration section may be informal or formally conducted as the student completes hands on activities such as performance tasks or labs. Assessments in the explanation section may be selection type or open ended in regards to the literacy, experience or multimedia activity that the students participated in. Assessments in the elaboration section may involve informal discussions, debates, role-playing or authentic experiences based on how the students can make connections with other subjects or prior knowledge. Finally, assessments in the evaluation sections should be formal and summative selection type, constructed response, claim-evidence-reasoning assessments or product creation assessments.

The curriculum provides rubrics for evaluating but typically schools or districts make decisions on which rubrics they want their teachers to use to gauge student mastery. Students that do not show proficient mastery of the desired learning outcomes in the evaluation section are provided with remedial activities to engage in. This is intended to provide the necessary means to show the necessary growth for students who are struggling. The curriculum provides translated materials for ELL students in Spanish for grades K-5 but have not been currently provided for those students in higher

grades. Students should continuously self-assess their initial hypothesis on the solution to the phenomenon throughout the 5E model. This initial understanding should be modified and adjusted as more knowledge is gathered as the students go through the process.

Resources

STEMscopes has an abundance of resources for teachers to access in order to best serve their students in each lesson. Each unit the teacher is supplied with explicit teacher directions, and student directions. These directions also include answer keys or examples of desired outcomes. The curriculum also provides teacher handouts for labs, literacy, and assessments. This is convenient for teachers to access. No longer do teachers need to search through a variety of sources to find these handouts and piece them together throughout the unit or chapter. On the Home feature, teachers are supplied with a materials list of consumables and resources for the whole storyline unit or chapter. Finally, within the curriculum, internet multimedia sources and other appropriate materials that a teacher may need to access are easily located in the Teacher Toolbox feature.

Conclusion

In conclusion, curriculum leaders should be aware of the many aspects of an effective curriculum. Curriculum should feature goals that are explicit and easily available to educators, students and the community. As it has been stated “ curriculum goals provide guidelines for determine the learning experiences” (Parkay, et al. 2014, pg. 7). If the curriculum does not provide educators, students and interested stakeholders with these goals, there can

be a loss of direction for the learning to take place. The curriculum should also be aligned and in accordance with district, state or national standards to ensure that the students are learning to appropriate content. Curriculum should state the learner expectations, include pacing guides, embedded literacy and technology, effective teaching strategies, learning activities, a variety of assessments and an assortment of resources for teacher, students and parents to access.

The curriculum analyzed, STEMscopes, embodied many of the aspects of an effective curriculum. Although this curriculum is science oriented, such practices, strategies and the abundance of resources available could and should be used to create similar digital curriculums across other course subjects. STEMscopes, needs to make modifications to the differentiation throughout the units based on readability levels and translated curriculums for higher grades. STEMscopes is not the perfect curriculum but I will continue to advocate for the use of it in Black County Schools. It is a new curriculum that still has to make the proper modifications going forward to improve the learning experience for all students.

References

- Parkay, F. W., Anctil, E. J., & Hass, G. (2014). Curriculum leadership: Readings for developing quality educational programs.(10thed.). Boston, MA: Pearson.