

Teacher Perceptions of Learning-Centered Strategies Modeled in Professional Learning Environments

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Abstract: This study presents an analysis of K-12 teacher perceptions. The study examines teacher perceptions of learner-centered strategies modeled in professional development and perceptions of learner-centered strategy and technology implementation in the classroom. The findings include strong positive perceptions of the learning strategies modeled with technology integration in their professional learning environments and strong positive perceptions of learner-centered strategies and technology implemented in their classrooms. These findings indicate that based on teacher perceptions, learner-centered strategies modeled with an integration of technology in professional development environments have an increased opportunity for classroom implementation for increased student success outcomes.

Keywords: professional development, differentiated instruction, learner-centered, learner-centered environment, teacher perceptions, technology integration.

Introduction

Effective Professional Development is defined as “structured professional learning that results in changes in teacher practices and improvements in student learning outcomes” (Darling-Hammond et al., 2017). With the COVID-19 pandemic, the lack of educator experience with learning environments beyond face-to-face became evident at the primary, secondary, and post-secondary levels. The use of various learning strategies efficiently within these environments was also evident. The expectation at the start of classes in the Fall of 2020 was for teachers to use these blended, flipped, or even online environments more extensively since the pandemic maintained its violent course across the globe. A blended learning environment is where course content is delivered online and face-to-face. A flipped classroom environment allows teachers to use technologies with students as they move through the curriculum allowing more time for collaborative activity in the classroom. An online learning environment is one where all course content is delivered online. However, instead, educators adopted the practice of emergency remote teaching (ERT).

ERT is a “temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances” (Hodges et al., 2020). This is the opposite of the practical learning environments described that are needed for effective student learning outcomes. More training for learner-centered strategies in these environments will be required for student and educator success. These training sessions need to include a list of strategies and an explanation of the instructional elements of content, process, and product. Educators will need awareness of the connection between what they did in the classroom and how they can use these techniques in blended, online, and face-to-face environments.

For example, Ismajli & Imami-Morina (2018) conducted a quantitative study where 120 students, 15 instructors, and 15 parents from two public and two non-public schools learned about the effective interactive strategies used on learners that differentiated instruction implemented by teachers. Students preferred group discussions when processing the content introduced. As we consider the implications of this study, it is clear that educators will now require training on conducting small group and whole class discussions in these environments. They will also have to understand how to develop a sense of community and trust in these environments. Due to its difference from the face-to-face classroom, educators will need successful exemplars of online learning to model, both synchronous and asynchronous. For example, teachers can still provide direct instruction, students can still learn from other students in class, and students can still get immediate feedback. In these online environments, of course, teachers must learn to do this using digital tools. For instance, they can create shorter chunks of instruction in a 10 - 15 minute video. Or they can offer small group discussions in a chat room or even a discussion board allowing students to get feedback and learn from other students.

Vargas-Parra et al. (2018) conducted a study on 29 10th-grade students on how they used a virtual learning environment where differentiated instruction was used to learn a foreign language. Findings in this study indicated the differentiated virtual learning environment affected teacher roles, learning tasks, the learning environment, and the language process. The role of teachers moved from being a provider of strategies, anticipators of problems, and facilitators of the learning process, to being reflective teachers. As teachers transition through these roles in the student learning process, they are adapting to the needs of students in their learning of the language. Students were engaged

because learning tasks were based on tier learning styles, readiness, and interests. Their learning environment encouraged a sense of community helping students build their self-confidence and skills in working collaboratively.

In short, providing this training for educators will build their confidence in the framework and strategies and their usage of them with their students. Most importantly, successful student learning and outcomes will take place. Instructional frameworks are the processes that are interwoven throughout a school system's educational framework allowing teachers to support all learners for successful student outcomes. Educational frameworks refer to the school vision, philosophy, and values. The strategy explaining "why" they are educating students. Instructional frameworks refer to the models and strategies used to teach students to get to student outcomes, the explanation of "how" schools will educate students.

This study aims to examine teachers' perceptions of learner-centered strategies modeled during professional development (PD) sessions and their effectiveness in integrating technology with these strategies in their classrooms. The present study will explore the following questions:

1. What is K-12 teachers' perceptions of the learning strategies modeled with the integration of technology in their professional learning environments?
2. What are teacher perceptions of learner-centered strategies along with technology being implemented in their classrooms?

Literature Review

As teachers provide opportunities for learning to students, there has been an increased expectation that student achievement is linked to teacher evaluation in the classroom (Alexander et al., 2017). The expectation of technology integration leading students to be career-ready through their education is also expected, though it has yet to be consistently achieved. The guiding force for these expectations of increased teacher knowledge, experience, and student achievement is outlined in the public law Every Student Succeeds Act (ESSA). The ESSA explicitly mentions the use of the instructional framework Universal Design for Learning (UDL) principles and the integration of technology for its implementation. Differentiated instructional strategies that engage students, allow them to work collaboratively, and choose how they present their learning and reflection should be interwoven throughout a school system's instructional framework (Logan, 2011). Therefore, it is only natural that they should be presented in teacher training for effective use throughout a school's system. This process doesn't just involve lesson planning, units, and assessments. It also includes classroom design and the structural design of the school day.

For the consistent practice of differentiated instruction to be successful, this consistency has to be supported by school administration for successful implementation across a school system. This consistent practice can be done through a professional learning environment where these same strategies are modeled in teacher learning. This literature review will explore differentiated professional development and learner-centered education.

Differentiated Professional Development

Differentiated professional development is also referred to as learner-centered professional development (LCPD). Teacher learning is centered on the needs of the student, who, in this case, is the teacher. When developing differentiated professional development, it should be distinguished by "active learning," where teachers are actively participating "recipients" of information, as this kind of engagement heightens the impact of professional development activities. In addition, teachers must engage in active learning, such as interacting with their colleagues regularly to discuss their work and their students' learning, to develop a deeper understanding of how children think and learn.

The principles of LCPD are similar to what teachers call for "effective professional development: focus on student learning, teacher-owned, develop knowledge of content and pedagogies, collaborative, ongoing, and reflective" (Polly & Hannafin, 2010). When teachers participate in LCPD, they are supported and, in turn, are equipped to implement learner-centered instruction. Teacher participation in student-focused learning happens when they attend training that equips them to address student learning issues. Teachers also take ownership of their learning and learning experiences (Garet et al., 2001). Teachers are collaborative when they work. They are also developing knowledge when content intersects with pedagogy. Lastly, reflection takes place when artifacts from the classroom are reviewed. LCPD increases teacher efficacy and the application of learner-centered instructional practices (Polly & Hannafin, 2011).

In contrast to the categories of PD (formal, informal, and independent), LCPD focuses on similar characteristics of professional development described by Guskey (2003), Desimone (2011), and Darling-Hammond et al. (2017). These characteristics include the following: focus on student learning, be teacher-owned, develop content knowledge and pedagogy, be collaborative, be ongoing, and be reflective. Unfortunately, Polly & Hannafin (2010) found in their study that what teachers thought they did and what they were observed doing was misaligned with the pedagogy from learner-centered professional development. Teachers believed they were implementing learner-centered pedagogy, but instead were observed using primarily didactic teaching methods. It was recommended that ongoing support be provided to teachers to better scaffold the transition from the LCPD sessions into the classroom and maintain its implementation.

Learning-Centered Education

Reigeluth, Myers, & Lee (2016) describe learner-centered education as a competency-based, task-centered, and personalized educational paradigm. The focus is on all learners learning at a pace that is beneficial for them, and not merely on time spent on topics and tasks. The current design of education, as a whole, is based on time spent; some students progress too soon, or they are held back when they are ready before others. Learner-centered education was derived from cognitivism, constructivism, and humanism theories. Learner-centered education is based on five universal principles: attainment-based instruction, task-centered instruction, personalized instruction, changed roles and changed curriculum (Reigeluth, Myers & Lee, 2016). The premise of these principles is to focus on the "whole child" where learning is not based on time but the progress of learning itself; instruction is based on authentic task performance, personalizing the task performed to showcase learning. The roles of teacher, learner, and

technology are transformed, and the curriculum is extended and reorganized (Reigeluth, Myers, & Lee, 2016). For example, teacher roles transform into being assistants in learner goal setting and the facilitation of learning. Learner roles transition into being self-regulators of their learning and peer teachers. Finally, technology transforms by supporting the recordkeeping of student learning and “to provide or support assessment for and of learning fully integrated with the instruction.” (p. 9)

Weimer (2012) describes learner-centered teaching as the efforts by teachers to use learning approaches that develop student autonomy and responsibility for learning, resulting in experiences that permanently change how students view learning and teachers acclimate to teaching. In addition to these changes, these strategies lead to transformative learning. Weimer (2012) describes this as learning that produces a significant change in beliefs affecting thoughts, actions, and worldviews. This learning can occur in formal and informal learning environments. Weimer identifies six learning approaches in learner-centered teaching: student choice over course content and pace of learning; peer-to-peer teaching of content; student accountability in making class policies and

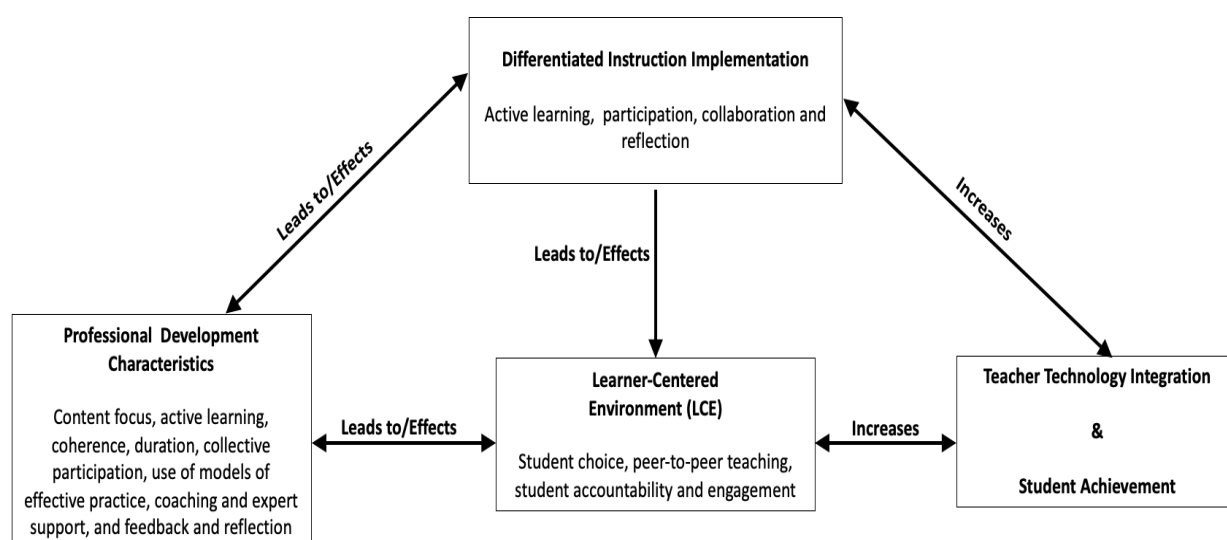
procedures; engagement in self and peer assessment activities. They can be categorized into three areas: the context of strategy use, content use with the approach, and learner readiness for approach implementation.

Conceptual Framework

To understand and evaluate the characteristics of learner-centered environments for teacher technology integration and student achievement, The Learner-Centered Environment Model (LCEM) was created by the researcher (as shown in Figure 1). The model was influenced by professional growth (Clark & Hollingsworth, 2002) and professional development (Desimone, 2009; Darling-Hammond & Richardson, 2009). The framework constructed from these models is appropriate as it allows us to investigate teacher professional learning while acknowledging factors that affect teacher learning, the implementation of the learning, and the results: technology integration and student achievement. The model reflects a non-linear process in the sense that it reflects model components affect each other throughout the learning process in the learner-centered environment.

Figure 1

Learner-Centered Environment Model (LCEM)



Professional Development Characteristics

The design of professional development is an essential component in the success of the implementation of instructional practices for student success. Desimone (2009) constructed a core conceptual framework of professional development design; in it, s/he describes five characteristics of effective professional development used by researchers such as Guskey & Yoon (2009) and expanded upon by Darling-Hammond & Richardson (2009) to evaluate professional development presented to teachers. Using these seven characteristics in these frameworks, teacher professional learning can be effectively evaluated (Guskey & Yoon, 2009) to support successful teacher implementation and student learning outcomes.

Effective professional development characteristics reflect the external domain of Clark & Hollingsworth's (2002) Interconnected Model of Teacher Professional Growth (IMTPG).

The positive effects of these domains can produce the results effected. The adverse effects can hinder student achievement and technology implementation. In the LCEM model, professional development characteristics are important because they lead to as well as affect the implementation of differentiation instruction involving content, process, and product.

Differentiated Instruction Implementation

It has been established that for successful differentiated instruction implementation to occur in classrooms, teachers need to receive LCPD (Gheysens et al., 2020). Active learning is essential in the core conceptual framework of professional development design. In addition, coaching and expert support, feedback, and reflection are essential to PD support teacher implementation and eventually successful technology implementation and improved student outcomes (Mavidou, & Kakana, 2019). In the LCEM model, differentiated instruction implementation adds to the

learner-centered environments by providing the supports for how students learn curriculum content.

Learner-Centered Environment (LCE)

Koellner & Jacobs (2015) used the problem-solving cycle as a theory of action to implement problem-solving as differentiated instruction for science teachers in developing curriculum for grades K-8. The problem model of professional development took teachers through the problem-solving cycle like they would take their students in the classroom. This model facilitated a learner-centered environment (LCE) for teachers while actively learning science standards. In the LCEM model, the learner-centered environment provides students with a sense of community in an environment where they have an opportunity to actively engage in their learning while having the ability to present their learning in a way that reflects their individual learning style.

Given these considerations of the LCEM model developed by the researcher, the primary objectives to be examined in this research are: (1) to evaluate the implementation of learner-centered frameworks presented in professional development and (2) to evaluate the integration of learner-centered strategies in the classroom leading to teacher perceptions of professional development and learner-centered model implementation.

There is limited research on the subject of learner-centered strategies concerning professional learning. The focus is often on evaluating participant reactions in professional learning environments. Collecting data on teacher learning, student outcomes, and reactions allows stakeholders to collectively make effective decisions on student learning goals (Guskey, 2000). This study seeks to understand this for the lasting applications of professional development on teachers and students and to see if, indeed, when teachers choose their PD models infused with the modeling of learner-centered strategies, they can create effective change in their classrooms.

Methodology

Design

A mixed methods design was used in this research. Within the quantitative research approach, the cross-sectional survey design was the most effective design for the study, as it allowed the researcher to identify the trends in attitudes, opinions, behaviors, or characteristics of a large population at one point in time (Creswell, 2015). Specifically, in this study, an online survey will collect K-12 teacher perceptions of modeled learning strategies in professional development.

Table 1
Demographic Results of Survey Participants

Demographic		N	Percent
Gender	Male	6	5.9
	Female	96	94.1
Age	Under 30 years	12	11.8
	Under 45 years	30	29.4

Teacher experiences with professional development, education technology, and learner-centered professional development were investigated to determine their effectiveness and success in teacher implementation in the classroom using the qualitative research approach. The phenomenon of interest in this study was the experiences of K-12 teachers with professional development and the implementation of education technology. The method used in this approach was semi-structured interviews with K-12 teachers. The research questions formed the basis of the protocol used for the semi-structured, open-ended, in-depth interviews to document teacher experiences.

Sample and Procedure

An IRB application was submitted to Central Michigan University and permission was granted. The survey was conducted with educators teaching in K-12 schools in a tri-county area of rural, suburban, and urban schools in the midwestern region of the United States. The target population of the study was K-12 teachers in these schools. Participants were also invited through social media postings on Facebook, Twitter, Instagram, and LinkedIn containing the Qualtrics survey link. An email was sent to the superintendents of school districts asking them to share the Qualtrics survey link with their K-12 educators. Additionally, the Qualtrics survey link was shared in seven private educator Facebook groups and posted on Instagram, LinkedIn, and Twitter. All participants were informed in the online invitation letter that participation in the survey, the interview, or both was voluntary and that there would be no harm to their personal and mental health. Participant consent was collected in the invitation letter before starting the survey. One week before the online survey closed, a follow-up email/post was sent to participants reminding them of the survey and their rights if they chose to participate.

Within the survey, teachers were offered the opportunity to participate in an in-depth interview with the researcher. Eight interviews were conducted based on teacher volunteer participation.

The total number of responses collected was 178. Survey incomplete responses were not counted. After the elimination of 74 incomplete responses, there were two respondents that chose not to participate in the survey. Table 1 presents the demographics of survey participants. Participants comprised six identifying as male, 96 as female, and ages ranging from 26 to 72 years old. Almost all the participants (94.1%) identified as female, and over one-third (35.5%) were under 55 years of age. Participant grade levels taught varied from kindergarten to high school, and content areas varied widely from English to Special Education.

	Under 55 years	36	35.3
	Over 55 years	24	23.5
Grade Levels Taught	Kindergarten	12	11.8
	Elementary	25	24.5
	Middle School	26	25.5
	High School	39	38.2
Content Area Taught ¹	English	39	22.7
	Science	29	16.9
	Social Studies	23	13.4
	Math	23	13.4
	Other	19	11.0
	Special Education	18	10.5
	Career & Technical Education (CTE)	8	4.7
Learning Environment ²	Face-to-Face	92	73.6
	Online	15	12.0
	Blended (i.e., flipped, hybrid, flex, etc.)	12	9.6
	Remote	6	4.8

Note. n=102. ¹ The total percentage exceeded 100% because some teachers taught more than one subject. ² The total percentage exceeded 100% because some teachers taught in more than one environment.

Figure 2 shows the comparison of technology experience among participants. The majority (80%) of participants self-reported their technology experience as being proficient, and 20% self-reported themselves as experts in technology. A majority (78%) of participants have also reported they are proficient in differentiated instructional practice, as observed in figure 3. The majority (74%) of teachers in this study teach in a face-to-face learning environment, as presented in figure 4.

Figure 2

Participant Self-Reported Technology Experience

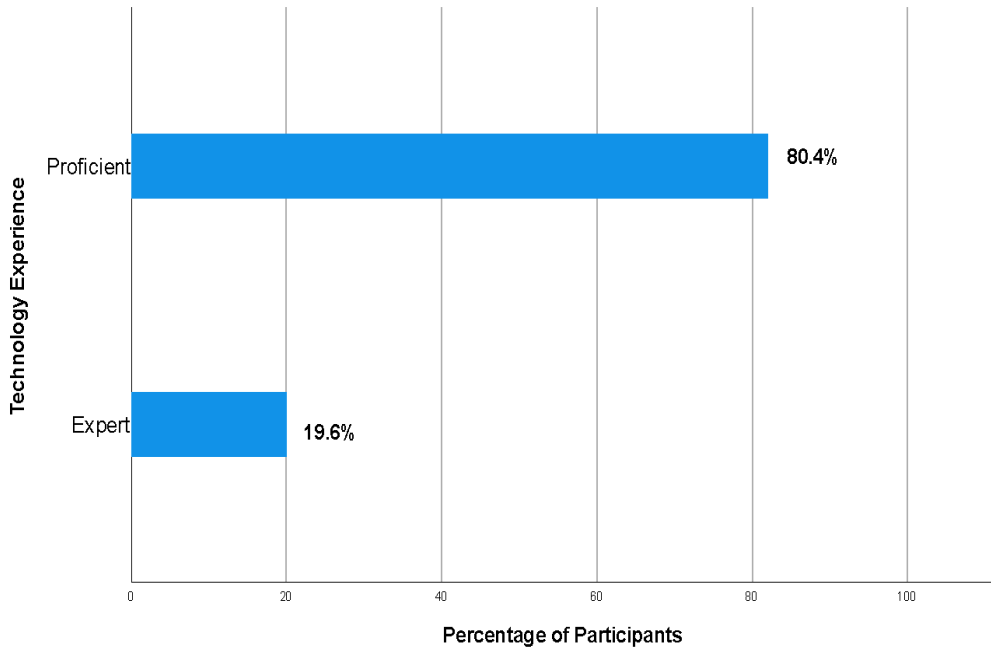


Figure 3

Differentiated Classroom Experience Responses

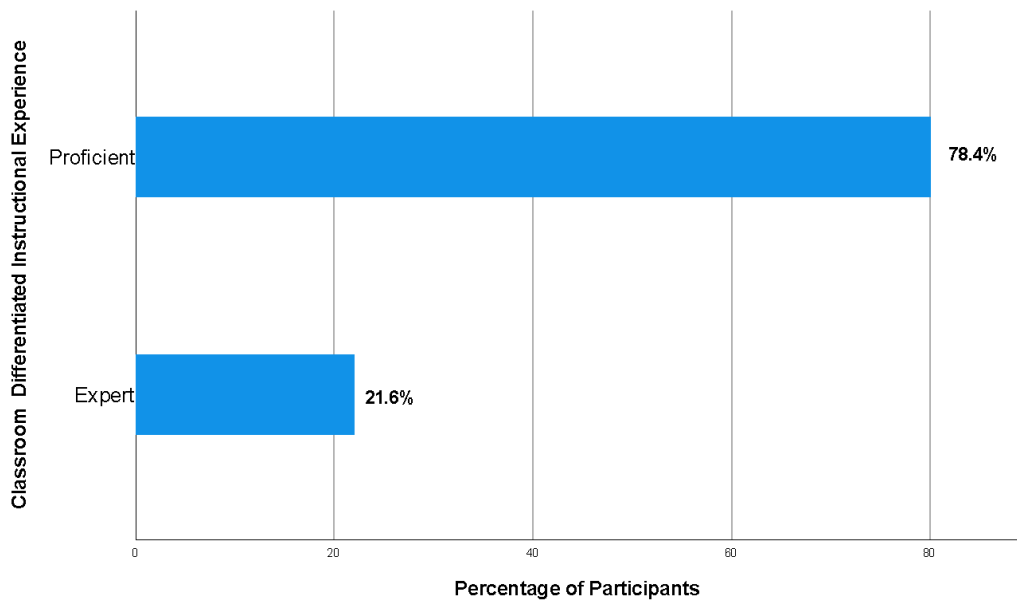
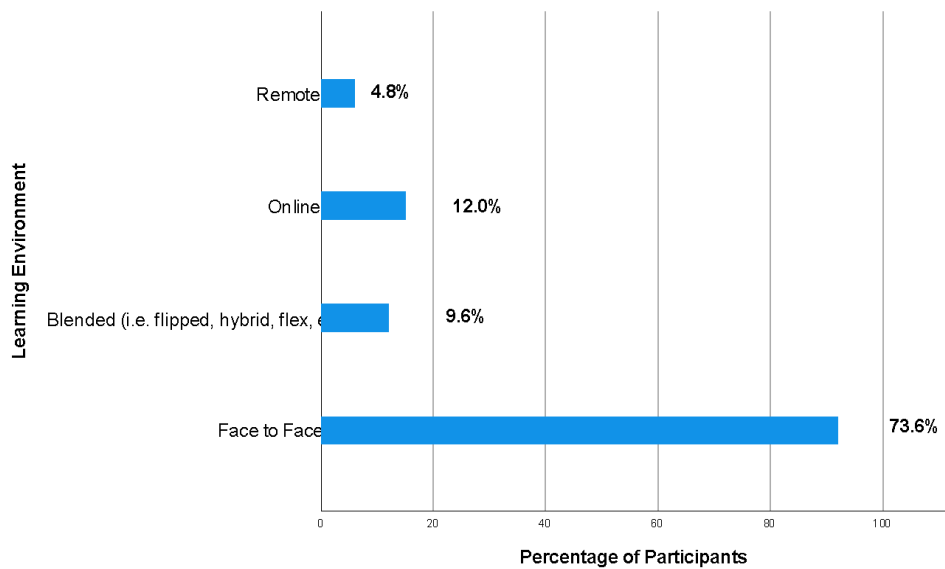


Figure 4

Learning Environment Responses



After participants completed the Qualtrics survey or if they chose not to participate, an invitation to participate in an interview was extended. After participants clicked a link, they received a consent letter and link to schedule an interview with the researcher.

Instrument

The survey used for this study was part of a more extensive survey on teacher professional development. This article presents partial data from the overall survey with the remaining data presented in the article, *Teacher Perceptions of Effective Professional Development and the Barriers of Successful Implementation*. The segments of the cross-sectional survey instrument used in this research had eight closed-ended perception questions, two open-ended perception questions, three professional development questions, four professional practice questions, and

ten demographic questions. All perception questions on the survey were based on a Likert scale of 1 to 5. Perception questions were divided into four groups to collect data for each research question. This study was focused on the questions related to modeling and implementing learner-centered strategies perceptions. Survey items were modified and created based on several studies (Abu-Tineh & Sadiq, 2018; Soine & Lumpe, 2014; Lowden, 2003; Rodriguez, 2012; Hsu, 2016; Logan, 2011; Whipple, 2012). The validity of the studies used was conducted using previous surveys and pilot studies of experts in the field. The open-ended questions in the survey were designed to capture teacher perceptions not captured in the survey. Themes for coding were based on research questions and subtopic questions and emerged from educators’ responses. A pilot study was conducted, with further adjustments made according to feedback.

Research question one (RQ1) concerning teacher perceptions of learning strategies modeled with technology in professional learning environments was answered using the Likert scale items and the open-ended question in Table 2. These

questions reflected the observation of learning strategies presented and modeled with the integrated use of technology in professional development.

Table 2

Survey Items Pertaining to Perceptions of Learning Strategies Modeled in Professional Development Environments

Section	Questions
Perceptions of Learning Strategies Modeled with the Integration of Technology in Professional Learning Environments (1-5 Likert Scale)	Learning strategies are modeled in my district’s professional development sessions.
	Teachers are expected to implement learning strategies without being modeled for them.
	The activities provided in professional development sessions model learning strategies.
	The learner-centered strategies modeled can be implemented in my curriculum.
Open-Ended Question	What are your perceptions of the learning strategies modeled with the integration of technology in their professional learning environments?

Research question two (RQ2) concerning teacher perceptions of learner-centered strategies and technology being implemented in classrooms was answered using the Likert scale items and open-ended questions in Table 3. These questions reflected the activities of teachers implementing the learning strategies presented through professional development experiences.

Table 3

Survey Items Pertaining to Perceptions of Learner-Centered Strategies Along with Technology Being Implemented in Classrooms

Section	Questions
Perceptions of Learner-Centered Strategies Along with Technology Being Implemented in Classrooms (1-5 Likert Scale)	Teachers in my district use a variety of learner-centered strategies to develop a classroom environment structured to support a variety of activities including group and/or individual work.
	Teachers in my district provide a variety of assessment tasks.
	Teachers in my district group students for learning activities based on readiness, interests, and/or learning preferences.
	Teachers in my district use a variety of methods of instruction to support student learning.
Open-Ended Question	How do you implement learner-centered strategies with technology in your classroom?

The interview protocol was centered on two main themes: (1) Learning Strategies and (2) Implementation of Learning Strategies and Education Technology in the classroom. Although these are the same themes in the survey, the interview protocol focused on specific teacher experiences concerning the themes.

Limitations

There were three main limitations to this study that have been identified. The first limitation is that data were collected through voluntary participation in the convenience sample. This implies that the responses might not represent all K-12 teachers and should not be considered for generalization in trends that could be drawn from this study. The second limitation is the sample of K-12 teachers in the midwestern region of the United States and their use of social media as a recruitment tool. The study’s results could be different if a truly random sample of teachers across the country were conducted in order to increase the generalization of this study. The third limitation is the sample size. The sample size was limited to the teachers in the tri-county area that were

contacted via district email and through the researcher’s own social media reach.

Results

The quantitative demographic data collected from the online survey were analyzed using descriptive statistics to determine participants’ perceptions of learner-centered strategies modeled in professional development and perceptions of learner-centered strategy and technology implementation in the classroom. The quantitative perception data collection from the survey was analyzed using simple and parametric inferential analyses to examine relationships between perceptions and demographic data. The qualitative data collected from open-ended survey questions and participant interviews were analyzed using thematic analysis . All responses were examined using a codebook, coded using deductive coding, and constantly compared to other data in order to determine patterns in responses.

Therefore, the following section will report the descriptive analysis, simple analyses, and parametric inferential analysis results of participant responses to the research questions.

Results of the open-ended survey questions and interview participant responses to perception questions will also be reported.

Differentiated Professional Development

In the methods section above, it was mentioned that questions were adapted from other existing surveys. Four questions were developed to measure teacher perceptions of learner-centered strategies modeled in professional development environments presented in Table 4. Findings for this section reveal that teachers have an overall positive perception of the learning strategies modeled with the integration of technology in their professional learning environments.

Table 4 provides the general perception of learning strategies modeled mean (M) and standard deviation (SD) in rank order. The numbers represent responses on a 5-point Likert scale

ranging from 1 (strongly agree) to 5 (strongly disagree). Most notable is that eighty-three percent of teachers strongly agree or agree that they are expected to implement learning strategies using various learning activities. Fifty-eight percent of teachers strongly agree or agree that modeled learner-centered strategies can be implemented in their curriculum. Forty-nine percent of teachers strongly agree or agree that the activities provided in professional development sessions in professional learning environments model learning strategies. Forty-seven percent of teachers strongly agree or agree that learning strategies are modeled in professional development sessions. A few respondents did not have an opinion on the focus of professional development in their professional learning environments. However, twenty-five percent of teachers were uncertain whether learner-centered strategies could be implemented in their curriculum.

Table 4

Teacher Perceptions of Learner-Centered Strategies modeled in Professional Development

Statement	M	SD
1. Learning strategies are modeled in professional development	2.95	1.2
2. Teacher implementation of learning strategies using various activities	2.08	.898
3. Professional development sessions model learning strategies	3.11	1 12
4. Modeled learner-centered strategies can be implemented in the curriculum.	2.51	1.02

Note. n = 102

Table 5

Statistical Results of Research Question #1 Survey Items

Survey Items 1-4	Strongly Agree		Agree		Disagree		Strongly Disagree		Undecided	
	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
Q28. Learning strategies are modeled in professional development.	6	5.9	42	41.2	29	28.4	10	9.8	15	14.7
Q29. Teacher implementation of learning strategies using various activities.	22	21.6	63	61.8	9	8.8	2	2.0	6	5.9
Q30. Professional development sessions model learning strategies.	6	5.9	44	43.1	29	28.4	8	7.8	15	14.7
Q31. Modeled learner-centered strategies can be implemented in the curriculum.	13	12.7	46	45.1	12	11.8	5	4.9	26	25.5

One participant explained the lack of modeling of learning strategies in their interview, stating, "Learning strategies weren't presented or modeled, they were given. 'Hey, go look at this.' but not modeled and not like lessons like, 'Here's how you

can use this in a lesson. Here's an example lesson with this program, this piece of technology, this application.' Okay know that we either figure it out on our own shared across platforms, or just didn't do."

Another described the process as a member of the training team, stating,

"So a learning strategy or strategy might be, I'm gonna pick a broad one formative assessment. And so, teachers are kind of taught about the benefits of formative assessment, but then they're shown a variety of tools and then might get to pick which tool to go explore for like five to 10 minutes. So that was one specific example, another learning strategy that we just, let's see, try to pick one that we just did. ... we talked about collaboration. And so that would be the learning strategy, collaboration. And then we had teachers actually collaborate using a slide deck where they had to share what they'd look at their reflection and share what they had in common. What was different? So it's another real specific example."

Another responded, "Mostly we have a content leader teach a lesson to model it, this is the most effective type of PD, seeing it in action." Other responses include,

- "There is evidence of learning strategies being modeled but not consistently over the course of the school year."
- "Learning strategies modeled during PD are limited and not readily transferable."
- "Very few strategies modeled, technology is used but often to read off slideshows or show videos."

One participant brought up an interesting point related to the current climate of education, "I think because of COVID the integration of technology became important in the professional learning environment."

Turning now to the first set of analyses, cross-tabulation was used to examine the relationship between technology experience and differentiated instruction experience observed in table 6. Overall, proficient teachers demonstrated a relationship between their technology experience and their differentiated instruction experience.

Table 6

A Crosstab of the Participants' Technology Experience vs. Differentiated Instruction Experience

Technology Experience Groups	<u>Expert</u>		<u>Proficient</u>	
	N	Percent	N	Percent
Expert	7	31.8	13	16.3
Proficient	15	68.2	67	83.8
Total	22	100	80	100

Note. n = 102

Another cross-tabulation was used to examine the relationship between professional development taken by teachers and their differentiated instruction experience. All teachers participated in some form of professional development and differentiated their instruction. Participants acknowledged seven primary offerings of professional development formats that were

attended observed in Table 7: workshops or seminars; curriculum development days; conferences; half-day or full-day presentations/demonstrations; classroom observation; mentoring; and graduate courses. Overall, there was a relationship between the type of professional development teachers participate in and their differentiated instructional experience.

Table 7

A Crosstab of the Participants' Professional Development Taken vs. Differentiated Instructional Experience

Professional Development Taken	<u>Expert</u>		<u>Proficient</u>	
	N	Percent	N	Percent
Individual Professional Development Plan	6	27.3	22	27.5
Individual Professional Improvement Plan	2	9.1	5	6.3
Guided Practice	5	22.7	19	23.8
Reflection	7	31.8	29	36.3
Classroom Observation & Assessment	17	77.3	40	50.0
Classroom Observation by a Fellow Teacher	5	22.7	21	26.3
Mentoring	9	40.9	42	52.5
Curriculum Development Days	12	54.5	53	66.3

Presentations or Demonstrations (1/2 day or 1 day)	13	59.1	47	58.8
Workshops or Seminars (1/2 day or 1 day)	15	68.2	61	76.3
Conferences	12	54.5	51	63.8
Expert Lectures or Motivational Speeches	8	36.4	26	32.5
Peer Study Groups	8	36.4	14	17.5
Inquiry/Action Research	5	22.7	13	16.3
Graduate Courses	11	50.0	37	46.3
Long-Term Courses within the District (8-10 sessions with support)	5	22.7	8	10.0
Long-Term Courses within the District (8-10 sessions without support)	2	9.1	7	8.8
Continuing education courses or Adult Education (not for credit)	4	18.2	15	18.8
Total	22		80	

Note. Percentages and totals are based on respondents. Dichotomy group tabulated at value 1.

A two-variable scatterplot was used to see if there was a relationship between teachers' years of experience and their perceptions of learning-centered strategies modeled in professional development in their school district. There was no relationship between teaching experience and teacher perceptions of learning-centered strategies modeled in professional development.

A multiple linear regression was conducted to predict teachers' total perception of learner-centered strategies modeled in professional development based on their age, teaching experience, technology experience, differentiated instruction experience, and differentiated instructional use. The regression was not significant ($F(5,96) = .438$, $p > .05$) with an R^2 of .022. Neither age, teaching experience, technology experience, differentiated instruction experience, nor differentiated instructional use were significant predictors of teachers' perceptions of learner-centered strategies modeled in professional development.

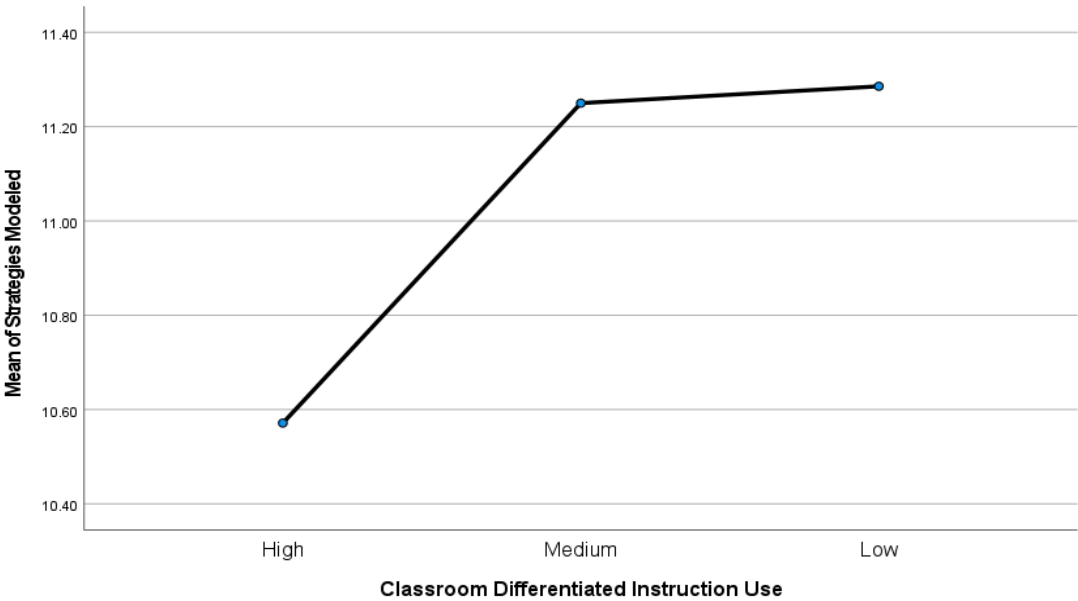
An independent-sample *t*-test was conducted to compare the mean score of teachers who have an undergraduate degree to the mean score of teachers who are identified as having a graduate degree. No significant difference was found ($t(96) = -.259$, $p > .05$). The mean of the undergraduate degree teachers ($M = 10.53$, $sd = 1.56$) was not significantly different from the mean of graduate degree teachers ($M = 10.67$, $sd = 1.73$). Overall, there was no significant difference in teachers' perceptions of learner-centered strategies modeled in professional development between their education levels.

Another independent-sample *t*-test was also conducted to compare the mean score of teachers who had expert differentiated instructional experiences to the mean score of teachers who were identified as having proficient differentiated instructional experiences. No significant difference was found ($t(100) = -.460$, $p > .05$). The mean of the expert differentiated instructional experienced teachers ($M = 10.50$, $sd = 1.44$) was not significantly different from the mean of proficient differentiated instructional teachers ($M = 10.69$, $sd = 1.75$). Overall, there was no significant difference in teachers' perceptions of learner-centered strategies modeled in professional development between their differentiated instructional experience levels.

The combined mean score of teacher perceptions of learner-centered strategies modeled in professional development and their use of learner-centered strategies in the classroom from three different categories were compared in a one-way ANOVA. No significant difference was found ($F(2,99) = .297$, $p > .05$). The teachers in the three different strategy usage categories did not differ significantly in their perceptions. Teachers classified as high-use (daily, weekly) had a mean score of ($M = 10.57$, $sd = 1.69$). Teachers classified as medium-use (monthly) had a mean score of ($M = 11.25$, $sd = 2.22$). Teachers classified as low (once a semester, never) use teachers had a mean score of ($M = 11.29$, $sd = 1.25$).

Figure 5

Mean Plot Chart of Learner-Centered Strategies Used and Total Perception of Learner-Centered Strategies Modeled in Professional Development



The figure above shows that low differentiated instructional use teachers had the strongest positive perception and high differentiated instructional use teachers had the weakest perception of learner-centered strategies modeled in professional development.

Learner-Centered Environment

The researcher adapted questions from other surveys and developed four questions to measure teacher perceptions of learner-centered strategies along with technology being implemented in their classrooms and observed in the classrooms of their peers displayed in Table 8. Findings from this survey section revealed that teachers perceive learner-centered strategies and technology implemented in their classrooms and the classrooms of other teachers positively. Table 8 provides the general perception of learning strategies modeled mean (M) and standard deviation

(SD) in rank order. The numbers represent responses on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). Most notable is that seventy-five percent of teachers strongly agree or agree that teachers used various methods of instruction to support student learning. Sixty-eight percent of teachers strongly agree or agree that teachers provided a variety of assessment tasks. Seventy-two percent of teachers strongly agree or agree that using a variety of learner-centered strategies to develop a classroom environment structured to support various activities, including group work or individual work. A few respondents did not have an opinion on the focus of professional development in their professional learning environments. However, twenty-three percent of teachers were undecided on grouping students for learning activities based on readiness, interest, or learning preferences.

Table 8

Teacher Perceptions of Learner-Centered Strategy and Technology Classroom Implementation

Statement	M	SD
1. Teachers use a variety of learner-centered strategies to develop a classroom environment structured to support a variety of activities including group and/or individual work.	2.31	.867
2. Teachers provide a variety of assessment tasks	2.49	.952
3. Teachers group students for learning activities based on readiness, interest, and/ or learning preferences.	2.72	1.03
4. Teachers use a variety of methods of instruction to support student learning.	3.68	.914

Note. n = 102

Table 9*Statistical Results of Research Question #2 Survey Items*

<u>Survey Items 5-8</u>	<u>Strongly Agree</u>		<u>Agree</u>		<u>Disagree</u>		<u>Strongly Disagree</u>		<u>Undecided</u>	
	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
Q39. Teachers use a variety of learner-centered strategies to develop a classroom environment structured to support a variety of activities including group and/or individual work.	11	10.8	62	60.8	10	9.8	2	2.0	17	16.7
Q40. Teachers provide a variety of assessment tasks	6	5.9	63	61.8	15	14.7	4	3.9	14	13.7
Q41. Teachers group students for learning activities based on readiness, interest, and/ or learning preferences.	6	5.9	48	47.1	19	18.6	6	5.9	23	22.5
Q42. Teachers use a variety of methods of instruction to support student learning.	10	9.8	66	64.7	9	8.8	4	3.9	13	12.7

The data demonstrated that teachers interchanged tools and strategies. This was evidenced in participant surveys and interview responses. One participant stated,

"I often use stations and have a tech component- either a self-paced Kahoot/Quizizz, an EdPuzzle to introduce a topic, or self-guided notes where I post the slide notes and students can go self-paced. I love using Padlet for anticipatory questions or discussion questions pre unit or throughout. Flipgrid is another tool I've been able to use to have students do a book review".

Another participant states,

- "Student choice with projects that include Canva, Google Slides, online readings, etc..."
- "Game-based learning, independent technology-based projects with audio/video peer feedback, collaborative projects such as podcasting with graphic design, and choice boards of assignments and projects that require tech tools (Padlet, Flipgrid, Adobe Creative Cloud Express, Canva, etc.)."
- "We use google classroom and google slides to do individualized assessment,

activities, projects and reading assignments."

One participant made a great point about technology implementation and strategy,

"So sometimes, I have to rethink things that are maybe more time consuming for the value of what it's actually, you know, giving back to them. Yeah, sometimes things get a little bit lost in technology and things. Yeah. And then you realize it will maybe take more time than it's really worth."

The participants received training in using varied instructional materials; employing flexible grouping, cooperative learning, learning stations/centers, and project-based/problem-based learning; and creating tiered assignments, student choice/choice boards; and universal design for learning. Although all participants showed some awareness of learner-centered strategies, seven of the 16 most common learner-centered strategies that participants shared the strongest awareness of are presented in Figure 6. Those strategies were flexible grouping, learning centers/stations, student choice/choice boards, project-based/problem-based learning, independent projects, tiered assignments, varied instructional materials, and cooperative learning. There were also eight strategies that participants had the most training in (see Figure 7).

Figure 6

Participant Responses for Instructional Strategy Awareness

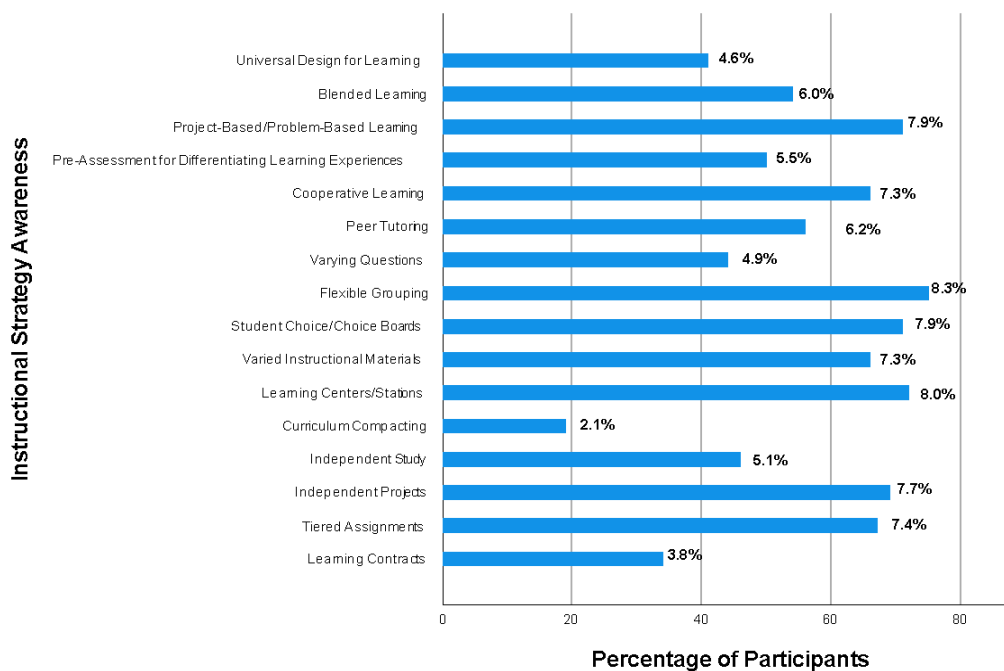
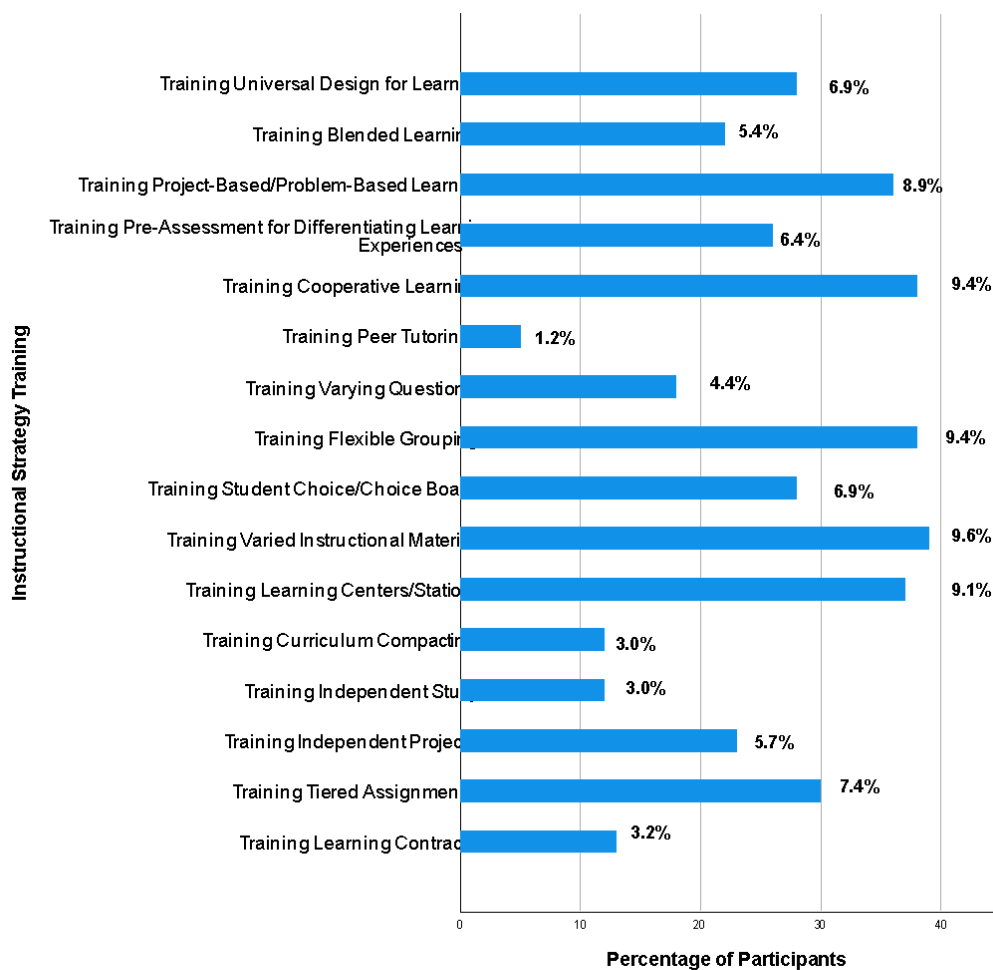


Figure 7

Participant Responses for Instructional Strategy Training Received



A cross-tabulation was used to examine the relationship between teacher awareness of learner-centered strategies and their technology experience. Although all participants showed some awareness of learner-centered strategies, there were six strategies that teachers with expert technology experience showed a strong awareness of, as observed in Table 10. Those strategies were project-based/problem-based learning and student choice/choice boards; blended learning; independent projects and flexible grouping; independent study; peer tutoring, learning

centers/stations, and varied instructional materials; and tiered assignment strategies. Teachers with proficient technology experience were aware of the following: learning centers/stations and flexible grouping; tiered assignments; cooperative learning; independent projects, project-based/problem-based learning; student choice/choice boards and varied instructional materials; peer tutoring; and pre-assessment for differentiated learning experiences. Overall, there was a relationship between teacher instructional strategy awareness and technology experience.

Table 10

A Crosstab of the Participants' Instructional Strategy Awareness vs. Technology Experience

<u>Instructional Strategy</u>	<u>Expert</u>		<u>Proficient</u>	
	<u>N</u>	<u>Percent</u>	<u>N</u>	<u>Percent</u>
Learning Contracts	6	30	28	34.1
Tiered Assignments	10	50	57	69.5
Independent Projects	14	70	55	67.1
Independent Study	12	60	34	41.5
Curriculum Compacting	3	15	16	19.5
Learning Centers/Stations	11	55	61	74.4
Varied Instructional Materials	11	55	55	67.1
Student Choice/Choice Boards	16	80	55	67.1
Flexible Grouping	14	70	61	74.4
Varying Questions	8	40	36	43.9
Peer Tutoring	11	55	45	54.9
Cooperative Learning	10	50	56	68.3
Pre-Assessment for Differentiated Learning Experiences	9	45	41	50.0
Project-Based/Problem Based Learning	16	80	55	67.1
Blended Learning	15	75	39	47.6
Universal Design for Learning	9	45	32	39.0

Note. Dichotomy group tabulated at value 1.

A second cross-tabulation was used to examine the relationship between teacher training on learner-centered strategies and their technology experience. There were six strategies that teachers with expert technology experience showed they were trained in, the most observed in Table 11. The strategies teachers with expert technology experience were most trained in included: project-based/problem-based learning; student choice/choice boards; blended learning; flexible grouping; learning centers/stations, varied instructional materials, and universal design for learning; and cooperative learning, independent projects, and

tiered assignments. Teachers with proficient technology experience were trained in the following: cooperative learning and varied instructional materials; learning centers/stations and flexible grouping; project-based/problem-based learning; tiered assignments; pre-assessment for differentiating learning experiences and universal design for learning; and student choice/choice boards. Overall, expert technology teachers show a relationship between their awareness of learner-centered strategies and their training.

Table 11*A Crosstab of the Participants' Instructional Strategy Training vs. Technology Experience*

Instructional Strategy Training Area	Expert		Proficient	
	N	Percent	N	Percent
Learning Contracts	3	15.0	10	12.2
Tiered Assignments	6	30.0	24	29.3
Independent Projects	6	30.0	17	20.7
Independent Study	3	15.0	9	11.0
Curriculum Compacting	2	10.0	10	12.2
Learning Centers/Stations	7	35.0	30	36.6
Varied Instructional Materials	7	35.0	32	39.0
Student Choice/Choice Boards	10	50.0	18	22.0
Flexible Grouping	8	40.0	30	36.6
Varying Questions	4	20.0	14	17.1
Peer Tutoring	1	5.0	4	4.9
Cooperative Learning	6	30.0	32	39.0
Pre-Assessment for Differentiated Learning Experiences	5	25.0	21	25.6
Project-Based/Problem Based Learning	11	55.0	25	30.5
Blended Learning	9	45.0	13	15.9
Universal Design for Learning	7	35.0	21	25.6

Note. Dichotomy group tabulated at value 1.

A two-variable scatterplot was used to see if there was a relationship between a teacher's years of experience and their learning-centered strategy and technology implementation of professional development perception in the classroom. There was no relationship between teaching experience and teachers' perceptions of learning-centered strategy and technology implementation in their classrooms.

A multiple linear regression was conducted to predict teachers' total perception of technology and learning-centered strategy implementation of professional development based on their age, teaching experience, technology experience, differentiated instruction experience, and differentiated instructional use. The regression was not significant ($F(5,96) = .528, p > .05$) with an R^2 of .027. Neither age, teaching experience, technology experience, differentiated instruction experience, nor differentiated instructional use were significant predictors of teachers' perception of technology and learning-centered strategy implementation of professional development.

An independent-sample *t*-test was conducted to compare the mean score of teachers with an undergraduate degree to the mean score of teachers identified as having a graduate degree. No significant difference was found ($t(96) = 1.492, p > .05$). The mean of the undergraduate degree teachers ($M = 11.85, sd = 1.52$) was not significantly different from the mean of graduate degree teachers ($M = 11.09, sd = 1.72$). Overall, there was no significant difference in teachers' perceptions of technology and learning-centered strategy implementation of professional development between their education levels.

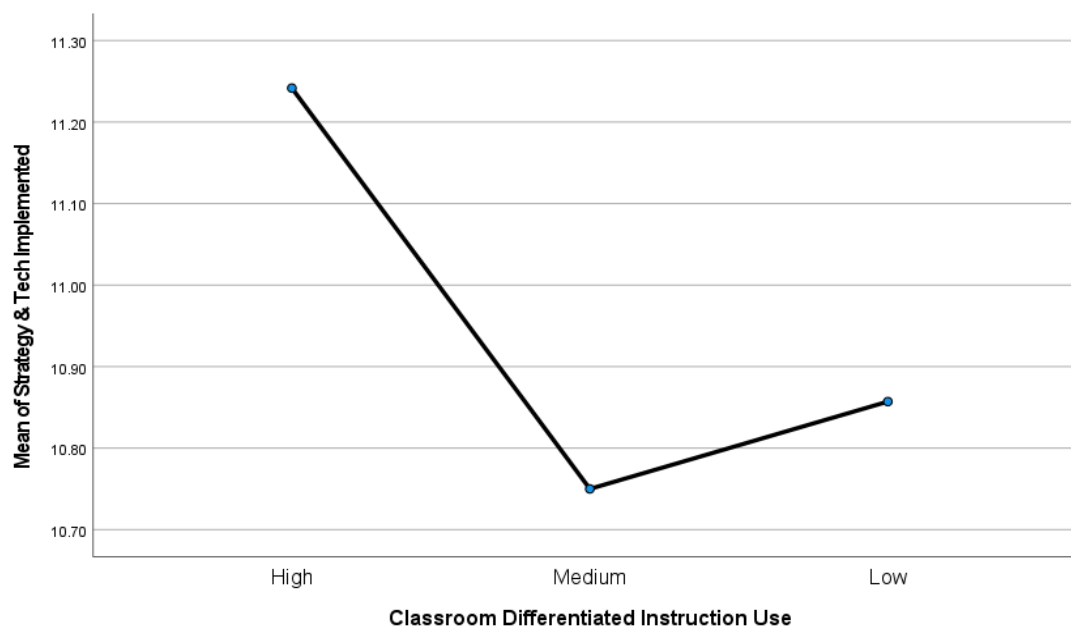
Another independent-sample *t*-test was calculated to compare the mean score of teachers who had expert differentiated instructional experiences to the mean score of teachers who were identified as having proficient differentiated instructional experiences. No significant difference was found ($t(100) = -.044, p > .05$). The mean of the expert differentiated instructional experienced teachers ($M = 11.18, sd = 1.56$) was not significantly different from the mean of proficient differentiated instructional

experienced teachers ($M = 11.20$, $sd = 1.77$). Overall, there was no significant difference in teachers' perceptions of technology and learning-centered strategy implementation of professional development between their differentiated instructional experience levels.

The combined mean score of teacher perceptions of learner-centered strategy and technology classroom implementation from three different categories were compared in a one-way ANOVA.

Figure 8

Mean Plot Chart of Learner-Centered Strategies Used and Total Perception Learner-Centered Strategy and Technology Classroom Implementation



The figure above shows that high-use differentiated instructional use teachers had the strongest positive perception of learner-centered strategy and technology classroom implementation. In contrast, medium-use teachers had the weakest perception of learner-centered strategy and technology classroom implementation.

All participants indicated some use of learner-centered strategies in their classroom. Eighty-nine percent of teachers showed high usage (daily -weekly), 7% showed low usage(semester-never), and 4% showed medium usage (monthly). Further investigation of participant responses provided details on specific strategies used by teachers. There were six strategies used on a daily/weekly basis by teachers. Sixty-six percent of teachers used varied instructional materials, 63% used cooperative learning, 61% used varying questions, 60% used flexible grouping, 47% used tiered assignments, and 41% used learning centers/stations daily/weekly basis. There were eight strategies that teachers used monthly. Thirty percent of teachers used pre-assessment for differentiating learning experiences; 28% used independent projects; 25% used student choice/choice boards monthly. Additionally, 24% used project-based/problem-based learning, 22% used peer tutoring and learning centers/stations, and 20% used tiered assignments and flexible grouping monthly. Finally, there were six strategies that teachers used once a semester or never used at all. Seventy-eight percent of teachers used curriculum

No significant difference was found ($F(2,99) = .297$, $p > .05$). The teachers in the three different strategy usage categories did not differ significantly in their perceptions. Teachers classified as high-use (daily, weekly) teachers had a mean score of ($M = 11.24$, $sd = 1.79$). Teachers classified as medium use (monthly) teachers had a mean score of ($M = 10.75$, $sd = .500$). Teachers classified as low (once a semester, never) use teachers had a mean score of ($M = 10.86$, $sd = 1.22$).

compacting, 76% used learning contracts, 66% used independent study, 58% used universal design for learning, 55% used independent projects, and 52% used blended learning once a semester or never in their learning environment.

A Pearson correlation coefficient was calculated for a relationship between teacher perceptions of learner-centered strategies modeled in professional development and technology and learning-centered strategy implementation of professional development perception. A weak correlation that was not significant was found ($r(100) = .150$, $p > .001$). Perceptions of learner strategies modeled in professional development were not related to perceptions of technology and learning-centered strategy implementation from professional development in the classroom.

Discussion

The results from this study suggest that teachers perceived learning strategies were modeled with the integration of technology in their professional learning environments. Teacher perceptions of the expectation that modeled learner-centered strategies be implemented in their curriculum were strongly positive. Teachers also had an enormously positive perception that activities modeled in LCPD support the expectation of their implementation in the classroom. This observation supports previous findings by Garett et al. (2001) about teachers owning their learning experiences and applying what was learned from those experiences, just as would be expected of students. This

study shows the relationship between the type of professional development teachers participate in and their differentiated instructional experience. Seventy-seven percent of teachers with expert technology experience engaging in classroom observation of their peers.

Given that this study was conducted during a global pandemic when emergency remote teaching and training was the norm, this may explain the high number of participants stating they had access to learner-centered strategies in PD sessions and the 25% of participants that were undecided about the implementation of strategies in their curriculum. It could also explain the strong positive perception of strategy modeling due to the high number of participants that use learner-centered strategies once a semester or never in their classrooms; it is likely that the COVID -19 pandemic forced them to use them on a daily to weekly basis. This also substantiates previous findings by Polly & Hannifin (2011) that LCPD increases teacher self-efficacy and the application of practices. In this study, this is evident in the increase in the number of strategies used when compared to training and technology experience. It is interesting to note that fewer teachers identified as working in a remote learning environment during the pandemic. Due to the interchangeable reference to the types of learning environments in the education community, participants may not have appropriately realize they were teaching in a remote temporary environment versus online or even face-to-face due to technology such as Microsoft Teams, Google Meet, or Zoom. This argument can also be extended as teachers were often listing tools versus strategies when referring to the strategies used/modeled in their LCPD environments. Participants listed tools such as Google Slides, Freckle, Canva, and Canvas. One participant identified this explicitly, stating, "They're (PD sessions are) built too much like tech workshops and not based in pedagogy a lot of times."

Subsequently, teacher perceptions were also strongly positive in relation to learner-centered strategies and technology being implemented in their classrooms. This finding is well substantiated by Weimer (2013) and the five characteristics of learner-centered teaching. The keys are student engagement, student choice, collaboration, reflection, and skill instruction. In the findings from these survey responses and interviews, teacher use of varied strategies in instruction, assessment, and the development of classroom community was evident. Teacher awareness of strategies compared to training and use reflects the practice shift from teacher-centered to learner-centered teaching in environments. As previously mentioned in results, the strategies that teachers were most strongly aware of reflected general learner-centered strategies. The strategies they received training for implementation, were more specific learner-centered strategies that are consistent with the five universal principles established by Reigeluth, Myers, and Lee (2016). The primary principles teachers in this study exhibited teaching in a learner-centered environment include task-centered instruction, personalized instruction, and changing roles.

Contrary to expectations, the study did not find a significant awareness or use of Universal Design for Learning as it is explicitly mentioned as an instructional strategy in the ESSA public law. Perhaps this is because of the focus on district or school improvement goals that lead to the daily and weekly usage of task-centered and personalized instruction as well as changing roles where there is less focus on teachers being the "sage on the

stage" and more of a facilitator in student learning. The finding of the strong perception of learning strategy implementation by teachers who use them daily and weekly as compared to the weak perception by teachers that use strategies monthly is consistent with Polly & Hannifin's (2010) findings where teachers' efficacy increases with training and increases the implementation of instructional strategies in the classroom environment.

Conclusion

Based on the research literature, teachers perceive that when learning strategies are modeled with the integration of technology in their professional learning environments, then they are likely to integrate them in a similar manner in their classrooms. The findings in this study suggest that teachers are expected to implement learning strategies using various learning activities in their curriculum modeled in their learner-centered professional development sessions. The results support the idea that PD should be characterized by active learning, thus increasing teacher implementation in the classroom. As such, this is a starting point for districts and schools to examine the alignment of their educational frameworks, with their instructional frameworks to ensure the training provided to teachers is focused on the instructional strategies to meet student needs in collaboration with technology versus a focus on technology implementation alone. As mentioned earlier, districts and schools need to align their structure of why they are educating students with their structure of how they are educating students.

One of the goals of this research was to examine teacher perceptions of learner-centered strategies modeled in professional development environments through a teacher's viewpoint. Based on the results of this study, administrators developing professional development for teachers should continue to align their development of programs with the defined characteristics of professional development as outlined by Guskey (2003), and Desimone (2011) in that training needs to be characterized by active learning and connected to other professional development provided such as technology implementation. Training should be spread over a period of time and should also be collaborative for teachers' successful implementation. When aligning LCPD development with these PD characteristics (active learning, participation, collaboration, and reflection) teachers ensure the ability to better assess the implementation of learner-centered strategies in their curriculum. Needs assessments of teacher awareness of strategies and technology experience that align with district instructional frameworks allow for better development of LCPD types and strategy content in LCPD sessions.

Another goal of this study was to examine teacher perceptions of learner-centered strategies and technology being implemented in their classrooms, determining the effectiveness of modeled instructional strategies in LCPD. Based on this study's results, teachers use various strategies and assessment tasks in their classrooms. However, based on the instructional framework presented by the school or district, teachers need to be aware of the practices they use to ensure they are meeting all the needs of their students. This study found that most teachers focused on three of the five principles of learner-centered education: task-centered instruction, personalized instruction, and changed roles and not attainment-based instruction and changed curriculum. (Reigeluth, Myers & Lee, 2016) The attainment-based instruction and

changed curriculum principles were focused on less. Attainment-based instruction or competency-based instruction focuses learning goals and not time. Changed curriculum focuses on emotional, social and character development in addition to content. (Reigeluth, Myers & Lee, 2016) In contrast, ESSA suggests that Universal Design for Learning (UDL) be used as an instructional approach to curriculum presentation for student success. UDL provides an approach that allows multiple means of engagement, representation, action, and expression for the student learning environment to be accessible to all students (CAST, 2018).

The implications of this study are significant in this time post-COVID-19. Educators and stakeholders alike must evaluate education as it is and make effective adjustments for the success of students and educators in their learner-centered environments to maintain educators and ensure student success.

Recommendations for Future Research

The population of the study was drawn from a tri-county area consisting of three regional education service areas in a midwestern state comprising 27 total school districts and approximately 4,883 educators. The population also consisted of seven private educator Facebook groups and educators on Twitter, Instagram, and LinkedIn. Future research should include the teachers of an entire state or broader region to capture a more reflective perspective on teacher perceptions of professional development in educational technology in a state. By conducting this research, state education agencies can collaborate with regional and local agencies to ensure the appropriate allocation of funding and that resources are available for training, ultimately leading to successful student outcomes across the state or region.

Although this study collected data on the types of professional development teachers were offered, participated in, and the learning strategies modeled and used in the classroom, it needed to provide a clearer picture of perceptions. This study was completed during remote learning during a life-threatening health pandemic. Based on the design of the survey and the tone of participants' written responses, their focus was on the present and not over time. Specifying a timeframe for participants to evaluate their experiences — perhaps prior to ERT, or what they expect in the future — could provide for a more robust discussion of effective professional learning that could be considered. Collecting this data will give researchers evidence that specific instructional strategies modeled meet teachers' needs and that the appropriate implementation increases student outcomes.

Finally, for the survey, interpretation of study results would have been enhanced if additional demographics were collected, such as location (city, county, state, country), race, and school type (rural, urban, suburban), which would allow a more thorough investigation of teacher perceptions. Collecting additional demographics would allow researchers to delve deeper into the lack of opinions by undecided teachers participating in the study.

To extend this line of research, further research on the instructional strategies modeled, implemented, and observed, technology tools used, and practical professional development components must be compared to actual classroom implementation through observation of teaching practices across grade levels and content areas.

Limitations

The results of this study are limited by the sample size, data collection, and research approach. The sample size of this study is limited due to recruitment within a tri-county area, via school email, and the researcher's own social media. The population should be in a larger region to effectively generalize study results. Expanding the population to cover an entire state — as compared to a Regional Educational Service Agency (RESA) — would allow more generalized results. With this study, data collection was limited due to timing as well. The limitation was primarily due to the current state of education during a life-threatening health pandemic.

In reviewing research, it was found that there are several lists of characteristics of instructional strategies and the interchanging of the terms instructional models and instructional strategies. Although there needs to be more consistency in developing a standard list of characteristics, future research can collect this information and compare it to studies that have developed in relation to research-based characteristics of instructional strategies.

The results of this study were based on quantitative and limited qualitative results. Future research should consider both quantitative and more extensive qualitative methods. Specifically focusing on the teacher's instructional use and technology experience. Education has a large veteran population whose needs need to be met, as perceived in this study. Future research should investigate this phenomenon when examining effective professional development, instructional strategies, and implementation.

Conflict of Interest

We have no known conflict of interest to disclose

Reference

1. An, Y.-J., & Reigeluth, C. (2011). Creating Technology-Enhanced, Learner-Centered Classrooms: K-12 Teachers' Beliefs, Perceptions, Barriers, and Support Needs. *Journal of Digital Learning in Teacher Education*, 28(2), 54-62. <https://doi.org/10.1080/21532974.2011.10784681>
2. Caffarella, R. S., & Zinn, L. F. (1999). Professional development for faculty: A conceptual framework of barriers and supports. *Innovative Higher Education*, 23(4), 241-254. <https://doi.org/0.1023/A:1022978806131>
3. Carpenter, J. P. (2016). Teachers at the Wheel. *Educational Leadership*, 73(8), 30-35.
4. CAST (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from <http://udlguidelines.cast.org>
5. Clarke, D., & Hollingsworth, H. (2002). Elaborating a model of teacher professional growth. *Teaching and teacher education*, 18(8), 947-967. [https://doi.org/10.1016/S0742-051X\(02\)00053-7](https://doi.org/10.1016/S0742-051X(02)00053-7)
6. Creswell, J. W. (2015). Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research. United Kingdom: Pearson.

7. Darling-Hammond, L., & Richardson, N. (2009). Research review/teacher learning: What matters. *Educational leadership*, 66(5), 46–53.
8. Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). Effective teacher professional development. *Learning Policy Institute*.
9. Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher*, 38(3), 181–199. <https://doi.org/10.3102/0013189X08331140>
10. Desimone, L. M. (2011). A primer on effective professional development. *Phi Delta Kappan*, 92(6), 68–71. <https://doi.org/10.1177/003172171109200616>
11. Dunn, K. E., Airola, D. T., & Garrison, M. (2013). Concerns, knowledge, and efficacy: An application of the teacher change model to data driven decision-making professional development. *Creative Education*, 4(10), 673. <https://doi.org/10.4236/ce.2013.410096>
12. Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What Makes Professional Development Effective? Results From a National Sample of Teachers. *American Education Research Journal*, 38(4), 915–945. <https://doi.org/10.3102/00028312038004915>
13. Gheysens, E., Consuegra, E., Engels, N., & Struyven, K. (2020). Good things come to those who wait: the importance of professional development for the implementation of differentiated instruction. *Frontiers in Education* 5(96), 1-14. <https://doi.org/10.3389/feduc.2020.00096>
14. Guskey, T. R. (2000). *Evaluating Professional Development*. Corwin Press.
15. Guskey, T. R. (2003). What Makes Professional Development Effective? *Phi Delta Kappan*, 84(10), 748–750. <https://doi.org/10.1177/003172170308401007>
16. Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020, March 27). *The difference between emergency remote teaching and online learning*. EDUCAUSE Review. <https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>
17. Ismajli, Hatixhe, & Imami-Morina, Ilirjana. (2018). Differentiated Instruction: Understanding and Applying Interactive Strategies to Meet the Needs of all the Students. *International Journal of Instruction*, 11(3), 207–218. <https://doi.org/10.12973/iji.2018.11315a>
18. Koellner, K., & Jacobs, J. (2015). Distinguishing models of professional development: The case of an adaptive model's impact on teachers' knowledge, instruction, and student achievement. *Journal of Teacher Education*, 66(1), 51-67. <https://doi.org/10.1177/0022487114549599>
19. Liao, Y. C., Ottenbreit-Leftwich, A., Karlin, M., Glazewski, K., & Brush, T. (2017). Supporting change in teacher practice: Examining shifts of teachers' professional development preferences and needs for technology integration. *Contemporary Issues in Technology and Teacher Education*, 17(4), 522-548.
20. Logan, B. (2011). Examining differentiated instruction: Teachers respond. *Research in Higher Education Journal*, 13.
21. Loucks-Horsley, S. (1995). Professional development and the learner-centered school. *Theory into practice*, 34(4), 265–271. <https://doi.org/10.1080/00405849509543690>
22. Mavidou, A. & Kakana, D. (2019). Teachers' Experiences of a Professional Development Program for Differentiated Instruction. *Creative Education*, 10(3), 555–569. <https://doi.org/10.4236/ce.2019.103040>
23. McCombs, B., & Vakili, D. (2005). A learner-centered framework for e-learning. *Teachers College record*, 107(8), 1582-1600. <https://doi.org/10.1111/j.1467-9620.2005.00534.x>
24. Orrill, C. H. (2001). Building technology-based, learner-centered classrooms: The evolution of a professional development framework. *Educational Technology Research and Development*, 49(1), 15-34. <https://doi.org/10.1007/BF02504504>
25. Polly, D. & Hannafin, M. J. (2011). Examining How Learner-Centered Professional Development Influences Teachers' Espoused and Enacted Practices. *The Journal of Educational Research*, 104(2), 120-130. <https://doi.org/10.1080/00220671003636737>
26. Polly, D. & Hannafin, M. J. (2010). Reexamining technology's role in learner-centered professional development. *Education Technology Research and Development*, 58(5), 557-571. <https://doi.org/10.1007/s11423-009-9146-5>
27. Reigeluth, C. M., Myers, R. D., & Lee, D. (2016). The learner-centered paradigm of education. In *Instructional-Design Theories and Models, Volume IV* (pp. 21-48). Routledge.
28. Rodriguez, A. (2012). An analysis of elementary school teachers' knowledge and use of differentiated instruction.
29. Soine, K. M., & Lumpe, A. (2014). Measuring characteristics of teacher professional development. *Teacher Development*, 18(3), 303-333. <https://doi.org/10.1080/13664530.2014.911775>

30. Smets, W. (2017). High Quality Differentiated Instruction--A Checklist for Teacher Professional Development on Handling Differences in the General Education Classroom. *Universal Journal of Educational Research*, 5(11), 2074-2080. <https://doi.org/10.13189/ujer.2017.051124>
31. Sparks, S. D. (2015). *Differentiated Instruction: A Primer*. Education Week. <https://www.edweek.org/leadership/differentiated-instruction-a-primer/2015/01>
32. Vargas Parra, Rodríguez Orejuela, J. A., & Mosquera, L. H. (2017). Promotion of Differentiated Instruction through a Virtual Learning Environment. *Folios (Bogotá, Colombia)*, 47. <https://doi.org/10.17227/folios.47-7404>
33. Weimer, M. (2012). Learner-centered teaching and transformative learning. *The handbook of transformative learning: Theory, research, and practice*, pp. 439–454.
34. Weimer. (2013). *Learner-centered teaching : five key changes to practice* (Second edition.). Jossey-Bass.
35. Whipple, K. A. (2012). *Differentiated instruction: A survey study of teacher understanding and implementation in a southeast Massachusetts school district* (Doctoral dissertation, Northeastern University).
36. Zagallo, P., McCourt, J., Idsardi, R., Smith, M. K., Urban-Lurain, M., Andrews, T. C., ... & Lemons, P. P. (2019). Through the eyes of faculty: Using personas as a tool for learner-centered professional development. *CBE—Life Sciences Education*, 18(4), ar62. <https://doi.org/10.1187/cbe.19-06-0114>.