Pilot Results: A STEM Approach to Learning Resilience as a Protective Factor to Adolescent Suicide

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Abstract

Resilience instruction was provided to eighth grade students over two sessions. The instruction looked at current Internet of Things (IoT) technology to construct a framework for examining resilience, self-efficacy, self-esteem, problem-solving, and the social support system. These elements are consistent with the World Health Organization as protective factors to suicide. The instruction asks if current technology can serve as a means to better understand the social support system by examining parallels in technology and social support within the context of a STEM curriculum. Suggestions for future directions and research are discussed.

Background

Stressful life experiences can be a contributor to the mental and physical health of children and adolesents. These stresses are not limited to low-income or disadvantaged youth (Luthar & Barkin, 2012; Ansary, McMahon, & Luthar, 2012). High achieving students, even those having certain socioeconomic advantages, can often struggle with the expectations of their parents and communities (Spencer, Walsh, Liang, Mousseau, & Lund, 2018). Left unchecked, these stresses, often in conjunction with other risks, can unfortunately lead to a number of debilitating issues, perhaps even suicide. Indeed, suicide is the second leading cause of death among children ages 10-14 and among young people ages 15-34 (CDC, 2016).

Resilience is the development of skills needed to manage stress in an optimal way, or an ability, perception or set of beliefs which buffer individuals from the development of suicidality in the face of risk factors or stressors (Why, 2018). The World Health Organization (WHO, 2014) looks at resilience at individual and community levels by recognizing the role of protective factors relative to suicide risk factors. A key protective factor is development and sustainment of healthy social support system where we both give and receive support. Another factor is spirituality as an access to a socially united and supportive community with a shared set of values. And, finally, having lifestyle practices of positive coping strategies, good self-esteem, self-efficacy and effective problem solving-skills. This includes the ability to reach out and find help when needed, which can often be a struggle in young peoples lives (McManama O'Brien, LeCloux, Ross, Gironda,& Wharff, 2017).

Ideally, we want these protective factors in place and practiced to best address personal challenges before they escalate into crises. But, introducing additional learning into existing school curricula often poses logistical and time constraints. By taking an approach that neither pathologizes nor imposes a significant shift from the focus of the curricula, the concepts of social support and resilience can be layered onto existing curricula to create additional insight and

transfer of learning opportunities. One area where such layering can occur is STEM, a curriculum that focuses heavily on the subjects of Science, Technology, Engineering, and Mathematics. STEM learning is intended to increase interest and literacy in the areas of science and technology and encourage higher education and associated careers.

To further the concept of a social support system, this layered learning approach first uses small-group problem-based learning to introduce positive coping skills and social support and then uses technology to illustrate the development of a personal social support through the use of visual programming objects. These objects are used to construct an application or "app" that allows the learner to contact members of that learner's social support system using the Internet of Things (IoT) communications. By understanding the roles that computer programming objects play to create a system, the learner also recognizes the distinct roles people play within support systems and the effort needed to effectively communicate. Thus, the parallels provided through using highly motivating technology to develop a computer system and that of developing a social support system further cements the importance of social support while fostering problem-solving skills, self-esteem, and self-efficacy.

If we again look to the protective factors set forth by the World Health Organization, that is development of social support systems and having lifestyle practices of positive coping strategies, good self-esteem, self-efficacy and effective problem solving-skills, a number of questions arise with regard to the proposed learning. Are the learners able to apply the positive coping skills to real life challenges? Are the learners better able to understand the role of a social support system? Can technology serve as a means to better understand resilience and the social support system. And, is this approach sufficiently motivating to hold the interest of eighth grade learners?

Method
Ten eighth grade male students from an urban charter school formed a convenience sample for this pilot study. Instruction occurred in two sessions over two consecutive weeks at the end of the spring semester 2018. Each session was under two hours in length inclusive of pre and post testing. Two researchers and the students' science instructor presented the instruction. The students were tested pre instruction and following the second session using the Resiliency Scale for Children and Adolescents (Prince-Embury, 2011).

The first session explored positive coping strategies, or skills, in a group problem-based learning setting. Of the five skills, titled Belief, Persistence, Strength, Trust, and Adaptability for the learning, Belief, Trust, and in part, Strength were addressed. Groups of two students worked together to answer the following consecutive questions for each skill.

• Think of a time in your life when you successfully used this skill or something much like it.
• Apply this skill to a current challenge in your life. Write about the challenge you or one your group is currently facing and how you will use the skill to meet the challenge. Post your completed group response on the wall at the back of the room.

- In your own words write down what is most important or useful to you about this skill. Again, post it to the wall.

The repetition of the two-skill questioning was intended to build upon prior resilience successes, foster problem-solving skills, build self-efficacy, and demonstrate the role of positive coping skills. Responses were posted anonymously with the intent of providing a visual mechanism demonstrating the effectiveness of a social support system while building self-esteem. Each student was provided a length of parachute cord and as each skill was completed, students tied a knot in the cord. At the completion of the first session, each student had three knots tied in the cord. The students were then asked, as homework, to teach someone in their social support system, e.g. parent, the three skills. Once they had completed that exercise, they were instructed to tie the ends of the parachute cord together with the expectation that all of the students would return with the cords tied.

The second session, applying the Persistence and Adaptability skills using technology, focused on the process of personal change more so than on the development of a technology device. Students worked in groups of two. This STEM exercise was sectioned into four components each having reflective questions. The questioning was performed as a group discussion.

Raspberry Pi Setup (Raspberry Pi, n.d.)
- How did this particular technology exercise help you to begin to understand and adapt to change brought about by technology?
- How did the technology enable you to better understand and use resilience and a social support system? More specifically, now that you have assembled the pieces necessary to make the Raspberry Pi into a working system, do you find parallels to roles individuals play within a social support system?
- How did the technology allow you to better understand the skills of Trust and Adaptability?

Using Node-RED (Node-RED, 2018)
- How did this particular technology exercise help you to begin to understand and adapt to change brought about by technology? More specifically, do you recognize that you needed to adapt your thinking, your beliefs, and persist in order to get a computer application to work?
- How did the technology enable you to better understand and use resilience and a social support system? More specifically, now that you have got the Node-RED application to work with you, do you find parallels to working with individuals within a social support system?
- How did the technology allow you to better understand the skills of Trust and Adaptability?

Beginning Hello World Node-RED Application
- How did this particular technology exercise help you to begin to understand and adapt to change brought about by technology? More specifically, do you better understand the concept of programming?
- How did the technology enable you to better understand and use resilience and a social support system? More specifically, now that you have created a program made of nodes where each

had a specific role to play, do you find parallels to roles individuals play within a social support system?
• Did the technology allow you to better understand the skills of Trust and Adaptability?

Simple MQTT (MQTT, 2018) Node-RED Application
• How did this particular technology application enable you to begin to understand and adapt to change brought about by technology? More specifically, do you have a better understanding of such concepts as a system, programming, and communication?
• How did the technology enable you to better understand and use resilience and a social support system? More specifically, now that you have created a program made of nodes that each have a specific role to play and got them to work together, do you find parallels to roles individuals play within a social support system?
• How did the technology allow you to better understand the skills of Trust and Adaptability?

Results
One student did not attend the second session due to illness and was eliminated from the evaluation. Results from Resiliency Scale for Children and Adolescents showed significant gains in the self-efficacy pretest (M = 26.22, SD = 4.79) scores to the post test (M = 28.67, SD = 4.0), t(8) = 2.63, p < .05.

Reflective student responses demonstrated a largely positive outcome to the research questions. With regard to the first question, are the learners able to apply the positive coping skills to real life challenges? The students demonstrated the ability to work together in problem-solving groups to apply positive coping skills to their challenges. Posted student results demonstrated application of the resilience skill to personal challenges.

Are the learners better able to understand the role of a social support system? Based on the posted student responses to the skills challenges, there appeared to be an improved understanding of the concept of social support system and its role in dealing with personal challenges during the first session, particularly so when their group problem-solving group responses were posted as a class. Yet, not all of the students returned the second session with their parachute cords, so the "tied ends" aspect of skills sharing with someone in their support systems was potentially not fully realized by all, though students uniformly indicated that they had shard the learning with a parent.

Can technology serve as a means to better understand resilience and the social support system? Students appeared to recognize the parallels of the system between that of social support and that of creating a technology system. That is, they recognized that each element within a technology system has a distinct role to play and applied that to recognizing each person in a social support system has a role to play. Further, they were able to recognize the parallels between the visual programming objects and the distinct rolls they played to make a system work, and again apply that idea to the social support system. Finally, as the students completed their IoT exercise they

were rewarded and surprised to see other students within the class sending messages to the class again reinforcing the concept of a social support system working on a shared challenge.

Is this approach sufficiently motivating to hold the interest of eighth grade learners? The novelty of working with current technology and applying those concepts to resilience and the social support system appeared to maintain a high level of student involvement. The students responded positively to both the problem-based component of the first session and the technology component of the second session indicating satisfaction with the methods nor did they feel there should be any changes made to the methods.

Conclusion

Students need effective resilience tools to help cope with the stressful demands that are placed on them as well as serve as a protective factor to the consequences of prolonged stress. While this pilot provided some interesting and encouraging results, much more research is needed. This would include demonstrating greater student diversity over multiple grade levels, and methods to sustain the resilience and assure the social support system beyond an initial classroom encounter. Including familial resilience training akin to the two hour first session has shown good results in the past with adults and should be explored as an extension of the classroom experience (Marks & Callahan, 2018). Additionally, having teacher reinforcement on an ongoing basis would factor into sustainment. This might be something as simple as the teacher asking students what resilience skills have they used over the past day. Finally, blending resilience and social support into other areas of the curricula, such as STEM, minimizes time commitments while encouraging transfer of learning. Other existing curricula likely offer unique opportunities to integrate resilience and social support.

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