2019

Effect of Service-learning Participation on High School Attendance and Science Achievement

Julia Roscoe
Walden University

Walden University

College of Education

This is to certify that the doctoral study by

Julia Jendrusik Roscoe

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Salina Shrofel, Committee Chairperson, Education Faculty
Dr. Kimberley Alkins, Committee Member, Education Faculty
Dr. Beate Baltes, University Reviewer, Education Faculty

The Office of the Provost

Walden University
2019

Abstract

Effect of Service-learning Participation on High School Attendance and Science Achievement

by

Julia Jendrusik Roscoe

MA, Madonna University, 2007

BS, Eastern Michigan University, 2002

Project Study in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Walden University

August 2019

Abstract

Students at an alternative high school located in a northern Midwest state demonstrated low science achievement and high rates of student absenteeism. Students who do not attend school regularly and achieve in science courses are at risk of not graduating from high school, so teachers at the study school implemented a 16-day service-learning project embedded in a Grade 10 environmental science unit. The purpose of this study was to determine the effect of 10th-grade students' participation in the service-learning project on student science achievement and attendance. The theoretical framework was Kearsley and Shneiderman's engagement theory. Archival data from school and teacher records were used for this quasi-experimental pretest–posttest control group study. Data from 114 students enrolled in 6 sections of Grade 10 general science classes were retrieved. The Mann-Whitney *U* test was calculated to determine the difference in science achievement change scores and the difference in number of absent days between students who participated in the service-learning project and students who did not. The findings showed a significant difference for science achievement gain scores ($U = 1{,}982.5$, $p = .042$) but not for days absent ($U = 2{,}048$, $p = .008$). A professional development project was created for high school science teachers focused on implementing service-learning projects, which included suggestions on how to get students excited about attending the service-learning project and school. The findings from this study could be used to guide district decision-making about embedding service-learning projects into science courses to improve student achievement in science, thus, achieving positive social change.

Effect of Service-learning Participation on High School Attendance and Science Achievement

by

Julia Jendrusik Roscoe

MA, Madonna University, 2007

BS, Eastern Michigan University, 2002

Project Study in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Walden University

August 2019

Dedication

I dedicate this doctoral study to all students. I hope that my research and findings will generate more conversations about meeting the educational needs of all students with the implementation of service-learning projects in high schools. Service-learning projects provide best practice instruction, differentiation in the classroom, build stakeholder relationships, and teach students to become responsible, civically engaged citizens for life beyond high school.

Acknowledgments

I would like to thank my husband, Robert, and my daughter, Isabel, for supporting me every step of the way throughout my doctoral journey. My husband and daughter encouraged me, believed in me, and literally stood by my side for six consecutive years. I am forever grateful for my husband and daughter who supported me every day and weekend that I spent numerous hours on the computer researching and writing this study in order to fulfill my lifelong goal in education. I would like to thank my sister and am honored that she followed in my footsteps. I would like to thank my mother and father for always being there for me. I would like to thank my extended family and friends for counting on me to accomplish this "big degree" in education. I would like to thank God for providing me with ongoing strength, stamina, and resilience to become the education professional that I am today.

I would like to thank my first chair Dr. Rachel Pienta for her guidance. I would like to thank my doctoral committee for their time and efforts especially Dr. Salina Shrofel. Dr. Shrofel continuously supported me and provided me with expert advice throughout my study. I would also like to thank my principal, colleagues, and school district for being on board with me in implementing service-learning projects in science to provide innovative educational opportunities for our students.

Table of Contents

List of Tables

Section 1: The Problem

The Local Problem

Approximately 5 to 7 million students exhibit chronic absenteeism in the United States (Curry-Stevens & Kim-Gervey, 2016). In 2016, the U.S. Department of Education claimed that chronic absenteeism is a "hidden educational crisis" (p. 1). *Chronic absenteeism* is defined as students who miss 10% or more school days in a given academic year, which is the equivalent of 15 or more missed school days (Chang, Bauer, & Byrnes, 2019). Students who have high rates of absenteeism are at risk of falling behind in school (Balkis, Arslan & Duru, 2016; Singh, 2014). In low-income communities, high rates of student absenteeism are more prevalent, and the consequences are even more significant (Balfanz, 2016; Curry-Stevens & Kim-Gervey, 2016). High rates of student absenteeism reduce a teachers' ability to provide learning opportunities for those students who are absent (National Center for Education Statistics, 2016). Additionally, chronic absenteeism is a relatively new issue in schools, and research has shown that students achieve at higher levels when they attend school regularly compared to students who have high rates of absenteeism (London, Sanchez, & Castrechini, 2016).

Rationale

The local setting for this research study was an alternative education high school (pseudonym AHS) within AHS District. Over the past decade, students at AHS have demonstrated high rates of absenteeism. According to an internal report from the school under study, AHS is part of a city and surrounding communities that have experienced a steady decline in student attendance and achievement within the decade. Low science

achievement is a concern in AHS (Gulosino & Lubienski, 2011). Not a single student at AHS was able to pass the Statewide Annual Standardized Science Performance Assessment in the last 5 years. Thus, the local problem for this study was low science achievement and high rates of student absenteeism at AHS. Despite the efforts taken by faculty and administration and the resources provided to assist students, AHS students have demonstrated low achievement in science and high rates of absenteeism for 5 consecutive school years. As Table 1 shows, the number of students with chronic absenteeism has increased steadily at AHS. Despite decades of research and school-based interventions, U.S. high school student attendance rates are a concern for educators and policymakers (Freeman et al., 2015).

Table 1

Frequency of Students with Chronic Absenteeism in U.S. Alternative High Schools

School Year	AHS	AHS District	United States
2017-2018	57.7 (310)	24.0 (955)	11 (5 million)
2016-2017	56.0 (289)	21.7 (868)	13 (6.8 million)
2015-2016	55.8 (309)	16.6 (692)	13 (6.8 million)
2014-2015	45.2 (198)	27.4 (1,153)	13 (6.8 million)
2013-2014	44.4 (210)	26.7 (1,196)	13 (6.8 million)

Note. Source: U.S. Department of Education (2018).

The National Assessment of Educational Progress reports national achievement level assessment results for science every 5 years. Student performance on the National Assessment of Educational Progress is measured at four different levels: below basic, basic, proficient, and advanced. Of the high school students that took the National Assessment of Educational Progress science assessment in both 2009 and 2015, 40% scored below basic, as reported in Table 2.

Table 2

Achievement Level Percentage for High School Students Assessed in National Assessment of Educational Progress Science: 2009 and 2015

School Year	Below Basic	Basic	Proficient	Advanced
2015	40	38	20	2
2009	40	39	19	1

Note. Source: National Center for Education Statistics (2016).

Because of low science achievement and high rates of student absenteeism, AHS decided to implement a course-embedded service-learning project in Grade 10 science to encourage students to attend science class regularly and achieve in science. The purpose of this study was to determine the effect of high school student participation in the service-learning project on student achievement in science and on student attendance in science classes at AHS.

Definitions

Academic achievement: A change score determined by the difference between a pretest score and a posttest score on a science assessment that determined the extent to which students have mastered important content (Danielson, 2007).

Attendance: Defined and measured in my study as the number of days a student was absent from science class during a 16-day environmental science unit (National Standards for Student Attendance Data Reporting, 2012).

Service-learning: A form of experiential education that students can engage in with activities that address human needs and community needs together with structured opportunities aligned with courses and classwork designed to promote student learning and development (Schlesselman et al., 2015).

Significance

In this study, I determined the effect of student participation in a course-embedded service-learning project on science achievement and student attendance in science classes at AHS located in a northern Midwest state. The findings of my study can inform teachers, administrators, school districts, and stakeholders that embedding service-learning projects in science courses can improve high school science achievement but may not improve student attendance in science classes. The insights gained from my study will provide information to school district administrators and teachers to use when making decisions about improving student outcomes in high school science courses.

The results from this study can inform other high schools with low science achievement and high rates of student absenteeism. School districts and high schools with low science achievement may be able to use this study as they make decisions about embedding service-learning projects into science courses to improve science achievement. School districts and high schools with high rates of student absenteeism may be able to use the findings from this study in that course-embedded service-learning projects may not improve student attendance in science classes. Thus, my study contributes to positive social change by informing and encouraging high school science teachers to embed service-learning into science courses in an effort to improve student achievement in science.

Research Questions

The problem that this study addressed was student low science achievement and high rates of student absenteeism at AHS. The purpose of this study was to determine the

effect of high school student participation in a 10th-grade course-embedded service-learning project on student achievement in science and on student attendance in science classes. In this quantitative, quasi-experimental, pretest–posttest control group design using archival data from school and teacher classroom records, the following research questions (RQs) were addressed:

RQ 1: What is the difference in student achievement as measured by pre to posttest score changes on an Environmental Science Pretest–Posttest between students who participated in a course-embedded service-learning project and students who did not?

$H_0$1: There is no significant difference in student achievement as measured by pre to posttest change scores on the Environmental Science Pretest–Posttest between students who participated in a course-embedded service-learning project and students who did not.

$H_1$1: There is a significant difference in student achievement as measured by pre to posttest change scores on the Environmental Science Pretest–Posttest between students who participated in a course-embedded service-learning project and students who did not.

RQ 2: What is the difference in student attendance in science as measured by the number of absence days during a 16-day environmental science unit between students who participated in a course-embedded service-learning project and students who did not?

$H_0$2: There is no significant difference in student attendance in science as measured by the number of absence days during a 16-day environmental science unit

between students who participated in a course-embedded service-learning project and students who did not.

$H_1$2: There is a significant difference in student attendance in science as measured by the number of absence days during a 16-day environmental science unit between students who participated in a course-embedded service-learning project and students who did not.

Review of the Literature

In this review of the literature, I discuss research about service-learning and related student outcomes such as achievement, attendance, motivation, civic engagement, and posteducation career path. I used the following keywords to search for relevant peer-reviewed literature: *service-learning*, *science*, *blended online learning*, *academic outcomes*, *leadership*, *participation*, *service-learning projects*, *student attendance + service*, *service-learning + high school*, *service-learning + participation*, *service-learning + student attendance*, and *service-learning + technology*. To identify relevant articles, I accessed the following databases through the Walden University library: Education Source, Science Direct, Education Research Complete, the Educational Resource Information Center (ERIC), and Sage Journals. I reviewed literature published between 2010 and 2019, although older, foundational sources were accessed for additional background information when needed. The subsections of the literature review are the following: Service-learning Projects in Schools, Service-learning and Student Motivation, Service-learning and Student Achievement, Service-learning and Student

Attendance, Service-learning and Civic Engagement, and Service-learning and Career Path.

Theoretical Framework

The theoretical framework for this study is Kearsley's and Shneiderman's engagement theory. Kearsley and Shneiderman (1998) developed this theory to explain that in order to learn, students need to be interested in the content, present in the classroom, and participating in interactive and worthwhile tasks with the teacher and with their peers. Engagement theory encompasses three primary tenets: relate, create, and donate.

Relate refers to collaborative planning among teachers and collaborative learning among students in the classroom (Kearsley & Shneiderman, 1998). This collaborative learning is motivational and is taken into consideration in schools where students have high absenteeism and high drop-out rates. Kearsley and Shneiderman (1998) stressed that collaborative learning is motivational and should include discussion of concepts and ideas among students.

Create, the second tenet of engagement theory, refers to learning activities that are purposeful and creative. This second principle refers to students creating their learning and learning experiences with a collaborative project in a classroom setting. Engaging in these activities is more interesting to students, prepares them for professional careers, and gives them a sense of control over their own learning during regular classroom instruction (Kearsley & Shneiderman, 1998).

The third tenet of engagement theory is *donate*, which refers to students donating and making an impactful and useful contribution during learning activities in class (Kearsley & Shneiderman, 1998). Each student project or experiential learning experience should be connected to the community or to an organization outside of the classroom that is aligned with an occupation or career interest (Kearsley & Shneiderman, 1998). Kearsley and Shneiderman (1998) argued that when these three tenets are implemented, students are more likely to engage in learning in the classroom and connect to the classroom curriculum. For students to be engaged in the classroom in this way encourages students to attend school. The theoretical framework informed the discussion and interpretation of the findings of this study.

Service-learning Projects in Schools

Service-learning offers a collaborative and experiential learning practice that is connected to coursework. Service-learning in K–12 schools combines the elements of traditional community service with classroom instruction and learning. This combination positively affects students' motivation toward school and deepens their understanding of course content (Lee, 2012). Approximately one in four elementary and secondary schools provides service-learning activities (Corporation for National and Community Service, 2017), and approximately 40% of elementary and secondary schools and 60% of colleges and universities have implemented service-learning as a part of their curricula (Corporation for National and Community Service, 2017). Because the data show that student participation in service-learning projects aids student learning, this approach has

received attention from educators and researchers in the United States (Corporation for National and Community Service, 2017).

Educators continue to utilize best practices such as service-learning to make education more meaningful for students (Roberts, Terry, Brown, & Ramsey, 2016). Service-learning is an experiential school-based activity that is aligned with the curriculum, is beneficial for school-age students, and connects students to a greater purpose (Kackar-Cam & Schmidt, 2014). Service-learning allows students to engage in "real world activities to practice skills and reflect upon their own competence" (Zimmermann, Dupree, & Hodges, 2014, p. 144). Service-learning can connect students to learning activities that are aligned with community initiatives, which improves student outcomes and enables students to apply critical thinking skills and gain a deeper understanding of course content through hands-on activities (Kropp, Arrington, & Shankar, 2015; Saitta, Bowdon, & Geiger, 2011). Students who have participated in service-learning projects have reported that service-learning makes them feel more responsible and makes school more meaningful (Hullender, Hinck, Wood-Nartker, Burton, & Bowlb, 2015). Service-learning projects allow students to take ownership of their learning and assume more responsibility in their education (Fisher & Frey, 2007). Service-learning has also been shown to help students improve academic outcomes in all areas, including reading and literacy (Fisher & Frey, 2007). In addition, service-learning allows teachers to collaboratively plan and differentiate instruction to meet students' diverse learning needs (Bonati, 2018).

Research has shown that course-embedded service-learning has a positive effect on student engagement, which improves student achievement (Hullender et al., 2015; Kropp, Arrington, & Shankar, 2015; Lee, 2012). Lee (2012) found that service-learning can deepen student understanding of course content. Hullender et al. (2015) also found that students who participated in service-learning felt more engaged with coursework. Further, Kropp, Arrington, and Shankar (2015) found that service-learning can make school and coursework more meaningful for students, concluding that this model has the potential to positively affect student achievement.

Service-learning and Student Motivation

In this subsection, I review the literature on the relationship between student participation in service-learning projects and student motivation to complete coursework in various academic areas. For example, Medina and Gordon (2014) found that intrinsic motivation associated with student participation in service-learning affects student effort, attitude, and desire with respect to completing coursework. A number of educational institutions, acknowledging that service-learning can increase student motivation toward completing mandatory coursework, are incorporating service-learning activities and projects into the classroom (Kalles & Ryan, 2015). These institutions perceive that service-learning adds value to a curriculum, provides flexibility, and offers innovative learning that benefits and motivates participating students (Kalles & Ryan, 2015). However, service-learning activities require planning and must be implemented only when appropriate and aligned with the curriculum, which can significantly improve students' motivation to learn (Kalles & Ryan, 2015).

Enhancing motivation in the classroom is a driver of student success (Kalles & Ryan, 2015; Medina & Gordon, 2014). In a study on two groups in a Spanish course (a service-learning group and nonservice-learning group), students experienced increases in four motivational factors related to learning Spanish, indicating that the service-learning language exchange improved participants' motivation to learn Spanish (Medina & Gordon, 2014). In another study on adult college students, results indicated from a group of 91 students between the ages of 27 to 61, 94.4% of the participants showed interest in service-learning activities. When service-learning replaced an exam or other course requirement, interest in service-learning increased to 95.5%. Most participants were interested in all service-learning opportunities, especially the activities associated with courses that could be matched with learning objectives (Phillips, 2013). Thus, the results indicated an increase in student motivation to excel at coursework connected to service-learning.

Other studies that have linked student motivation with service-learning activities have shown that service-learning assists students with academic goal setting (Darby, Longmire-Avital, Chenault, & Haglund, 2013). A mixed methods study of 134 college students attending a private liberal arts university in the Southeast United States showed that students who participated in service-learning opportunities reported becoming more internally motivated when they enjoyed the experience and had an interest in helping people (Darby et al., 2013). Though the results also showed a decrease in motivation over the course of the semester (Darby et al., 2013), students still reported an appreciation for

the value of service-learning, which suggests a potential link between service-learning and student motivation.

Student engagement is closely aligned with student motivation in service-learning. Service learning gives students the opportunity to actively participate in class, apply concepts they learned from class in the real world, and gain responsibility in assisting local communities in a variety of ways (Noyes, Darby, & Leupold, 2015). Noyes et al. (2015) found that students were inspired and motivated in courses with a service-learning component, as 77% of 217 participants indicated that the course-aligned service-learning experience added to their satisfaction with and enthusiasm for the course, and participants who engaged in the service-learning experience had higher academic grades throughout the course (Noyes et al., 2015). In another study, 20 undergraduate students were required to complete actionable data" service-learning through a research project on their campus to bring about meaningful policy change, which led to a positive effect on students' interest in civic engagement (Maloyed, 2016). Newman, Dantzler, and Coleman's (2015) also showed how middle school students' interest in science increased due to participating in science, technology, engineering, and math (STEM) service-learning projects.

Overall, studies have shown that student participation in service-learning activities can increase student motivation toward and engagement in coursework and related subject matters (Darby et al., 2013; Kalles & Ryan, 2015; Maloyed, 2016; Medina & Gordon, 2014; Newman et al., 2015; Noyes et al., 2015; Phillips, 2013). The following

subsection includes studies on the link between service-learning and student achievement.

Service-learning and Student Achievement

In this subsection, I review the literature on the relationship between service-learning projects and student achievement in several academic areas. Research has shown that implementing service-learning can help students better understand coursework and thereby contribute to improved student achievement (Darby et al., 2013; Medina & Gordon, 2014). For example, Currie-Mueller and Littlefield (2018) explored undergraduate student perceptions and experiences of service-learning projects at a Midwestern university in the United States and found that more than 95% of the student participants attributed their improved achievement and understanding of the course content to their involvement in the service-learning project.

Service-learning projects can be implemented in a variety of subject areas and integrated into either core classes or elective classes. It is an effective learning method at all stages of education from the elementary to the university level. Prokopy, Williams, Bowling, and Thompson (2014) explored the effect of several class sessions of a university service-learning course on student achievement in the Department of Natural Resources through a pretest and posttest. The results indicated that the service-learning course improved students' content knowledge in the area of natural science (Prokopy et al., 2014). In addition, students who participated in service-learning were more committed to learning and to making a positive difference in their communities. The instructors of the university service-learning courses agreed that service-learning in

natural resources courses can improve achievement as well as help produce civic-minded individuals (Prokopy et al., 2014).

Students who participate in courses with service-learning projects often report improved academic achievement. Hébert and Hauf (2015) found that students who engaged in service-learning reported significantly greater improvement in civic responsibility and academic skills such as speaking, communication, and writing than students who did not ($p < .05$) as well as higher academic achievement. In a similar study, Pelco, Ball, and Lockeman (2014) examined the effect of a service-learning project on student achievement of 856 undergraduate students in a large urban public university course. The students who participated in a service-learning course reported improvement in all areas of academic skill (Pelco et al., 2014). Additionally, research has shown that students who participated in a service-learning program achieved higher grades than those who did not (Brail, 2016).

Service-learning projects in foreign language classes have also been shown to affect student achievement. Bettencourt (2015) examined the relationship between student participation and student achievement in a service-learning project as part of an intermediate-level Spanish course. The 12-student Spanish course incorporated a service-learning project in to have students reflect on their actions, get involved in their community, and improve learning outcomes. The study measured the attainment of course-specific learning outcomes using various data collection methods including oral reflections, surveys, conversations in focus groups, and student interviews (Bettencourt, 2015). Two student learning outcomes measured in this study included: (a) being able to

synthesize authentic spoken Spanish and (b) being able to engage in conversation in Spanish. At the end of the semester, student survey data for both student learning outcomes revealed that 90% of the students self-reported that they had improved their spoken Spanish, improved scores on tests, and were able to meet the learning outcomes (Bettencourt, 2015).

Research has also indicated the benefits of service-learning on student achievement at different education levels. McBride, Chung, and Robertson (2016) explored the effects of a school-based service-learning program on middle school students with school discipline issues like suspensions and failing grades. A community youth organization, two public middle schools in the Midwest, and a local university designed and delivered the program to all seventh-grade students in a social studies course with 148 participants. The findings demonstrated that the service-learning intervention had positive effects on student academic success. However, it is important to pay attention to the design of the service project and an understanding of the mechanisms of change involved in service-learning partnerships and processes (McBride et al., 2016).

Service-learning is also being incorporated in different ways to improve student achievement. Increasingly, elementary schools, secondary schools, and universities are requiring students to participate in technology-based service-learning activities to improve student academic outcomes (Herring, 2013). Survey results from 8,178 students in 31 different states in the United States indicated that students who participated in STEM service-learning projects improved academically in STEM courses and were more knowledgeable about their potential career options (Wyss & Tai, 2012). Further, students

of all ages from the survey reported an increase in overall satisfaction with school, increased civic and community appreciation, and improved attendance following STEM service-learning. The study did suggest, however, that student interest in STEM fields may not be directly related to (or a justification for) implementing service-learning in high school-level science classrooms (Wyss & Tai, 2012).

Distance learning is another way in which schools are incorporating service-learning into their curricula. In a study on service-learning, technology, and distance education, Soria and Weiner (2013) explored the benefits of a service-learning virtual field trip used in a distance education technical writing course. The virtual field trip service-learning project connected students to community stakeholders and exposed them to writing with a purpose for future employment. Thirty students were randomly assigned to an online non-service-learning course and 36 to the online service-learning virtual field trip and technical writing course. Students' technical writing skills increased by .54 points after participation in the virtual field trip service-learning course. The data suggested a positive relationship between service-learning and the virtual course, which helped students make real-world connections and improve their writing skills (Soria & Weiner, 2013).

The studies described in this subsection generally support the idea that student participation in course-embedded service-learning projects has the potential to increase student academic achievement (Bettencourt, 2015; Brail, 2016; Hébert & Hauf, 2015; McBride et al., 2016; Pelco et al., 2014). Other studies found that many schools are requiring students to participate in technology-based service-learning activities to

improve student outcomes (Herring, 2013; Soria & Weiner, 2013; Wyss & Tai, 2012). Taken together, this research suggests that students who participate in service-learning projects can improve their academic achievement.

Service-learning and Student Attendance

In this subsection, I review the literature examining the relationship between course-embedded service-learning projects and student school attendance. One indicator of school engagement is attendance, or the willingness to come to school every day (Furrer, Magnuson, & Suggs, 2012). According to the National Dropout Prevention Center (2017), one of the most effective, research-based strategies to engage students and reduce the number of absences from school is for students to participate in service-learning projects. Scales, Roehlkepartain, Neal, Kielsmeier, and Benson (2006) conducted a study investigating the effect of service-learning on the attendance, engagement, and academic achievement of at-risk middle school and high school students. The findings indicated that students who participated in service-learning reported missing fewer school days and achieved significantly higher grades than those students who did not participate in service projects. The study included a large, diverse sample of approximately 217,000 middle and high school students from 300 communities in the United States. Principals and students completed a Student Life Behavior survey to measure student development and social-emotional behaviors. Student self-reports indicated that the most challenged urban high schools had fewer average absences (1.61) than other schools (1.90) following the service-learning intervention. The researchers

argued that service-learning improved both attendance and student achievement of study participants.

In research focusing on six low-income K-8 public schools in northern California, Biag and Castrechini (2016) examined the effect of service programs on student attendance and achievement from 2006 to 2013. Through a long-term longitudinal study, they examined whether student attendance changed after students were given the opportunity to participate in a service program. Students who took part in extended learning/service activities (n = 5,003) were more likely to have better attendance than in previous years ($p < .001$; Biag & Castrechini, 2016).

Service-learning programs connected to afterschool programs have been shown to improve overall attendance among high school students as well. Furrer et al. (2012) investigated a sample of 441 high school students divided into two demographically similar groups in Portland, Oregon. They found that students who participated in 30 or more days of an afterschool high school service-learning program had more frequent attendance than those who did not stay for the afterschool program (89.8% and 85.6%, respectively; Furrer et al., 2012). Afterschool service-learning program participants also earned more course credits during the school year.

In an effort to improve student attendance, some schools have implemented intervention programs featuring service-learning projects. Nelson, McMahan, and Torres (2012) conducted a study of a 2-year community intervention at an urban, high-minority junior high school in the southwestern United States. The intervention was led by 20 community partners from the area who worked together to develop various school wide

initiatives, including a school pride campaign, mural painting, afterschool clubs, and a career preparation program, among other efforts. The study measured the effect of this long-term initiative on seventh- and eighth-grade student attendance among 758 at-risk junior high school students. The researchers used a quasi-experimental, mixed-method design, employing interviews, focus groups, and a school climate survey to collect data. After one year, findings on attendance rates revealed a slight increase, from 94.6% attendance to 96.6% attendance ($p < .001$). Nelson et al. (2012) concluded that involving the local community with schools in an intervention service-style program for students is one way to positively affect student attendance and student perceptions about school.

The studies reviewed on service-learning and student attendance indicated that student participation in service-learning projects improves daily student attendance (Biag & Castrechini, 2016; Furrer et al., 2012; Nelson et al., 2012; Scales et al., 2006). Scales et al. (2006) found that students who participated in service-learning missed fewer school days and achieved academically at higher levels compared with students who did not participate in service-learning. Biag and Castrechini (2016) found that from one year to the next, students who participated in service-learning projects had progressively better attendance than in previous years. Furrer et al. (2012) found that afterschool, extended-day service-learning programs improved student attendance for high school students.

Service-learning and Civic Engagement

In this subsection, I review the literature exploring the relationship between service-learning projects and student civic engagement. According to Shaw, Brady, McGrath, Brennan, and Dolan (2014), “Civic engagement can be described as a

collective action in which people participate to improve the well-being of a community and provide opportunities for reflection" (p. 301). The studies reviewed here aligned course learning goals and a community project to a service-learning experience for student participants ranging from the elementary level to undergraduate level.

Service-learning has been linked to improved civic engagement, self-determination, academic achievement, leadership, and problem-solving skills among students. Kackar-Cam and Schmidt (2014) examined the effect of participating in a community-based service-learning project on 125 high-school students' perceptions of community engagement. After participating in a service-learning project, 61% of these students indicated on a post service survey that they would be highly likely to participate in service-learning in the future, showing that service-learning positively influenced some students' perceptions about civic engagement. In another study, Holz and Pinnow (2015) modeled the class registration process with undergraduate students at a Midwestern public liberal arts university to examine differences between students who chose to enroll in a service-learning course and those who did not. Their results indicated that students who elected to register for a service-learning course had a greater sense of civic responsibility than those who did not. Those who selected a service-learning course also reported more enjoyment with past service-learning experiences compared with students who did not select a service-learning course (Holz & Pinnow, 2015). The researchers' findings suggest that an interest in service-learning is correlated to higher levels of civic engagement.

Service-learning projects are one way for students to connect classroom learning to local issues related to their schools and surrounding communities (Carter, Swedeen, & Moss, 2012) and to enhance students' sense of responsibility toward their communities (Phillips, 2013). Richards et al. (2013) conducted a study of 86 middle-school students in either fifth or seventh grade in a large, urban city to evaluate the effect of a new service-learning program. Students in the intervention group received the service-learning curriculum, while those in the control group received the traditional curriculum. The results from student surveys and a comparison of pretest and posttest scores indicated that members of the intervention group significantly strengthened their confidence ($p < .05$) in their own leadership capabilities and potential following the intervention. Researchers predicted prior to the study that the middle school students would report a greater sense of civic responsibility after participating in the service-learning project, and the results were consistent with this prediction (Richards et al., 2013).

Scott and Graham (2015) found that implementing service-learning projects during class time can discourage misbehavior and promote civic responsibility among elementary-school students. In the study, 155 at-risk elementary school students participated in a five-session service-learning program and completed a pretest and posttest evaluating their empathy and community engagement levels. They found significant positive changes in students' grades and sense of community engagement ($p < .01$). Following the service-learning program, participants scored 0.33 points higher on engagement than prior to the intervention (Scott & Graham, 2015), further indicating that

student community engagement increases following participation in a service-learning project.

Lester (2015) conducted a study of service-learning projects and student leadership using a course designed to combine service-learning and the promotion of student leadership. The data for this study included 8 years of lesson plans outlining what students were to learn in the service-learning course. The course was designed with a service-learning component and was offered to college students in order to strengthen student leadership skills. The data from this study included teacher observations and student surveys. The course was redesigned each year based on student feedback as well as feedback from participating teachers regarding the effectiveness of coursework and service-learning. Student self-reports indicated that more than 30% of participants strengthened their perceived leadership skills, communication skills, teamwork, and self-confidence through the service-learning course (Lester, 2015).

Researchers have found that civic engagement is closely linked to an interest in community leadership among students. In their work developing a service-learning student facilitator program, Kropp et al. (2015) found that students who participated in service projects for academic courses were more likely to aspire to be leaders who help build community partnerships. Faculty mentors surveyed student participants (N = 13) at the beginning, middle, and end of the study using eight open-ended questions. The questions asked students to reflect on their progress in the service-learning project. Survey data from the participants following the study revealed a mean score of 5.43 out of 6 on all eight survey items, which could indicate that student participants developed a

new respect for service-learning projects. The results of the project allowed the university to implement a student facilitator program, and the lessons learned from the course helped shape training for faculty mentors to effectively train student facilitators in subsequent semesters (Kropp et al., 2015).

A study of the effect of service-learning on college students enrolled in a health science major course was conducted by Saleh and Hamed (2014). The college students participated in an educational outreach initiative with a group of high school students, pairing the 17 health science college students with 17 high school students. Saleh and Hamed (2014) administered pretest and posttest surveys to both student groups that focused on the following themes: academics, civic responsibility, career, self-efficacy, and empowerment. Pretest and posttest comparisons indicated that both groups showed statistically significant ($p < .05$) changes following the service-learning project. The undergraduate students showed improvements in every area including civic responsibility, as opposed to high school students who only increased in self-efficacy. The undergraduate students' increased civic responsibility demonstrates the positive impact that service-learning can have on students' engagement with the community.

All of the studies reviewed in this subsection support that student participation in service-learning projects helps individuals cultivate a stronger sense of civic responsibility (Carter et al., 2012; Kackar-Cam & Schmidt, 2014; Phillips, 2013; Saleh & Hamed, 2014; Scott & Graham, 2015). Kackar-Cam and Schmidt (2014), found that service-learning provided opportunities to strengthen civic engagement and problem solving for life after high school. Saleh and Hamed (2014) found that college students

who engaged in a service-learning project with high school students experienced increased civic responsibility following the project. Other studies indicated that student participation in a service-learning project strengthened student leadership potential (Kropp et al., 2015; Lester, 2015; Richards et al., 2013).

Service-learning and Career Path

In this subsection, I review the literature that explored the relationship between service-learning projects and student career path. Service-learning offers students an opportunity to implement skills in a real-world setting and can be used to prepare students for the professional world and help promote best practices for the development of a professional identity (Rinaldo, Davis, & Borunda, 2015). Leaders in higher education believe that service-learning projects prepare students for careers and encourage them to become aware of community and social problems (Stavrianopoulos, 2014). In a study by Rinaldo et al. (2015) that involved a service-learning project with community partners, the majority of community partners stated that students were helpful, were motivated to do well, and wanted to make a difference in the community. Among the 146 participants between the ages of 21 and 63, the researchers found that students participating in the service-learning project brought fresh perspectives and new energy to community partners.

Researchers examined a college course designed to prepare students for future careers. Coulter-Kern, Coulter-Kern, Schenkel, Walker, and Fogle (2013) studied the effect of a service-learning project that involved college students teaching high school students about career paths in order to help high school students make future career

decisions. The goal of the study was to compare the learning of the college students participating in the career-based service-learning project with that of students who received career instruction only. An independent-sample *t* test was used to compare the posttest scores of college students who participated in the service-learning project to the scores of those college students who did not participate in the service-learning project. Coulter-Kern et al. (2013) found that the posttest scores of the service-learning college group showed more understanding of career decisions and goals than did those of the non-service-learning students. The scores of students who participated were significantly higher ($p < .05$), indicating that service-learning encouraged college students to learn more about career decision making (Coulter-Kern et al., 2013).

Researchers studied a service-learning program for engineering university students to how alumni perceived the service-learning program had influenced their preparation for the workplace (Huff, Zoltowski, & Oakes, 2016). The researchers collected survey data from 523 participants who compared service program experiences to their experiences in a workplace within the engineering field. The survey results revealed that participants saw the service-learning program as a way to directly connect theory to practice and that they felt it allowed them to gain experience and professional skills. The findings from the study demonstrated a significant link between the service-learning program and the goal of the study, which was to prepare students for the engineering workplace.

Internships for college students often include a service-learning component. Anderson, Taylor, and Gahimer (2014) integrated a service-learning project into an

existing clinical course and student internship in a mixed-methods study with 35 student participants. The researchers compared two groups of students: one group who wanted to participate in service-learning and one group who did not want to participate. Students who did not participate in service-learning attended their assigned 8-week clinical internship. Students participating in service-learning substituted the first week of their 8-week clinical internship for the service-learning experience. The service-learning project was linked to career knowledge and professional behaviors with a group of students seeking a career in physical therapy. The qualitative portion of the study included two written student reflections. Students who participated in the service-learning project rated their learned skills more highly than those who did not participate. Results from this study suggest that engaging in a service-learning project for students in health care provider education is associated with significant professional behavior development and improvement of interpersonal skills (Anderson et al., 2014).

Integrating service-learning projects into academic courses is one way to introduce college students to a variety of careers. Obhi and Woodhead (2015) found that service-learning provided an opportunity for students to deepen their understanding of career choices in a field of work they were interested in pursuing. In this particular study, 753 college students volunteered to be caregivers for older adults. A pretest–posttest questionnaire was used with the participants to measure attitudes toward older adults. Before the intervention, a majority of the students scored higher than 96 on the survey, indicating a negative attitude toward working with older adults. After the service-learning intervention where students volunteered with older adults and learned about aging and

care for the elderly, the student participants reported being significantly more interested than they previously were in working with older adults.

Smith et al. (2014) conducted a study about how service-learning prepares students for future careers. The study included 24 student participants in a community engagement project that taught soil management lessons to groups of people in underserved communities. One of the goals of the project was to evaluate the effectiveness of service-learning course activities and to prepare students for employment after graduation. The mixed-methods approach included a quantitative survey of pre- and post service-learning experiences and qualitative pre- and post service-learning student interviews and field observations. The service-learning students perceived themselves as having increased their ability to teach science lessons for a variety of learners ($p < .05$), suggesting that the members of the intervention group developed confidence in their ability to perform their duties as instructors in a diverse community. The data on service-learning in this study were also positively correlated with an increase in participants' competence as teachers, which was measured through leadership skills and instructional strategies. Interview data revealed an increase ($p < .05$) in the number of times students cited confidence in their new professional skills and career goals through the service-learning project. Taken together, the mixed-methods data show that students in the service-learning group rated themselves as having gained more confidence with career-relevant skills (Smith et al., 2014).

Research has also explored the impact of service-learning on students' interest in a medical career. Medical students at an academic medical center initiated a service-

learning project in the form of an educational outreach program for high school students to encourage their interest in medicine (Karpa et al., 2015). Each year, about 40 to 70 high school students participated in a course that included mentoring by 10 to 15 medical students and opportunities for students to work with health care providers. Former participants (medical students) from 7 years prior were asked to complete an electronic questionnaire. Of the respondents, 81% indicated that participation in the course better prepared them for the medical field and influenced their decision to pursue a career related to medicine (Karpa et al., 2015).

The studies reviewed in this subsection suggested that service-learning can be used to prepare students for careers and can assist in the development of professional skills (Coulter-Kern et al., 2013; Huff et al., 2016; Rinaldo et al., 2015; Smith et al., 2014). Anderson et al. (2014) found that service-learning projects help students' link career knowledge and professional behaviors. Obhi and Woodhead (2015) found that service-learning projects within courses are an effective way to introduce students to a wide range of careers. Huff et al. (2016) demonstrated that student participation in career-specific service-learning courses like engineering better prepared students for work in that field. This research suggests that service-learning can help students gain career-relevant skills.

Summary of the Literature Review

Service-learning is becoming a desirable method of instruction for educators to engage students more effectively (Roberts et al., 2016), enabling student participation in organized school-related projects that provide a service to the community (Kropp et al.,

2015). The findings from the research reviewed provide evidence for promoting service-learning projects as an educational methodology to increase achievement (Bettencourt, 2015; Brail, 2016; Hébert & Hauf, 2015; McBride et al., 2016; Pelco et al., 2014); improve attendance (Biag & Castrechini, 2016; Furrer et al., 2012; Scales et al., 2006; Wyss & Tai, 2012), teach students about civic engagement (Carter et al., 2012; Kackar-Cam & Schmidt, 2014; Phillips, 2013; Saleh & Hamed, 2014; Scott & Graham, 2015), and prepare students for career paths (Anderson et al., 2014; Coulter-Kern et al., 2013; Karpa et al., 2015; Rinaldo et al., 2015; Smith et al., 2014) in academic courses at the secondary and undergraduate levels.

Critical Discussion of the Literature

The research reviewed on service-learning projects was conducted at a variety of education levels, including elementary, middle school, high school, and college. The majority of the studies were relatively short in duration, lasting less than 1 year. The largest percentage of the research reviewed was conducted in university-level classrooms and may not be generalizable to elementary and secondary public schools (e.g., Lester, 2015; Obhi & Woodhead, 2015; Rinaldo et al., 2015; Smith et al., 2014). At the postsecondary level, more service-learning projects were conducted in elective versus required courses.

Many of the studies I reviewed on service-learning and student achievement were conducted by the implementers of the service-learning projects themselves and did not use an experimental approach (e.g., Lee, 2012; Medina & Gordon, 2014; Prokopy et al., 2014; Richards et al., 2013; Saitta et al., 2011). The pretest and posttest design used by

these researchers was weak given that the same sample was used for the entire study, without a control group for comparison. The reliability of the surveys used was unclear and procedures were not standardized. The samples for most of the studies reviewed were small, and some studies used student self-reports of achievement (e.g., Kropp et al., 2015; Lester, 2015; Saleh & Hamed, 2014), which tend to be less reliable than official test scores or grades. Moreover, since service-learning practice is not standardized, the design of the service-learning component was different in each study, potentially limiting generalizability. Many researchers did not fully describe the service-learning projects, leaving out important details regarding study design and data collection procedures that would make the research easier to replicate with a different sample (Thomas & Magilvy, 2011). Finally, external influences on students that may have impacted results, such as race/ethnicity, income level, parents' education level, etc., were not controlled for or considered in many of these studies.

The evidence that student participation in service-learning positively affects student attendance is rather weak. Of the literature reviewed on this topic, a small effect or minimal increase in attendance when student groups participated in service-learning projects was shown in five of the studies (e.g., Biag & Castrechini, 2016; Furrer et al., 2012; Nelson et al., 2012; Scales et al., 2006). Most of these studies used student self-reports of attendance, which may be less accurate than official school attendance records.

Research on service-learning projects was largely limited to elective courses, nonacademic programs, and afterschool activities (e.g., Furrer et al., 2012; Kackar-Cam & Schmidt, 2014; Medina & Gordon, 2014; Saleh & Hamed, 2014; Scott & Graham,

2015). This limitation makes it more difficult to determine the effect of service-learning on student academic achievement in core academic coursework. Given the limitations of the studies in this area, further research is warranted to explore the relationship between student achievement, attendance, and service-learning programs.

Implications

The purpose of my study was to determine the effect that high school student participation in a service-learning project embedded into a science course had on student academic achievement and attendance in science classes. The problem that my study addressed was low science achievement and high rates of student absenteeism at AHS. The findings from my study could have led to three possible project deliverables: a professional development plan for teachers at the local level, a position paper with recommendations for implementing service-learning projects in science, or a program evaluation of service-learning projects in science. Based on my study's findings, I created a professional development plan targeting high school science teachers in a northern Midwest state.

Summary

Due to the low science achievement and high rates of student absenteeism identified in science classes at AHS, my study aimed to determine the effect of high school student participation in a service-learning project on student achievement and attendance in science classes at the school. The literature review focused on research concerning the effect of service-learning projects on student outcomes in several areas, including student motivation, student achievement, student attendance, civic engagement,

and career paths. In general, the findings of the literature in this review supported service-learning as an approach with the potential to positively influence student motivation, achievement, attendance, civic engagement, and potential career paths. In Section 2, I will describe the research design and approach for the research project, the setting and sample, instrumentation and materials, data collection and analysis, assumptions, limitations, scope and delimitations, protection of participants' rights, and data analysis results. In Section 3, I will describe the project that I designed based on the findings of my study. In Section 4, I will reflect on and discuss my conclusions, the project strengths, limitations, recommendations, scholarship, professional development, self-analysis, and possible directions for future research.

Section 2: The Methodology

Research Design and Approach

The local problem addressed through this study was student low science achievement and high rates of student absenteeism at AHS. A quantitative, pretest–posttest control group design, using archival data retrieved from school records and teacher classroom records, was used to compare two groups to determine the effect of high school student participation in a course-embedded service-learning project (see Appendix B) on student achievement and student attendance in science classes during a 16-day environmental science unit at AHS. I selected a quasi-experimental design for this study to determine the difference between change scores on the Environmental Science Pretest–Posttest and the number of absence days during a 16-day environmental science unit between students who participated in a course-embedded service-learning project (experimental group) and students who did not (control group).

The first dependent variable for my study was student science achievement as measured by change scores on the Environmental Science Pretest–Posttest. The second dependent variable was student attendance as measured by the number of days a student was absent during a 16-day environmental science unit. The independent variable for my study was student participation in a course-embedded service-learning project in a 10th-grade environmental science unit. All the students were randomly placed in the control or experimental group because that was the appropriate quarter to take their science course. The two groups were composed of students who were placed in science class sections by the school counselors and administration.

I used archival assessment data provided by the 10th-grade science teacher and archival attendance data obtained from the student information system at AHS. The archival data for achievement were the change scores on the Environmental Science Pretest–Posttest between who participated in the course-embedded service-learning project and students who did not. The archival data for achievement was deidentified by the science teacher. Attendance data were deidentified by the principal's secretary, who downloaded the data from the student information system.

Setting and Sample

AHS is an alternative education high school located in a suburb of a large city in a northern Midwest state. According to the principal of the school participating in this study, AHS offers students a learning program to accommodate a population of students at risk of not graduating from high school. AHS offers state required academic and elective courses in all subject areas for students in Grades 9 through 12. Students are required to attend courses during a typical September to June school year. The school year is 146 school days in length, and students are not required to attend school on Fridays. It is mandatory that students attend school daily during these 146 school days.

The local setting has open enrollment and enrolls students from the state metro area. Students attend class for 4 hours, 4 days each week. AHS has a zero-absence attendance policy but allows students to make up missed seat time by coming to school on Fridays and working with their teachers to complete assignments. Students must have zero absences at the end of each quarter to earn a grade and credit for each of their courses. If a student does not make up the seat time that he/she missed during the quarter

in which he/she is enrolled, then that student does not receive a credit or a grade for the course or the coursework that he/she has completed. The student will receive a "W" for withdrawal on his/her transcript instead of course credit and academic grade.

To address achievement and attendance, the school administrators implemented a course-embedded service-learning project into the Grade 10 general science curriculum during the 2016 to 2017 school year. The course-embedded service-learning project was implemented in three Grade 10 quarter long general science sections as part of a 16-day environmental science unit that was a part of the general science course at AHS. The data of all Grade 10 students (N = 114) enrolled in science during the 2016 to 2017 school year were retrieved for this study. The experimental group consisted of all students (n = 57) who experienced the course-embedded service-learning project in three Grade 10 science classes during the spring quarter of the 2016 to 2017 school year. The control group consisted of all students (n = 57) who were enrolled in three Grade 10 general science classes during the 2016 to 2017 winter quarter. No students in either group were repeating the course. Both the control and experimental groups were taught by the same science teacher who followed the Grade 10 general science curriculum. The science teacher for this study was the only Grade 10 science teacher at AHS, has a master's degree in science, and had been teaching Grade 10 science each quarter at AHS for 5 years.

A G*power analysis with the standard settings for educational research (alpha = .05, power = .80, and medium effect size) for a two-tailed t test would require 64 data sets per group (see Cohen, 1992). Each of the groups in my study had 57 participants,

showing that my study was slightly underpowered for analysis using two-tailed *t* tests. However, because the data did not meet two of the assumptions for the two-tailed *t* test, I analyzed the data using the nonparametric Mann-Whitney U test. There is no agreed standard for minimum sample size for the use of nonparametric tests (Warner, 2013).

Instrumentation and Materials

An instrument in a quantitative study is a tool for collecting data that is used to measure the variables (Creswell, 2012). Valid and reliable instruments used in quantitative research lead to meaningful interpretations of data (Creswell, 2012). The instrument used in my study was the Environmental Science Pretest–Posttest (see Appendix C). The instrument is used at AHS in science classes with an environmental science component to measure student content knowledge in science. The instrument was designed by the Science Department at AHS to align with six science standards from the Next Generation Science Standards and is composed of 20 multiple-choice test questions, each correct answer worth 1 point. Each multiple-choice question has four answer options with one response being the correct one. The maximum score possible on the assessment is a raw score of 20 points. The raw score for each participant was calculated by the number of items correct. Participants took the environmental science assessment as a pretest, then as a posttest 16 weeks later. The two scores from each participant were used to calculate a change score.

To determine whether the Environmental Science Pretest–Posttest test instrument was clear and consistent, the instrument was piloted by the Science Department at AHS during the 2015 to 2016 school year, 1 year before I conducted my study. The pilot study

took place in two science classrooms during an environmental science unit taught by two different teachers. Each science class consisted of a group of 20 students who were representative of the student population at AHS. For the pilot study, the test instrument was administered in the same way in both classrooms. The start and end time were recorded to determine how long it would take students to complete the test. The teachers graded the tests then read and discussed each test item with students who took the test to check for student understanding of and clarity of the test items. The mean score for both classes combined was 16.9 (out of the maximum 20). The science teachers who piloted the test discussed the findings with each other to determine the validity of the test instrument and whether the test instrument was clear and consistent.

The Science Department piloting the test wanted to make sure that the test was reliable and followed protocol to ensure reliability. To determine whether the instrument was stable and reliable over time, the science teachers conducted a test–retest session at the end of the term. The mean score for both classes for the test–retest session combined was 15.65. The test–retest reliability session measured whether the test was consistent from one examination point to the other. Based on the results of the pilot testing, the Science Department determined that the test was valid, reliable, clear, and consistent. The test has been used by science teachers in the school for 3 years.

Data Collection and Analysis

Data Collection

The participating science teacher in this study collected and recorded student pretest and posttest scores and daily student attendance during the 16-day environmental

science unit of all the students enrolled in the six Grade 10 general science classes for Quarter 3 (winter) and Quarter 4 (spring) as part of normal instruction. The science teacher gave the deidentified data to the school secretary who then gave the archival data to me for my study. The science teacher taught both groups and all six sections using the same syllabus, course grading rubrics, and class materials in all the classes. The science teacher taught the course using English for all communication. The science teacher administered the environmental science assessment pretest to each student present on the first day of the environmental science unit. If a student was absent, he/she was permitted to make up the environmental science assessment pretest on the next day that he/she was present. The same procedure took place for the environmental science assessment posttest data collection at the end of the environmental science unit. The science teacher graded all the tests.

The independent variable for this research study was high school student participation in a course-embedded service-learning project in science (see Appendix B). Two dependent variables were measured and analyzed. The first dependent variable was the change score between the pretest and the posttest environmental science assessment. The second dependent variable was student attendance as measured by the number of days a student was absent during the 16-day unit. I organized the data into two Excel spreadsheets, one for achievement data and one for attendance data. The spreadsheet for achievement data contained five columns: student identification, pretest score, posttest score, condition (control/experimental), and change score. On the Excel spreadsheet, a formula was entered in the change score column to calculate the change scores from

pretest to posttest for each group. The spreadsheet for attendance data contained three columns: student identification, number of absence days, and group membership (control or experimental).

Analysis

I uploaded all the raw data from the Excel spreadsheet into SPSS Version 24. I calculated descriptive statistics (mean scores, medians, and standard deviations). I calculated inferential statistics to determine the effect of student participation in a course-embedded service-learning project on the entire sample of participants in two groups on two dependent variables (change scores for achievement and number of absence days for attendance). To decide whether to accept or reject the null hypotheses, I planned to conduct independent samples *t* tests. However, because the data did not meet the assumptions of the independent samples *t* test, I analyzed the data using the nonparametric Mann-Whitney *U* test (Laerd Statistics, 2015). The descriptive, inferential, and nonparametric tests provided answers to the RQs that AHS faculty and similar school districts could use to determine the effect of high school student participation in course-embedded service-learning projects on student science achievement and student attendance during a 16-day science unit in science classes.

Assumptions, Limitations, Scope, and Delimitations

Assumptions

In my study, it was assumed that students would complete the Environmental Science Pretest–Posttest with attention and answer test items to the best of their ability. It was also assumed that the student participants would not communicate with each other

about the Environmental Science Pretest–Posttest or share tests and answer items honestly. To ensure that test items were not shared between students, the participating science teacher in the study collected and kept the graded Environmental Science Pretest–Posttests from students each quarter. The Environmental Science Pretest–Posttests and student scores were kept secure and confidential by the participating teacher. Another assumption in my study was that students were taking their education and coursework seriously by trying to learn and to attend school daily. It was assumed that the student groups were similar each quarter at AHS because school counselors enroll students into courses based on the completion of prerequisites and graduation requirements. It was also assumed that the control and experimental groups were both representatives of the population of students at the school.

Limitations

Limitations are potential weaknesses in a study that are out of the control of the researcher, but could affect the outcome (Creswell, 2012). Limitations can arise from the methodology and study design and can limit the direction and result of the study (Simon & Goes, 2013). My study design was a quasiexperiment. The findings of the variables of student science achievement and student attendance from my study will not be generalizable to other schools because my school is an alternative high school.

Another limitation of my study was that the participating science teacher knew which students were in the control group and which students were in the experimental group. The teacher's enthusiasm for the service-learning project might have also affected the teaching and the students' learning. Because the service-learning project was part of

an existing 16-day environmental science unit for the experimental group, it was possible that the group could have been limited to receiving less direct instruction. The length of time of the treatment was limited to 16-days. The novelty effect was also considered to be a limitation of this study (Lodico, Spaulding, & Voegtle, 2010) because a service-learning project may have been new and different for some students, which might have heightened student interest in the service-learning project.

Scope

The scope of the study refers to the parameters of the study (Simon & Goes, 2013). The local setting for the study was an alternative education high school in a northern Midwest state. The research was conducted in six Grade 10 science classes. The study included only one participating science teacher who taught the six classes, collected the data, and recorded the data. The data collection included only two sources: (a) archival data from the Environmental Science Pretest–Posttest used at the local setting, and (b) archival student attendance data from the 16-day environmental science unit. The students enrolled in the winter quarter comprised the control group.

Delimitations

Delimitations are boundaries that have been imposed on the study by the researcher that can arise from the limitations of the study (Simon & Goes, 2013). The delimitations of my study include my choice of the independent variable of a service-learning project and the dependent variable of 10th-grade science achievement and 10th-grade student attendance during a 16-day environmental science unit. The problem addressed in the study was low science achievement and high rates of student

absenteeism at AHS. The participants were 10th-grade students enrolled in 10th-grade science. I did not include other grade level classrooms in my study. Other variables related to the local problem could have been chosen for this study. However, I delimited my study to the problem of low science achievement and high rates of student absenteeism in science class at the local setting. In putting together my study, I declared that I wanted to determine the effect of high school student participation in a course-embedded service-learning project on student science achievement and student attendance in science classes.

Protection of Participants

I applied for permission to conduct this study, and the Walden University Institutional Review Board approved that my study with archival data had no risk for the participants (approval # 01-12-18-0465293). I contacted the participating science teacher about the study to discuss the data collection and protection of the participants. To protect student participants, I instructed the participating science teacher not to discuss the data or the study with the students, parents, and other staff members at the school. The science teacher who taught the science courses for the study deidentified the student archival data for achievement for the control and experimental groups to protect the confidentiality of the students. The secretary to the principal deidentified student archival data for attendance for both groups to protect the confidentiality of the students. The deidentified archival data for my study was stored on a flash drive and locked in a secure location in a locked data room at the local setting. The data will be kept for 5 years and then

destroyed. The school day procedures, rules, policies, and structured class time remained business as usual to protect the instructional quality and time for participating students.

Data Analysis Results

I first analyzed the data using descriptive statistics to describe the characteristics of the variables (mean, range, and standard deviation). After I described the variables, I conducted an inferential analysis of the data. I provided the descriptive statistics for the variables and I provided an inferential analysis of the data using the Mann-Whitney *U* test for each variable. From the results of the inferential analysis, I accepted or rejected the null hypothesis for each RQ.

Descriptive Analysis

RQ 1: What is the difference in student achievement as measured by pre to posttest score changes on the Environmental Science Pretest–Posttest between students who participated in a course-embedded service-learning project and students who did not?

To answer RQ 1, I used descriptive statistics to determine the difference in pretest–posttest change scores between students who participated in a 16-day service-learning project in science and students who did not. In Table 3, I report the sample size, mean, standard deviation, and range for science achievement change scores for each group represented in this study (control group and experimental group). Table 3 shows science achievement change scores for both groups. I calculated the change scores by using a formula in Excel that subtracted the pretest score from the posttest score. I uploaded these raw scores into SPSS to calculate the mean of the change scores of both

groups. The students enrolled in the experimental group had a higher mean change score (M = 11.04) than did the student enrolled in the control group (M = 9.39).

Table 3

Science Achievement Change Scores by Group

Group	*N*	*M*	*SD*	Range
Control	57	9.39	3.825	2-16
Experimental	57	11.04	4.204	3-19

Note. N = sample size; M = mean; SD = standard deviation.

RQ 2: What is the difference in student attendance in science as measured by the number of absence days during a 16-day environmental science unit between students who participated in a course-embedded service-learning project and students who did not?

To answer RQ 2, I used descriptive statistics to determine the difference in the number of absence days for the students who participated in a 16-day course-embedded service-learning project and students who did not. In Table 4, I report the sample, mean, standard deviation, and range for the number of absence days of students enrolled in the experimental group and control group. Table 4 shows the mean number of absence days for each group. Students enrolled in the control group had a lower number of absence days (M = 2.05) than the students enrolled in experimental group (M = 3.75).

Table 4

Number of Absence Days by Group

Group	*N*	*M*	*SD*	Range
Control	57	2.05	4.202	0-15
Experimental	57	3.75	4.327	0-14

Note. N = sample size; M = mean; SD = standard deviation.

Consideration of Assumptions Underlying the Independent Samples *T* Test

I began my inferential analysis of the data using an independent samples *t* test. There are six assumptions of the independent samples *t* test that needed to be met to justify the use of the test (Laerd Statistics, 2015).

Assumption 1. One dependent variable is measured at the continuous level. My study met this assumption because the data were composed of two dependent variables that were measured on a continuous level.

Assumption 2. One independent variable that consists of two categorical, independent groups. My study met this assumption because the independent variable for my study was categorical and consisted of two independent groups.

Assumption 3. Assumption 3 requires that there must be independence of observations and no relationship between the observations in each group of the independent variable or between the groups themselves. My study met this assumption because it had independence of observations, different participants in each group, and no relationship between observations in each group of the independent variable or between groups.

Assumption 4. Assumption 4 requires that there should be no significant outliers in the two groups of the independent variable in terms of the dependent variable. To determine whether my groups had outliers, I generated box plots for each variable. The box plots showed that there were outliers for the dependent variable in the control group.

Assumption 5. Assumption 5 requires that the dependent variable should be approximately normally distributed for each group of the independent variable. To

determine whether my data for the dependent variable of achievement for the experimental group were normally distributed, I conducted a Shapiro-Wilk's test. Table 5 shows that the dependent variable of achievement in the experimental group was normally distributed, but was not normally distributed for the control group, as assessed by Shapiro-Wilk's test ($p > .05$). Table 5 also shows the data for the dependent variable of attendance in both groups was not normally distributed, as assessed by a Shapiro-Wilk's test ($p > 0.05$).

Table 5

Shapiro-Wilk Test of Normality

Achievement Change			
Group	Statistic	Df	Sig
Control	.952	57	.026
Experimental	.971	57	.191
Number of Absence Days			
Group	Statistic	Df	Sig
Control	.553	57	.000
Experimental	.815	57	.000

Note. $p > .05$

Assumption 6. Assumption 6, which is the assumption of homogeneity of variances, requires that the population variance for each group of the independent variable is the same. I conducted a Levene's test of equality of variances. For both groups of the dependent variables, the mean difference between the two groups was statistically significant ($p < .05$). My study met this assumption since the sample size in each of my groups was similar.

Because my data violated assumptions 4 and 5, it was not appropriate to conduct the analysis using the independent samples *t* test. To analyze the data that were not

normally distributed, it was appropriate to analyze data using the nonparametric Mann-Whitney *U* test (Laerd Statistics, 2015).

Consideration of Assumptions Underlying the Mann-Whitney *U* Test

There are four assumptions of the Mann-Whitney *U* test that need to be met to justify the use of the test (Laerd Statistics, 2015). My study met all four assumptions.

Assumption 1. Assumption 1 requires that there must be one dependent variable that is measured at the continuous level (Laerd Statistics, 2015). My study met this assumption because the data were composed of two dependent variables that were measured on a continuous level. The first dependent variable was student change scores from pretest to posttest Environmental Science Pretest–Posttest. The second dependent variable was the number of student absence days during a 16-day science unit.

Assumption 2. Assumption 2 requires that the study must have one independent variable that consists of two categorical, independent groups (Laerd Statistics, 2015). My study met this assumption because it had two independent groups, a control, and an experimental group.

Assumption 3. Assumption 3 requires that there should be independence of observations in that there is no relationship between the observations in each group of the independent variable or between the groups themselves (Laerd Statistics, 2015). My study met this assumption because it had independent groups, with different participants in each group.

Assumption 4. Assumption 4 requires the researcher to determine whether the distribution of scores for both groups of the independent variable have the same shape or

a different shape (Laerd Statistics, 2015). Using SPSS, I generated graphic reports for each Mann-Whitney *U* test. Following the advice of Laerd Statistics (2015), I inspected the graphics for each Mann-Whitney *U* test. My study met this assumption because I determined that the two distributions of scores for both groups of the independent variable had the same shape.

Results of the Non-Parametric Analysis

RQ 1: What is the difference in student achievement as measured by pre to posttest score changes on the Environmental Science Pretest–Posttest between students who participated in a course-embedded service-learning project and students who did not?

To determine whether to accept the null hypothesis, I applied the Mann-Whitney *U* test. In Table 6, I provide the median change scores for the dependent variable of achievement and the results of the Mann-Whitney *U* test.

Table 6

Achievement Change Score Results for Mann-Whitney U Test

Condition	Median	Mean Rank Value	*U*	*Z*	*P*
1	10.00	51.22	1982.5	2.035	.042
2	11.00	63.79			

Note. Condition 1 is the control group. Condition 2 is the experimental group.

A Mann-Whitney *U* test confirmed that the median of the change scores for the experimental group (*Mdn* = 11.00) was significantly higher than the control group (*Mdn* = 10.00), *U* = 1,982.5, *z* = 2.035, *p* = .042, using an exact sampling distribution for *U*. I rejected the null hypothesis and concluded that the change scores were significantly

higher for the experimental groups than for the control group. I calculated the effect size for achievement and determined that it was $d = .412$, a small effect (Cohen, 1992).

RQ 2: What is the difference in student attendance in science as measured by the number of absence days during a 16-day environmental science unit between students who participated in a course-embedded service-learning project and students who did not?

To determine whether to accept the null hypothesis, I applied the Mann-Whitney *U* test to determine the difference in the number of absence days for the students who participated in a 16-day course-embedded service-learning project and students who did not. In Table 7, I provide the median number of absence days for the dependent variable of attendance and the results of the Mann-Whitney *U* test.

Table 7

Number of Absence Days for Mann-Whitney U Test

Condition	Median	Mean Rank Value	*U*	*Z*	*P*
1	0.00	50.07	2048	2.660	.008
2	1.00	54.93			

Note: Condition 1 is the control group. Condition 2 is the experimental group.

A Mann-Whitney *U* test confirmed that the median of the number of absence days for the experimental group (*Mdn* = 1.00) was significantly higher than the control group (*Mdn* = 0.00), *U* = 2,048, *z* = 2.660, *p* = .008, using an exact sampling distribution for *U*. I accepted the null hypothesis and concluded that the number of absences days for the experimental group was not significantly lower.

Discussion of the Findings

In my research study, I studied the effect of high school student participation in a course-embedded service-learning project on student achievement in science and on student attendance during a 16-day environmental science unit in science classes at an alternative education high school. The dependent variables of student achievement in a course-embedded service-learning project in science and student attendance in science classes during a 16-day environmental science unit were measured and analyzed in this study. The results for students that participated in the course-embedded service-learning project indicated a small positive effect on student achievement in the environmental science unit. The results from my study on science achievement can assist educators in making important decisions associated with curriculum and instruction toward improving student achievement in high school science. Findings show that service-learning helps students improve academic achievement (Bettencourt, 2015; Darby et al., 2013; Medina & Gordon, 2014; Prokopy et al., 2014).

For student achievement, my findings were in accordance with the literature reviewed on service-learning projects. Service-learning is a desirable best practice method for teachers to make learning more effective for students (Roberts et al., 2016). Noyes et al. (2015) found that 170 of 217 high school students that participated in a service-learning project had higher final grades than those students in a traditional classroom without a service-learning project. Darby et al. (2013) found that service-learning helped to engage, motivate, and increase achievement with 110 undergraduate college students. A variety of teachers nationwide have also reported increased student

achievement in classrooms with the addition of service-learning projects (Bettencourt, 2015; Hébert & Hauf, 2015; Lee, 2012; Pelco et al., 2014; Prokopy et al., 2014).

For student attendance during the 16-day environmental science unit in science classes, my findings showed that the rate of absences increased among the students who participated in the course-embedded service-learning project. These results can assist educators in making decisions about the implementation of service-learning projects and their potential relationship to student attendance. It is recommended that administrators be cautious in implementing service-learning for the purpose of increasing student attendance. The literature is not strong in the area of service-learning and attendance. My findings can assist educators in the area of service-learning and attendance. The qualitative nature of the literature that currently exists on service-learning and students attendance were self-reports and not strong enough to conclude that service-learning positively influences student attendance (Biag & Castrechini, 2016; Furrer et al., 2012; Nelson et al., 2012; Scales et al., 2006).

Project as an Outcome

Because my findings showed that student participation in a course-embedded service-learning project led to increased student achievement, I developed a professional development program that will support teachers in designing effective service-learning projects for improving student achievement in high school science. This program will also provide opportunities for science teachers to participate in an ongoing professional learning community (PLC). The program will be a 3-day retreat that will provide teachers with an opportunity to collaborate as a PLC at the retreat, then as PLC throughout the

school year. The professional development program will teach science teachers how to design effective and engaging course-embedded service-learning projects. The teacher participants at the retreat will learn new strategies for teaching science and how to embed service-learning projects into science courses to improve student achievement in high school science.

Conclusion

I determined the effect of student participation in a service-learning project on student attendance during a 16-day unit and student achievement during a 16-day environmental science unit at AHS, an alternative high school in a northern Midwest state. To determine the effect, I conducted a quasi-experimental study. I collected and analyzed student achievement data as measured by student pretest–posttest change scores and attendance data as measured by the number of student absence days in science classes. The findings presented in my study can help guide teachers in decision making about developing service-learning projects and embedding service-learning projects into science courses and curriculum to improve student outcomes in the science classroom.

In Section 3, I will describe and outline a project that will provide teachers the opportunity to collaborate and design service-learning projects in science. I will describe the goals, activities, process, and the evaluation plan for my project. I will present a scholarly review of literature related to the project genre. In Section 4, I will reflect on the importance of my work and my project. I will provide implications, applications, and directions for future research.

Section 3: The Project

Introduction

My project will be a professional development program for high school science teachers in a northern Midwest state. I chose to focus on a professional development program because my research showed that participation in a science service-learning project positively affected student achievement as measured by changes in pretest and posttest scores. Based on this finding, I determined that a professional development program that would allow high school science teachers to collaborate in a PLC to design effective service-learning projects in science would be appropriate.

The goal of my professional development program is to provide an opportunity for science teachers in a northern Midwest state to learn and implement strategies associated with best practices instruction for service-learning projects in the science classroom. The platform will be a 3-day retreat and professional development program called *The Science of Service-learning* (see Appendix A). Teachers will attend various breakout sessions to review and discuss my findings on service-learning and science achievement, design a service-learning project in science, and learn some best practice teaching strategies in science for use during service-learning projects. Teachers will continue to meet in PLCs after the retreat to collaborate on their service-learning project.

In this section, I will discuss the rationale for my professional development project. I will also review the literature related to professional learning communities for teachers. Then I will discuss the goals, purpose, and target audience of my professional development project as well as the components of my project, the timeline for

implementation, and the activities that teachers will complete at the professional development retreat. I will also describe the resources needed for implementation at the retreat, the project genre, the existing supports, and potential barriers. Next I will discuss an evaluation plan for the project and how the project will lead to positive social change. Finally, I will discuss the importance of this project for science students and science teachers.

Rationale

The results from my study showed that students who participated in a course-embedded service-learning project had higher achievement scores than students who did not participate. Because of these findings, a professional development program about implementing service-learning in science courses is an appropriate project. Service-learning is a customizable method that must be designed for a specific environment to address course goals. Applying the service-learning method more broadly within high school science programs may help solve the issue of low achievement in science. My professional development program will address low achievement in science and will provide high school science teachers the opportunity to learn how to develop effective service-learning projects in science.

The literature suggested that professional development programs in the form of PLCs can improve practice and increase student learning when teachers work together (Battersby & Verdi, 2015; Lutrick & Szabo, 2012). A PLC allows teachers to work together throughout the school year to implement strategies into classroom practice (Chen & Mitchell, 2015). These findings led me to develop my program in the form of a

PLC. Science teachers across the state will work in PLCs to learn to design effective service-learning projects in science.

Review of Literature

In the literature review, I present current research about best practices for the development of professional development programs for teachers and the different components of professional development programs. I conducted the literature search using the Walden University online library. All searches were limited to articles published in peer-reviewed journals between 2013 and 2018, although older articles were accessed for additional background when needed. The literature selected was based on its relevance to the research topic of professional development programs for teachers. The databases included Education Source, Science Direct, Education Research Complete, Educational Resource Information Center (ERIC), Sage, and ProQuest. My search terms included *professional development, designing professional development programs, professional learning communities, professional development for science, best practices in professional development,* and *effective service-learning projects*. I considered my literature search to have reached saturation when I encountered repeated results that yielded no new sources. The literature review is organized under the following headings: (a) Best Practices for Teacher Professional Development, (b) Professional Learning Communities, and (c) Professional Learning Communities for Science Teachers.

Best Practices for Teacher Professional Development

Several recent studies have explored best practices for developing effective teacher professional development programs (Colwell, MacIsaac, Tichenor, Heins, &

Piechura, 2014; Guss, Norris, Horm, Monroe, & Wolfe, 2013; Lampi, Domino, & Taylor, 2015; Willis & Templeton, 2017), which are reviewed in this section. Historically, professional development programs for teachers have been offered as 1-day workshops conducted by an outside expert who provided teachers with innovative strategies, approaches, and pedagogy to take back to their classrooms (Han, 2014). However, these lecture-based professional development workshops have been found to be largely ineffective (Jao & McDougall, 2016) and are being replaced with more collaborative approaches (Avalos-Bevan & Bascopé, 2017; Locke, 2015). Many contemporary professional development programs use a PLC format in which teachers work together over a period to implement new pedagogy into daily practice (Chen & Mitchell, 2015). This type of collaborative professional development activity can help teachers integrate knowledge into practice (Han, 2014). Other professional development approaches that facilitate teacher learning through collaboration include teacher inquiry, action research, professional development schools, and lesson study sessions (Han, 2014).

Researchers have suggested that professional development programs can improve teaching efficacy and student learning in schools when teachers are given the opportunity to work together (Battersby & Verdi, 2015). In one qualitative study, Colwell et al. (2014) interviewed educators about their perceptions of professional development and professional development standards from the National Council for the Accreditation of Teacher Education. The study involved seven principals of *Title I* schools from various parts of the country as well as four university faculty participants with over 18 years of experience with professional development initiatives. Participating educators repeatedly

noted that professional development was more successful when participants engaged in collaboration and activities driven by classroom data. In addition, the school principals found that professional development is most successful when it is sustained over time and aligned with student academic achievement and district-wide goals (Colwell et al., 2014).

Professional development is effective when researchers, teachers, and practitioners can collaborate to identify and address school wide initiatives (Avalos-Bevan, & Bascopé, 2017). For example, Lampi et al. (2015) explored a shared growth professional development model that three college-level educators, two community college practitioners, and one university researcher implemented to improve their curriculum and develop more innovative strategies for integrated reading and writing. The teachers collaborated on planning course content through regular meetings, review of materials, reflection, and feedback throughout the school year and summer. After the foundation for the professional development group was established, they expanded it into a larger PLC by inviting additional faculty to join them. As new generations of professors and graduate student teaching assistants joined the program, they benefitted from this ongoing PLC model, with older generations of faculty passing on expertise and knowledge. The authors suggested that professional development should be a long-term endeavor (rather than 1-day conferences or workshops) with ongoing opportunities to translate learning into practice (Lampi et al., 2015).

Researchers have examined multiple best practice strategies for professional development, rendering it difficult to ascertain which individual strategies are most effective and why certain professional development approaches may have been

successful (Klute, 2013). For example, Guss et al. (2013) explored classroom observation in an early childhood education setting as a professional development method to help teachers transfer new knowledge into their practice. To facilitate classroom observation that has a positive impact on teacher practice and/or learner outcomes, the following components are important: (a) specific and well-articulated goals and objectives, (b) practice as the focus of professional development, (c) collective participation of teachers from the same classrooms or schools in the professional development, and (d) continued intensity and duration of the content being covered and implemented (Guss et al., 2013). Classroom observations enable educators to critically examine their teaching beliefs and practices and help improve the effectiveness of their teaching for the students in their classroom. The data gathered through classroom observations could be used to inform the teaching reflection and curriculum design work that teachers accomplish in professional learning communities (Guss et al., 2013).

Professional Learning Communities

A PLC is one approach to collaborative teaching and professional development (McLester, 2012). PLCs are aligned to three main ideas that are intended to transform education practices: (a) ensuring that students are learning, (b) establishing a collaborative culture of teachers, and (c) focusing on results (DuFour, 2004; McLester, 2012). An effective PLC should involve an ongoing program through which teachers learn to implement best practices over an extended period and collaborate with other teachers throughout the school year (Hord, 1997). Participants in PLCs have a shared vision and purpose to improve student learning, to provide evidence of student learning,

and to be supported in these efforts by supportive leadership (Hord, 2009). When teachers work in a collaborative environment, they are more invested in the work and school systems are more likely to thrive (Stewart, 2014). After establishing a PLC, teachers should regularly work together to address the school's needs over the course of a school year or semester with the goal of district-wide or school-wide professional improvement (Stewart, 2014). Teachers working in PLCs can work together critically to identify and address specific gaps in student learning (Stewart, 2014).

When teachers participate in PLCs their students learn at higher levels (Muñoz & Branham, 2016). PLCs can allow teachers to work together and hold themselves accountable in terms of the outcomes they are working toward such as helping them utilize achievement data to improve student learning. In a study involving 10 elementary and three middle schools in Louisville, Kentucky with high numbers of at-risk urban students, Muñoz and Branham (2016) concluded that student learning can improve when teachers collaborate through PLCs to set learning goals for all students by gathering evidence of learning and creating a targeted plan to improve and adjust instruction.

Researchers have also explored how certain school districts can improve their implementation of PLCs to improve student outcomes to meet state mandates (Thessin, 2015). In a 2-year study of one urban district in the Midwest, 28 teachers in six schools implemented 13 PLCs with the objective of using research-based practices to facilitate improvement. The PLCs involved schoolwide professional development to create a collaborative school culture. The findings from a district-wide teacher survey providing feedback on the PLC program indicated that districts need to provide more in-depth,

targeted support and resources to schools to aid in the development of PLCs during the initial years of the program. Teachers also suggested that schools should be more involved in the planning and design of PLCs prior to their implementation, including establishing the PLC characteristics, setting goals, and designing school improvement processes for professional development (Thessin, 2015). The PLC model has been shown to be particularly effective with science teachers, which is discussed in the following section.

Professional Learning Communities for Science Teachers

To improve science teaching and learning, various collaborative professional development approaches are becoming more common, including instructional coaching, dialogues, and in-person and online PLCs aimed at promoting collaboration and empowering science teachers' conversations around teaching (Deneroff, 2013). In lieu of traditional departmental meetings, many science teachers have begun meeting in collaborative teams to work together to improve student achievement in science (Miller, 2018). These teams can be approached in various ways: by content type, grade level, building level, district level, or even across multiple school districts (Miller, 2018). Participating teacher teams have worked collaboratively in three areas: (a) curriculum, (b) instruction and assessment, and (c) teaching and learning. The advantage of shared work teacher teams—as opposed to science departmental meetings—is that these teams involve a distributed leadership model of school improvement in which teachers work together to make evidence-based changes. Within the teacher teams, teachers have been able to make

building- and district-wide decisions with the shared goal of improving student standardized test scores and report card ratings (Miller, 2018).

A discussion protocol can be a part of PLCs as a guide to help teachers support each other through cycles of action and reflection with the objective of aligning teaching and learning (Harris & Rosenman, 2017). For example, science teachers in California have engaged in intensive professional development activities, including attending summer sessions, evening workshops, and PLC meetings throughout the school year. This also involved a discussion protocol to create more opportunities for teachers to put research into practice and learn how to teach students to think, talk, write, and act like scientists, as required by national standards. The PLC sessions upheld three main principles: (a) creating a safe space, (b) defining specific roles for teachers, and (c) providing reflection and feedback, with each session focused on one individual teacher's classroom. The discussion protocol used during each PLC session guided the group reflection and feedback process in a way that enabled teachers to support each other in making practice-based shifts toward aligning teaching with the national science standards known as the Next Generation Science Standards (Harris & Rosenman, 2017).

Implementing PLCs has been effective in improving teaching and learning processes in science and math classrooms (Lutrick & Szabo, 2012). In a study focused on changing teacher practices and improving student learning outcomes in science and math, a PLC was implemented through a university–urban high school partnership. Ndunda, Van Sickle, Perry, and Capelloni (2017) studied the effects of this mandated school wide, content-based PLC that was implemented as part of school reform efforts to address the

school's low graduation rates and its failure to meet Adequate Yearly Progress. Assessments conducted 15 weeks into the program indicated that the PLCs had been successfully implemented and had positively impacted student math and science outcomes. In science classrooms, 70% to 92% of students passed a summative exam, compared to an 11% average passing rate in prior semesters. Students in math classes improved their Measures of Academic Progress scores by 50%. Two main themes emerged from the study regarding the implementation of a successful PLC: creating a sense of caring and building professional school wide interactions. The PLC was also successful because teachers had a shared vision, had supportive leadership, and worked together as collective learners (Ndunda et al., 2017).

Beyond their mastery of pedagogical and content knowledge, research has shown that science teachers are more effective when they also interact with other science teachers who value science education (Bryce, Wilmes, & Bellino, 2016). In a case study of science teacher professional development, three teacher-practitioners reflected on their teaching experiences and considered how to transform science teacher professional development into PLCs. In their exploration of professional development approaches that would support inquiry-based science, the authors (three teacher-practitioners) presented their reflections, mentoring experience, and implementation of a PLC as potentially effective methods (Bryce et al., 2016). Based on the discussions in the case study, all three practitioners agreed that professional development for science teachers should focus on transforming student learning, provide teachers the opportunity to experience inquiry, and include the formation of a PLC (Bryce et al., 2016).

Science teachers need focused and practical professional development activities for their PLCs to more effectively guide their efforts at redesigning science lesson plans (Lewis, Baker, Bueno Watts, & Lang, 2014). Based on findings from the Communication in Science Inquiry Project, Lewis et al. (2014) developed a step-by-step professional learning activity for science teachers to implement within a PLC model. Teachers worked collaboratively in their PLC to redesign a science lesson that followed a scientific classroom discourse community methodology. Components of the redesigned lesson included inquiry, oral presentation, writing, language development, and learning principles. Following the Communication in Science Inquiry Project's professional development program, teacher participants found that they were better equipped to align lessons and teaching to meet the Next Generation Science Standards. They also reported feeling better equipped to redesign traditional teacher-directed science lessons into inquiry-based lessons. Based on this research, PLCs with science teachers are most effective when they have focused professional development activities to guide their group sessions (Lewis et al., 2014).

Summary of Review of Literature

Professional development for teachers plays an important role in implementing innovative classroom activities such as service-learning projects. The findings reviewed in the subsection about PLCs indicated that teachers in PLCs share work, agree on school wide initiatives, and extend professional learning throughout the school year in order to achieve school improvement goals. In the studies reviewed, several common criteria emerged for effective PLCs: (a) that there should be specific goals and objectives for

school improvement, (b) that teacher practice and collaboration should be the focus of professional development, (c) that there should be collective participation of teachers from the same classrooms or schools, and (d) that PLCs should meet regularly and the duration of the programs should be long term.

According to the literature on professional development for science teachers, PLCs have become increasingly popular and have been found to be more effective than more traditional approaches like departmental meetings (Miller, 2018). For science teachers to be effective, they must interact and learn with other science teachers (Harris & Rosenman, 2017). Working in a shared learning situation of the PLC, science teachers gain the ability to teach students how to think, talk, write, and act like scientists, as required by the Next Generation Science Standards (Lewis et al., 2014). Moreover, they offer science teachers the opportunity to support each other in making practice-based shifts toward increasing student achievement (Miller, 2018). PLCs are therefore a potentially valuable professional development tool for science teachers, and further research is warranted to investigate their benefits for educators (and students) and the best practices for their implementation.

Project Description

Based on the review of literature about best practice for professional development design, I developed a project where teachers will collaborate and form professional learning communities. This may be an effective way for high school teachers to collaborate, design, and implement service-learning in science. *The Science of Service-learning* is a professional development program and 3-day retreat that I designed for high

school science teachers. I developed this professional development for science teachers to use the findings from my study to discuss the implementation of service-learning projects in high school science. My professional development program will allow teachers to develop plans, collect data, and design effective service-learning projects for high school science to improve student achievement.

During the professional development program, teachers will attend three days of workshops in the form of breakout sessions. In the breakout sessions, teachers will discuss the results of my study, design an ongoing service-learning project to implement in their classrooms, and gain additional information about some best practice strategies for the science classroom. Teachers will have the opportunity to work in groups to form a PLC of their own to create a service-learning project focused on improving student achievement. After the 3-day professional development program, teachers will be able to implement their service-learning project in their schools, continue to collaborate with their group about their project throughout the school year, and collect data on student achievement. The teachers will plan to meet monthly, discuss their data collection on student achievement, and address concerns or make improvements upon their service-learning project. Teachers in their schools will share their findings with their colleagues and administrators in the form of a presentation.

The goals of this professional development program are as follows: (a) teachers will learn to design and implement a service-learning project in their science courses, (b) teachers will achieve an understanding of how service-learning projects affect science achievement, and (c) teachers will become a part of an ongoing PLC based around a

service-learning project for high school students. The target audience for the professional development program is high school science teachers in a northern Midwest state.

Teacher participants should be able to do the following upon completion of the program:

- Explain the benefits of service-learning projects in high school science.
- Understand the relationship between service-learning projects and student achievement.
- Utilize and embed best practice strategies within service-learning projects in science.
- Design a service-learning project in science with a group of teachers.
- Participate in an ongoing PLC as a result of my project.

Components of the Retreat

The Science of Service-learning retreat will be implemented June 28, 29, and 30, 2020 from 8:30 a.m. to 3:00 p.m. Teacher participants will be eligible to receive continuing education credits toward maintaining teacher certification each day of the retreat for an additional $30 to the state teacher certification board. A working lunch will be provided each day of the workshop along with snacks and water that will be available all day. Teachers will be asked to bring a laptop or tablet. Teachers will be provided a journal to use throughout the retreat. Teachers are expected to attend all three days with lodging and meals included on site.

Day 1. Day 1 will include the following scheduled breakout sessions:

1. *The Effect of Service-learning Participation on Student Achievement.* This breakout session will be a 60-minute presentation of research-based findings on Service-learning Projects in high schools including the findings from my research study. The purpose of the session is to inform participants about the effect of student participation in service-learning projects on student achievement in high school science. Teachers will receive a handout with service-learning project ideas and links to a variety of service-learning projects in science (see Appendix A). I will facilitate this session and answer questions at the end of the session.
2. *Building Collaboration with Service-learning Projects.* This breakout session will be part of a group of meeting times during which teachers will learn best practice pedagogy for implementing service-learning projects. This presentation is 60-minutes. Teachers will learn how to teach their students to collaborate in teams and how to have effective classroom discussions. In this session, teachers will create a physical circle space to practice discussions and ideas related to service-learning projects. Teachers will learn to use the circle to create a classroom culture of learning and discussion for effective service-learning projects. Representatives from Youth Driven Space will be presenting this session.
3. *Strengthening Collaboration with Service-learning Teams*. This breakout session is a 60-minute outdoor team building activity that will allow teachers to practice and strengthen collaboration for service style activities. Teacher

participants will work in groups that mimic student groups in the classroom. Each teacher group will engage in different challenges. The groups will complete different tasks using collaboration and problem-solving. The challenge activities are classroom-ready for teachers to use with their student service-learning teams. The facilitator will hold a question and answer session at the end. Groups will eat lunch following this activity. There will be four highly qualified and certified support staff on site conducting this session. The four staff members will be high school science teachers.

4. *Service-learning with Science Education Outdoors Part 1*. This breakout session is a 90-minute hands-on outdoor activity aligned to a service-learning project in a high school ecology course. Teachers will learn how to conduct a soil analysis and pond water quality analysis based on the quantity and types of pond life. Teachers will learn how to teach their students to perform this analysis and how to read and report the results to a local Department of Natural Resources and Environmental Protection Agency as a service project and service to the community. Teachers will also learn about ways to have their students create public service announcement to inform the community about issues related to water and soil quality in the area. This service-learning activity will be performed and completed in teams of teachers on Day 1. This activity will show teachers how to implement science service-learning activities into the classroom and make connections with community stakeholders. Each team of teachers will receive a science notebook for

recording scientific data from the class. Two certified science teachers will facilitate this session.

5. *Becoming a Service-learning PLC – Day 1*. This breakout session is a 40-minute group discussion and activity hour that will extend into a yearlong online virtual PLC. Teacher groups will be working on building a service-learning project following a rubric (see Appendix A) that will be implemented in their classrooms this upcoming school year. Teachers will work in groups for all three days of the retreat. Teacher groups will present their collaborative service-learning project idea on Day 3 at the last breakout session and service-learning science fair. These teachers will meet via web technology once per month throughout the school year to work as a PLC on their service-learning project. A website and online communication forum will be developed by and for these teachers to collaborate all school year during this breakout session.

Day 1 will conclude with a 20-minute journal writing reflection and gallery walk. Participants will reflect on their learning by writing in their journals. Teachers will have a change to gallery walk and share ideas on large post-it notes placed around the main room in the lodge. Teachers will write words, phrases, comments, and questions on the post-its focused around service-learning projects. Teachers will have a quick share out session at the end. Teachers will fill out a short evaluation of the Day 1 breakout sessions (see Appendix A).

Day 2. Day 2 of the retreat will include the following breakout sessions:

1. *Collecting and Organizing Data for Service-learning Activities.* This breakout session will be a 60-minute session on collecting, organizing, and analyzing data for service-learning projects. The purpose of the session is to show teachers ways to collect and organize real-time and relevant scientific data for service-learning projects using Excel, PowerPoint, and Google Forms. Teachers will have the opportunity to work with three different data templates that will be provided on flash drives for teachers to take back to their classroom. This session will also introduce teacher participants to sample service-learning projects that have utilized and shared data to measure activities and outcomes tied to the service-learning project. A list of additional references and technology resources will be provided (see Appendix A). A teacher colleague, with a master's degree in educational technology, will be conducting this session.
2. *Differentiating Science Lessons within Service-learning.* This 60-minute session shows teachers different ways to differentiate science lessons for students participating in service-learning projects. Teachers will be provided a Bloom's Taxonomy chart and flip book. Teachers will also be provided with examples of differentiated student products and final presentations from service-learning projects (see Appendix A). Teacher participants will have opportunities to share strategies during the session.
3. *Service-learning with Science Education Outdoors Part 2.* This 90-minute outdoor science service-learning activity is aligned to the state standards and

coursework for biology and ecology classes. Teacher participants will learn to conduct a leaf and tree identification for a community and learn how to report the statistics to the local Department of Natural Resources. Teachers will also participate in a neighborhood bird count session where they will learn to identify and record sightings of birds during a specific time frame. Teachers will learn to record their information and set up a plot sight on the Cornell University website as participants in a local and nationwide service-learning project for the Cornell Lab of Ornithology. Teachers will set up their plots and data on the website. A discussion will follow about how to build this service-learning activity into science course work. Groups will eat lunch after this activity.

4. *Science Scavenger Hunt*. One of the most important skills in service-learning is teamwork. This session will demonstrate how to engage students and break down potential barriers when working in team situations in science. This 60-minute outdoor session ties together science, service-learning, and problem-solving. This science scavenger hunt incorporates communication and listening skills for teams to be successful in the activity. Several certified teaching staff members from AHS will be on site to conduct this activity.
5. *Service-Learning PLC – Day 2*. This session is a continuation of *Service-learning PLC* from Day 1. It is a 40-minute session for predetermined teacher groups to discuss and design a service-learning project and ongoing PLC. On Day 2, the same teacher PLC groups from Day 1 will be working on

completing a learning project following the service-learning rubric provided by the presenter (see Appendix A). The teacher groups will decide on a presentation format for the Day 3 service-learning science fair. Teachers may use technology, a science fair board, YouTube video, or other creative option. Paper, poster board, and art supplies will be available on site in the main lodge. The groups will continue to collaborate, share and extend the service-learning in an online PLC throughout the school year.

Day 2 of the retreat will conclude with a 20-minute journal writing reflection and gallery walk. Participants will reflect on their learnings by writing in their journals. Teachers will gallery walk and write words, phrases, comments, and questions on the large post-it notes in the main lodge (different from Day 1). Teachers will have a quick share out session at the end. Teachers will fill out a short evaluation of the Day 2 breakout sessions (Appendix A).

Day 3. Day 3 of the retreat will include the following breakout sessions:

1. *Star Spangled Service-learning.* This 60-minute session will show teachers actual footage of some of the most dynamic high school service-learning projects from around the United States. Three different videos will feature high school students engaged in their service-learning projects from start to finish. A discussion will follow the session. The video links will be shared with teacher participants (see Appendix A). I will be facilitating this session.
2. *Five Simple Science Service Ideas.* This 60-minute breakout session will introduce teachers to six different ideas for service-learning projects in the

science classroom. The first idea includes inviting students to research a local landmark or community park using STEM to find ways to improve the landmark for visitors while maintaining its historical integrity. The second idea includes sponsoring an after-school service-learning science club where students could put their talents to work by providing childcare and teaching younger children hands-on science experiments. The third idea involves having students put together an Ecology Club with a local-grounds clean-up and water quality testing program. The fourth idea involves implementing a school recycling program. The recycling program will include students creating a video or audio public service announcements and advertisement to discuss the importance of recycling and waste reduction. Students could then post their videos to the school website for the community to view. The fifth idea includes having students start a gardening project and mentor program with children at a local elementary school. A certified science teacher will conduct this session.

3. *Service-learning with Science Education Outdoors Part 3*. This breakout session is the final segment to outdoor nature and science service-learning activities for science courses. This session is 90-minutes in length and teaches participants about biodiversity in a community, environmental awareness, and civil engineering. Teachers will learn how to integrate a community environmental awareness service-learning project into a variety of science courses in high school. The environmental awareness service-learning project

will include a community plant and animal biodiversity count as well as a school and neighborhood clean-up. Teachers will receive handouts and support materials that will guide them through the biodiversity count (see Appendix A). Groups will eat lunch after this activity.

4. *Stakeout the Stakeholders for Service-learning.* This is a 60-minute session where teachers will learn strategies to connect to local stakeholders to support and collaborate with students for service-learning projects in schools. Three guest speakers and stakeholders from Kellogg, BASF, and Ford Motor Company will be on site for this presentation. They will discuss their community partnerships and grant opportunities. These guest speakers will also have tips and tricks for gaining and maintaining stakeholder relations. Teachers will have access to a list of current and ongoing service-learning projects. Teachers will have an opportunity to meet the stakeholders and learn how to join in on projects that are underway for the upcoming school year.
5. *Service-Learning Science Fair and PLC – Day 3*. Teachers will finalize their service-learning projects. It will allow teacher groups to finalize plans for their service-learning project and ongoing PLC for the upcoming school year. The teacher groups will also set up for a science fair style presentation for all of the other teachers at the retreat. Groups will also set potential meeting dates and times to continue their PLC throughout the school year.

Day 3 of the retreat will conclude with a 60-minute service-learning science fair. Participants will take turns presenting in the main lodge. Teachers will have the

opportunity to walk around and ask questions at the end of the session. Teachers will fill out a short evaluation of the Day 3 breakout sessions as well as complete an overall evaluation of the 3-Day retreat (Appendix A). The evaluation will provide me with feedback from the participants to improve upon the training in the future.

Potential Resources and Existing Supports

The *Science of Service-learning* 3-day retreat is a professional development program for high school teachers in a Northwest state. The retreat requires time, technology (internet, computers, and projector), art supplies, teacher journals, as well as stakeholder and teacher support and participation. Teachers need a large lodging facility, gathering space, and outdoor nature center for this retreat. All of the resources mentioned are available for this professional development.

Continuing education. Teachers in the state are expected by most school districts to participate in 30 hours of professional development each year. Each summer, when teachers are on summer break, teachers have the opportunity to seek learning opportunities and professional development hours toward their certification. This three-day retreat offers teachers the opportunity to earn up to 30 hours of professional development. The retreat will run from 8:30 a.m. to 3:00 p.m. each day. Teachers must attend each day and pay an additional $10 per day toward their continuing education credits in the state.

Technology. Teachers will be required to bring a personal electronic device such as a tablet or laptop. The facilitators and presenters will be using an LCD projector,

internet, and computer for some of the presentations. The main lodge gathering space will provide teachers with technology resources and a few additional desktop computers.

School supplies. Large and small post-it paper, markers, tape, journals, science fair boards, construction paper, scissors, glue, stencils, and other miscellaneous supplies will be available to teacher participants for them to present their service-learning project on the third day of the retreat.

Potential Barriers

A potential barrier to *The Science of Service-learning* development program might be low participant enrollment since the retreat is being held during the summer. Many teachers may be out of town or have earned enough professional development hours during the school year. Another barrier to this professional development program might be the travel time required for the retreat. The retreat will be offered at a remote location approximately two hours away from many of the state's big cities. Cost for participants may also be another barrier to attending the program. A stipend from the local intermediate school district will be offered to the first 20 applicants to cover the cost of the retreat. This stipend will cover the cost of the entire retreat, which includes lodging, food, and the professional development program. Another way to eliminate some of these barriers will be to advertise the retreat to science teachers on science websites and in local science publications. Participants who facilitate a breakout session in future workshops will receive a discount.

Proposal for Implementation and Timetable

I intend to make a formal proposal to the stakeholders and staff at the nature preserve and retreat facility in Fall 2019. At this time, I will ask for permission to hold the professional development retreat at the end of June 2020. During this presentation and meeting with the facility staff, I will present my study, the breakout sessions, and the details of the professional development program. I will proceed with the planning of the professional development upon approval from the Chief of Staff at the retreat facility. Additional planning will include printing the breakout session materials, gathering supplies, and reaching out to facilitators and stakeholders. Requesting a salary quote, continuing to advertise the professional development program, and starting the registration process are also part of the planning for the program.

Roles and Responsibilities of Student and Others

I will be the facilitator of *The Science of Service-learning* Retreat. My duties are to coordinate the breakout sessions, organize the retreat schedule, gather resources, and connect with other facilitators and stakeholders for the professional development program. I am responsible for retreat registration, reserving the location of the retreat, making sure the retreat runs smoothly and having the resources available for each breakout session. I am also responsible for reaching out to the participants after the workshop and checking in with them to support the implementation of their service-learning project. The staff at the retreat facility will be responsible for preparing breakfast, lunch, and snack for the three-day retreat. The retreat facility staff will also be

responsible for maintaining the lodging gathering room as well as maintaining the sleeping quarters.

Project Evaluation Plan

A survey is the most common data collection tool used to evaluate programs (Lodico et al., 2010). I am going to use two tools to evaluate my project. A summative survey evaluation will be used to gather feedback from the teacher participants at the end of the retreat (see Appendix A). Participants will also be asked to fill out a formative survey evaluation form after each breakout session. Both surveys (formative and summative) will be used to gather feedback from the participants about the breakout sessions and retreat. The feedback will be used to make improvements to the retreat for the future. The input will also be shared with the breakout session facilitators so they can make improvements for future meetings.

Project Implications

The purpose of *The Science of Service-learning* professional development retreat is for teachers to learn how to design effective service-learning projects in science, learn effective hands on experiences in science, and be able to collaborate in an ongoing PLC. My findings indicated that student participation in a course-embedded service-learning project improved student achievement in science. My project can assist teachers in embedding effective service-learning projects into science courses and curriculum to improve student achievement in high school science. My project offers teachers unique ways to incorporate science and best practice into service-learning activities.

Conclusion

The findings of my study indicated that high school student participation in a course-embedded service-learning project in science improved student achievement in science. As a result, I created a professional development program that would allow teachers to collaborate in a PLC to design effective service-learning projects in science. In this section, I described *The Science of Service-learning*, a 3-day retreat and professional development program that would allow science teachers in a northern Midwest state to use PLCs to collaborate and design effective service-learning projects in science. During this professional development program, teachers will collaboratively research, design, and implement service-learning projects in science to improve student achievement. I described the project's goals, schedule, activities, and assessments. I provided the project in Appendix A. In the final section, Section 4, I will reflect on my project, my practice as a scholar and practitioner, and the strengths and weaknesses of my project. I will address the limitations of the project, reflect on the development of my project, and discuss its implications on my professional and personal growth as an educator.

Section 4: Reflections and Conclusions

Project Strengths and Limitations

I developed this project as a way to help high school science teachers collaborate in a PLC and to address the findings of my study. My project is a professional development program PLC that will allow teachers to work together to design effective service-learning projects and collect additional data about the effect of student participation in service-learning projects on student achievement in science. I developed a 3-day professional development retreat based on the findings of my study. The purpose of the project is for teachers to learn how to engage students with service-learning in science to improve student achievement, collaborate and build service-learning into an indoor and outdoor classroom, and design and develop a service-learning project through an ongoing PLC throughout a school year. In this section, I discuss my reflections and conclusions to my project. I also explain the project strengths, limitations, and recommendations for alternative approaches. Finally, I reflect on my scholarship, project development, leadership, change, and suggestions for future research.

Project Strengths

The Science of Service-learning professional development program demonstrates some strengths. First, the professional development program is a 3-day retreat held at a remote nature preserve and outdoor activity center 2 hours away from the local setting. The strength of having the retreat at this location is that it will take teachers out of their element, provide them with a fresh learning environment, and allow them to collaborate with other science teachers from across the state. Each day of the retreat, the learning

activities and breakout sessions will be held in both indoor and outdoor settings. The location of the retreat is in a wooded area on the outskirts of a small city in a northern Midwest state. This unique and remote setting may contribute to the productivity of each teacher participant as it provides a natural environment where teachers can utilize the skills that they are learning. The retreat will also give the teachers an opportunity to network, learn in a shared work setting, and design a useful service-learning project to improve student achievement in science for the upcoming school year.

The second strength of this 3-day retreat and professional development program is that it offers research-based breakout sessions each day. The breakout sessions range from best practice strategies for classroom instruction for building effective service-learning projects to designing professional learning communities for service-learning projects in high school science. The design of each breakout session is set up for teachers to practice strategies learned while collaborating with other teachers. Teachers will be introduced to innovative ways to engage students in science and hands-on activities aligned to usable and relevant service-learning projects. At the end of each day of the retreat, teachers will reflect and discuss their experiences, which includes explaining how they will take their learning back to their colleagues and classroom.

Third, teachers will have the opportunity to meet with stakeholders and make connections that may assist them in developing service-learning opportunities for students. Teachers will collaborate in professional learning communities for 3 days to put research into practice and build a sustainable service-learning project with other teachers (Chen & Mitchell, 2015; Locke, 2015). Educational researchers suggest that teachers

need to construct new knowledge into their practice with different styles of professional learning such as PLCs (Han, 2014; Walton, Nel, Muller, & Lebeloane, 2014). I designed *The Science of Service-learning* retreat for high school teachers to learn innovative ways to engage students in classwork and service-learning style activities. I believe that the science teachers who participate in the 3-day retreat will work collaboratively and effectively to design service-learning projects in science for the upcoming school year.

Project Limitations

My project has three limitations. The first limitation is the location. Despite its potential advantages, having the retreat in a remote area requires teachers to travel and stay away from home for 3 days during a summer month. In the future, if travel is an issue for teachers attending the retreat, I will recommend that the event be hosted at a statewide central location without overnight accommodations.

The second limitation is that teacher participants are geographically isolated from each other. The project is a statewide retreat where teachers from all over the state are invited to attend. Except for the ongoing PLC, which will be conducted online, teachers may have a difficult time collaborating on their service-learning projects. I recommend that teachers reach out to and work with other teachers in their individual buildings so they can continue to work on their service-learning projects.

The third limitation is that there is not a follow-up retreat scheduled at this point. However, there is an evaluation form for teachers to fill out on the last day of the retreat. I recommend that teacher participants provide feedback on the evaluation regarding their interest in a follow-up of *The Science of Service-learning* professional development

program. The feedback would be used to make decisions regarding a future *Science of Service-learning* professional development program.

Recommendations for Alternative Approaches

The purpose of *The Science of Service-learning* professional development retreat is for teachers to learn how to design effective service-learning projects for high school science students while collaborating in a PLC. An alternative approach to my project could be to space out the professional development program throughout the school year. The program could be held at various locations throughout the state on Saturdays where teachers would receive instruction and collaborate in PLC meetings. Another approach could be to conduct the professional development online. Teachers could participate in an online webinar once per month throughout the school year. Teachers would collaborate and receive instruction online. These alternative approaches could provide more teachers the opportunity to participate in the professional development.

Scholarship, Project Development, and Leadership and Change

Scholarship

Throughout this doctoral journey, I have learned how to develop a doctoral study using evidence and scholarly research. I have learned to define a problem, develop an argument, write a proposal, and collect and analyze quantitative data. By conducting this study, I became more aware of researcher bias and to take steps to prevent it during the research process. I have matured and grown professionally in many areas throughout this journey. I have become a better teacher, educational leader, and researcher. The dedication and work involved in this doctoral journey have allowed me to think on a

deeper level, advocate for education, and work with schools and stakeholders to ensure schools do not have one-size-fits-all educational forum.

Completing this doctoral research is also part of my investment in education. I have been and will continue to be dedicated to a process where mental stamina, integrity, and high levels of learning are major components in developing scholarly research to improve on my pedagogy and best practice instruction. Immersing myself into this level of education was an important part of scholarship and a lifelong goal of mine.

Project Development

By developing a professional development project, I have learned how to address a local problem and design a best practice program for teachers. As an agent of change, my data collection served as a guide for me to create a unique project and professional development program designed for science teachers. My professional development project allowed me to learn how to provide a forum for teachers to learn, practice, share, and collaborate in a PLC with the intent of increasing science achievement.

Developing this research has also helped me to understand how to address a research problem systematically, then create a project based on my research findings. I have not only gained knowledge and valuable skills in conducting a research study, but I have learned about developing an engaging project and program from start to finish as an outcome of my research. Because of this opportunity and my dedication to my research and project study, I am now able to design professional development programs that are engaging, collaborative, and follow best practice that is differentiated to meet the learning needs of all types of learners.

Leadership and Change

Over the past 17 years as a classroom teacher, I have been an integral part of the school improvement process. As a teacher leader, I strive to help make a difference in schools and in the classroom in the best interest of student learning. The completion of my doctoral study has taken my teacher leadership role to the next level as I have learned to understand how to utilize research and bring about the change needed in an educational setting. Additionally, my plan for implementation of my professional development project will help teachers work together on school improvement and equip them with the tools needed to be effective agents of change for students in their schools.

The years of work invested in my research study has helped me better understand my connection to my career and critical role as a teacher and educational leader in the public school system. I am a lifelong learner and am an advocate for public education. The completion of my doctoral study is not the end of my road as a scholar and leader. It is only the beginning. I will continue to learn, think, research, analyze, and grow as an educator in the world around me. None of this would be possible without the relationships that I have made and the knowledge that I have gained from my Walden University professors, building administrator, teacher colleagues, and stakeholders in the field of education.

Analysis of Self as Scholar

I have always been a hard worker and dedicated to school for as long as I can remember. From a very young age, I remember being interested in and passionate about learning new things, especially in the field of education. As my doctoral journey comes to

a close, I realize that I have been resilient throughout this process. I have been able to survive, persevere, and stay focused on an academic path for many consecutive years in the face of some adversity along the way. As a scholar and a person, I have managed to finish strong. I maintained focused and connected to my research and studies throughout even with a few minor setbacks and personal conflicts. Guided by my chair, second member, and other scholars in education, I have been able to learn, grow, and progress as an educator and conduct a high-quality level of research. I am dedicated to learning and passionate about helping others in education. I have learned valuable skills in collecting and analyzing data to make conclusions about a research problem. I have developed the ability to conduct research based on a problem to improve student achievement.

Analysis of Self as Practitioner

My study provided me the opportunity to become a better educational practitioner. I have developed leadership skills that have led me to become an instructional coach, teacher mentor, and school improvement chairperson in my school. I am confident with my pedagogy and knowledge to make data driven-decisions that address concerns in my district to improve schools in the best interest of student learning and student achievement. With the research that I conducted with my doctoral study and professional development project, I now have the confidence to critically assess school initiatives to make decisions with best practice committed to social change.

Analysis of Self as Project Developer

Based on my research and findings from my study, I developed a project to address a problem within an alternative education high school. I developed a project in

the form of a PLC, which was familiar to teachers at the local setting. Based on the nature of the problem of low science achievement, I designed a professional development program that was engaging and relevant for teachers and students. The research I conducted supported the idea that teachers learn better when they collaborate and practice shared work throughout the school year. I set up my professional development in a PLC so teachers can utilize a research-based approach to design effective service-learning projects for high school students. This project allowed me to develop a program for teachers aligned to goals, objectives, a data collection, and an evaluation plan. The project goal is for teachers to (a) learn to design and implement a service-learning project in their science courses, (b) achieve an understanding of how service-learning projects affect science achievement, and (c) become a part of an ongoing PLC based around a service-learning project for high school students. Through designing this professional development program, I have learned to develop a project that assists teachers with collaboration and implementing a best practice for improving student achievement. School improvement is an ongoing process.

In developing my project, I learned how to create a professional development program that allows teachers to collaborate in PLCs and make informed decisions for school improvement. Professional learning communities give teachers the opportunity to discuss school-wide problems, collect data, adjust instruction, and find solutions to improve practice. Teachers must provide engaging student learning and research-based instruction. Teachers need to create a classroom culture of learning and prepare students for life beyond high school. Researching service-learning, collecting data on service-

learning, and developing my project, helped me realize that teachers and schools need to provide their students' opportunities such as service-learning that allows them to take ownership of their education. Within their PLCs, teachers will be designing effective service-learning projects to increase student responsibility, accountability and ultimately student achievement. I am confident that I can now create and implement professional development programs that allow teachers to address a local problem and improve schools with collaborative professional development in the form of PLCs.

Reflection on Importance of the Work

Teacher collaboration based on student learning needs in the form of PLCs can bring about positive social change in high school classrooms. This project is important because it aims to improve teacher collaboration and science curriculum with service-learning, which will potentially affect social change. Designing this project provided me the opportunity to engage in research to positively affect faculty members, stakeholders, and student success in high school. Teacher participants in *The Science of Service-learning* 3-day retreat and professional development program will be able to use what they have learned from the program in the classroom as well as share strategies and resources with other teachers in their building and school district. My professional development project can assist teachers in improving science education and teacher collaboration in their schools. My project could potentially influence social change by allowing more teachers to engage in shared work activities based on school improvement initiatives. Teachers can work together on school goals and objectives that will bring

about positive social change in science and student learning, which could also extend to other academic areas.

Implications, Applications, and Directions for Future Research

Implications

My findings and conclusions from my study will provide useful and meaningful information for science teachers and administrators to better understand the effect of student participation in service-learning projects on student achievement in science. I developed a project called *The Science of Service-learning* professional development program. My project may influence positive change by providing high school science teachers an opportunity to collaborate in PLCs to build effective service-learning projects in science. Science teachers can benefit from sharing information learned from this study and collecting new knowledge to improve practice and guide decision making in implementing service-learning projects. My project may also enhance the science curriculum, promote shared learning, encourage teacher collaboration, and motivate students to perform better in science classes. Researchers have concluded that teachers working in professional learning communities improve practice (Avalos-Bevan & Bascopé, 2017; Colwell et al., 2014; Guss et al., 2013; Han, 2014; Lampi et al., 2015; Lewis et al., 2014; Locke, 2015; Muñoz & Branham, 2016; Stewart, 2014). The findings from my research will provide teachers and administrators with valuable information that will allow them to make informed decisions about service-learning, science curriculum, and student achievement in science. This information may help teachers build confidence

in implementing service-learning and create solutions to improving student achievement in high school science classes.

Applications

Professional development in the form of PLCs is an effective means of building a culture of collaboration for teachers to transform educational practices (Deneroff, 2013; Dufour, 2004; McLester, 2012; Miller, 2018; Thessin, 2015). My project will provide teacher participants with new and innovative ideas for their individual schools to make important curriculum decisions to improve student achievement in science. The target audience for my research study is high school science teachers, but administrators, support staff, stakeholders, and teachers in other core areas could benefit from reading my study and professional development project. My project encourages teacher collaboration in PLCs and teaches educators best practice strategies to design an effective service-learning project in science. One of my personal goals for this project was to influence social change in a way that would encourage teachers to implement best practice strategies in their classroom instruction to engage students in science.

Directions for Future Research

There are some recommendations for further research that arise from my project study. Future studies could implement a course-embedded service-learning project in science over an entire quarter, semester, or school year. The purpose of the study would be to examine whether a course-embedded service-learning project in science influenced student achievement and attendance. The findings from future studies may provide additional information on service-learning, student attendance, and student achievement

in high school science. This data could provide valuable insight into curriculum planning, school improvement, and professional development for high school and middle school science in the future.

Conclusion

The purpose of my study was to determine the effect of high school student participation in a 10th-grade service-learning project on student achievement in science and on student attendance in science classes. This research study used a quantitative, quasi-experimental, pretest–posttest control group design using archival data from school and teacher classroom records. A quasi-experiment design was selected to determine whether there was a significant difference in student achievement in science and student attendance between students who participated in a service-learning project (experimental group) and those who did not (control group).

The findings from my research indicated that student participation in service-learning projects positively significantly affected student achievement in science. The study, however, did not find that students who participated in service-learning had significantly higher attendance than students that did not. These findings suggest that high schools could implement course-embedded service-learning projects in science as a means of positively affecting student science achievement.

References

Altman, M., & Meis, A. (2012). Kinvolved: Utilizing technology to communicate, evaluate, and advocate for improved attendance and family and community engagement. *Journal of Educational Technology Systems*, *41*(4), 319-332. doi:10.2190/ET.41.4.c

Anderson, J., Taylor, L., & Gahimer, J. (2014). Assessing the impact of a short-term service-learning clinical experience on the development of professional behaviors of student physical therapists: A pilot study. *Journal of the Scholarship of Teaching and Learning, 14*(4), 130-143. doi:10.14434/josotl.v14i4.12788

Avalos-Bevan, B., & Bascopé, M. (2017). Teacher informal collaboration for professional improvement: Beliefs, contexts, and experience. *Education Research International*, 1-13. doi:10.1155/2017/1357180

Balkis, M., Arslan, G., & Duru, E. (2016). The school absenteeism among high school students: Contributing factors. *Educational Sciences: Theory & Practice*, *16*(6), 1819-1831. doi:10.12738/estp.2016.6.0125

Battersby, S. L., & Verdi, B. (2015). The culture of professional learning communities and connections to improve teacher efficacy and support student learning. *Arts Education Policy Review, 116*(1), 22-29. doi:10.1080/10632913.2015.970096

Balfanz, R. (2016). Missing school matters. *Phi Delta Kappan, 98*(2), 8-13. doi:10.1177/0031721716671898

Bettencourt, M. (2015). Supporting student learning outcomes through service-learning. *Foreign Language Annals, 48*(3), 473-490. doi:10.1111/flan.12147

Biag, M., & Castrechini, S. (2016). Coordinated strategies to help the whole child: Examining the contributions of full-service community schools. *Journal of Education for Students Placed at Risk (JESPAR), 21*(3), 157-173. doi:10.1080/10824669.2016.1172231

Bonati, M. (2018). Collaborative planning: Cooking up an inclusive service-learning project. *Education and Treatment of Children, 41*(1), 139-152. doi:10.1353/etc.2018.0005

Brail, S. (2016). Quantifying the value of service-learning: A comparison of grade achievement between service-learning and non-service-learning students. *International Journal of Teaching and Learning in Higher Education, 28*(2), 148-157. Retrieved from https://files.eric.ed.gov/fulltext/EJ1111129.pdf

Bryce, N., Wilmes, S., & Bellino, M. (2016). Inquiry identity and science teacher Professional development. *Cultural Studies of Science Education, 11*(2), 235-251. doi:10.1007/s11422-015-9725-1

Carter, E. W., Swedeen, B., & Moss, C. K. (2012). Engaging youth with and without Significant disabilities in inclusive service-learning. *Teaching Exceptional Children, 44*(5), 46-54. doi:10.1177/004005991204400505

Chang, H., Bauer, L., & Byrnes, V. (2019). Data matters - Using chronic absence to accelerate action for student success. *Education Digest, 84*(*7*), 40-49. Retrieved from https://www.attendanceworks.org

Chen, Y., & Mitchell, C. (2015). Interactions between professional learning communities and the educational culture where they are employed: Comparative research

across Beijing and Ontario schools. *International Studies in Educational Administration (Commonwealth Council for Educational Administration and Management (CCEAM), 43*(2), 39-52. Retrieved from Education Source database.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155-159. doi:10.1037//0033-2909.112.1.155

Colwell, C., MacIsaac, D., Tichenor, M., Heins, B., & Piechura, K. (2014). District and University perspectives on sustaining professional development Schools: Do the NCATE Standards matter? *Professional Educator, 38*(2), 17-26. Retrieved from https://files.eric.ed.gov/fulltext/EJ1048336.pdf

Corporation for National and Community Service. (2017). *State of the Evidence Annual Report*. Retrieved from https://www.nationalservice.gov/sites/default/files/evidenceexchange/FR_2017%20State%20of%20the%20Evidence%20Report_0.pdf

Coulter-Kern, R. G., Coulter-Kern, P. E., Schenkel, A. A., Walker, D. R., & Fogle, K. L. (2013). Improving students understanding of career decision-making through service-learning. *College Student Journal, 47*(2), 306-311. Retrieved from https://eric.ed.gov/?id=EJ1022293

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research.* Boston, MA: Pearson Education.

Currie-Mueller, J. L., & Littlefield, R. S. (2018). Embracing service-learning opportunities: Student perceptions of service-learning as an aid to effectively learn course material. *Journal of the Scholarship of Teaching and Learning,*

18(1), 25-42. doi:10.14434/josotl.v18i1.21356

Curry-Stevens, A., & Kim-Gervey, C. (2016). *Chronic absenteeism report.* Retrieved from https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1002&context=care_pubs

Darby, A., Longmire-Avital, B., Chenault, J., & Haglund, M. (2013). Students' motivation in academic service-learning over the course of the semester. *College Student Journal*, *47*(1), 185-191. Retrieved from https://www.tamiu.edu/profcenter/documents/StudentsMotivationinAcademicSL.pdf

Danielson, C. (2007). *Enhancing professional practice: A framework for teaching* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Deneroff, V. (2013). Professional development in person: Identity and the construction of teaching within a high school science department. *Cultural Studies of Science Education*, *11*(2), 213-233. doi:10.1007/s11422-013- 9546-z

DuFour, R. (2004). What is a professional learning community? *Educational Leadership*, *61*(8), 6-11. Retrieved from http://www.ascd.org/publications/educational-leadership.aspx

Fisher, D., & Frey, N. (2007). *Better learning through structured teaching: A framework for the gradual release of responsibility.* Alexandria, VA: ASCD.

Freeman, J., Simonsen, B., McCoach, B., Sugai, G., Lombardi, A., & Horner, R. (2015). An analysis of the relationship between implementation of school-wide positive

behavior interventions and supports and high school dropout rates. *High School Journal, 98*(4), 290-315. doi:10.1353/hsj.2015.0009

Furrer, C., Magnuson, L., & Suggs, J. (2012). Getting them there, keeping them there: Benefits of an extended school day program for high school students, *Journal of Education for Students Placed at Risk (JESPAR), 17*(3), 149-164, doi:10.1080/10824669.2012.695920

Gulosino, C., & Lubienski, C. (2011). School's strategic responses to competition in segregated urban areas. *Education Policy Analysis Archives, 19*(13), 1-25. doi:10.14507/epaa.v19n13.2011

Guss, S. S., Norris, D. J., Horm, D. M., Monroe, L. A., & Wolfe, V. (2013). Lessons learned about data utilization from classroom observations. *Early Education and Development, 24*(1), 4-18. doi:10.1080/10409289.2013.739543

Han, H. (2014). Supporting early childhood teachers to promote children's social competence: components for best professional development practices. *Early Childhood Education Journal, 42*(3), 171-179. doi:10.1007/s10643-013-0584-7

Harris, E., & Rosenman, A. (2017). Discussing science in professional learning communities. *Science and Children, 55*(1), 53-57. doi:10.2505/4/sc17_055_01_53

Hébert, A., & Hauf, P. (2015). Student learning through service-learning: Effects on academic development, civic responsibility, interpersonal skills and practical skills. *Active Learning in Higher Education, 16*(1), 37-49. doi:10.1177/1469787415573357

Herring, D. N. (2013). 21st Century learning: Providing academic library services for

Ohio's first STEM-focused high school. *Reference Librarian*, *54*(4), 280-296. doi:10.1080/02763877.2013.768192

Holz, K., & Pinnow, E. (2015). Self-selection effects in service-learning. *Journal of the Scholarship of Teaching and Learning*, *15*(6), 39-47. doi:10.14434/josotl.v15i6.18912

Hord, S. M. (1997). Professional learning communities: Communities of continuous inquiry and improvement. Washington, D.C. Southwest Educational Development Laboratory; U.S. Dept. of Education, Office of Educational Research and Improvement, Educational Resources Information Center. Retrieved from http://www.sedl.org/pubs/change34/plc-cha34.pdf

Hord, S. M. (2009). Professional learning communities: Educators work together toward a shared purpose. *Journal of Staff Development*, *30*(1), 40-43. Retrieved from https://eric.ed.gov/?id=EJ827545

Huff, J. L., Zoltowski, C. B., & Oakes, W. C. (2016). Preparing engineers for the workplace through service-learning: Perceptions of EPICS Alumni. *Journal of Engineering Education*, *105*(1), 43-69. doi:10.1002/jee.20107

Hullender, R., Hinck, S., Wood-Nartker, J., Burton, T., & Bowlb, S. (2015). Evidences of transformative learning in service-learning reflections. *Journal of the Scholarship of Teaching and Learning*, *15*(4), 58-82. doi:10.14434/josotl.v15i4.13432

Jao, L., & McDougall, D. (2016). Moving beyond the barriers: Supporting meaningful teacher collaboration to improve secondary school mathematics. *Teacher Development*, *20*(4), 557-573. doi:10.1080/13664530.2016.1164747

Kackar-Cam, H., & Schmidt, J. A. (2014). Community-based service-learning as a context for youth autonomy, competence, and relatedness. *High School Journal*, *98*(1), 83-108. Retrieved from https://eric.ed.gov/?id=EJ1043499

Kalles, S., & Ryan, T. G. (2015). Service-learning: Promise and possibility in post-secondary education. *International Journal of Progressive Education*, *11*(1), 132-148. Retrieved from https://eric.ed.gov/?id=EJ1060893

Karpa, K., Vakharia, K., Caruso, C., Vechery, C., Sipple, L., & Wang, A. (2015). Medical student service-learning program teaches secondary students about career opportunities in health and medical fields. *Advances in Physiology Education, 39*(4), 315-319. doi:10.1152/advan.00124.2015

Kearsley, G., & Shneiderman, B. (1998). Engagement theory: A framework for technology based technology-based teaching and learning. *Educational Technology, 38*(5), 20. Retrieved from ERIC database

Klute, M. (2013). Connecting research to practice: Viewing data utilization through the lens of professional development. *Early Education and Development*, *24*(1), 63-67. doi:10.1080/10409289.2013.736129

Kropp, J., Arrington, N. M., & Shankar, V. S. (2015). Developing a service-learning student facilitator program: Lessons learned. *Journal of Community Engagement and Scholarship*, *8*(1), 45-58. Retrieved from Education Source database.

Laerd Statistics (2015). *Statistical tutorials and software guides*. Retrieved from https://statistics.laerd.com/

Lampi, J., Domino, R., & Taylor, J. (2015). Connecting practice and research: A shared

growth professional development model. *Journal of Developmental Education, 39*(1), 32-33. Retrieved from https://files.eric.ed.gov/fulltext/EJ1106055.pdf

Lee, A. (2012). Learners as teachers: Student and community outcomes of service-learning in an undergraduate chemistry course. *Transformative Dialogues: Teaching and Learning Journal*, *6*(2), 1-12. Retrieved from Education Source database.

Lester, S. W. (2015). Melding service-learning and leadership skills development. *Journal of Experiential Education*, *38*(3), 280-295. doi:10.1177/1053825915576196

Lewis, E., Baker, D., Bueno Watts, N., & Lang, M. (2014). A professional learning community activity for science teachers: How to incorporate discourse-rich instructional strategies into Science Lessons. *Science Educator*, *23*(1), 27-35. Retrieved from https://files.eric.ed.gov/fulltext/EJ1034757.pdf

Locke, T. l. (2015). The impact of intensive writing workshop professional development on a cross-curricular group of secondary teachers. *New Zealand Journal of Educational Studies*, *50*(1), 137-151. doi:10.1007/s40841-015-0003-2

Lodico, Spaulding, & Voegtle (2010). *Methods in educational research: From theory to practice.* San Francisco, CA: Jossey-Bass.

London, R. A., Sanchez, M., & Castrechini, S. (2016). The dynamics of chronic absence and student achievement. *Education Policy Analysis Archives*, *24*(111/112), 1–27. doi:10.14507/epaa.24.2741

Lutrick, E., & Szabo, S. (2012). Instructional leaders' beliefs about effective professional

development. *International Journal for Professional Educators*, *78*(3), 6–12. Retrieved from Education Source database.

Maloyed, C. L. (2016). Actionable data projects: Social science and service-learning in general education courses. *Journal of Political Science Education*, *12*(2), 115-127. doi:10.1080/15512169.2015.1060889

McBride, A. M., Chung, S., & Robertson, A. (2016). Preventing academic disengagement through a middle school-based social and emotional learning program. *Journal of Experiential Education*, *39*(4), 370-385. doi:10.1177/1053825916668901

McLester, S. (2012). Rick and Becky DuFour. *District Administration*, *48*(8), 61-70. Retrieved from https://eric.ed.gov/?id=EJ979417

Medina, A., & Gordon, L. (2014). Service-learning, phonemic perception, and learner motivation: A quantitative study. *Foreign Language Annals*, *47*(2), 357–371. doi:10.1111/flan.12086

Miller, K. (2018). Installing glass walls and doors in the science classroom: A science teacher team framework for improving student achievement. *Science Scope*, *41*(5), 6-10. doi:10.2505/4/ss18_041_05_6

Muñoz, M. A., & Branham, K. E. (2016). Professional learning communities focusing on results and data use to improve student learning: The right implementation matters. *Planning & Changing*, *47*(1/2), 37-46. Retrieved from https://eric.ed.gov/?id=EJ1145332

National Center for Education Statistics (2016). National Assessment for Educational

Progress. Retrieved from https://nces.ed.gov/nationsreportcard/

National Dropout Prevention Center (2017). 15 effective strategies for dropout prevention. Retrieved from http://dropoutprevention.org/effective-strategies/

National Standards for Student Attendance Data Reporting (2012). Definition of student attendance. Retrieved from http://www.acara.edu.au/_resources/National_Standards_for_Student_Attendance_Data_Reporting_-_FINAL_Dec_12.pdf

Nauer, K. (2016). Battling chronic absenteeism. *Phi Delta Kappan, 98*(2), 28-34. doi:10.1177/0031721716671903

Ndunda, M., Van Sickle, M., Perry, L., & Capelloni, A. (2017). University−urban high school partnership: Math and science professional learning communities. *School Science and Mathematics*, *117*(3/4), 137-145. doi:10.1111/ssm.12215

Nelson, L. l., McMahan, S. K., & Torres, T. (2012). The impact of a junior high school community intervention project: Moving beyond the testing juggernaut and into a community of creative learners. *School Community Journal*, *22*(1), 125-144. Retrieved from https://files.eric.ed.gov/fulltext/EJ974689.pdf

Newman, J. L., Dantzler, J., & Coleman, A. N. (2015). Science in action: How middle school students are changing their world through STEM service-learning projects. *Theory Into Practice*, *54*(1), 47-54. doi:10.1080/00405841.2015.977661

Noyes, E., Darby, A., & Leupold, C. (2015). Students' emotions in academic service-learning, *Journal of Higher Education Outreach and Engagement*, *19*(4), 63-94. Retrieved from https://files.eric.ed.gov/fulltext/EJ1086106.pdf

Obhi, H., & Woodhead, E. (2015). Attitudes and experiences with older adults: A case for service-learning for undergraduates. *Gerontology and Geriatrics Education*, *37*(2), 108-122. doi:10.1080/02701960.2015.1079704

Pelco, L. E., Ball, C. T., & Lockeman, K. S. (2014). Student growth from service-learning: A comparison of first generation and non-first-generation college students. *Journal of Higher Education Outreach and Engagement*, *18*(2), 49-65. Retrieved from https://files.eric.ed.gov/fulltext/EJ1029848.pdf

Phillips, L. (2013). Working adult undergraduate students' interest and motivation in service-learning and volunteering. *Journal of Continuing Higher Education*, *61*(2), 68-73. doi:10.1080/07377363.2013.796239

Prokopy, L. S., Williams, R., Bowling, L., & Thompson, A. (2014). Service-learning in natural resources classes: Measuring the impacts on university students. *NACTA Journal*, *58* (1-4), 204-209. Retrieved from Education Source database.

Richards, M. H., Sanderson, R. C., Celio, C. I., Grant, J. E., Choi, I., George, C. C., & Deane, K. (2013). Service-learning in early adolescence: Results of a school-based curriculum. *Journal of Experiential Education*, *36*(1), 5-21. doi:10.1177/1053825913481580

Rinaldo, S. B., Davis, D. F., & Borunda, J. (2015). Delivering value to community partners in service-learning projects. *Journal of Community Engagement and Scholarship*, *8*(1), 115-124. Retrieved from Education Source database

Roberts, R., Terry, R., Brown, N., & Ramsey, J. (2016). Students' motivations, value, and decision to participate in service-learning at the National FFA Days of

Service. *Journal of Agricultural Education*, *57*(2), 187-202. doi:10.5032/jae.2016.02187

Saitta, E., Bowdon, M., & Geiger, C. (2011). Incorporating service-learning, technology, and research supportive teaching techniques into the university chemistry classroom. *Journal of Science Education and Technology*, *20*(6), 790-795. doi:10.1007/s10956-010-9273-0

Saleh, S. M., & Hamed, K. M. (2014). Service-learning through partnership with a community high school: Impact on minority health science students. *Journal on Excellence in College Teaching*, *25*(1), 95-111. Retrieved from https://eric.ed.gov/?id=EJ1026163

Scales, P. C., Roehlkepartain, E. C., Neal, M., Kielsmeier, J. C., & Benson, P. L. (2006). Reducing academic achievement gaps: The role of community service and service-learning. *Journal of Experiential Education*, *29*(1), 38-60. Retrieved from https://eric.ed.gov/?id=EJ740926

Schlesselman, L., Borrego, M., Bloom, T. J., Mehta, B., Drobitch, R. K., & Smith, T. (2015). An assessment of service-learning in 34 US schools of pharmacy follow up on the 2001 Professional Affairs Committee Report. *American Journal of Pharmaceutical Education*, *79*(8), 1-11. doi:10.5688/ajpe798116

Scott, K., & Graham, J. (2015). Service-learning: Implications for empathy and community engagement in elementary school children. *Journal of Experiential Education*, *38*(4), 354 –372. doi:10.1177/1053825915592889

Shaw, A., Brady, B., McGrath, B., Brennan, M. A., & Dolan, P. (2014). Understanding

youth civic engagement: debates, discourses, and lessons from practice. *Community Development*, *45*(4), 300-316. doi:10.1080/15575330.2014.931447

Simon & Goes (2013). Excerpts from assumptions, limitations, delimitations and scope of the study. *Dissertation and Scholarly Research: Recipes for Success*. Seattle, WA: Dissertation Success LLC. Retrieved from http://www.dissertationrecipes.com

Singh, A. (2014). Test score gaps between private and government sector students at school entry age in India. *Oxford Review of Education*, *40*(1), 30-49. doi:10.1080/03054985.2013.873529

Smith, S., Prohn, S., Driscoll, L., Hesterberg, D., Bradley, L., & Grossman, J. (2014). Preparing students for a diverse future: Using service-learning for career training in soil science community outreach. *NACTA Journal*, 58(4), 293-301. Retrieved from Education Source database.

Soria, K., & Weiner, B. (2013). A virtual fieldtrip: Service-learning in distance education technical writing course. *J. Technical Writing and Communication*, *43*(2), 181-200. doi:10.2190/TW.43.2.e

Stavrianopoulos, K. (2014). Changing college student perceptions and participation in organ donation: A classroom and service-learning intervention. *Journal of Social Distress & the Homeless*, *23*(2), 71-79. doi:10.1179/1573658X14Y.0000000005

Stewart, C. (2014). Transforming professional development to professional learning. *Journal of Adult Education*. *43*(1), 28-33. Retrieved from https://files.eric.ed.gov/fulltext/EJ1047338.pdf

Thessin, R. A. (2015). Learning from one urban school district: Planning to provide essential supports for teachers' work in professional learning communities. *Educational Planning, 22*(1), 15-27. Retrieved from https://files.eric.ed.gov/fulltext/EJ1208550.pdf

Thomas, E., & Magilvy, J. K. (2011). Qualitative rigor or research validity in qualitative research. *Journal for Specialists in Pediatric Nursing*, *16*(2), 151–155. doi:10.1111/j.1744-6155.2011.00283.x

U.S. Department of Education. (2016). Chronic absenteeism in the nation's schools. Washington, D.C. Retrieved from https://ed.gov/datastory/chronicabsenteeism.html

U.S. Department of Education. (2018). Chronic absenteeism in the nation's schools. Washington, D.C. Retrieved from https://www2.ed.gov/datastory/chronicabsenteeism.html

Walton, E., Nel, N. M., Muller, H., & Lebeloane, O. (2014). 'You can train us until we are blue in our faces, we are still going to struggle': Teacher professional learning in a full-service school. *Education as Change*, *18*(2), 319-333. doi:10.1080/16823206.2014.926827

Warner, R. M. (2013). Applied statistics: From bivariate through multivariate techniques (2nd ed.). Thousand Oaks, CA: Sage.

Willis, J. C., & Templeton, N. R. (2017). Investigating the establishment and sustainability of professional learning communities in rural east Texas: The principals' perspectives. *Rural Educator, 38*(1), 30-37. Retrieved from Education

Source database

Wyss, V. L., & Tai, R. H. (2012). Service-learning in high school biology and college major choice. *College Student Journal*, *46*(2), 459-464. Retrieved from Education Source Database.

Zimmermann, J., Dupree, J., & Hodges, J. (2014). The delivery of recreation programs: Students gain entry level management skills through service-learning. *Journal of the Scholarship of Teaching and Learning*, *14*(4), 144-163. doi:10.14434/josotl.v14i4.4761

Appendix A: The Project

The Science of Service-learning
A Retreat for High School Science Teachers

Participants will

- Design and implement a service-learning project in their science courses
- Understand how a service-learning project can affect student engagement and science achievement
- Become a part of an ongoing professional learning community based around a service-learning project for students

Based on the research study: "The Effect of Student Participation in Service-learning Projects on High School Attendance and Science Achievement"

DAY 1: Breakout Sessions
-The Effect of Service-learning Participation on Student Achievement
-Building Collaboration with Service-learning Projects
-Strengthening Collaboration with Service-learning Teams
-Service-learning Science Education Outdoors Part 1
-Building a Service-learning PLC - Day 1

DAY 2: Breakout Sessions
-Collecting and Organizing Data for Service-learning Activities
-Differentiating Science Lessons with Service-learning
-Service-learning Science Education Outdoors Part 2
-Science Scavenger Hunt
-Building a Service-learning PLC - Day 2

DAY 3: Breakout Sessions
-Star Spangled Service-learning
-Five Simple Service Ideas
-Service-learning with Science Education Outdoors Part 3
-Stakeout the Stakeholders for Service-learning
-Service-learning Science Fair / PLC Day 3

Location: Leadership Retreat Center, Some City, XX
Date: June 28, 29, and 30, 2020

Title: The Science of Service-learning: A Retreat for High School Teachers	
Purpose	The purpose of the service-learning retreat is for teachers to (a) learn to design and implement a service-learning project in their science courses, (b) achieve an understanding of how service-learning projects affect science achievement, and (c) become a part of an ongoing professional learning community based around a service-learning project for high school students.
Goal	The goal of the workshop is to provide a platform and a toolkit for science teachers to learn and implement strategies associated with best practice and service-learning in the science classroom. • **Knowledge**: Participants who attend the workshop will gain an understanding of the pedagogy and best practices involved in designing and implementing an engaging service-learning project for high school students in science. • **Skills**: Teacher participants will be able to utilize the strategies learned during the breakout sessions, which include collaboration and designing a comprehensive service-learning project.
Learning Outcomes	Upon completion of *The Science of Service-learning*, participants will be able to: 1. Explain the benefits of service-learning projects in high school science. 2. Understand the relationship between service-learning projects and student achievement. 3. Utilize and embed best practice strategies within service-learning projects in science. 4. Design a service-learning project in science with a group of teachers. 5. Participate in an ongoing professional learning community as a result of my project.
Target Audience	Secondary Education Science Teachers
Timeline	3 Days
Location	Leadership Retreat Center Some City, XX

DAY ONE: SCIENCE OF SERVICE-LEARNING RETREAT BREAKOUT SESSIONS

BREAKOUT SESSION	TIME	DETAILS	LOCATION	PRESENTER	MATERIALS
Check in	8:30 am – 9:00 am (30 mins)	Sign in	Main Lodge Room 1	Facilitator: Julia Roscoe	Name Tags Agenda Breakfast Snack Journal
Session 1: The Effect of S L P on Student Achievement	9:00 am – 10:00 am (60 mins)	Presentation on Service-learning in High School Science	Main Lodge Room 1	Facilitator: Julia Roscoe	Internet Computer LCD Projector Handouts Pens
Session 2: Building Collaboration with S L Ps	10:00 am – 11:00 am (60 mins)	Interactive strategies for teachers and discussion	Main Lodge Room 1	Facilitator: Youth Driven Space - YDS	Chairs in a circle Poster paper Journal
Session 3: Strengthening Collaboration with S L Teams	11:00 am – 12:00 pm (60 mins)	Team building for teachers and students	Outside Field 1	Facilitators: AHS Teachers	Large outdoor area String / Ring apparatus
Lunch Break	12:00 pm – 12:30 pm (30 mins)	Provided Tacos	Main Lodge Room 2	Live stream Music	Snack table, coffee, and water are available all day
Session 4: S L with Science Education Outdoors Part 1	12:30 pm – 2:00 pm (90 mins)	Outdoor nature and science experiments	Pond and Barn	Facilitators: AHS Science Teachers	Ecology Lab Kits: Pond Water Analysis, Invertebrate Identification, Soil Analysis
Session 5: Becoming a S L P PLC Day 1	2:00 pm – 2:40 pm (40 mins)	Build a SLP and ongoing PLC	Main Lodge Room 1	Participants work in content area groups	Laptop Art supplies Notebooks Poster Board
Day 1 Closing	2:40 pm – 3:00 pm (20 mins)	Reflection Gallery Walk Share Out	Main Lodge Room 1	Individual teacher participants	Post Its Markers Journals

DAY TWO: SCIENCE OF SERVICE-LEARNING RETREAT BREAKOUT SESSIONS

BREAKOUT SESSION	TIME	DETAILS	LOCATION	PRESENTER	MATERIALS
Check in	8:30 am – 9:00 am (30 mins)	Sign in	Main Lodge Room 1	Facilitator: Julia Roscoe	Name Tags Agenda Breakfast Snack Journal
Session 1: Collecting and Organizing Data for S L Activities	9:00 am – 10:00 am (60 mins)	Using data for SLPs with students and Excel	Main Lodge Room 1	Facilitator: AHS Technology Teacher	Internet Computer LCD Projector Handouts Pens
Session 2: Differentiating Science Lessons with SL	10:00 am – 11:00 am (60 mins)	Tool kit of strategies and discussion	Main Lodge Room 1	Facilitator: Julia Roscoe	Scaffolding Foldable Blooms Taxonomy Leveled readers Web resources
Session 3: S L with Science Education Outdoors Part 2	11:00 am – 12:30 pm (90 mins)	Tree Id and Bird Count Reporting to EPA and DNR	Barn and Pond	Facilitators: AHS Teachers	Tree Id Kit Bird Id Kit Web Resources for EPA, DNR, and Cornell University
Lunch Break	12:30 pm – 1:00 pm (30 mins)	Provided Soup and Sandwiches	Main Lodge Room 2	Live stream Music	Snack table, coffee, and water available all day
Session 4: Science Scavenger Hunt	1:00 pm – 2:00 pm (20 mins)	Breaking down barriers and building team skills	Outside Field 2	Facilitators: AHS Science Teachers	Puzzles Storybook
Session 5: Becoming a S L P PLC Day 2	2:00 pm – 2:40 pm (40 mins)	Build a SPL and ongoing PLC	Main Lodge Room 1	Teachers work in content area groups	Laptop Art supplies Notebooks Science Fair Board
Day 2 Closing	2:40 pm – 3:00 pm (20 mins)	Reflection Gallery Walk Share Out	Main Lodge Room 1	Individual teacher participants	Large Post Its Markers Small post its Journal

Note. EPA = Environmental Protection Agency, DNR = Department of Natural Resources

DAY THREE: SCIENCE OF SERVICE-LEARNING RETREAT BREAKOUT SESSIONS

BREAKOUT SESSION	TIME	DETAILS	LOCATION	PRESENTER	MATERIALS
Check in	8:30 am – 9:00 am (30 mins)	Sign in	Main Lodge Room 1	Facilitator: Julia Roscoe	Name Tags Agenda Breakfast Snack Journal
Session 1: Star Spangled Service-learning	9:00 am – 10:00 am (60 mins)	Video presentation of different service-learning projects	Main Lodge Room 1	Facilitator: Julia Roscoe	Quadrant Chart 3 Tier Triangle Handouts Post its
Session 2: Five Simple Science Service Ideas	10:00 am – 11:00 am (60 mins)	Examples and discussion of six simple SLPs for science classes	Main Lodge Room 1	Facilitator: AHS Teacher	Laptops Internet LCD projector
Session 3: S L with Science Education Outdoors Part 3	11:00 am – 12:30 pm (90 mins)	Environmental awareness campaign, campus clean up	Pond and Barn	Facilitators: AHS Teachers	Biodiversity Kit Environmental Awareness Kit Civil Engineering Kit
Lunch Break	12:30 pm – 1:00 pm (30 mins)	Provided Stir Fry and Rice	Main Lodge Room 2	Live stream Music	Snacks, coffee, and water available all day
Session 4: Stakeout the Stakeholders for Service-learning	1:00 pm – 2:00 pm (60 mins)	Presentation by three guest stakeholders	Pond and Barn	Facilitators: Kellogg, BASF, Ford Motor Company	Computer LCD Projector Handouts
Session 5: Service-learning Science Fair / PLC - Day 3	2:00 pm – 3:00 pm (60 mins)	Presentation of collaborative SLPs	Main Lodge Room 1	All teacher participants	Laptop Art supplies Notebooks Science Fair Board
Day 3 Closing	2:00 pm – 3:00 pm (60 mins)	Presentations Science Fair Style	Main Lodge Room 1	All teacher participants	Science Fair boards or technology presentation

The Science of Service-learning Day 1 Breakout Sessions / Resources

Session 1: The Effect of Service-learning Participation on Student Achievement
The Effect of Service-learning Participation on Student Achievement. This breakout session will be a 60-minute presentation of research-based findings on Service-learning Projects in high schools including the findings from my research study. The purpose of the session is to inform participants about the effect of student participation in service-learning projects on student achievement in high school science. Teachers will receive a handout with service-learning project ideas and links to a variety of service-learning projects in science (see Appendix A). **Resource:** Roscoe, Julia (2018). The Effect of Service-learning Participation on Student Attendance and Science Achievement at an Alternative High School. Walden University. Minneapolis, MN.

Session 2: Building Collaboration with Service-learning Projects
This breakout session will be part of a group of meeting times during which teachers will learn best practice pedagogy for implementing service-learning projects. This presentation is 60-minutes on how to collaborate and have effective classroom discussions. In this session, teachers will create a physical circle space to practice discussions and ideas related to service-learning projects. **Resource:** Clifford, Amos. (2015). Center for Restorative Process. Teaching Restorative Practices with Classroom Circles. San Francisco, CA.

Session 3: Strengthening Collaboration with Service-learning Teams
This breakout session is a 60-minute outdoor team building activity that will allow teachers to practice and strengthen collaboration for service style activities. Teacher participants will get into random groups that mimic student groups in the classroom. Each teacher group will work through different challenges. There will be four highly qualified and certified support staff on site conducting this session. The four staff members will be high school science teachers. **Resource:** Ulmen, Michelle. (2016). Cooperative Games and Initiative Activities.

Session 4: Service-learning with Science Education Outdoors Part 1
This breakout session is a 90-minute hands-on outdoor activity aligned to a service-learning project in a high school ecology course. Teachers will learn how to conduct a soil analysis and pond water quality analysis based on the quantity and types of pond life. Teachers will learn how to train their students to perform this analysis and how to read and report the results to a local Department of Natural Resources (DNR) and Environmental Protection Agency (EPA) as a service project and service to the community. Teachers will also learn about ways to have their students create public service announcement to inform the community about issues related to water and soil quality in the area. This service-learning activity will be performed and completed in teams of teachers on Day 1. This activity will show teachers how to implement science service-learning activities into the classroom and make connections with community stakeholders. Each team of teachers get a science notebook. Two certified science teachers will be facilitating this session. **Resource:** www.nwfsc.noaa.gov/education

Session 5: Becoming a Service-learning PLC – Day 1. This breakout session is a 40-minute group discussion and activity hour that will extend into a yearlong online virtual professional learning community. Teacher groups will be working on building a service-learning project following a rubric (see Appendix A) that will be implemented in their classrooms this upcoming school year. Teachers will work in groups according to common science subject area for all three days of the retreat. Teacher groups will present their collaborative service-learning project idea on Day 3 at the last breakout session and service-learning science fair. This project and teacher group will meet online all school year to work as a professional learning community sharing ideas and data about their service-learning project in their classrooms. A website and online communication forum will be developed by and for these teachers to collaborate all school year during this breakout session. **Resource:** Shapiro, Debbie (2009). Blending Science and Service-learning. NSTA. http://learningcenter.nsta.org/

The Science of Service-learning Retreat Day 2 Breakout Sessions / Resources

Session 1: Collecting and Organizing Data for Service-learning Activities
This breakout session will be a 60-minute session on collecting, organizing, and analyzing data for service-learning projects. The purpose of the session is to show teachers ways to collect and organize real-time and relevant scientific data for service-learning projects using Excel, PowerPoint, and Google Forms. This session will also introduce teacher participants to sample service-learning projects that have utilized and shared data to measure activities and outcomes tied to the service-learning project. A list of additional references and technology resources will be provided (see Appendix A). A teacher colleague, with a master's degree in educational technology, will be conducting this session. **Resource:** Barton, M and Jordan, D. (2001). Teaching Reading in Science - McREL. Association for Supervision and Curriculum Development. Alexandria, VA.

Session 2: Differentiating Science Lessons within Service-learning
This 60-minute session shows teachers different ways to differentiate science lessons for students participating in service-learning projects. Teachers will be provided resources for leveled readers, scaffolding, and multiple intelligences. Teachers will also be provided with examples of differentiated student products and final presentations from service-learning projects (see Appendix A). Teacher participants will have opportunities to share strategies during the session. **Resource:** Hudson, D. (2006). Differentiated Instruction for Science: Instructions and Activities for the Diverse Classroom. Walsh Publishing. Portland, MA.

Session 3: Service-learning with Science Education Outdoors Part 2
This 90-minute outdoor science service-learning activity is aligned to state standards and coursework for biology and ecology classes. Teacher participants will learn to conduct a leaf and tree identification for a community and learn how to report the statistics to the local Department of Natural Resources. Teachers will also participate in a neighborhood bird count session where they will learn to identify and record sightings of birds during a specific time frame. Teachers will learn to record their information and set up a plot sight on the Cornell University website as participants in a local and nationwide service-learning project for the Cornell Lab of Ornithology. Teachers have time to set up their plots and data on the website. A discussion will follow about how to build this service-learning activity into science course work. Groups will eat lunch after this activity. **Resource:** www.nwfsc.noaa.gov/education and https://ebird.org

Session 4: Science Scavenger Hunt
One of the most important skills in service-learning is teamwork. This session will demonstrate how to engage students and break down potential barriers when working in team situations in science. This 60-minute outdoor session ties together science, service-learning, and problem-solving. This science scavenger hunt incorporates communication and listening skills for teams to be successful in the activity. Several certified teaching staff members from AHS will be on site to conduct this activity.
Resource: Science Scavenger Hunts https://www.pinterest.com/pin/205547170466259078/?lp=true

Session 5: Service-Learning PLC – Day 2.
This session is a continuation of *Service-learning PLC* from Day 1. It is a 40-minute session for predetermined teacher groups to discuss and design a service-learning project and ongoing professional learning community. On Day 2, the same teacher PLC groups from Day 1 will be working on completing a learning project following the service-learning rubric provided by the presenter (see Appendix A). The teacher groups will decide on a presentation format for the Day 3 service-learning science fair. Teachers may use technology, a science fair board, YouTube video, or other creative option. Paper, poster board, and art supplies will be available on site in the main lodge. This group will continue to collaborate, share and extend the service-learning in an online PLC throughout the school year. Resource: www.character.org/key-topics/service-learning/

The Science of Service-learning Retreat Day 3 Breakout Sessions / Resources

Session 1: Star Spangled Service-learning
This 60-minute session will show teachers actual footage of some of the most dynamic high school service-learning projects from around the United States. Three different videos will feature high school students engaged in their service-learning projects from start to finish. A discussion will follow the session. The video links will be shared with teacher participants (see Appendix A). I will be facilitating this session. **Resources:** www.edweek.org and www.21things4teachers.net and REMC

Session 2: Five Simple Science Service Ideas
This 60-minute breakout session will introduce teachers to six different ideas for service-learning projects in the science classroom. The first idea includes inviting students to research a local landmark or community park using STEM (science, technology, engineering, and math) to find ways to improve the landmark for visitors while maintaining its historical integrity. The second idea includes sponsoring an after-school service-learning science club where students could put their talents to work by providing childcare and teaching younger children hands-on science experiments. The third idea involves having students put together an Ecology Club with a local-grounds clean-up and water quality testing program. The fourth idea involves implementing a school recycling program. The recycling program will include students creating a video or audio public service announcements and advertisement to discuss the importance of recycling and waste reduction. Students could then post their videos to the school website for the community to view. The fifth idea includes having students start a gardening project and mentor program with children at a local elementary school. A certified science teacher will conduct this session. **Resource:** www.weareteachers.com and www.ydnetwork.org

Session 3: Service-learning with Science Education Outdoors Part 3
This session is the third part of the ecology outdoor laboratory activities for high school classrooms. This session will allow teachers to explore biodiversity, environmental awareness, and civil engineering practices. Teachers will have completed a notebook full of activities after this three day retreat. The activities involve components of providing services for maintaining community parks, ponds, and nature reserves for service-learning. **Resources:** www.nwfsc.noaa.gov/education

Session 4: Stakeout the Stakeholders for Service-learning
This is a 60-minute session where teachers will learn strategies to connect to local stakeholders to support and collaborate with students for service-learning projects in schools. Three guest speakers and stakeholders from Kellogg, BASF, and Ford Motor Company will be on site for this presentation. They will discuss their community partnerships and grant opportunities. These guest speakers will also have tips and tricks for gaining and maintaining stakeholder relations. Teachers will have access to a list of current and ongoing service-learning projects. Teachers will have an opportunity to meet the stakeholders and learn how to join in on projects that are underway for the upcoming school year. Resources: www.kelloggcompany.com, https://corporate.ford.com/company.html, and https://basf.com/us

Session 5: Service-Learning Science Fair and PLC – Day 3
This session will be a 30-minute wrap-up session for teacher groups from Day 1 and Day 2. It will allow teacher groups to finalize plans for their service-learning project and ongoing PLC for the upcoming school year. The teacher groups will also set up for a science fair style presentation for all of the other teachers at the retreat. Groups will also set potential meeting dates and times to continue their professional learning community throughout the school year.

The Science of Service-learning Retreat
End of Sessions Evaluation

Your feedback is important. Please fill out the following survey for each breakout session. Thank you for attending the Science of Service-learning retreat.

Name of Session_____

PLEASE CIRCLE YOUR RESPONSE TO EACH OF THE FOLLOWING ITEMS.

The facilitator demonstrated sufficient content knowledge on the subject matter.				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The session was relevant and organized.				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The material presented was user friendly and can be modeled in the high school classroom.				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The session enhanced my understanding of the subject.				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Resources and materials provided were relevant and usable for teachers and students.				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

How will you use the information learned in this session?

_____
_____
_____

Explain whether you would be interested in a future follow up retreat.

_____

What would you like to see differently for each session or future sessions?

_____
_____
_____

Service-learning Retreat Summative Evaluation

Thank you for attending the Science of Service-learning. Your feedback is important. Please complete the following survey based on the three day retreat.

PLEASE CIRCLE YOUR RESPONSE TO EACH OF THE FOLLOWING ITEMS.

The workshop was well-organized				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The workshop was relevant and easy to follow				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The physical environment (indoors and outdoors) was conducive to learning				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The material was presented in sufficient depth				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
As a result of attending the workshop, I have a better understanding of best practice instruction for classroom service-learning projects				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
As a result of attending the workshop, I have an understanding how to use to share resources and work in collaboration with science teachers				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
As a result of attending the workshop, I have an understanding of how design effective service-learning projects				
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Please describe what part of the workshop was most valuable and what suggestions you may have for future workshops

_____

_____

_____

Retreat Breakout Sessions Handouts
DAY 1 - BREAKOUT SESSION 1 HANDOUT

SERVICE-LEARNING PARTICIPATION ON STUDENT ACHIEVEMENT

A list of a few service-learning projects in science are provided on this handout. Links to useful service-learning websites are listed. The service-learning projects are considered STEM and cross curricular.

Science Service-learning Project Ideas

SAVING WETLANDS - Identify and map the location of all vernal pools in your town. Use the data to create a policy that classifies vernal pools as wetlands. The policy can be presented to the local government in an effort to restrict development in these areas.

STREAM TEAM - Partner with a local chapter of the Environmental Protection Agency to monitor the water quality of a local river or creek. Compare data with other school stream teams in the state via video conference. Start a professional learning community between students across the state.

WAVE MOTION – Study wave motion and its effects on local beaches. Formulate solutions to local beach erosion and presented these findings to local officials.

EMISSION CONTROL - Monitor the impact of vehicular idling outside of your school. Utilize the information to develop a policy banning idling near entrances of school buildings. Share findings with the state in the hopes of banning idling outside of all school buildings.

Science Service-learning Project Links

http://projectwild.org/learning.htm
https://nylc.org/resources/
https://gsn.nylc.org/
https://www.globe.gov/web/scrc/overview
http://www.promiseofplace.org/
https://www.epa.gov/students/community-service-environmental-project-ideas-students-and-educators
https://www.estrellamountain.edu/students/service-learning/service-learning-ideas
http://www.doe.mass.edu/csl/practices.aspx
https://www.snow.edu/academics/servicelearning/downloads/projects.pdf
https://www.learningtogive.org/resources/service-learning-toolkit-animal-projects
https://cees.iupui.edu/servicelearningALL/all-service-learning-projects
https://mcpasd.k12.wi.us/mhs/about-us/general/personal-enrichment-programs/service-learning/service-learning-classroom-projects

DAY 1, 2, 3 - BREAKOUT SESSION 5 HANDOUT

Service-learning Project Rubric and PLC Link

STANDARDS	Strong Impact 3 pts	Good Impact 2 pts	Some Impact 1 pt
Community Need This activity meets an actual need in the community, builds compassion, and is coordinated through a professional learning community	Determined by or discovered through extensive research and collaboration with teacher and community sponsor	Determined or discovered through basic research and collaboration with faculty advisor and community sponsor.	Determined by making a guess as to what the community needs may be. No collaboration with faculty advisor or community sponsor.
Academics / Learning This activity provides the students with an opportunity to use existing skills, develop new ones, and use skills in a scientific, real world setting.	Students have direct application of new skills or knowledge in community service. Service-learning is seen as a vital instructional activity.	Students have some active application of new skills or knowledge. Service-learning has strong connection to instruction.	Students has some application of new skills or knowledge. Service-learning has minimal connection to instruction.
Student Reflection This activity will provide students an opportunity to reflect upon their own learning and their role in society.	Students actively reflect on their learning and think, share, and produce reflective products based upon those reflections.	Student reflection provides basic insight into their learning. Students produce minimal reflective products based upon those reflections.	Student share minimal reflection on service-learning and produce no individual reflection projects.
Building Relationships This activity will provide students the opportunity to collaborate with others and build ongoing stakeholder relationships.	Student reflections show the importance of service in one's ability to make a difference. Student will likely take the initiative to serve again.	Reflections show growing understanding of the importance of service in student's ability to make a difference. Student may serve again.	Reflections show limited understanding of the importance of service. Student may serve again if asked.
Science and Technology This activity is aligned with science and will provide students the opportunity to utilize technology.	Service activity facilitates change or insight, helps solve a problem, meet a need or address an issue in community served using technology.	Service activity provides some change or insight. Service enhances an already good community situation.	Service mainly decorative, but activity provides some benefit to community served. No technology usage or product.

PLC LINK: _____

Online Collaboration Days 2019 – 2020

September ___ October ___ November ___ December ___ January ___ February ___

March _____ April ___ May ___ June ___ Other ___

DAY 2 - BREAKOUT SESSION 1 HANDOUT

Collecting and Organizing Data for Service-learning Activities

Technology Resources and SLP Data Examples

GLOBE Climate Foundations https://www.globe.gov/web/scrc/overview/climate-foundations
Example of Data Collection Site

EPA Watersheds and Coffee to Compost http://www.greenmapping.org/map.php
Example of Data Collection Site

More technology resources with data collection sites

Ecological Society of America
http://www.esa.org/

Nature Serve Explorer
http://www.natureserve.org/explorer/

Society for Ecological Restoration
http://www.ser.org/

"Alien Invasion", PBS Online News Hour
http://www.pbs.org/newshour/bb/environment/july-dec04/species_7-1.html

Amur Honeysuckle, Its Fall From Grace
http://arnoldia.arboretum.harvard.edu/pdf/articles/470.pdf

Invasive Species - Federal Government Agency
http://www.invasivespecies.gov

National Invasive Species Information Center
http://www.invasivespeciesinfo.gov/

The Nature Conservancy
http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/indiana/journeywithnature/asian-bush-honeysuckle.xml

Ready-made and usable Google Forms

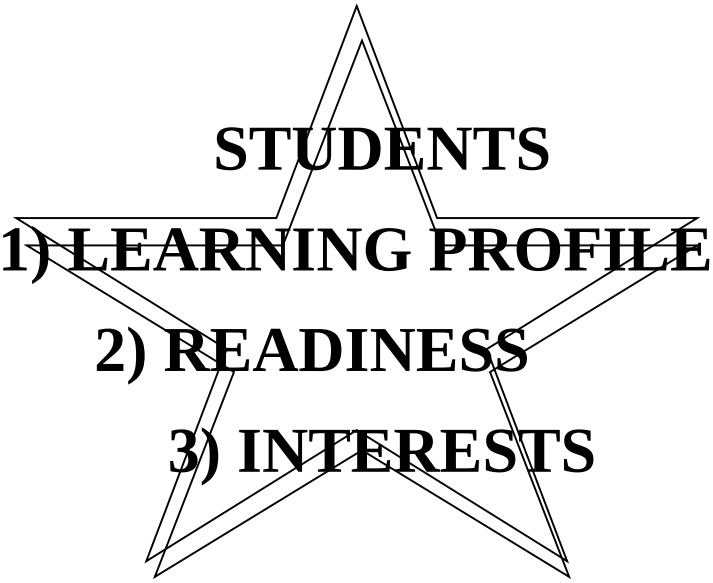
https://docs.google.com/forms/d/1_RL24h9BMT9YEhufWk56pKpN0BTT4EOTuInR6w6knSo/edit

DAY 2 – BREAKOUT SESSION 2 HANDOUT

Service-learning = DIFFERENTIATED INSTRUCTION

DIFFERENTIATED INSTRUCTION

Multiple Intelligences help address differences among learners



TEACHERS CAN DIFFERENTIATE

CONTENT-PROCESS-PRODUCT

Student learners have individual strengths

Teachers can maximize learning potential

DAY 3 – BREAKOUT SESSION 1 HANDOUT
Star Spangled Service-learning

Videos

Service-learning Project for Anatomy Class
https://www.edutopia.org/video/anatomy-project-give-me-shelter

Service-learning Pleasant Valley High School
https://drive.google.com/file/d/0Bw_1pg9TVgBqR0V5eGNLMUM0anc/view
Service-learning: Turning Ideas into Action
National and Community Service
https://www.youtube.com/watch?v=4JE_zmCUDtg

Service-learning: Real Life Applications for Learning
https://www.youtube.com/watch?v=7t30ZMX8uGw

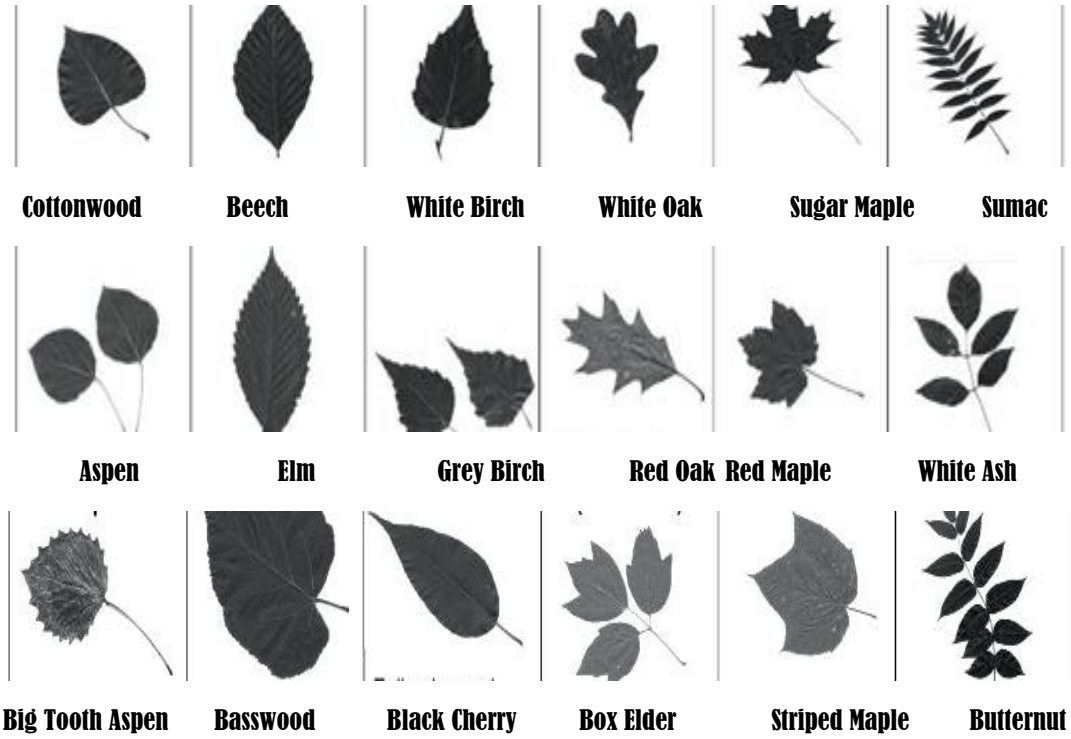
Building Empathy through Community Projects
https://www.edutopia.org/video/building-empathy-through-community-projects

Service-learning Assignments, Expectations, Requirements
https://csuart325.com/service-learning-and-outreach/service-learning-case-study-assignments-expectations-requirements/

Breakout Session Handout

Service-learning with Science Education Outdoors

TREE & LEAF IDENTIFICATION



More Resources

What Tree Is That?
http://treelink.org/whattree/index.htm

Basics of the Tree ID
http://www.fw.vt.edu/dendro/forsite/key/intro.htm

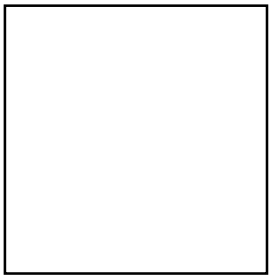
Tree Identification
http://forestry.msu.edu/extension/ExtDocs/Identkey/opening.htm

Tree Identification
http://forestry.msu.edu/uptreeid/

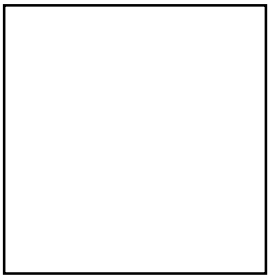
Breakout Session Handout

SOIL ANALYSIS

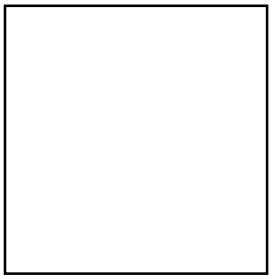
SOIL SAMPLE 1
Location: _____
Color: _____
Temperature: _____
Particle Size: _____
Moisture Level: _____



SOIL SAMPLE 2
Location: _____
Color: _____
Temperature: _____
Particle Size: _____
Moisture Level: _____

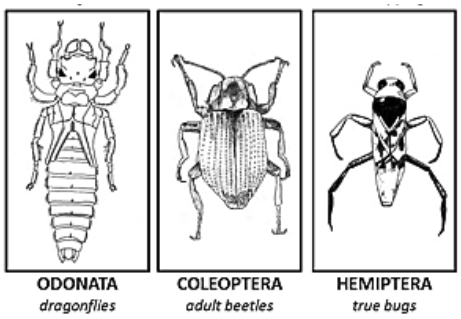


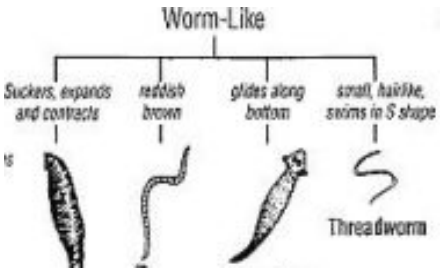
SOIL SAMPLE 3
Location: _____
Color: _____
Temperature: _____
Particle Size: _____
Moisture Level: _____

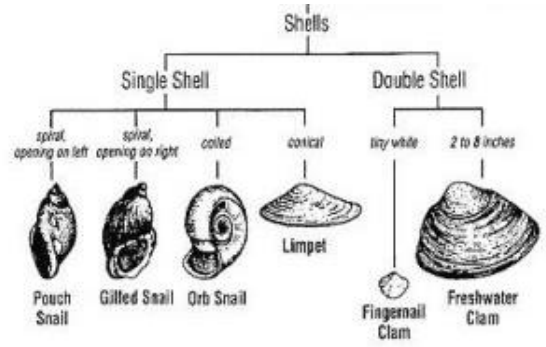


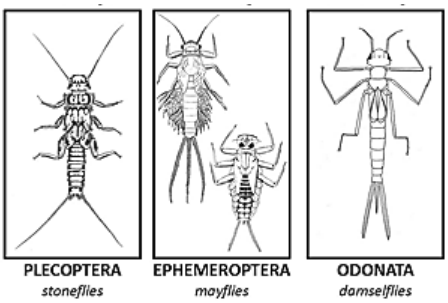
Breakout Session Handout

Invertebrate Investigation: Potential Pond Species Sightings









Bird Count and Bird Species Identification Resources

https://ebird.org/myebird

Download the following applications to your smart device, tablet or laptop: Sibley Bird App and Leaf Snap

Appendix B: Course-Embedded Service-learning Project

Course-Embedded Service-learning Project
Keeping Our School Clean and Green

What is Service-learning?

Service-learning provides students, teachers, and schools a variety of future focused opportunities that encourage students to become effective citizens. Service-learning projects engage students in learning as well as community involvement. Service-learning allows students to learn more, enjoy the learning process, and increase interest in civic engagement. Service-learning is an effective tool for building student character. Studies revealed that students who have participated in service-learning have gained social responsibility, were more caring, and had better academic achievement. In addition, service-learning, as a teaching method, can facilitate positive social change by integrating meaningful service to the community through curriculum-based or community-based learning. This type of service project incorporates project based learning, student-community awareness, and science laboratory activities aligned with coursework.

What is the Purpose of Service-learning?

The purpose of this service-learning project is for high school science students to participate in a building-wide school grounds clean up, community garden, and wildlife habitat.

Phases of Service-learning

1. Preparation

For this project, students will devote about 20 minutes of the 50-minute class period each day of the unit to working on parts of the service-learning project. The service-learning project will be called “Keeping Our School Clean and Green.” The service-learning project will include a school grounds outdoor clean-up and a building a community garden in the school courtyard. The service-learning project will take place during class time in a general science class that already exists at the local setting. The participants will be 10th grade science students in the experimental group.

2. Action

School Grounds Clean-Up: Students will go outside the school building during the last 20 minutes of class periodically throughout the environmental science unit and throughout the quarter with permission from the school principal. The students will collect litter, debris, and trash from around the school building and put it in the proper trash receptacle.

Community Courtyard Garden: The service-learning project will include students building a community vegetable garden and butterfly habitat in the school courtyard. The principal of the school has given permission to the students to redesign the courtyard and build a community garden. Students will use the last 20 minutes of class throughout the 16-day environmental science unit to build a user-friendly community garden and animal habitat within the school courtyard. Each day of the environmental science unit and service-learning project, students will be taking 20 minutes of class time to go outside to the courtyard to dig, plant, and design a vegetable garden for the community to enjoy. Students will also plant butterfly plants for a habitat / observatory with the intention of

releasing butterflies in the warmer seasons. Students will use grant money from a science grant to purchase the vegetable and butterfly plants. Students will design several public service announcements that will advertise the community garden and educate others about environmental issues. The ultimate plan for the courtyard garden will be to provide students, families, and community members with a self-sustaining vegetable garden and wildlife habitat observatory.

Newspaper Articles: Students in the English classes with the help of the students in the science classes will write a newspaper article about the garden project. In order to differentiate instruction, some students will write a news article about the progress and implementation of the garden. Some students will write a feature article about the butterfly garden and observatory. The articles will be published in the local newspaper in order to advertise the student project and invite community members to the courtyard.

Culminating Technology Presentation: On day 14 and 15 of the unit, students will work in teams to compile a technology project with pictures and descriptions of the community courtyard garden and recycling project to be presented in class and to the school board at an upcoming school board meeting. An official ribbon cutting ceremony hosted by students when the courtyard is complete.

3. Reflection

Culminating Technology Presentation: On day 14 and 15 of the unit, students will work in teams to compile a technology project to be presented in class and to the school board at an upcoming school board meeting.

4. Demonstration / Celebration

This service-learning project will allow students of all ages to collaborate with teachers, parents, and other community members to complete a community-based education project. Students will have a ribbon cutting ceremony for the community garden when it is complete. Community members, stakeholders, administrators, students, parents, teachers, and school board members will attend the ceremony. The community garden will be place where everyone can come and observe wildlife, plants, and pick vegetables that have been grown by the students who participated in the service-learning project.

Differentiation / Learner Needs

The activities involved in this service-learning project will be differentiated for students based on student interest and abilities. Students will work in teams of three or four. They will select their own teams and determine each member's role for the project. Students will work together on all parts of the project, but choose who will lead in each part of the project.

District Need Linked to Student Learning

The partnership between science and the environment in service-learning projects can help students make greater connections to the world around them. Service-learning provides many benefits to students, faculty, and communities within the context of academic courses.

Cross Curricular Connections

This service-learning project is a STEM (science, technology, engineering, math) project as well as a cross curricular activity. The project connects Next Generation

Science Standards with English standards and technology. Students will engage in concepts learned in class and team up with English classes to write a newspaper article about the service-learning project. Students will have the opportunity to work with the technology teacher if needed to make a student video or PowerPoint presentation.

16-Day Service-learning Project

In this section, the treatment of a service-learning project will be described. The environmental science unit is 16 days long and students in the experimental group will devote about 20 minutes of the 50-minute class period each day of the unit to working on parts of the service-learning project. The service-learning project will be called "Keeping Our School Clean and Green." The service-learning project will include a school grounds outdoor clean-up and building a community garden and animal habitat in the school courtyard. The service-learning project will take place during class time in a general science class that already exists at the local setting. The participants will be 10th grade science students in the experimental group.

School Grounds Clean-Up: Students will go outside the school building during the last 20 minutes of class periodically throughout the environmental science unit and throughout the quarter with permission from the school principal. The students will collect litter, debris, and trash from around the school building and put it in the proper trash receptacle.

Community Courtyard Garden: The service-learning project will include students building a community vegetable garden and butterfly habitat in the school courtyard. The principal of the school has given permission to the students to redesign the courtyard and

build a community garden. Students will use the last 20 minutes of class throughout the 16-day environmental science unit to build a user-friendly community garden and animal habitat within the school courtyard. Each day of the environmental science unit and service-learning project, students will be taking 20 minutes of class time to go outside to the courtyard to dig, plant, and design a vegetable garden for the community to enjoy. Students will also plant butterfly plants for a habitat / observatory with the intention of releasing butterflies in the warmer seasons. Students will use grant money from a science grant to purchase the vegetable and butterfly plants. Students will design several public service announcements that will advertise the community garden and educate others about environmental issues. The ultimate plan for the courtyard garden will be to provide students, families, and community members with a self-sustaining vegetable garden and wildlife habitat observatory.

Newspaper Articles: Students in the English classes with the help of the students in the science classes will write a newspaper article about the garden project. In order to differentiate instruction, some students will write a news article about the progress and implementation of the garden. Some students will write a feature article about the butterfly garden and observatory. The articles will be published in the local newspaper in order to advertise the student project and invite community members to the courtyard.

Culminating Technology Presentation: On day 14 and 15 of the unit, students will work in teams to compile a technology project with pictures and descriptions of the community courtyard garden and recycling project to be presented in class and to the

school board at an upcoming school board meeting. An official ribbon cutting ceremony hosted by students when the courtyard is complete.

Environmental Science Unit (control and experimental group)

The business as usual environmental science unit at the local setting will include 16 days of lessons based on six NGSS standards for environmental science for both the control and experimental group. The lessons will be associated with the topics of fracking, pesticides, industrial waste, and lead levels in water resources. Students will also be utilizing technology resources such as You Tube, cellular phone video cameras, websites, and online discussions for assignments that need to be completed throughout the unit. Students will collaborate in class and online to propose solutions to environmental science issues. Both the control and experimental group will have equal access to these resources.

Day to Day Lessons for Environmental Science Unit and Service-learning Project

Day 1: Standard HS-ESS3-3 Pretest and Virtual Field Trip

Attendance will be taken in class per usual and recorded in MISTAR-Q and on paper. Students will take the pre-test multiple choice summative assessment (see Appendix C). Students will receive a vocabulary sheet of the key terms as a study guide for the entire unit. The class will take a virtual field trip on Nearpod (https://nearpod.com), which is a free an interactive teaching resource that teachers and student have access to at the local setting. On Nearpod, students will take a virtual field trip to a waste water treatment facility. Students will learn about wastewater, the importance of clean water, and other environmental issues associated with water.

Students will take notes and a formative assessment on the Nearpod session at the end of the virtual field trip. Students will be responsible for answering the Moodle Discussion Board question for Day 1 at the end of the 50-minute class period.

Day 2: Standard HS-ESS3-4 Fracking

Attendance will be taken in class per usual. In collaborative, preexisting groups of three or four, based on the current seating chart, students will watch a video clip from their laptop computers in class. Students can choose to watch the videos together in a group or independently with ear buds, which are supplied by each individual student. The video that the students will be watch is on fracking (https://www.youtube.com/watch?v=Uti2niW2BRA). After they watch the video, students will share-pair in their group by designing a concept map for fracking on a sheet of blank paper. They also have the option to make the concept map in a computer program such as PowerPoint. At the end of the class period, students will log into their Moodle accounts and answer the Moodle Discussion Board question. The posttest items that will be addressed include 6 and 7. During the last 20 minutes of class, students will walk outside to the courtyard to stake out the garden and butterfly habitat.

Day 3: Standard HS-ESS3-4 Industrial Waste

Attendance will be taken in class per usual. In the same collaborative, preexisting groups of three or four, from the previous day, students will watch a video on industrial waste (https://www.youtube.com/watch?v=_NkqwMitQ8o) from their laptop computers in class. Students can choose to watch the video together in a group or independently with ear buds. After they watch the videos, students will share-pair again in their group

by designing a different concept map for industrial waste. It can be hand drawn or computer generated. At the end of the class period, students will log into their Moodle accounts and answer the Moodle Discussion Board question. The posttest items that will be addressed include 19 and 20. Students will go outside to the courtyard and begin digging and turning over the soil for the vegetable garden. One group of students will be in charge of the vegetable garden. One group of students will be in charge of researching and planting butterfly plants.

Day 4: Standard HS-ESS3-1 Biological Magnification

Attendance will be taken in class per usual. Students will read an article individually on www.newsela.com about pesticides. They will also visit the Monsanto website and view the introductory video. Students will have a discussion about biological magnification, the benefits and harms of pesticide use, and the healthy potential of organic products. Students will make a Venn diagram comparing pesticide use to organic products. Post-test items 4 and 11 will be addressed. At the end of each class students, students will answer the Moodle Discussion Board question. Students will continue digging and planting in the courtyard during the last 20 minutes of class.

Day 5: Standard HS-ESS3-1 Pesticides

Attendance will be taken in class per usual. Students will discuss a variety of political cartoons based on the dangers of pesticides that will be retrieved from Google Images. Students will design their own slogan either promoting or condemning pesticide usage on food or other products. Test item 14 will be addressed. At the end of class students, will answer the Moodle Discussion Board question. Students will discuss the

use of pesticides in the school garden. Students will continue to work on the garden project at the end of class.

Day 6: Standard HS-ESS2-6 Environmental Issues

Attendance will be taken in class per usual. Students will listen to a lecture from the instructor on pollution and chemicals in the environment. Students will research world issues using internet resources and fill in a mind map on taking action to identify a world problem such as pollution. Students will answer the Moodle Discussion Board question for the day. The post-test item addressed will be 2. Students will continue to work in the garden during the last half of class.

Day 7: Standard HS-ESS2-6 Environmental Issues

Attendance will be taken in class per usual. Students will finish researching world issues using internet resources and filling in the mind map on taking action to identify a world problem from the previous day. Students will answer the Moodle Discussion Board question for the day. The posttest item addressed will be 9. Students will be working on completing the planting of vegetable and butterfly plants and discussing a plan for watering the plants each day.

Day 8: Standard HS-ESS2-2 Environmental Action

Attendance will be taken in class per usual. Students will complete a sustainability score card (energy, air, water, waste, nature, transportation, buildings) for their own city. Students will then write an essay explaining ideas to put into action in their city. The essay should be three paragraphs, with four sentences in each paragraph. There will be an intro, body, and conclusion explaining ideas and projects that the city

could utilize to improve air and water quality as well as energy and waste resources. Post-test items 1 and 3 will be addressed. Students will answer the Moodle Discussion Board question for the day. Students will work in the garden and on a plan for watering the plants in the garden.

Day 9: Standard HS-ESS2-2 Environmental Action

Attendance will be taken in class per usual. Students will finish writing their essay explaining ideas to put into action in their city. Post-test items 5 and 8 will be addressed. Students will answer the Moodle Discussion Board question for the day. Students will continue working on the garden project

Day 10: Standard HS-ESS3-6 Careers in Environmental Science

Attendance will be taken in class per usual. Post-test items 10 and 12 will be addressed. Students will explore environmental science careers. Students will research the careers using internet resources. The students will compile information on the career that includes what the individuals does for the environment, how many years of college and what is the name of the degree, what colleges have the degree for the career, and how does this position impact the environment. Students will make a PowerPoint presentation of 5 to 7 slides on the environmental career of their choice with pictures on each slide. Students will present these to the class on the next day. Students will complete Moodle Discussion Board question for the day. Students will continue working on the garden each day during the last 20 minutes of class.

Day 11: Standard HS-ESS3-6 Careers in Environmental Science

Attendance will be taken in class per usual. Posttest items 13 and 15 will be addressed. Students will take turns presenting their environmental science career exploration presentation to the class. Students will complete Moodle Discussion Board question for the day.

Day 12: Standard HS-ESS3-2 Vocabulary and Unit Review

Attendance will be taken in class per usual. Items 16 and 17 will be addressed. Students will review vocabulary terms and the discussion board questions. Students will answer the Moodle Discussion Board question for the day.

Day 13: Standard HS-ESS3-2 Kahoot.it Review Game

Attendance will be taken in class per usual. Item 18 will be addressed. Students will answer the Moodle Discussion Board question for the day. The class will play a review game based on the environmental science unit vocabulary sheet and the posttest items with Kahoot.it.

Day 14: Student Video Presentations

Attendance will be taken in class per usual. Item 18 will be addressed. Students will compile a 1 to 2 video presentation with a group of three to four students of the lessons they learned and the work they completed throughout the environmental science unit. Students will complete the Discussion Board question for each day. Students will prepare for a ribbon cutting ceremony for the community garden. Administrators, community members, parents, and students will attend the ribbon cutting ceremony.

Day 15: Grand Opening of the Community Garden

Students will host a Ribbon Cutting Ceremony for community garden.

Day 16: Posttest and Video Presentations

Attendance will be taken in class per usual. Item 18 will be addressed. Students will take the posttest multiple choice, summative assessment. Students will complete the Day 16 discussion board question and post-project survey. Students will take turns presenting their videos to the entire class.

Post Project Survey: Keeping Our School Clean and Green

Part 1: Constructed Response. Respond to the items for the service-learning experience.

1. What was the most memorable thing you learned from this service-learning project?

2. What was the most difficult thing you encountered during this service-learning project?

3. How did you work around the challenges that were presented?

4. What suggestions might you have for the future of this service-learning project?

5. What will you take away from this project?

Part 2: Place a 1 – 4 rating in each box for each statement.

Statements	Scale Rating (strongly agree, agree, disagree, strongly disagree)
Providing a service to my school and community is something that I would like	
Ideas from my high school classes play a role in helping me understand life issues	
I feel confident that I can improve my community with the help of my classmates	
I often see a connection between what I learn in school and everyday life	
Helping those in need is an obligation of everyone	
I know all about issues that challenge society	
I see little practical use for what I learn in high school	
I can think logically about complex material	
I can approach most problems creatively	
I do not see myself spending time volunteering to help my school and community	

Appendix C: Instrument: Environmental Science Pretest–Posttest Assessment

Environmental Science: Pretest Posttest Assessment

Directions: Read each item on this assessment. Each item is linked to a science content standard learned in class. Write the correct answer in the blank provided. Each item is worth one point. This is worth 20 points.

Multiple Choice.

Standard HS-ESS3-6

1. All of the following are true about atmospheric ozone, EXCEPT _____.
 a. ozone in the stratosphere protects the earth from excessive UV radiation
 b. automobile exhaust can help replace ozone in the troposphere
 c. ozone in the troposphere has toxic effects on animals and plants
 d. ozone levels in the stratosphere have been dangerously reduced, particularly by refrigerants and propellants containing CFCs that have been released into the atmosphere

Standard HS-ESS2-6

2. All of the following are consequences of air pollution except _____.
a. acid precipitation
b. eutrophication
c. global warming
d. depletion of the ozone layer

Standard HS-ESS2-2

3. The burning of fossil fuels contributes to all of the following except _____.
a. acid precipitation
b. smog
c. loss of the ozone layer
d. increased production of greenhouse gases

Standard HS-ESS3-1

4. The rapid growth of plant life and death of animal life in a shallow body of water as a result of excessive organic and inorganic nutrients is which of the following?
a. biological inversion
b. diversification
c. eutrophication
d. biological magnification

Standard HS-ESS2-2

5. Which of the following is the most significant “greenhouse gas”?
a. methane
b. carbon dioxide
c. water vapor
d. CFCs

Standard HS-ESS3-4
6. The major contributor to the formation of acid precipitation is _____.
a. ozone
b. nitrogen oxide
c. sulfur dioxide
d. carbon dioxide

Standard HS-ESS3-3
7. All of the following are ways in which human activity has jeopardized freshwater supplies except _____.
a. excessive water use
b. water pollution
c. using no-till farming practices
d. deforestation and removal of vegetation

Standard HS-ESS3-6
8. Which of the following organisms would be expected to have the highest concentration of mercury pollution in its tissues?
a. primary consumers, such as zooplankton
b. the secondary consumers, such as sardines and herring
c. primary producers such as aquatic plants, phytoplankton, and algae
d. the tertiary consumers, such as tuna and sharks.

Standard HS-ESS2-6
9. Which of the following contributes most to oceanic oil pollution?
a. oil disposal on land
b. natural seepage
c. oil spills at sea
d. acid precipitation

Standard HS-ESS3-6
10. Which of the following is the current greatest source of mercury pollution into the environment?
a. natural runoff and leaching into waterways
b. automobile exhausts
c. the burning of low-grade coal
d. paper pulping industry discharges

Standard HS-ESS3-1
11. Which of the following is NOT a cause of the destruction of habitats by humans?
a. deforestation
b. subsistence farming
c. exploitation of resources
d. global extinction

Standard HS-ESS3-2
12. Which of the following will NOT contribute to the establishment of a sustainable world?
a. increasing fertility rates
b. decreasing world poverty
c. increasing recycling
d. decreasing consumption

Standard HS-ESS3-6
13. In which of the following ways does human activity diminish biodiversity?
a. Deforestation removes habitats.
b. Urbanization alters habitats and reduces both plant and animal biodiversity.
c. Pollution destroys habitats.
d. All of the above reduce biodiversity.

Standard HS-ESS3-1
14. The use of chemical fertilizers on farms _____.
a. BOTH helps farmers grow more food AND causes water pollution.
b. causes water pollution.
c. helps farmers grow more food to feed a larger population.
d. NEITHER helps farmers grow more food NOR causes water pollution.

Standard HS-ESS2-2
15. When fossil fuels such as gas, oil, and coal are burned, ____ is released into the atmosphere.
a. Carbon dioxide
b. Sodium chloride
c. Oxygen
d. Chlorofluorocarbon

Standard HS-ESS3-6
16. If the ozone layer disappeared, we would be exposed to _____ from the sun.
a. higher levels of ultraviolet radiation
b. the same amount of ultraviolet radiation
c. no ultraviolet radiation
d. lower levels of ultraviolet radiation

Standard HS-ESS3-2
17. People can help protect the environment by which of the following?
a. Using public transportation, biking, or walking instead of driving.
b. Throwing more things away in landfills instead of recycling.
c. Building more coal power plants.
d. all of the above

Standard HS-ESS3-2
18. Recycling can help the environment by reducing the impacts from which of the following?
a. cutting down trees
b. mining
c. industrial waste
d. all of the above

Standard HS-ESS3-4
19. Farms cause a lot of water pollution by their use of which of the following?
a. seeds
b. pesticides and fertilizers
c. oil and coal
d. all of the above

Standard HS-ESS3-4
20. To help reduce water pollution when disposing of household chemicals such as paint and motor oil, you should do which of the following?
a. pour them on the ground in a far-away place
b. pour them into a storm drain
c. pour them into the trash
d. take them to a hazardous waste drop-off site