ABSTRACT OF CAPSTONE

Robin L. Hyden

The Graduate School

Morehead State University

June 20, 2018

NEXT GENERATION SCIENCE STANDARDS WEBPORTAL: TECHNOLOGY FOR THE 21ST CENTURY SCIENCE TEACHER

Abstract of Capstone

A capstone submitted in partial fulfillment of the
Requirements for the degree of Doctor of Education in the
College of Education
At Morehead State University

By

Robin L. Hyden

Paintsville, Kentucky

Committee Chair: Jeannie Justice, Associate Professor

Morehead, Kentucky

June 20, 2018

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789 East Eisenhower Parkway
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NEXT GENERATION SCIENCE STANDARDS WEBPORTAL: TECHNOLOGY FOR THE 21ST CENTURY SCIENCE TEACHER

On September 20, 2011 Kentucky was announced as a Lead State Partner in the development of the Next Generation Science Standards (NGSS) with Achieve, Inc. During the June 5, 2013 meeting the Kentucky Board of Education approved Next Generation Science Standards and announced they would be implemented into the K-12 classrooms.

Kentucky public school teachers became increasingly nervous about implementing the new standards due to several new aspects of the standards, such as engineering and technology. Teachers worried they would not have resources to teach the new standards effectively and were concerned when they sat down to discuss the deconstruction of each standard. In my current school district, teachers spent hours of professional development in creating instructional units for each domain. After the creation of our instructional units, we housed them on OneDrive, which many teachers found to be frustrating and hard to navigate. The Next Generation Science Standards WebPortal capstone project was created to ease the frustration of accessing the teacher created units and allows teachers the ability to easily access resources needed to implement each standard into their classrooms.

The NGSS WebPortal was created using Google Sites which is a program in the Google Apps For Education and hosted at the https://sites.google.com/johnson.kyschools.us/primaryngss/home domain.

KEYWORDS: Next Generation Science Standards, Professional Development, STEM Education, Student Achievement, Elementary Education

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Candidate Signature

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Date

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By

Robin L. Hyden

Approved by

_____
Dr. Robert Boram
Committee Member Date

_____
Dr. Rachael Holbrook
Committee Member Date

_____
Dr. Jeannie Justice
Committee Chair Date

_____
Dr. Timothy L. Simpson
Department Chair Date

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DEDICATION

This capstone is dedicated to my husband, Jeremy, who has always stood by my side and provided support during this whole process. I know I may have driven you crazy during this pursuit but we made it.

To my children, Jaxson and Matilynn, I did all of this for you. To my son Jaxson, you are the most caring and thoughtful child I could have wished for. You always checked to see how I was coming along with my homework and wondered when I would be finished. I want you to know that mommy is finally finished with her work, let's go play! To Matilynn, I want you to always keep your personality and drive. I did all this to demonstrate that girls can accomplish their goals if they never give up. Don't ever give up on a dream no matter how big or small. Just because you are from a small town doesn't mean you need small town dreams.

To my grandparents for giving me my life. To my grandmother, Wilma Jean, for instilling in me the importance of hard work and an education. I owe my life to you for all the sacrifices you made to ensure that I never went without. I only wish you were here to see me finish.

ACKNOWLEDGEMENTS

This capstone was made possible by the all the amazing educators from Meade Memorial to Central Elementary. I have been privileged to work with some of the best and brightest educators across the state. You have given advice and suggestions which have molded me into the educator I am today.

To my Doctoral Committee, Dr. Jeannie Justice, Dr. Robert Boram, and Dr. Rachael Holbrook for agreeing to take time out of their busy schedules to focus on me and to ensure the success of my project. A special thanks to my Doctoral Chair, Dr. Jeannie Justice for being my rock, my support, and my guide through this process and her unwavering belief in me. I would not be here without you.

Thank you to Johnson County, Kentucky school district for providing me with opportunities to develop my leadership skills and to ensure that we all are the best educators we can possibly be. This project would not be possible without Mrs. Vanessa Dials suggesting that we need help implementing the new Next Generation Science Standards into the classroom.

Last, but certainly not least, I want to thank all the members of Cohort 4. Through the course of this adventure you became friends that pushed, encouraged, and held me accountable and for that I am forever thankful.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The core purpose of this capstone.

The core purpose of this capstone is to provide teachers in the Johnson County School District with a Next Generation Science Standards Web Portal that will house resources that are aligned with Next Generation Science Standards. This site was designed to house resources such as sample lesson plan ideas, professional development videos, the Through Course Task (TCT) video series, and links to our newly adopted STEMscopes curriculum. For the 2017/2018 school year, Kentucky schools are required to submit two Through Course Tasks to their supervisor. These tasks are then reviewed at the Kentucky Department of Education to determine the interperentiation of the task and NGSS throughtout the state. The video series that I helped create, demonstrated the implementation process of the TCT. This video series is important for any teacher who may not understand the process in which they should be implemented. This capstone was created for K-5 teachers across the district and to ease science anxiety so implementation will be effective in their classrooms. The Webportal will be an ongoing, eveolving site as TCT's, and professional development resources become available. These resources will continued to be updated by the building representative for each school as needed.

Who is the capstone meant to impact?

This capstone project will impact all 150 K-5 educators, students, and administrators in the Johnson County, KY School District. Primary teachers often feel overloaded with teaching the newly adopted Common Core State Standards and they

feel like implementing Next Generation Science Standards into the classroom is "just another thing" to do (Mangiaracina, 2015). My goal for this capstone project is to provide teachers who feel overwhelmed with a sense of security and reassurance.

How was the capstone project implemented?

In April, 2015, the Kentucky Department of Education announced they were rolling out Google Apps for Education (GAFE). The GAFE suite comprises Gmail, Google Drive, Google Groups, Google Calendar, Google Docs, Google Sites, and Google + (Kentucky Department of Education, 2015). Google Apps for Education is a powerful cloud-computing solution that works for students regardless of their location, time, or the type of device being used. GAFE is used by thousands of schools and universities worldwide to make effective use of collaboration tools for students and faculties, with the primary objective of enhancing teaching and learning (Awuah, 2015).

In particular, GAFE tools enable users to work together virtually on documents, presentations, and projects in the cloud (Awuah, 2015). By introducing GAFE, teachers now have the ability to access Google apps using a single sign on (SSO). This SSO allowed teachers to use two or more programs simultaneously and eliminated the need for multiple usernames and passwords for various programs (Kentucky Department of Education, 2015).

Johnson County School District is currently a Google-based platform district. By using Google Sites (a program within GAFE), to create the webportal and hosting it at https://sites.google.com/johnson.kyschools.us/primaryngss/home will allow

teachers to have a one-click option to log in and will eliminate having multiple site passwords for teachers to remember. Since Google Sites is a cloud computing program it has several advantages over traditional computer based programs. Google Apps eliminates all compatibility issues for teacher trying to work on documents/assignments at school and home. It provides an integrated solution where everyone will have access to their work both at school and at home in a collaborative environment without the worry of losing or incompatibility data (Nevin, 2009).

During district mandated monthly Professional Learning Community meetings, Johnson County primary teachers are currently working on creating science units, lessons, and assessments to implement Next Generation Science Standards (NGSS) into the classroom. Teachers were paired up into teams to locate resources and materials that would align to each science domain. As we found the resources we were to upload them to the OneDrive file that was created for each domain. What we found by using OneDrive to upload and store resources was that it was not user friendly and many quit uploading resources all together. The simplicity of using Google Sites to create my NGSS WebPortal will allow teachers to upload directly to their domain by using a simple one click log in function.

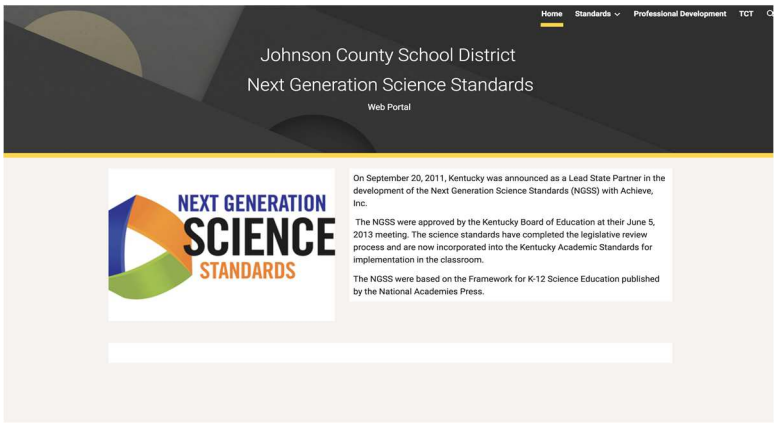

Figure 1. The homepage of the Johnson County School District NGSS WebPortal.

The homepage of the Johnson County NGSS WebPortal as seen in Figure 1 displays the simplicity of design. At the top of the page you will find links to standards, professional development resources, and links to the most up to date Through Course Tasks that are available along with the Through Course Task video series that was created in partners with the Kentucky Department of Education and the Kentucky Valley Educational Cooperative.

Figure 2. The homepage of the Kindergarten standards with links to each science topic.

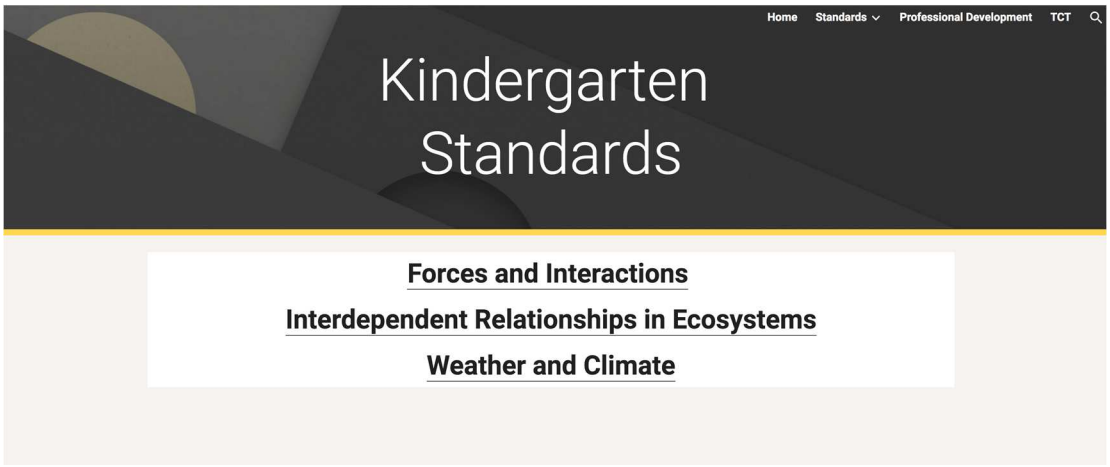

Figure 2, is a detailed description of each grade level standard page. On each grade level standard page, you will find links to each domain that has instructional resources to implement each standard into the classroom. Many of these resources are recommended by the Kentucky Board of Education and several are teacher created instructional units.

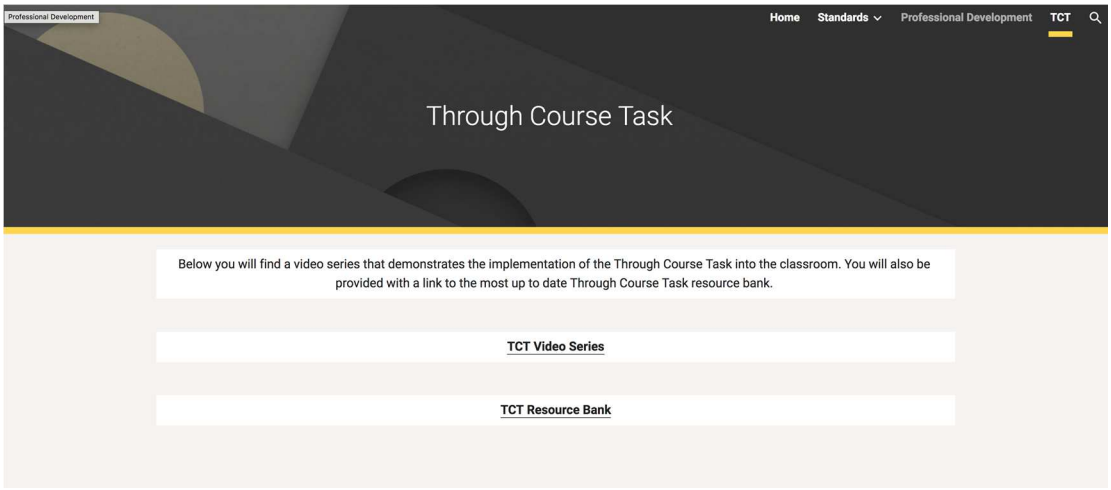

Figure 3. The Through Course Task homepage.

Through Course Tasks are an important part of NGSS in the classroom. These new tasks are written by a panel of teachers from across the state of Kentucky. Each year teachers collaborate to review student work samples and revise the task based on student work and feedback. Each grade level is given two separate tasks that are implemented after the specific standard is taught. A link to the three-part TCT video series along with a direct link to SharePoint, which houses the most current TCT, are housed.

Why were this capstone and related strategies selected?

In 2001, the National Academies Press released *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*, the first step in a two-step process aimed at developing new standards for science education (Bartholomew, 2015). Educators say NGSS represents a seismic shift in the way

science is taught and learned in the classroom. Instead of the traditional teaching methods-in which students are exhorted to remember facts and formulas, the emphasis is on demonstrating the scientific process (Schachter, 2013). These processes involve collaboration, creativity, and uncertainty and can be exciting as new insights emerge (Krajcik & Merritt, 2012).

In 2012, the Kentucky Department of Education adapted the Next Generation Science Standards as their main science standards. Gov. Steve Beshear implemented the new Kentucky Next Generation Science Standards under his own authority, after a legislative review panel rejected them. A spokesman for the governor said in a statement that the governor "views these standards as a critical component in preparing Kentuckians for college and the workforce," and that they should be implemented despite the rejection (KY. to move forward on science standards, 2013).

Since its inception, the Next Generation Science Standards (NGSS) blue print has attracted interest from more than 40 states in the United States. The overall objective of these proposed changes is to align K-12 science education with current trends in technology and career needs (Harris, Sithole, & Kibirige, 2017). According to the National Academies of Sciences, Engineering, and Medicine (2015) "many American students and adults still fail to grasp fundamental scientific concepts and to understand the process of scientific discovery". In addition, emerging trends point to a technology-based education in the future. According to the Next Generation Science Standards Lead States there is need to develop science standards which will stimulate and build students' interest in the science, technology, engineering, and mathematics

(STEM) fields. STEM education refers to teaching and learning in the fields of science, technology, engineering, and mathematics (Kennedy & Odell, 2014). Thus, the K-12 STEM fields in the United States need to be strengthened, the NGSS Lead States (2013) described the K-12 STEM field talent pipeline as impermeable because not many students are entering the field. One of the approaches towards this goal is to implement Next Generation Science Standards (NGSS) (Harris, Sithole, & Kibirige, 2017).

Studies have shown that introducing STEM education at an elementary level has shown to produce a higher interest in STEM careers (Dejarnette, 2012). Individuals begin to develop perceptions and knowledge of STEM prior to and during their elementary education, which increases the importance of teaching STEM at the elementary level (Nadelson, Callahan, Pyke, Hay, Dance & Pfiester, 2013). Workforce preparation must begin in primary and secondary educational settings. Teachers are perfectly positioned to increase student awareness of and interest in careers in engineering and technology; unfortunately, they are often not well informed about jobs in these fields (Nugent, Kunz, Rilett, & Jones, 2010). Primary school teachers are, in the main, general practitioners by the way of their training and their work in developing students' abilities across a number of key learning areas. Very few have specialized in a particular subject area in their teacher training due to the nature of primary education (De Nobile, 2007). However, it is unrealistic to expect teachers to teach or promote engineering when most K-12 teachers do not have a good understanding of engineering practices, applications or careers.

Furthermore, most undergraduate teacher education programs do not include engineering concepts or engineering design practices in their curriculum (Pinnell, Rowly, Preiss, Blust, & Beach, 2013).

A lack of knowledge could also make a teacher feel unsure about his/her abilities, which would be manifested in a reduced confidence in teaching STEM, a reduction in efficacy, and an overall feeling of being uncomfortable teaching STEM concepts (Nadelson, 2013). It has been repeatedly cited (Rockland, Bloom, Carpinelli, Burr-Alexander, 2010, Robelen, 2013) that elementary teachers' negative beliefs about science had yielded devastating results: poor attitudes and even anxiety toward science in students, and a drop in teachers' confidence and time spent teaching and helping students involved in scientific activities (Bursal, 2012).

In order for students to become engaged in science education, there first needs to be a change in the classroom starting at the elementary level (Sabel, Forbes, & Zangori, 2015). Teachers will have to redesign their science instruction by changing how they teach and incorporate more investigational activities (Robelen, 2013). According to Merrill (2011, p.13), "STEM teaching and learning focuses on authentic content and problems, using hands-on, technological tools, equipment, and procedures in innovative ways to help solve human wants and needs". The most important changes are: the way teachers teach, the way they continue to grow as teachers, how student learning is assessed, the way content is defined, how science programs are built, and how the entire school system supports the needed reforms (Nadelson, 2013).

Having a WebPortal readily available with resources, professional development videos, assessments, and activities, means that teachers will no longer have to spend hours searching through websites or Teachers Pay Teachers to find materials that align with each standard. This webportal provides teachers with everything they need to feel successful while they are implementing NGSS into their classroom.

When was the capstone implemented?

Development of the NGSS webportal began in January 2018 and will be introduced in July 2018 during grade level professional development week. District teacher leaders in grades K-5 have been established by district school principles and will be responsible for maintaining their grade level standards. They will also be responsible for monitoring the site and making sure the material being uploaded is congruent and aligns with each standard.

Impact of the capstone?

Research has shown that decreasing teacher anxiety students' success would increase (De Nobile, 2007). Nadelson (2013) stated that a lack of knowledge could make a teacher feel unsure about his/her abilities, which would be manifested in a reduced confidence in teaching STEM, a reduction in efficacy, and an overall feeling of being uncomfortable teaching STEM concepts. This lack of knowledge is often referred to as science anxiety. Science anxiety has been defined as a fear of or aversion toward science concepts, scientists, and science related activities (Bursal & Paznokas, 2006).

Limitations with the study?

There are two types of threats to validity: internal threats and external threats. Internal validity threats are experimental procedures, treatments, or experiences of the participants that threaten the researcher's ability to draw correct inferences from the data about the population in an experiment (Creswell, 2014).

The internal threats to validity that my webportal will face are:

1. History. Teaching standards in the K-12 education field are always evolving. As of 2018, Kentucky teachers are currently teaching NGSS in the classroom. They are also implementing Through Course Task lessons to gauge understanding of content and thought process. These tasks are currently being written by teachers across the state of Kentucky and have changed over the course of the last two years based on feedback that has been submitted to the commissioner of education.
2. Selection. Teachers across the K-12 field have varying levels of technology skills. Some teachers are more advanced in GAFE and can operate all applications with ease. Others, are not as advanced and still struggle with these applications. This threat to validity has the potential to determine how much and who is uploading resources. Those teachers who have more advanced technology skills would be able to navigate, locate resources, and upload teaching units with ease while others could struggle. This struggle could also affect the amount of time teachers actually use the

portal. The other potential limitation of this study is that it is currently limited to the K-5 elementary teachers within the Johnson County, KY school district.

External validity threats arise when experimenters draw incorrect inferences from the sample data to other persons, other settings, and past or future situations (Creswell, 2014).

1. Generalizability. Generalizability is a measure of how well a researcher thinks their project results can be extended to the population as a whole. By creating the NGSS WebPortal, I am generalizing that all K-5 elementary science teachers in Johnson County, Kentucky, will use this portal and find it to be effective in the implementation of NGSS into their classroom.

Reflection

After the creation of my capstone project, I found uploading resources to be a very effective way to distribute resources to all K-5 science teachers. Teachers are more than willing to provide feedback on how to continually make the site more user friendly. They are also excited to save time when looking for lessons and resources to teach each standard. This project will be ongoing as long as NGSS is being taught in the classroom. Each year, during the summer, as teachers meet in their grade level professional learning communities, instructional units will continue to be tweaked based on student and teacher feedback. I will also be monitoring material that is being uploaded to ensure it is being uploaded to the current standard and the resources are relevant and congruent to each domain.

As I was constructing the WebPortal with Google Sites, I found a few advantages and disadvatages to using this platform. First, the reason I chose this platform was primarily due to the ability to collaborate. Google Sites is built for collaboration. Team members can work together and make edits and uploads easily. Second, Google Sites automatically backs up the site on Google Drive instantly. This design feature saved me from accidently closing out and loosing what I had designed. Next, uploading documents and links was very simple the drag and drop option made the design process quick and easy.

There were a few design issues I encountered. First, I was limited with the font desings and sizes to use on my slides. There were very little font choices to choose from and I was also limited on where I could place the font and titles. Also, unlike Microsoft products where you can choose the size of the font, you did not have this option on Google Slides. Many of the font sizes and options is not what I would have chosen but due to lack of options I had to choose what I thought was best. Overall, this program was great to design with and flows very easily with the GAFE that Kentucky teachers are expected to use.

References

Awuah, L.J. (2015). Supporting 21st-century teaching and learning: the role of Google apps for education (GAFE). *Journal of Instructional Research*, 412-22.

Bartholomew, S. (2015). Who teaches the "STE" in STEM? *Technology and Engineering Teacher*, 75 (2), 14-19.

Brown, R., Brown, J., Reardon, K., & Merrill, C. (2011). Understanding STEM: Current perceptions. *Technology & Engineering Teacher*, *70*(6), 5-9.

Bursal, M. (2012). Changes in American preservice elementary teachers' efficacy beliefs and anxieties during a science methods course. *Science Education International*, 23 (1), 40-55. Retrieved from: http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=EJ975549

Bursal, M., & Paznokas, L. (2006). Mathematics anxiety and preservice elementary teacher's confidence to teach mathematics and science. *School Science & Mathematics,* 106 (4), 173-180,

Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches.* 4th ed. Thousand Oaks, California: SAGE Publications.

De Nobile, J. (2007). Primary teacher knowledge of science concepts and professional development: Implications for a case study. *Teaching Science: The Journal of the Australian Science Teachers Association*, *53*(2), 20-23.

Dejarnette, N. K. (2012). America's children: Providing early exposure to STEM (Science, Technology, Engineering, Math) initiatives. *Education*, *133* (1), 77-84.

Harris, K., Sithole, A., & Kibirige, J. (2017). A needs assessment for the adoption of Next Generation Science Standards (NGSS) in K-12 education in the United States. *Journal of Education and Training Studies*, 5(9), 54-62.

Kenndy, T.J., & Odell, M.L. (2014). Engaging students in STEM education. *Science Education International*, 25 (3), 246-258

Kentucky Department of Education. (April 21, 2015). Google apps sso to office 365 integration. Retrieved from http://education.ky.gov/districts/tech/Documents/GAFE+ActiveDirectory_v%201%206.pdf

Krajcik, J., & Merritt, J. (2012). Engaging students in scientific practices: What does constructing and revising models look like in the science classroom? *Science Teacher*, *79* (3), 38-41.

Mangiaracina, M. m. (2015). Adapt or discard? A teacher shares his experience implementing the Next Generation Science Standards, from struggle to success. *Science & Children*, *53*(4), 30-32.

McConnell, T., Parker, J., & Eberhardt, J. (2013). Assessing teachers' science content knowledge: a strategy for assessing depth of understanding. *Journal of Science Teacher Education*, 24 (4). 717-743.

Nadelson, L. S., Callahan, J., Pyke, P., Hay, A., Dance, M., & Pfiester, J. (2013). Teacher STEM perception and preparation: Inquiry-based STEM professional development for elementary teachers. *Journal of Educational Research*, *106* (2), 157-16.

Nevin, R. (2009). Supporting 21st century learning through Google apps. *TeacherLibrarian*, 37(2), 35-38.

Nugent, G., Kunz, G., Rilett, L., & Jones, E. (2010). Extending engineering education to K-12. *Technology Teacher*, *69*(7), 14-19.

Pinnell, M., Rowly, J., Preiss, S., Franco, S., Blust, R., & Beach, R. (2013). Bridging the gap between engineering design and PK-12 curriculum development through the use the STEM education quality framework. *Journal of STEM Education: Innovations & Research*, *14*(4), 28-35.

Robelen, E. W. (2013). Teachers shift instructional approaches to bring Next Generation into class. *Education Week*, *32*(32), 1.

Rockland, R., Bloom, D. S., Carpinelli, J., Burr-Alexander, L., Hirsch, L. S., & Kimmel, H. (2010). Advancing the "E" in K-12 STEM education. *Journal of Technology Studies*, *36*(1), 53-64.

Sabel, J. j., Forbes, C., & Zangori, L. (2015). Promoting prospective elementary teachers' learning to use formative assessment for life science

instruction. *Journal of Science Teacher Education*, *26*(4), 419-445.

Sahin, A., & Top, N. (2015). STEM students on the stage (SOS): Promoting student voice and choice in STEM education through an interdisciplinary, standards-focused, project based learning approach. *Journal of STEM Education: Innovations & Research*, 16 (3), 24-33.

Schachter, R. (2013). Get ready for NextGen science. *District Administration*, *49* (6), 45.

Supovitz, J.A., & Turner, H.M. (2000). The effects of professional development on science teaching practices and classroom culture. *Journal of Research in Science Teaching*, 37 (9), 963-980.

VITA

ROBIN L. HYDEN

EDUCATION

May, 2007	Bachelor of Arts Morehead State University Morehead, Kentucky
May, 2011	Master of Arts Morehead State University Morehead, Kentucky
Pending	Doctor of Education Morehead State University Morehead, Kentucky

PROFESSIONAL EXPERIENCES

August, 2007- Present	Teacher Johnson County School District Paintsville, Kentucky