Mutualism as Mutual Trust: An Ethnographic Case Study on an Elementary-School Teacher-Team Participation in a Science PD Program

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Abstract
This grounded in social constructivism yearlong ethnographic case study was conducted at the final stage of a larger, longitudinal, multisite, and multi-year project. The current research focused on a group of urban public elementary schoolteachers who volunteered to participate in the National Science Foundation (NSF)-funded interdisciplinary science and engineering partnership (ISEP) project. These teachers were enrolled in the professional development (PD) college courses in physics and engineering design, summer research in university laboratories, and interdisciplinary science inquiry (ISI) pedagogy sessions. This research sought to understand the factors which contributed to successful teamwork at the elementary school under investigation. Additionally, this study investigated the changes in the ISEP-participating educators’ teaching approaches, methods, and techniques upon their completion of their studies with the ISEP Summer Institute. Data were collected from the structured interviews with the participating teachers and their students and observations of the school-based activities during in-class and extra-curricular instruction. The researchers used Saldaña’s (2013) thematic and value coding and Miles and Huberman (1984) memoing for data analysis. This research found that the teachers’ team embedded their newly acquired research experiences and pedagogic knowledge into their instruction. Joint endeavors of the project participants lead to higher interest and engagement in learning processes in this school’s student population as well as greater involvement of the schoolchildren, their families, and the surrounding community in the team-organized science-based educational events and activities.

Keywords
ethnographic case study, interdisciplinary science and engineering partnership (ISEP), interdisciplinary science inquiry (ISI), professional development (PD), professional learning community (PLC), science teaching

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Mutualism as Mutual Trust: 
An Ethnographic Case Study on an Elementary-School Teacher-Team Participation in a Science PD Program

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This grounded in social constructivism yearlong ethnographic case study was conducted at the final stage of a larger, longitudinal, multisite, and multi-year project. The current research focused on a group of urban public elementary school teachers who volunteered to participate in the National Science Foundation (NSF)-funded interdisciplinary science and engineering partnership (ISEP) project. These teachers were enrolled in the professional development (PD) college courses in physics and engineering design, summer research in university laboratories, and interdisciplinary science inquiry (ISI) pedagogy sessions. This research sought to understand the factors which contributed to successful teamwork at the elementary school under investigation. Additionally, this study investigated the changes in the ISEP-participating educators’ teaching approaches, methods, and techniques upon their completion of their studies with the ISEP Summer Institute. Data were collected from the structured interviews with the participating teachers and their students and observations of the school-based activities during in-class and extra-curricular instruction. The researchers used Saldaña’s (2013) thematic and value coding and Miles and Huberman (1984) memoing for data analysis. This research found that the teachers’ team embedded their newly acquired research experiences and pedagogic knowledge into their instruction. Joint endeavors of the project participants lead to higher interest and engagement in learning processes in this school’s student population as well as greater involvement of the schoolchildren, their families, and the surrounding community in the team-organized science-based educational events and activities.

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Introduction

This yearlong ethnographic case study within a larger, longitudinal, multi-year and multisite research project addresses the topic of the effects from professional development (PD) in the areas of interdisciplinary science and engineering on public school teachers’ practices. As a team of researchers, we conducted this study in one of the Northeastern states of the United States of America. Our project aimed to answer a highly important question: Why do PD programs have success in some schools, while they do not give any significant results in many others? Our research focused on a group of teachers in an urban public elementary school who volunteered to participate in the National Science Foundation (NSF)-funded interdisciplinary science and engineering partnership (ISEP) professional development
program. The above program was offered to the teachers in the form of summer research in the participating university laboratories, in which the teachers-participants were guided by the mentor-faculty members and assisted in developing their researcher skills. Within the ISEP project, the teachers took several university courses in physics and engineering design and attended a series of interdisciplinary science inquiry (ISI) pedagogy sessions.

Our research aimed to explore the teachers’ perceptions of this program. We were also eager to investigate how these teachers developed professionally, and whether they implemented the newly acquired research experiences and pedagogic knowledge in their classrooms. One of our research goals was to see how the participating teachers evaluated the ISEP project.

The major purpose of this study was to investigate the effects this ISEP project had on teaching and learning practices, the changes in teaching methods and approaches it resulted in, and the factors, which contributed to the successful implementation of the ISEP objectives at the school in the focus of this research.

This ethnographic case study attempted to answer the following central (Creswell, 2007) research questions:

1. What has changed, if at all, in the ISEP participating educators’ teaching approaches, methods, and techniques after their studies with the ISEP Summer Institute?
2. What factors contributed to the change and implementation of the ISEP project?

Other sub questions (Creswell, 2007) of the researchers’ interest were:

- What factors, in addition to the highly skilled leadership of this school’s principal, contributed to successful teamwork within the elementary school culture under investigation?
- What helped the collaborative team of teachers stay strongly bound and avoid possible professional disintegration?

Additionally, through the lens of Vygotsky’s (1978, 1987) and Bronfenbrenner’s (1993) perspectives, this study aimed to understand whether the team of teachers perceived themselves as progressing through their own Zones of Proximate Development (ZPDs) when mentored by the university faculty in this ISEP project, while pursuing the goal to lead their young elementary school students more efficiently through their ZPDs. We also sought to find out whether this program helped the teachers to re-shape their school culture, as well as the ecological systems of the schoolchildren’s social and learning environment (Glancy & Moore, 2013). All mentioned above inquiry formed the pool of our research procedural questions (Creswell, 2007).

As we anticipated, sharing the findings of this study with wide educational and academic audiences might give educators some new ideas to consider, experiment with, and implement in their classrooms. The expected result might be a range of benefits to their students, including better educational opportunities offered by the ISI approach to teaching and learning, greater involvement in the experiential learning, technology-based instruction, and supplemental after-school and out-of-school educational activities.
Literature Review and Theoretical Framework

Literature Review

In preparation for this ethnographic case study, we reviewed the available literature on professional development and collaboration in PD and their effects on teaching and learning processes. A number of qualitative and quantitative studies showed that PD programs, including school-university partnerships, in which educators established professional learning communities and collaborated towards common objectives might be highly effective (e.g., Akerson et al., 2006; Avalos, 2011; Bofill, 2013; Cavanaugh, 2003; Fancourt et al., 2015; Mondahl & Razmerita, 2014; Montiel-Overall, 2005; Tsui & Law, 2007; Waitoller & Kozelski, 2013).

Nevertheless, this review of literature resulted in identifying a gap in the research in the field of professional development in the areas of ISI and science, technology, engineering, and math (STEM) education. This gap persisted although over the recent decades, the American and International researchers put a strong emphasis on the research focused on the PD in all areas of STEM (e.g., Avery, 2013; Gusky, 2009; Hayden et al., 2011; Pinnel et al., 2013; Staples et al., 2005; Wallace & Brooks, 2015). With regards to the issue with insufficient knowledge in PD in the field of STEM, Gardner et al. (2019) directly stated, “Expansive reform initiatives in science, technology, engineering, and mathematics (STEM) education over the past several decades necessitate advancing the body of research on professional development for STEM education” (p. 1).

Importantly, multiple studies in diverse educational fields found collaboration more productive than independent work performed by individuals (e.g., Briscoe & Peters, 1997; Bush, 2002; Goddard & Goddard, 2007; Lehman et al., 2014; Samuelsson, 2010). Glancy and Moore (2013), contemplating the choice of STEM-appropriate theories, noted the collaborative nature of STEM. Akerson et al. (2006), via their study with pre-service and in-service science teachers, also found that both categories of educators strongly benefitted from their participation in collaborative projects.

Coherently, Wallace and Brooks (2015) in their report of the findings in their ethnographic study on teaching elementary science stressed that teaching and learning processes are based on sociocultural construction of knowledge. Thus, collaboration, in contrast to autonomy, is one of the cornerstones of successful teaching and learning (Wallace & Brooks, 2015, p. 194). In accord with the above, Lehman et al. (2014) grounded their longitudinal mixed-method research in Gajda’s (2006) collaboration theory, which was further developed in the following publications (e.g., Gajda, 2006; Gajda & Koliba, 2007). These researchers specifically studied collaboration between university and school in the form of partnerships in the field of STEM education. These authors directly stated that, “Collaborative school - university partnerships represent one way to address national calls for the improvement of K-12 STEM education” (p. 26). These findings correlate well with the ones outlined in the publications by other American and International researchers (e.g., Fancourt et al., 2015; Gardner et al., 2019).

Many International authors also suggested that changes in teacher professional development appeared to be the key to the changes in their classroom instruction (e.g., Avalos, 2011; Tang & Shao, 2014). Avalos (2011) reviewed a decade worth of articles on the topics of PD for educators. Having reviewed tens of publications on teacher PD, this author concluded that inquiry-based education was highly beneficial for teachers in the role of learners during PD. Avalos (2011) also stressed the collaborative power of teacher co-learning (p. 17). Tang and Shao (2014), in their qualitative case study report, specifically stressed the significance of
contribution from rich professional interactions between teachers within professional development programs versus autonomy.

Regardless of the availability of the literature on benefits from collaborative professional development practices in STEM education, little is known on the effects of PD programs with a focus on interdisciplinary science inquiry (ISI). Only a few studies address this topic. For example, Daniel et al. research found, “…after the [PD] workshop, participants reported increased connections across disciplines” (2022, p. 1). Some other researchers (e.g., Clark et al., 2011) provided some practical advice to science teachers and scholars on their professional development. Grigg et al. (2013) study found some experimental effects and impacts from the conducted scientific inquire PD on the teachers’ practices. Nevertheless, our longitudinal ethnographic case study was designed to delve deeper into the participants’ perceptions and find more information on the studied topic (see this research questions in the Introduction section above). This is why we conducted our study with the purpose to fill this specific gap: the gap in the qualitative ethnographic case study research on the effects of collaborative, university-to-school professional development initiatives on teachers’ practices in ISI. The focus of our research on collaborative PD programs in ISI makes the contribution from our study to the field of PD in STEM unique and significant.

Theoretical Framework

This study was grounded in the ideas of social constructivists, such as Bronfenbrenner (1979, 1993), Bronfenbrenner and Morris (1998), Dewey (1948, 1963), and Vygotsky (1978, 1987). Our research also draws on the collaboration theory developed by Gajda (2004). Gajda defined it as “a theory of how multiple individuals or entities work together to develop a relationship,” which is “complex and can represent a multitude of intra- and inter-organizational alliances” (2004, p. 68). The above theory by Gajda rests on five major principles: (1) collaboration is an imperative, (2) it is known by many names, (3) it should be viewed as a journey rather than a destination, (4) collaboration recognizes the personal as important as procedural, and is developed in four stages (2004, pp. 67-70). These four stages of the collaboration theory include coming together to form a joint venture; establishing roles and tasks for each member of the collaborative alliance; planning together and elaborating the working norms; and working together towards the planned transformation, where the group members evaluate and assess their performance and their findings (Gajda, 2004, p. 70).


This position by Vygotsky (1978, 1987) laid the foundation of the theories by Bronfenbrenner (1993) who elaborated his model of human development where combination of layers of social environment (i.e., microsystem, mesosystem, exosystem, macrosystem, and chronosystem) influence, affect, shape, and “govern the lifelong course of human development in the actual environment, in which human beings live” (Bronfenbrenner, 1993, p. 37; See Figure 1 below for Bronfenbrenner’s ecological systems model used in the ISEP project).
Figure 1
Bronfenbrenner’s Ecological Systems Model Adapted by Farhana Hasan for this ISEP Project

Note. The illustration of Bronfenbrenner’s ecological systems model is used with permission of Yang et al. (2018).

Method

Research Paradigm

As it was highly important for us to deepen understand our research participants’ experiences within the offered to them PD opportunities within the particular social context and chronotope (Bakhtin, 1981), we viewed the Dewey (1948, 1963) postmodernism paradigm fundamental for our study as it allowed us to interpret the findings in our research via exploring the subjective nature of the studied reality. Echoing Dewey’s postulates, Vygotsky’s and Bronfenbrenner’s views align well with the philosophy of postmodernism, which moved us to alignment of the three and using them as a philosophical umbrella for our research.

We explain the choice of the method, i.e., a qualitative ethnographic case study, with the necessity for the researchers’ team to longitudinally reside within the research site to be able to gain a deep understanding of the development of the processes connected to implementation of the ISEP project and the participants’ perceptions of its multiple stages in the course of the time. It was highly significant for us to gain the understanding of the complex phenomena of all “whys” and “hows” in the participants’ external behaviors and their internal motivations, which underpinned their decision making. As it is most treasurous for qualitative studies, the participating teachers’ feelings, emotions, and thinking appeared to be evaluable for obtaining the deep understanding of each person’s research portrait, as well as the landscape
of the whole group thinking. The above required a complete immersion into the school culture and the context within the PD project in which the participants were placed.

Another concept underlying our research paradigm and selection of the ethnographic case study design was our focus on the observational stance as described by Van Maanen (1988). Van Maanen’s (1988) realistic approach and vision of this method rests on Creswell’s beliefs. Creswell beheld, “Realist ethnography is an objective account of the situation” which is “reporting objectively on the information learned from participants at a site,” where a realist ethnographer, while remaining omnisciently in the background, “narrates in a dispassionate voice on what is observed or heard from participants” (2007, p. 69). Further on, Creswell (2007) continued, “The ethnographer produces the participants’ views through closely edited quotations and has the final word on how the culture is to be interpreted and presented” (p. 70). In alignment with the above postulates, we recognized the exigency “to marry” the social constructivism with the realistic ethnography. So, we tailored our methodological approach to be not just an ethnography, but an ethnographic case study because our project focused on one case, which we scrutinized; that was the case with the ISI-based ISEP PD project implementation in the elementary school.

Regarding the choice of an ethnographic “case study” per se, we must explain that Denzin and Lincoln (1994) defined a case study as a “study of things in their natural settings, attempting to make sense of, or interpret phenomena, in terms of the meanings people bring to them (p. 2), which aligns well with Van Maanen’s (1988) vision. Creswell (2007) furthered these ideas stating that, “For a case study, as in ethnography, analysis consists of making a detailed description of the case and its setting” (p. 163). This theorist also recommended analyzing multiple sources of data to determine “evidence for each step or phase of the evolution of the case” (Creswell, 2007, p. 163).

Hence, the methodology and the design of our study allowed us to listen to individual voices of each and all participants within the recruited group, observe their practices within the school culture, and see their stories fulfilled live in their classrooms. This method helped us to not only base our findings on the educational practices we observed, but also hear the answers to our central research questions, sub questions of the researchers’ interest, and the procedural research questions, while seeking to hear the answers to them from the primary sources, i.e., from the teachers participating in this project. Ethnographic case study approach uniquely enabled our researchers’ team to see the effects the ISEP project had on the participating educators’ teaching practices. It allowed the major researcher (first author) to “live” at that school for a whole year and observe the changes in teaching approaches, methods, and techniques made by the teachers thanks to their studies with the Summer Institute and participation in the collaborative PD programs. Ethnographic case study design allowed the major researcher (further addressed as MR) to witness teachers progressing through their ZPDs with the guidance from the ISEP participating university and college mentor-professors, who taught teachers within the Summer Institute, during PD sessions, and advised or consulted them in person. Frequent and regular visits to school made it possible for the MR to witness how teachers were implementing in their classrooms the new knowledge they acquired through the PD program over that year. Thanks to this ethnographic case study design, the MR could talk to the teachers and their students throughout the year and observe the teaching and learning processes in and out of class during the time this project was in progress. This approach also allowed to see how exactly the teachers assisted their students through their ZPDs. The ethnographic case study design allowed us to deeper understand why the teachers’ team managed to avoid professional disintegration. Additionally, it led the researchers to a deeper understanding of the factors, which, in addition to the high leadership skills of the school principal, contributed to the success of the ISEP at that school. Due to the major researcher’s (MR’s) “omni-present” and omniscient observational activity (Creswell, 2007), which
included formal and informal interviews and conversations with the school faculty and children, taking notes, pictures, and making video- and audio-recordings, this ethnographic case study made it possible for us to widely study this school culture in depth (Wallace & Brooks, 2015).

**Site**

Thompson Elementary School (pseudonym), where this study was conducted, was an urban elementary school within a public school district. This school served students on grade levels from Pre-Kindergarten through 8th grade. The school site was a multistoried construction, which consisted of several buildings connected by hallways. The whole architectural ensemble formed a square with a green courtyard inside. Different grade levels were located separately, in different buildings, and on different floors, which created a convenient, ranked system of operations due to its being organized by grade level.

The school foyer had the American flag, the flag of the school, the school uniform, and multiple professionally printed posters with slogans, which encouraged students to be responsible, honest, and caring citizens and residents of the United States. Large flags of different countries were mounted along the central hallways with the purpose of honoring international student populations at this school.

This educational complex was in the middle of a poor neighborhood, where many residential houses looked shabby; their structures were deteriorating, and the paint was scaling off the old wooden walls. On the contrary, the school was quite a new construction. There was nothing inside or outside this building that would serve as a reminder of poverty in the neighborhood around. The school looked well-maintained and overall taken care of. The building materials used for exteriors and interiors were of high quality. Overall, this school building met the high American standards set for educational institutions for children.

**Participants**

Purposeful sampling method was used for recruiting subjects to participate in this current one-year-long research within the larger, five-year long project. The researchers’ team targeted as participants in this study 20 teachers (3 males and 17 females) at Thompson Elementary (Pre-K through grade 8). The recruitment process did not present any challenge; the targeted teachers agreed to participate in this one-year-long project willingly, on the same day when our researcher tandem visited the school site, talked to the school principal, and to the recruits, the potential subjects.

Some history from the greater, five-year-long project might be helpful to the readers’ understanding of the ease of recruitment for this current research. The first three teachers volunteered to participate in the larger, multi-year ISEP project upon the initial, on-site presentation by the research team. The others joined the ISEP project by referral from the first three participants. So, at different times, during the period of five years when this longitudinal project was in progress, more teachers made their decision to join the ISEP project and the research, based on their observations of the first-commers’ experiences and shared by them reflective remarks. As the result, the whole team of the ISEP-participating teachers at Thompson Elementary volunteered to take part in this new, one-year-long study within the larger, five-year-long project in response to the recruitment e-mails, the oral on-site presentations by the research team, and in-person conversations with the researchers.

Each of these 20 teachers taught students on one of the grade levels ranging from grade four to grade eight at the same public elementary school. Some of the participants (e.g., media specialist, the English as a New Language (ENL) teachers) taught students on several grade
levels. During the final phase of this project, we interviewed and observed 18 teachers out of 20 because two faculty members left for personal reasons.

Some of the teachers at this school were paired and worked in partnership with each other. The others formed close collaborative tandems due to a range of factors. Some of the reasons for pairing the teachers were teaching in neighboring classrooms, being the only two teachers at one of the school’s departments or being assigned to a class as a homeroom teacher. Homeroom teachers’ duties included accompanying students during a whole day daily.

Here are some examples to help readers visualize the teaching tandems: Ms. Helen Stewart and Ms. Elizabeth Murphy (pseudonyms are used here and throughout this paper) co-taught their fifth graders. Ms. Pattie Johnson and Mr. Gregory Baker taught the fourth-grade special education class together. Ms. Cindy Morgan and Ms. Janet King taught English as a New Language (ENL). Mrs. Rhonda Jackson and Mr. John Smith worked in the next-door classrooms for years. Ms. Liz Davis and Mr. Michael Kane were co-teaching fifth graders (See the demographic information about the paired teachers and the assigned to them classes in Table 1 below).

<table>
<thead>
<tr>
<th>Paired teachers</th>
<th>Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helen Stewart &amp; Elizabeth Murphy</td>
<td>5&lt;sup&gt;th&lt;/sup&gt; grade</td>
</tr>
<tr>
<td>Liz Davis &amp; Michael Kane</td>
<td>5&lt;sup&gt;th&lt;/sup&gt; grade</td>
</tr>
<tr>
<td>Pattie Johnson &amp; Gregory Baker</td>
<td>4&lt;sup&gt;th&lt;/sup&gt; grade Special Education</td>
</tr>
<tr>
<td>Cindy Morgan &amp; Janet King</td>
<td>ENL classes</td>
</tr>
<tr>
<td>Rhonda Jackson &amp; John Smith</td>
<td>Upper-level Science classes</td>
</tr>
</tbody>
</table>

Graduate student, Mr. Dan Morris, was assigned to Thompson Elementary schoolteachers as a Graduate Project Assistant and facilitated the ISEP participating teachers with multiple instructional and extracurricular activities.

**Roles of the Researchers**

The research team in this study consisted of the major researcher (MR), the first author of this paper, who conducted this study under the guidance of the principal investigator (PI), the second author. The role of the MR was to observe the site and the practices by ISEP-participating teachers, to conduct, audio record, and transcribe interviews with these teachers. The MR also collected video, photo, and hard copy artifacts (e.g., lesson plans, video-recordings, and photos of in-class teaching and learning processes, after-school supplemental activities, out-of-school educational activities, and other project-related practices). After having completed the observations, the MR added field notes, observation notes, and analytical memos to her researcher’s log (Spradley, 1980). The PI and the MR also gave presentations at the PD sessions for the ISEP-participating teachers at the City Museum of Science. Two graduate research project assistants who took part in the greater, multi-year project and are recognized in the Acknowledgments section, participated in the process of designing the research questions for this project.

**Data Collection**

As soon as the Principal Investigator secured the IRB permissions for this study, we completed the recruitment process, and the major researcher proceeded with the data collection through weekly site observations (Spradley, 1980). The MR observed the school culture
overall, for example, daily routines and practices, the interactions between students and teachers, and in between the educators. She also attended and observed the events organized by school for students and for the community (e.g., the Science Night event at school, the local Humane Society support campaign, the Nature Park geographic and botanical exploration). The MR took notes during her weekly visits and special event trips. She also wrote analytical memos during and soon after every visit to school describing and documenting all the observed practices by the school community (Creswell, 2007). To receive a better picture of how the participating teachers implemented their newly acquired knowledge, the MR joined the school at their ISEP grant-sponsored field trips and conducted observations during the out-of-school educational activities. She took photos of the students, teachers, events, activities, and artifacts (e.g., students’ work). All this data were collected to help us to deeply understand this school’s culture.

The MR also observed multiple lessons given by the teachers based on their research at the Summer Institute. During these observational visits to the classrooms, she collected artifacts (e.g., teacher-developed materials, student work, photos, and video-recordings of classroom activities, of the teachers teaching and interacting with their students). To see the ISEP project implementation and development, the MR also observed scientific presentations, which involved demonstrations and simulations given to the students by the Graduate Project Assistant and the professors from the ISEP-partnering colleges and universities.

Together with the school team, the MR attended the school district-wide event at the City Museum of Science, where the teachers from different schools presented their research findings in a poster session format. The posters created by the ISEP participating teachers reflected on the research conducted by these participants within the ISEP Summer Institute PD program. Later, the MR observed the lessons and out-of-school activities based on the teachers’ summer research projects. The weekly observations of the school site, teachers teaching, and presenting their research allowed the researchers to understand how these educators embedded their summer research findings in their classroom instruction.

MR collected the data through individual structured interviews of 18 people participating in the ISEP grant (Seidman, 2013). The interview questions were designed to help us find the answers to our central research questions, the sub questions of the researchers’ interest, and the procedural research questions we outlined above in the Introduction section of this paper. Overall, the MR has conducted series of interviews; made audio- and video-recordings, which totaled about 444.2 minutes of recordings during the final phase in this project. Though the interviews were structured, the MR often asked the interviewees to clarify or further some of their ideas. All the above constituted this research data.

Data Analysis

The MR approached the data analysis processes through the lens of Saldaña’s (2015) “thinking qualitatively” and used thematic and value coding (Saldaña, 2013). The memoed data was processed according to the guidelines developed by Miles and Huberman (1984). With the purpose “to answer a string of our research questions” (Miles & Huberman, 1984, p. 110), MR developed four conceptually clustered matrices, which assisted her with better visualization of the recurring themes and topics addressed by our research participants in their interviews (see Appendices section of this paper). MR triangulated the data from the audio-recorded and transcribed interviews with the data from observations, and artifacts (Creswell, 2007; Glesne, 2010). She looked for recurring themes and patterns in the data (Saldaña, 2013). MR scrutinized the video-recordings of the observed lessons and extracurricular activities and conducted multimodal visual and audible language analysis (Callow, 2014, which also contributed to the data triangulation. The filmed videos allowed the MR to compare the
The observable data with the self-reflective stories shared by the schoolteachers in their interviews (Erickson, 2004, 2011).

Besides, MR examined the data from teacher- and student-created artifacts and from photos (Callow, 2014). What was interesting for these data analysis was how steadily the student-created content corresponded with the material taught by the participating teachers. The artifacts that MR collected were the works created by students, teaching materials developed by the teachers, and the posters where these educators reflected their research findings made at the times of their studies with Summer Institute. MR took pictures of multiple classroom activities organized by different teachers. MR also took photos during afterschool and special events (e.g., field trips, excursions, and teacher-created poster presentations). Upon the collection, MR analyzed all the data looking for emerging patterns in the reflected by the students’ ideas, which they obtained through the newly taught content (e.g., Creswell, 2007; Ely et al., 1991; Glesne, 2010). The comparative analysis of the visual and audible data (e.g., audio- and video-recordings, photos, artifacts) allowed the MR to identify strong recurring patterns upon every visit and while recapitulating the entire project. Along with the data from observations, field notes and memos served as unbeatable evidence in addition to the data from interviews. Altogether, the results of the data analysis allowed the researchers to deeper understand this school’s culture.

Moreover, the data from the interviews with the teachers and the informal conversations between the MR and the students of the participating educators helped MR to find answers to the central research questions, the subquestions of the researchers’ interest, and the procedural questions, while providing “a detailed view of aspects about the case – the facts” (Creswell, 2007, p. 163). In accordance with the principles by qualitative research methodologists (e.g., Creswell, 2007; Saldaña, 2013; Stake, 1995), MR utilized four forms of data analysis, which included aggregation of the emerging case-relevant meanings, direct interpretation of the collected data, looking for patterns, recurring themes and values, and developing “generalizations that people can learn from the case either for themselves or to apply to a population of cases” (Creswell, 2007, p. 163).

To be more particular, MR transcribed and analyzed all the interview data looking for recurring themes and values (Saldaña, 2013, 2015, 2018). Categorization of the themes allowed MR to evaluate the major set of most frequently emerging themes addressed by subjects in each of their interviews. Another part of the data analysis based on the value coding enabled MR to draw conclusions of the most meaningful for the participating teachers benefits of the ISEP project and its affordances. So, Saldaña’s (2013) thematic and value coding was fundamental for this research data analysis, which resulted in the solid, evidence-based findings in this one-year-long project.

To ensure trustworthiness, MR made a strong effort in terms of identifying such strategies of data collection, which would allow her to triangulate the data from multiple sources (e.g., Webb et al., 1965). Miles and Huberman (1984) reflected on triangulating processes concluding that, “an important part of the internal validation process is checking a new item. . . against other, already validated. . . If they concur – overlap, correlate strongly – the new item. . . has good ‘concurrent validity’” (p. 234). We will report our findings in accordance with Saldaña’s (2018) postulates on writing qualitatively in the next section of this article. This means, the readers of this report will be granted an opportunity to hear the participants’ voices in the form of the quotes from their interviews, which, within the context of the rich description of the contingency of the research is a “privilege of a qualitative report” (Gould-Yakovleva, 2023b, p. 15).
Findings

ISEP Project Snow-Ball Expansion

This research data analysis resulted in a large set of findings, which will be further discussed in this section. It was highly satisfying for this project developers to see the evidence of success of the ISEP project. Precisely, the collaborative endeavors by the teachers’ team led to increase in their students’ motivation and interest in learning processes as well as a greater engagement of the schoolchildren, their parents, and the adjacent community members in science-based educational events and activities. Most importantly, the first few teachers who had initially volunteered on this project managed to engage a greater number of their colleagues in the ISEP. For the readers’ convenience, in this paper, ISEP participating teachers will be referred to as “Beginners,” the ones who were in the ISEP project for one or two years, and “Veterans,” those educators who worked with the ISEP from three to five years.

This research found some variations in participants’ perceptions according to the number of years they dedicated to the ISEP project. These differences in perceptions by the Beginners and Veterans may be explained by the fact that psychological effect of excitement and novelty might have subsided over time, giving the way to not only greater self-confidence, but also feeling accustomed to the innovations and on-going changes, which might have been perceived less challenging by the Veteran participants due to them having formed certain professional habits and skills over duration of the ISEP-grant-funded project.

Despite of the variations between the Beginners’ and Veterans’ responses to the interview questions, certain themes, and values persistently recurred and formed traceable patterns (Saldaña, 2013; See also the interview-based data in Tables 1-4 in the Appendices section of this paper).

Though every teacher was distinctly unique by his or her nature, type of personality, and temperament, many research participants expressed similar ideas, which allowed MR to note the recurring themes and “to see real added evidence of the same pattern” (Miles & Huberman, 1984, p. 216).

Many themes formed saliently traceable patterns. For example, practically all teachers indicated that five years before, the ISEP partnership project was launched at their school by the three enthusiastic educators. These “founding fathers” were the eighth-grade science teacher Mrs. Rhonda Jackson, the seventh-grade science teacher Mr. John Smith, and the school media specialist teacher Ms. Lillian Reed. Rhonda, John, and Lillian joined the grand, five-year-long project hoping to “discover new horizons in teaching,” as they approached it. The three initially had had no intention to facilitate spreading this initiative until they understood how beneficial it might be to both school children and teachers.

Most interviewees stated that the ISEP-participating team began snowball-growing after the three initial participants started sharing their highly positive impressions about the opportunities this project had to offer to teachers and their students. According to the trio of this project Veterans, the schoolteachers might benefit from entering the ISEP project via receiving such opportunities as continuous professional development, funding for extracurricular activities, and professional support from the participating college and university faculty members, to name just a few.

The possible outcomes of participation in the ISEP project, as anticipated by the teachers, might contribute to a significant cognitive growth of school faculty members. When enrolling in this project, some teachers expected to acquire knowledge of the newest educational technologies and the latest methods, techniques, and approaches in teaching sciences. The others aimed to further develop their research skills. All the teachers expected
their students to benefit from receiving customized instruction, which would be tailored to suit modern children’s quest for technology-based learning.

Many of the teachers realized that traditional school textbooks had great value. Yet, these days, the print-based information is not sufficient for students, who are thirsty for the newest, technology-based knowledge when trying themselves as emergent researchers and scientists of today who strive to further their education in colleges and universities. The teachers understood that the type of education their students longed for to succeed at school and get prepared for their future studies in higher education establishments needs to be grounded in the newest, up-to-date research-based information in multiple scientific fields and areas with rich inclusion of the educational technologies. Through participation in this program, the teachers also realized that the new generation learners also needed to be taught how to develop their academic research skills.

Upon having received from the first three participants their highly enthusiastic and encouraging remarks about the ISEP grant affordances, the upper grade teachers decided to join the team. As the new project appeared to work well with the seventh and eighth graders, the growing team of ISEP participants promoted the new methods to the teachers in lower grades as well. In this way, by the second year of the grant, the team of the sixth-grade teachers was welcomed aboard. In the following year, the project spread through all upper grades descending to grade five. By the last year of the grant, the leader of the teachers’ team, the project-coordinator Mrs. Rhonda Jackson involved the fourth-grade team teachers. By that time, the number of ISEP participating teachers reached 20. Importantly, none of the participating educators planned or intended to leave the team.

### The Role of Leadership

One of the significant findings in this research was the positive role of leadership. During the interviews, practically every teacher mentioned that the “secret” of the ISEP project success in their school was directly connected to supportive attitude from their school administration. For example, when questioned about the reasons standing behind the successful teamwork within the project, the fifth-grade teacher Ms. Lynn Adams explained emphasizing the word very, “Our principal is very supportive."

This phrase recurred in practically every interview in response to the question about the relationship between this school’s principal Mrs. Mary McLaughlin (pseudonym) and the ISEP-participating teachers. All the interviewees credited their leader for the success of their team, as well as for her skillful and thoughtful leadership manner. According to these teachers’ descriptions, Mrs. McLaughlin belonged to the type of leaders, who did not target nor watch to penalize. On the contrary, this school’s principal was described as a good listener and a thoughtful professional who aimed to attend to her schoolteachers’ needs. Mrs. McLaughlin encouraged her school faculty members to collaborate. According to the teachers, their school principal was highly supportive in terms of facilitating this school’s team in their endeavors to make innovative changes to their teaching practices. John Smith directly pointed out the leading role of McLaughlin. He shared, “We were one of the first schools. That was because our principal bought in right away… Her commitment and belief in the system allowed us to take a great advantage of the grant in the program.”

Mrs. McLaughlin, as shared by her school’s faculty, had never said “no” to a proposition or an innovative initiative. The teachers stated that their school principal’s enthusiastic support was the weightiest factor in the ISEP project’s growth at their school.
The Role of Informal Leadership

According to the interview data, another powerful factor that greatly contributed to successful progress of the ISEP project in this school was the highly enthusiastic endeavor from the side of the project-coordinating teacher, Mrs. Rhonda Jackson. This idea was expressed by all the teachers in multiple interviews. For example, Mr. Baker, the fourth-grade teacher exclaimed:

Rhonda is wonderful! Oh, Rhonda is fantastic! I mean she is the one that comes to us. She came to me and said, “Do you want to do this? I WANT [vocally stressed] you to do this! Get your team to do this. We really enjoyed doing this.” And Rhonda does a lot of stuff for us. I mean, whatever we need, she gets it for us. (Baker)

MR asked Rhonda, the project coordinator, to share her understanding of why the teamwork of the ISEP-participating teachers at this school turned out to be a fruitful collaboration. Mrs. Rhonda Jackson passionately explained:

I don’t think there is a teacher at our program that does not honestly believe that no matter what’s going on, we got their back. I mean, in this building [this school], we have all been together for quite a while… We just trust [strongly emphasized intonation] in each other. The administration trusts us [strong emphasis]. And our parents trust [vocally stressed] that we know better what is best [extremely emphatically] for their kids. (Jackson)

This high importance of mutual trust between all community members at school was clearly noted and strongly emphasized by Mrs. Rhonda Jackson. She genuinely believed it was the key factor to this school’s team collaborative success. This theme recurred and could be heard in many other interviews given by this school’s teachers. They made it clear that developing strong professional inter-relationships within their team contributed to maintaining a good ideological and moral atmosphere in their school community.

The professional relationships within this school worked just like in a natural healthy symbiotic relationship, where all members co-existed, cooperated, and collaborated, without attempting to dominate, over-power, outlive, or leave out the others.

ISEP-Based Changes Made by Teachers

According to the data from the teachers’ interviews, 91% of the Beginners and 86% of Veterans expressed their appreciation of being introduced to the ISI approach. Same numeric ratio (91% against 86%) appeared in the participants’ reflections on their implementation of the newly acquired ISEP methods, which focused on teaching learning skills, rather than requesting from students the exact answers or the results of their work.

About 84% of all teachers highly appreciated the opportunity to adopt and implement a hands-on teaching and learning approach, which was promoted by the ISEP. Importantly, 73% of Beginners and 86% of Veterans noticed higher motivation and engagement in their students due to the technology-based teaching and learning methods, which they mastered during their Summer Institute studies and which they started implementing in their classroom instruction. For example, Veteran-participant Mr. John Smith pointed out significance of technology-based education to the modern days’ students, who he referred to as “Digital Natives.” Mr. Smith shared:
I notice I am more willing to use some modern media. It does not necessarily fascinate me personally, but I can see where it gets the child’s attention. Even while it does not suit my personal learning style or teaching style, [laughs] if I can get to the kids, and get to pull across, that part is valuable. (Smith)

Intermediate grades teacher Ms Jane Allen expressed her fascination with the benefits of technology-based learning, which she started using with her students with special needs. Ms. Allen revealed:

Watching how they flourish with the program and watching how they interact with code.org, and what they are doing really opened my eyes. And even some of the low functioning students were really able to grasp it. It made me say, “These students might have harder times with the traditional curriculum in science.” (Allen)

Importantly, about 64% of Beginners and 43% of Veterans observed increase in students’ interest in learning processes and activities when these educators started implementing the teaching approaches, methods, and techniques mastered at the time of their studies with the ISEP Summer Institute. Additionally, 64% of Beginners and 86% of Veterans noticed significant beneficial effect on their students’ involvement and understanding of the content of classes. Thanks to this grant, as stated by the teachers, they got the opportunity to offer their students some new thematic out-of-school educational activities, content of which corresponded with the curriculum-based material they taught in class. For example, Mr. John Smith, who sponsored the Rocket Club as one of the after-school extra-curricular ISEP-based activities shared his impressions on the role of hands-on, real-life learning in student engagement. As this teacher believed, it was very important for children to see the practical results and implementation of the product of their joined work to get deeply engaged. Mr. Smith explained:

This year, we included an accelerated program with the software, which creates animation, graphic design, and that kind of stuff, which is fascinating some of them [students]. We are planning next month or so to get into some of more robotic end of what we are doing. We are just trying to give them a new stepping-stone from code.org, just learning the basic algorithm principles where they are trying to put it into the product. There is a product on the other end. (Smith)

Importantly, nearly 64% of Beginners and 43% of Veterans recognized advantages of students’ collaborative teamwork. About 44% of all teachers also noticed an increase in self-confidence in their students in response to the ISEP teaching philosophy appropriated by the schoolteachers as the result of their PD studies within this project. Ms. Susan Bailey pointed out a noticeable difference between traditional text-book-based learning versus the collaborative experiential and explorative teaching and learning style she mastered through the ISEP project PD sessions and Summer Institute. Ms. Bailey clarified:

For science, textbooks have their place. And I think they are useful tools. But in a subject like science, there are so many things that kids can do [emphasized]! I do not just think that this all needs to be textbook-driven. (Bailey)
Due to the PD opportunities offered by the faculty members from colleges and universities, about 56% of all teachers felt academically and professionally supported, guided, and advised. A significant number of Beginners (64%) and 43% of Veterans noticed their own professional and cognitive growth, which they attributed to their studies within the ISEP project. These teachers also reported their growing tendency to develop, explore, and implement new ideas of their own. When fourth grade teacher Mr. Steve Hall was questioned in what way his approach to teaching science changed since he had joined the project, this participant directly credited the influence from the ISEP participating university and college professors. Mr. Hall shared:

It [his approach to science teaching] has changed because it has been in the circle of different professionals that engage in science in different roles. It brought me to a different circle of people that I was not around before. And when you are in the circle of people who enjoy doing science, you are engaged in different things and peer learning that I wasn’t around before. (Hall)

Among other advantages of the ISEP project, many teachers in both categories mentioned benefits to the English as a New Language (ENL) speakers and special education students. Teachers appreciated greater access to new resources offered by this grant. Thanks to these new affordances, they were able to dramatically change their practices. For instance, these teachers noted their lesser dependence on textbooks due to greater employment of multimodality, including but not limited to technology, whiteboards, visuals, real life experiences, hands-on activities, and after-school learning opportunities offered by the ISEP grant.

ENL teacher Ms. Janet King clarified in detail about the modifications she made to her teaching upon her studies with the Summer Institute. Ms. King furthered:

In New York State, science is based on the New York State science exam. So, because the [ENL] students have trouble reading the tests, it’s very likely there is this reading portion of the test and then, the hands-on portion of the test. So, I definitely tried to help them with hands-on because they are able to do that easier. So, I created a unit Using Science Tools last year, and then, this year… I created the strategies, flashcards, visuals, websites they can go to. Anything that was linking speaking, listening, reading, and writing for the [ENL] kids. (King)

All the teachers reported using for their teaching their posters created by themselves for presenting their Summer Institute research. These teachers-researchers embedded their summer research topics in their classroom instruction. Multiple visual artifacts in the forms of photos and video-recordings served as evidence of implementation of the Summer Institute research by teachers for teaching and learning activities in class and during their educational field trips sponsored by the ISEP grant.

**Change of Professional Learning Community**

Teachers recognized multiple factors that contributed to effective progress of the ISEP grant project work at their school. As the major positive factor, 86% of Veterans and 64% of Beginners named long-time clustered supportive and collaborative practices of professional learning community (PLC) at their school. The faculty members merged into one strongly interconnected entity in which people “trusted,” “respected,” and “supported” each other. For
example, the fifth-grade team developed unique collaborative co-planning practices when in the ISEP project. Ms. Lynn Adams described these co-planning meetings in detail:

It was a fifth-grade team. And we met at one of the teachers’ homes. So, if someone had kids, they could bring them in; she had a pool; she had a backyard. It was a nice weather, so we worked outside all the time. And we brought our lunch with us, so we had our lunch, and we could sit and work together. So, it was once a week that we were meeting. And between the meetings, we could do our research and make copies for everybody if we needed. (Adams)

Nearly 82% of Beginners and 71% of Veterans started their paired teaching practices. These teachers found paired teaching and co-teaching highly beneficial for supporting their students’ ability to focus on their studies. About 72% of all ISEP teachers found useful their co-planning practices in the form of on-going formal and informal communication. Sixth-grade teachers clarified their model of collaboration within their own grade level team and beyond. For example, Ms. Stewart explained:

The biggest piece of our relationship or the drive is that we are able to train each other. And then, we go to fifth grade team, and we say, “We tried this, and we did this. And this worked and this did not work.” (Stewart)

Many teachers valued support from the Graduate Project Assistant, a doctoral student from one of the ISEP project-participating universities who was assigned to assist the teachers at this school with multiple ISEP-based classroom and extra-curricular activities. For example, Elisabeth Murphy, sixth Grade science teacher who was paired to co-teach with Special Education teacher Helen Stewart said that this Graduate Project Assistant, Mr. Dan Morris made a powerful contribution to the teachers’ planning and performing multiple project-based educational activities. Ms. Murphy stressed:

We would go to Dan [Graduate Project Assistant] for anything we need. And he is always there to help us. If he cannot solve it right then, he would come over again and come back to us and say, “This is what I’ve figured out for you.” (Murphy)

Among other factors that contributed to the successful progress of the ISEP project at this school, the teachers named support from the university and college faculty members, summer research, co-planning opportunities, availability of new resources from Summer Institute, and the financial affordances of the grant. For example, Mr. Hall expressed his high appreciation of the PD conducted by the university professors. With a strong emphasis on the positive words, Hall stated, “The team, and the professionals, and collaboration was wonderful! [emphasized] It was very interesting [strongly emphasized] and very challenging.”

**Discussion**

To conclude this report, it is imperative to note that we have not found any comparable publications in the pool of the available to us literature among which we could position these current research findings. To be more exact, the uniqueness of this study in its intention to carefully listen to every participant’s voice aiming to elicit each teacher’s perceptions, feelings, ideas, and conclusions about their new and quirky but zealous venture within this innovative
project. Thus, we believe our study presents quite an interesting contribution to the field where our predecessors studied a range of components within many adjacent areas (e.g., Clark et al., 2011; Daniel et al., 2022; Grigg et al., 2013; Yang et al., 2018).

Prior to publishing this article, the principal investigator and the major researcher presented the findings of this project to large audiences of peers at an International educational research conferences seeking an additional peer-review process. To ensure trustworthiness and avoid any possible biases, our research team engaged in rich discussions with the audiences at the National and International conferences. Importantly, none of the discussants provided any negative remarks about this research project.

Some limitations of our research are that this project was conducted in only one urban school district, located in the Northeast of the United States, and focused on only 20 teachers at the same elementary school, out of which only 18 reached the end of this project due to their personal issues. Some of the implications are that more studies are needed on this topic with a larger number of participating teachers who teach on different grade levels, in different schools, nation-wide, and globally.

Yet, the team of researchers conclude that the major implication of this study is that the PD within the ISEP project based on the ISI approach was found to be highly beneficial for both teaching and learning processes by this school’s team of teachers. The above finding is coherent with the ones made by other researchers (e.g., Hayden, 2019; Waitoller & Kozelski, 2013; Wallace & Brooks, 2015). We have noted that having formed a long-time collaborative relationship, the teachers investigated within our project school succeeded in making significant changes via implementing the ISEP teaching techniques, methods, and approaches.

Multiple benefits to the school student population reported by the ISEP participating teachers serve as evidence of successful collaborative practices of the schoolteachers in partnership with the college and university faculty, which aligns well with the principles by social constructivists (e.g., Bronfenbrenner, 1979, 1993; Dewey, 1948, 1963; Vygotsky, 1978, 1987). These findings also support the ideas of the collaboration theory developers (e.g., Briscoe & Peters, 1997; Gajda, 2004). Thanks to the regular PD sessions, the schoolteachers have successfully progressed through their own ZPDs and were able to work more efficiently on closing the gaps in their content and modern educational technology knowledge. Rich implementation of hands-on and technology-based multimodalities facilitated the teachers with engaging and motivating their students in teaching and learning processes and more efficiently leading these young learners through their ZPDs. These findings support the ones made in the other studies by the American and International researchers (e.g., Cloonan, 2011; Gould-Yakovleva, 2023a, 2023b; Gould-Yakovleva et al., 2020; Miller & Borowicz, 2005).

We found that the PD program these schoolteachers received within this project helped these educators to re-shape their school culture and the ecological systems of the schoolchildren’s social environment (Bronfenbrenner, 1979, 1993, Bronfenbrenner & Morris, 1998). Upon having progressed through their ZPDs, teachers felt better equipped for assisting their students with their progressing through their individual ZPDs (Vygotsky, 1978, 1987). This evidence might allow public school district administrators nationwide and internationally to attempt implementing similar projects in their schools with the purpose to not only improve their school culture, but also offer a greater population of students better educational opportunities. The latter might include school-university partnerships, ISI-based instruction, research-based teaching, experiential, hands-on, and technology-based learning, after-school, and out-of-school STEM-based supplemental educational events and activities, etc.

Significant changes, like the ones achieved by the schoolteachers in this ISEP project may be expected if school faculty reshape their school culture via forming mutualistic professional learning communities within which they might interactively collaborate while moving towards common objectives (e.g., Avalos, 2011; Tang & Shao, 2014; Tsui & Law,
Wide educational audiences might consider taking as a role model the example given in this paper, where the team of teachers joined their endeavors and strengthened their school culture via developing their long-term “mutualistic” relationship (Zhao & Frank, 2003). Acting as a closely interconnected PLC, this team of teachers set and pursued common goals, which allowed them to avoid possible professional disintegration. These educators trusted and helped each other in making the changes in their instruction with the purpose of making a change not only in their students’ classroom experiences, but also in their whole school and community culture. The ISEP-participants’ team at Thompson Elementary School demonstrated that, as a highly united and collaborative team, teachers can take challenges in acquiring and implementing the newly obtained knowledge, help their students to achieve higher, and turn their school into a thriving community.

References


interdisciplinary researchers: Findings from a professional development workshop. *PLOS ONE, 17*(4), e0267234. [https://doi.org/10.1371/journal.pone.0267234]


## Appendix A

### Table 1
Positive Effects and Benefits of ISEP Project as Noted by the Beginners, the Teachers who Worked within the Project for One or Two Years

<table>
<thead>
<tr>
<th>#</th>
<th>Recurring themes</th>
<th>Johnson</th>
<th>Hall</th>
<th>Allen</th>
<th>Rogers</th>
<th>King</th>
<th>Reed</th>
<th>Davis</th>
<th>Morgan</th>
<th>Adams</th>
<th>Baker</th>
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<td>✓</td>
<td>✓</td>
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<tr>
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<td>20</td>
<td>Benefits for special education &amp; ESL students</td>
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<td>✓</td>
<td>✓</td>
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</table>

### Table 2
Positive Effects and Benefits of ISEP Grant on Teaching and Learning Noted by the Veterans, the Teachers and the GA Student Who Worked within the Project for Three to Five Years

<table>
<thead>
<tr>
<th>#</th>
<th>Recurring themes</th>
<th>Smith</th>
<th>Young</th>
<th>Murphy</th>
<th>Stewart</th>
<th>Bailey</th>
<th>Jackson</th>
<th>Morris, GA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Teachers achieved set goals</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>2</td>
<td>Students’ need in technology-rich learning met</td>
<td></td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>3</td>
<td>Increase in students interest &amp; motivation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>4</td>
<td>Focus on teaching learning skills</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>5</td>
<td>Focus on interdisciplinary approach</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>6</td>
<td>Focus on the process rather than result/answer</td>
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<td>7</td>
<td>Raising self-confidence in students</td>
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<td>✓</td>
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<tr>
<td>8</td>
<td>After-school clubs and activities</td>
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<td>✓</td>
<td>✓</td>
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<td>9</td>
<td>Out-of-school supplemental instruction</td>
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<tr>
<td>10</td>
<td>Support from universities faculty</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>11</td>
<td>Hands-on activities, building, experimenting</td>
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<td>12</td>
<td>Students’ team work</td>
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<td>13</td>
<td>Financial benefits of ISEP</td>
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<td>Sammer research</td>
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<tr>
<td>15</td>
<td>Access to new resources</td>
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<td>16</td>
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<tr>
<td>19</td>
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<td>✓</td>
<td>✓</td>
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Table 3
Factors that Contributed to Efficient Progress of the Teachers’ Teamwork within the Project as Noticed by the Beginners, the Participants Who Worked within the Project for One or Two Years

<table>
<thead>
<tr>
<th>Names of the teachers</th>
<th>Johnson</th>
<th>Hall</th>
<th>Allen</th>
<th>Rogers</th>
<th>King</th>
<th>Reed</th>
<th>Davis</th>
<th>Morgan</th>
<th>Adams</th>
<th>Baker</th>
<th>Carter</th>
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<tbody>
<tr>
<td><strong>Recurring themes</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>1 Supportive long-time PLC</td>
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<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>3 Effective leadership by project coordinator</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4 Co-teaching and paired teaching</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
</tr>
<tr>
<td>5 Support from graduate project assistant</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>6 Presentations by university faculty</td>
<td>✓</td>
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<td>✓</td>
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<tr>
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<td>✓</td>
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<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>8 On-going communication and co-planning</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>9 Financial affordances of ISEP</td>
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<td>✓</td>
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<td>10 Summer research opportunities</td>
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<tr>
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Table 4
Factors that Contributed to Efficient Progress of the Teachers’ Teamwork within the Project as Noted by Veterans, the Participants Who Worked within the Project from Three to Five Years

<table>
<thead>
<tr>
<th>Names of teachers and GA student</th>
<th>Smith</th>
<th>Young</th>
<th>Murphy</th>
<th>Stewart</th>
<th>Bailey</th>
<th>Jackson</th>
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<tr>
<td><strong>Recurring themes</strong></td>
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<td>3</td>
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<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>1 Supportive long-time PLC</td>
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<td>✓</td>
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<tr>
<td>2 Supportive principal</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>3 Effective leadership by project coordinator</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>4 Co-teaching and paired teaching</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>5 Support from graduate project assistant</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
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<td>✓</td>
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<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>8 On-going communication and co-planning</td>
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Author Note

Olga Gould-Yakovleva, Ph.D., SUNY, UB Alumna; is an Assistant Professor at the Curriculum & Instruction Department, ENMU, USA. Please direct correspondence to olgagoul@buffalo.edu

Xiufeng Liu, Ph.D., is Director of Center for Educational Innovation and Professor at the Learning & Instruction Department, SUNY, UB, USA.

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