Ilaria, D. (2017). The efficacy and impact of a hybrid professional development model on handheld graphing technology use. *Contemporary Issues in Technology and Teacher Education, 17*(2), 194-204.

# The Efficacy and Impact of a Hybrid Professional Development Model on Handheld Graphing Technology Use

Daniel Ilaria
West Chester University

Online teacher professional development is becoming more prevalent as the ability to harness technology to bring teachers and resources together becomes easier. Research is needed, however, to determine the effectiveness of models and to share practices that increase teacher knowledge of content and pedagogy. This study examines how a hybrid professional development model impacted secondary teachers' implementation of handheld graphing technology through an analysis of the participants' perceived growth in skill with the technology and their perceived ability to provide support to other teachers using the same technology. Participant surveys as well as follow-up observations and interviews of selected participants indicated an increase in handheld graphing technology use prompted by participation in the professional development workshop.

In the current educational climate, many reform efforts are driving changes in content, pedagogy, and assessment. The implementation of new mathematics standards requires teachers to revisit mathematical content from new perspectives. Research on the benefits of discussion (Cirillo, 2013) and formative assessment (Wiliam, 2007) demonstrate the need for teachers to implement instructional strategies that require knowledge of connections between content, pedagogy, and assessment. The proliferation of educational technologies available for classroom use motivates teachers to incorporate technology more meaningfully in their instruction.

These changes require professional development of teachers at a time when funding for education is limited. Research indicates that one-shot workshops and one-time in-service seminars are ineffective in producing change in teacher instructional beliefs (Smylie, 1989). Nevertheless, little progress has been made in offering sustained professional development around content. In fact, investments in professional development appear to be increasingly focused on least-effective models (Wei, Darling-Hammond, & Adamson, 2010).

At the same time that teachers are expected to use technology to encourage student learning, particularly in mathematics (National Council of Teachers of Mathematics [NCTM], 2000; Common Core State Standards Initiative, 2010), technology has provided teachers with an alternative means for professional development. Online teacher learning provides a way to implement professional development best practices in terms of content, active learning, coherence, duration, and collective participation (Desimone, 2009). Online professional development (PD) also provides the potential for satisfying cost conscious budgets, while meeting the demands of teachers' schedules. Moreover, online PD provides teachers with access to global resources while affording a means for ongoing engagement in learning.

## Literature Review

### Professional Development Research

The role of PD in teacher learning has shifted in recent years to focus more squarely on the impact of student learning. Wei et al. (2009) defined effective PD "as that which results in improved teachers' knowledge and instructional practice, as well as improved student learning outcomes" (p. 3). Overall, effective PD is job embedded and includes the following elements: (a) collaborative learning; (b) active learning; (c) facilitation of deeper knowledge of content and how to teach it; (d) linkages among curriculum, assessment, and professional learning decisions in the context of the teaching of specific content; and (e) sustained study over a long time period (Wei et al., 2009).

Research on PD with handheld graphing technology indicates that substantial work is needed beyond learning how to use the device (Burrill et al., 2009). The introduction of handheld graphing technology into the classroom does not automatically produce changes in teaching strategies, but Burrill et al.'s (2009) review of the research concluded that students who had regular access to technology had a better understanding of functions, variables, and graphs, as well as an ability be more flexible in problem solving. Therefore, teachers need PD with handheld graphing technology that focuses on how the technology can impact their ability to achieve instructional goals while influencing the mathematics that they teach.

### Online Professional Development

Online teacher professional development (oTPD) is becoming more prevalent as the ability to harness technology to bring teachers and resources together becomes easier. Online PD meets several objectives for educational improvement, such as introducing new curricula, altering the pedagogical practices of teachers, changing school structure and culture, and enhancing relationships between school and community (Dede et. al., 2009).

Graham (2013) found nearly 200 research publications on blended learning – a "combination of face-to-face experiences, in which learners are co-located, with online experiences" (Owston, Sinclair, & Wideman, 2008, p. 202) – across corporate, higher education, and K-12 settings. Despite the varied contexts where blending learning exists, the rationale for such experiences remains much the same, including (a) more effective teaching and learning; (b) greater instructional flexibility and access to learning; and (c) more cost-effective instruction (Graham, 2013).

These justifications can also be motivations for increased occurrences of blended teacher PD. Dede et al. (2009) provided a review of research related to oTPD, along with a proposed agenda for future research. Currently, most research regarding oTPD centers on program design and effectiveness. For instance, Owston et al. (2008) conducted research regarding blended professional development of in-service mathematics teachers. In their study, teachers participated in face-to-face sessions and posted reactions to an online discussion group. While the teachers showed overall satisfaction with the professional development and teachers' beliefs and practices appeared to change, teachers were mixed about how well the program prepared them to teach the curriculum. Dede et al. (2009) stated that most evidence of effectiveness is from participant surveys completed immediately after the PD ends, with no consideration for long-term impact.

Within the broader scope of teacher effectiveness, this research project also involved other underresearched categories: educational improvement, which includes interventions aimed at teacher change, programs designed to improve content area knowledge and subject matter expertise, and interventions designed to improve pedagogical skills. While online PD is expanding, little is known about best practices.

Dede et al. (2009) made several recommendations for future research related to oTPD. The recommendations related to the research described in this paper are the following: (a) research questions that address the impact of professional development on teacher change; (b) research methods using both qualitative and quantitative analysis; and (c) taking advantage of the unique data collection possible in online programs by extending the analysis of outcome measures across time to allow measurement of different stages of teacher change or teacher learning.

## Research Question

The purpose of this research was to determine how a hybrid professional development model affected the use of handheld graphing technology in classrooms. This goal meets the call of Dede et al. (2009) for research of oTPD that develops additional measures of teacher change beyond self-reported data provided by teacher surveys.

The guiding question of this research was, How does a hybrid professional development model impact secondary teachers' implementation of handheld graphing technology? This question was addressed through an examination of participants' perceived growth in skill with the technology and their ability to provide support to other teachers using the technology.

## Methodology

The participants for the study consisted of in-service teachers selected by Texas Intruments' Teachers Teaching With Technology group to participate in their Teacher Leader Cadre (TLC) PD program. Participants completed an application form to attend the workshop and were chosen from a larger pool of applicants by the Teachers Teaching With Technology professional development program administrators. The accepted participants in the TLC represented high school teachers across the United States, including one from Hawaii. Other participants included a teacher from Canada, two college professors, and two administrators whose responsibilities included curriculum development, design, and implementation.

The TLC program is a 9-day face-to-face leadership training program, sponsored by Texas Instruments, for teachers interested in further developing their skills with handheld graphing technology, specifically the TI-*n*Spire, while becoming teacher leaders with regard to this technology. Due to the availability of online meeting software, the face-to-face version of the TLC was redesigned to deliver content in a hybrid or blended professional development model. The new model consisted of 2 days, approximately 20 hours, of face-to-face meetings followed by 18 online sessions, using WebEx online meeting software.

The initial cohort consisted of 24 teachers. Over the course of the study, two participants dropped out of the program and study due to time commitment conflicts. The sample for this study consists of 14 of the 22 teachers who completed the workshop and agreed to participate in the study by signing a consent form. All teachers participated in approximately 20 hours of face-to-face PD meetings, followed by 18 ninety-minute online sessions over a 10-month period.

The face-to-face meetings occurred at the start of the TLC. Participants met in a conference room on the Texas Instruments' campus in Dallas, Texas. Two instructors led the participants through graphing calculator-based activities designed to teach calculator skills and activities designed to engage participants in thinking about working with the adult learner. Participants worked with partners or small groups during the sessions. Another feature of these meetings included common meals so participants could socialize to become acquainted with their cohort members.

The online sessions were also led by the two instructors, with each session focusing on one or two topics. Topics included calculator skills, such as using a slider feature to create a mathematical exploration activity; using technology to deepen mathematical content understanding, such as how to connect multiple representations; and leading a professional development session with adult learners.

Collected data consisted of two surveys, administered midway and at the completion of the online sessions. The surveys included four Likert-style items and short answer prompts that provided teachers with an opportunity to justify their rankings. The items addressed three areas of the professional development experience: (a) effectiveness online environment for professional development, (b) skill acquisition with the handheld graphing technology, and (c) ability to mentor other teachers.

Participants were asked to rate each of these areas on a scale of 1 to 5, with 5 being the highest. The use of multiple surveys addressed the concern of Dede et al. (2009) regarding measuring effects with varied timing to capture a better understanding of how teachers make sense of their new knowledge and apply it in the classroom. The results were analyzed using a *t*-test comparing the differences in the means between survey responses.

Dede et al. (2009) also suggested taking advantage of the data streams collected in online environments – information not typically captured in face-to-face environments. In light of this recommendation, we captured recordings of each session to provide additional data to address the research question. Finally, since participants were able to email the instructors throughout the 10-month period, email communication was used to provide further qualitative evidence of teacher beliefs regarding their learning experience.

Surveys or self-reported data are limited in their capacity to provide complex descriptions of PD (Desimone, 2009). Additional measures of teacher change that are more objective are required (Dede et al., 2009). According to Desimone (2009), observation can provide more objective and comprehensive descriptions of PD. Additionally, interviews can provide deeper explanations and examples of impact.

Mindful of recommendations offered in the research literature, three participants were selected for follow-up visits during the school year following the completion of the TLC workshop. The three participants were selected to represent varied geographical areas, school districts, and prior teaching experience with the technology. Teacher 1, Mr. M, worked in a southeast school district serving a minority population, had been teaching for 8 years, and is a Presidential Award for Excellence in Mathematics and Science Teaching recipient. He had used the TI-*n*Spire with students in AP courses for 2 years prior to enrolling in the PD program. During this study, Mr. M taught precalculus and calculus courses.

Teacher 2, Mr. T, taught geometry and algebra in an ethnically diverse school district in California and had 10 years of classroom teaching experience. He had been using the handheld technology for 8 years with all of his students.

Teacher 3, Mr. D, worked in a middle class suburban school district in the Midwest, had 13 years of experience, and taught mostly Advanced Placement level mathematics classes. He had not used the handheld technology in the classroom prior to joining the TLC program.

Observations of classrooms and informal interviews comprised the data collected during these visits. Observations occurred for 1 full day of instruction, with teacher interviews following at the end of the school day. Observations of classroom lessons focused on how the teachers implemented handheld graphing technology in the classroom and how the teachers and students used technology. The field notes allowed for the creation of a classroom vignette of teacher and student interaction with technology and mathematics in order to provide a qualitative description of the quantitative data collected in the surveys.

Interview questions focused on how the teachers used the skills learned during PD during the school year, changes in the curriculum prompted by the PD, and support provided by the teacher for colleagues. Additional questions were asked as needed. The informal interviews provided information about the teacher’s insight regarding curriculum, technology, mentoring, and any larger district changes based on participation in the TLC, in order to ascertain the impact of the professional development.

## Survey Results and Discussion

The first two questions in the survey addressed the efficacy of the online environment as a PD vehicle. The second two questions addressed the participants’ perceived growth in skill with the technology and their ability to provide support to other teachers using the technology.

Table 1 provides an average score of participants’ responses regarding the effectiveness of the online learning sessions; comfort level with online learning, abilities with the technology, and ability to mentor other teachers to use the technology.

A cursory look at the data suggests the following about the participants over the course of the workshop:

- Perception of the effectiveness of the online learning sessions decreased.
- Comfort level with participation increased.
- Teachers' appraisal of their abilities with the technology increased.
- Rating of their ability to mentor other teachers decreased.

**Table 1**
Average Participant Response Score

| Questions | Mid-Workshop Survey Average Score | End-of-Workshop Survey Average Score |
|---|---|---|
| How would you rate the effectiveness of the online sessions for learning? | 4.36 | 4.14 |
| How would you rate your level of comfort participating in the online sessions? | 4.5 | 4.71 |
| How would you rate your ability with using the features of the TI-nspire? | 4.14 | 4.21 |
| How would you rate your ability to mentor other teachers on the uses of the TI-nspire? | 4.36 | 4.21 |
| *Note*. Questions all begin with "Using a scale from 1 to 5 with 1 being 'Poor' and 5 being 'Excellent' ..." | | |

A *t*-test comparing the differences of the means for each category indicated no significant difference in scores for participant perception of the efficacy of the workshop (Mid-Workshop Survey: $M = 4.36$, $SD = .497$; End Workshop Survey: $M = 4.14$, $SD = .865$); $t(13) = -1$, $p > 0.05$, skill acquisition (Mid-Workshop Survey: $M = 4.14$, $SD = .865$; End Workshop Survey: $M = 4.21$, $SD = .699$); $t(13) = -.2915$, $p > 0.05$, or mentoring ability (Mid-Workshop Survey: $M = 4.36$, $SD = .633$; End Workshop Survey: $M = 4.21$, $SD = .579$); $t(13) = .8062$, $p > 0.05$, from the middle to final workshop surveys. These results suggest that the professional development did not have a significant impact on participants' perceptions of improvement in any of these areas.

As Desimone (2009) indicated, self-reporting surveys are limiting; observations and interviews provide more information about the impact of PD. In this section, the research question is addressed through a discussion of three areas: (a) the effectiveness of the online model for learning; (b) the participants' abilities with technology and impact on teaching; and (c) the impact of the oTPD on leadership abilities with technology.

### Effectiveness of Online Model for Learning

No significant difference in rating the "effectiveness of the online session for learning" or "comfort level with participating in the online sessions" suggests that the environment did not adversely impact the learning of the participants. When asked whether the online sessions were effective for learning over the course of the workshop,

- Two of 14 participants scored the effectiveness higher;
- Eight provided the same level of effectiveness both times;
- Four scored effectiveness lower.

Participants who felt the effectiveness stayed the same or increased stated that they liked being able to work from home, enjoyed fewer distractions than is typical in whole-group settings, and appreciated more accountability that the online sessions provided to stay "on task."

Participants who said the effectiveness decreased noted there was less structure to the online sessions. They indicated that the sessions focused on participant questions that were often irrelevant to them and that a few participants dominated the conversation. In general, they preferred a faster pace with more learning activities. Across both surveys, all participants indicated the online environment software did not detract from their experience.

An additional question asked if the online environment kept participants engaged throughout the sessions:

- Twelve of 14 responded affirmatively at the midpoint;
- Nine of 14 responded affirmatively at the end.

When examining engagement factors midway through the workshop, interest in the topic being discussed was the most important factor impacting engagement. At the end of the workshop, the content was still the main factor, but four of the participants responded that they were not engaged, indicating that either the 9 p.m. meeting time was too late (this was a particular problem for participants living in the Eastern time zone) or that the sessions distracted them from work on other school-related projects.

Based on participants' perceptions of the online environment, the software and interaction were effective for learning for most of the participants. Furthermore, the responses illustrate that engagement in online learning can be impacted by outside factors. The benefits of long-term PD is well-documented in the literature; but as the PD sessions continued in this study, responsibilities of the participants impacted the engagement in online learning activities.

### Teaching With Technology

With no significant difference in participants' perceptions of technology ability, the qualitative data provide some possible explanations for this result. When examining participant feedback about their abilities with TI-*n*Spire technology over the course of the workshop,

- Five of 14 participants scored their ability higher;
- Eight responded at the same levels across two administrations of the survey;
- One decreased.

Of the eight that stayed the same, six responded they were at Level 4 or 5 throughout the workshop, suggesting that many of the participants already came to the PD workshop with high abilities and knowledge of the technology.

The participant whose score decreased initially stated that the consistent practice and requirement to complete homework assignments and submit calculator files helped. At the end of the workshop, the participant ranked her ability lower, but indicated that after every session she applied what she learned to her own teaching. This participant was also the most frequent presenter to share files created for use in the classroom over the last 4 weeks of the workshop and contacted the instructors at least once per week over the final 6 weeks of the workshop.

While many participants ranked their abilities at the same level, many noted a specific feature of the technology they learned, such as using math boxes or sliders, or they noted the learned best practices for implementing the technology. Only one of the eight participants who provided a rank at the same level provided no evidence of self-perceived growth in skills in their written reflections. The one participant consistently noted the mathematical content was above the level of his students, and as a result, the workshop did not interest him.

Twelve of the 14 participants noted that the PD helped them to learn at least one skill (five ranked their abilities increased and seven noted a new skill that they learned despite an unchanged ranking at the end of the workshop). During the following school year, observations and interviews of three of the participating teachers examined how the skills learned translated into classroom use.

The observations and interviews of the teachers indicated three areas of increased use of the graphing handheld technology. The first area was the use of discovery, or exploratory, activities. The teachers indicated they were enacting more lessons that had students explore concepts on the handheld. For example, during the observation of Mr. M’s precalculus class, students plotted polar coordinates in a dynamic environment. The discussion following the exploration focused on why polar coordinates are not unique.

The second area was the use of the handheld for assessment. In interviews, all three teachers indicated they were using the handheld as a formative assessment tool. This use required the TI-Navigator, a wireless communication system that allowed the teacher to view and share student handhelds via computer software.

During the observation of Mr. M’s calculus class, students were learning about the *u*-substitution method of integration. During whole-class discussion, Mr. M asked students to contribute their own values for *u*, then the class would discuss the results. This approach allowed Mr. M to determine how many students in the class were correctly beginning the process. He made adjustments for subsequent problems to pose based on the students' feedback. Mr. T said students regularly used the handheld to complete homework assignments. When students created a diagram and completed calculations, they took a screen shot of their work and posted it to their online portfolio. Mr. T used the handheld screen shots to assess student solutions to problems.

The third area that teachers identified was the use of handheld as a means for generating discussion in the classroom. Mr. T began the lesson by asking students whether the circumference or height of a cardboard toilet paper roll was longer. Students responded on their handhelds, and the results were shown on the projector screen. When students finished responding, Mr. T asked students to find someone who voted differently and share their thinking with each other.

Afterwards, Mr. T asked the students to vote again. The class viewed the results, and a student created a net for the cylinder in order to determine the longer dimension. Similarly, in his lesson on properties of quadrilaterals, Mr. D asked students to name a property they thought characterized a particular quadrilateral. He manipulated a dynamic representation of the quadrilateral and asked students to discuss in their groups if the characteristic held based on what they saw.

While all three teachers suggested that the PD experience improved their teaching, the examples from observations and interviews showed that the teachers applied their knowledge in different ways. Mr. M discussed how the using the TI-Navigator communication system encouraged him to ask more questions, with students answering on their handhelds. Mr. T stated he did not gain much knowledge about the use of the calculator during the PD sessions, but he was able to integrate it more into different aspects of his teaching, such as homework problems, student projects, and classroom discussion. Mr. D used the features he learned about to pose more questions to students, particularly in Advanced Placement Statistics, where he stated students were able to analyze data more quickly and easily. He also stated he used his new technology skills to make the mathematics more dynamic for students.

An unexpected result from the PD was the impact on pedagogy with increased use of exploration, formative assessment, and discussion. None of these topics were explicit goals of the PD workshop. Since the topic sessions focused on learning skills of the calculator and leading PD with adult learners, discussions surrounding mathematics content and pedagogy may have influenced the pedagogical thinking of the three follow-up teachers during the subsequent year. An analysis of the dialogue during the online sessions uncovered that nine of 18 sessions included a discussion about teacher questions and assessment, even though the stated topic of the session related to a specific calculator skill or leading workshop activities with adult learners.

### Impact on Technology Leadership

When examining participant responses regarding perceived ability to mentor other teachers over the course of the workshop,

- Two participants scored their ability higher;
- Eight participants ranked themselves at the same level;
- Four participants lowered their ranking.

All participants stated that they had the opportunity to mentor another teacher using TI-*n*Spire technology during the workshop timeframe.

The four participants with lower scores at the end of workshop indicated that face-to-face sessions would have provided a better method for learning how to mentor other teachers. These participants noted that their individual conversations with other participants during the face-to-face sessions were more valuable than the online interactions.

The eight participants who ranked their ability to mentor at the same level indicated they were at level of 4 or 5 already. Their responses noted that both the online environment and face-to-face environment provided some support for learning how to mentor. One participant responded the face-to-face sessions were too short to learn mentoring techniques, but the online environment did address some strategies for working with adult learners.

As the survey results indicate, many of the participants preferred face-to-face interactions to learn mentoring techniques. For the teachers visited, the ability to take on a leadership role varied based upon school and personal factors. Mr. M assumed the role of district coordinator for technology midway through the school year. The work under this new role involved leading PD and curriculum changes in the mathematics department for every school in the district.

Mr. T worked with teachers on a one-on-one basis as teachers asked for assistance. On a voluntary basis, he sent out information to his department regarding his lesson plans, skills learned, and ideas. In his interview, Mr. T indicated that the oTPD provided him with confidence about working with peers, noting that he benefited from the collaboration with other participants in sharing knowledge. However, in applying his perceived abilities in his school district, he indicated there were several teachers in the department who did not allow the use of calculators in mathematics because they were not comfortable with such an approach. Additionally, his school district was in the process of evaluating an iPad pilot for school-wide adoption, so he "was having trouble convincing mathematics teacher of the capabilities of the handheld."

Mr. D's school received a grant to work with Google to integrate tablets and Google apps for education into the school. Since the Google-based technology did not meet the needs of the mathematics department, they did not adopt the tools, but needed to attend the PD. This limited the time Mr. D could spend working with teachers on integrating the TI-*n*Spire technology into the classroom. In his interview, Mr. D also indicated that it was difficult to implement what he learned in the PD as the year progressed and his coaching responsibilities began.

In the survey data, the teachers indicated they mentored another teacher during the workshop and acquired mentoring skills at some point during the professional development sessions. Based on the interviews and observations of these three teachers, the opportunity to mentor other teachers on a consistent basis depended largely on school factors. Therefore, it is unclear whether the oTPD alone attributed to the participants' technology leadership.

## Conclusion

The survey data showed, based on the participants' perceptions, that the TLC accomplished the goals of effectiveness of the PD, skill acquisition with the handheld graphing technology, and ability to mentor other teachers for some of the participants. While the short-term goals of the PD workshop were met for most participants, the impact observed during the following year shows the blended PD model may have the potential to impact teacher pedagogical change. Based on the data from following up with the three teachers, future research could examine how teachers change from a telling to a facilitating approach in instruction.

It appears from this case study that a 10-month timeline of the online sessions could have contributed to this success for participants who implemented skills in their teaching and shared their results during PD sessions. The opportunity to apply information provided during the workshop in the classroom and get feedback may have allowed teachers to assess and improve their own learning. These two suggestions for practice align to the findings of Wei et al. (2009), who noted that effective PD is job embedded, involves active learning, and is sustained over a long period of time.

In an educational climate where teachers need to find ways to continue to improve and learn new ideas, the possibility of impactful blended PD may provide an additional avenue for teacher learning.

## References

Burrill, G., Allison, J., Breaux, G., Kastberg, S., Leatham, K., & Sanchez, W. (2003). Handheld graphing technology in secondary mathematics: Research findings and implications for classroom practice. Retrieved from the Texas Instruments Education Technology Research archive: http://education.ti.com/research

Cirillo, M. (2013). What does the research say the benefits of discussion in mathematics class are? *NCTM Research Briefs.* Reston, VA: National Council of Teachers of Mathematics

Common Core State Standards Initiative. (2010). Common core state standards for mathematics. Retrieved from http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf

Dede, C., Ketelhut, D. J., Whitehouse, P., Breit, L., & McCloskey, E. M. (2009). A research agenda for online teacher professional development. *Journal of Teacher Education*, *60*(1), 8-19.

Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher*, *38*(3), 181-199. doi: 10.2102/0013189X08331140

Graham, C. R. (2013). Emerging practice and research in blended learning. In M. G. Moore (Ed.), *Handbook of distance education* (3rd ed., pp. 333 - 350). New York, NY: Routledge.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

Owston, R. D., Sinclair, M., & Wideman, H. (2008). Blended learning for professional development: An evaluation of a program for middle school mathematics and science teachers. *Teacher College Record*, *10*(5), 1033-1064.

Smylie, M.A. (1989). Teachers' view of the effectiveness of sources of learning to teach. *Elementary School Journal*, *89*(5), 543-558.

Wei, R. C., Darling-Hammond, L., Andree, A., Richardson, N., & Orphanos, S. (2009). *Professional learning in the learning profession: A status report on teacher development in the United States and abroad.* Dallas, TX. National Staff Development Council.

Wei, R.C., Darling-Hammond, L., & Adamson, F. (2010). *Professional learning in the United States: Trends and challenges.* Dallas, TX: National Staff Development Council.

Wiliam, D. (2007). *What does the research say the benefits of formative assessment are?* Reston, VA: National Council of Teachers of Mathematics.

## Author Note

Daniel Ilaria
West Chester University
dilaria@wcupa.edu