Assessing the Role of Exposure to Learning Styles Theory on K-12 Teachers

A Survey-Based Analysis

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Abstract

Despite a lack of empirical evidence, learning styles theory (LST) enjoys widespread support in education, leading many researchers to refer to it as a "myth." Although previous research has demonstrated LST's popularity, the impact of exposure to LST on teachers is not yet known. Here original survey data of K–12 teachers (n = 240) was used to determine how prevalent LST is, the sources that most commonly expose teachers to LST, and what impact exposure to LST has on them. Respondents reported widespread exposure to LST, particularly within teacher education programs, as well as widespread support for LST. Data analysis demonstrated a positive correlation between degree of exposure to LST and implementation of LST. These results are revealing of the lack of progress that researchers have made in moving K–12 teachers beyond LST, are suggestive of the role of research in teacher education programs, and raise potential implications regarding the impact of teacher education on the apprenticeship of observation.

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Introduction

Learning styles theory (LST) is among the most persistently popular beliefs in education. Even a casual online search will result in untold numbers of recent articles on LST as well as commercially available materials based on LST. Furthermore, it has become broadly popular to conduct research grounded in the assumption of the existence of student learning styles. This is despite the fact that there is little empirical evidence to justify the implementation of LST, and there is some evidence to suggest that its implementation may do students harm. Recent research has demonstrated that K–12 teachers are exposed to LST through K–12 state standards and policy, pedagogy textbooks, and higher education instruction, but it remains unclear if these exposures influence K–12 teachers and thus impact students' experience in the classroom. The aim of this study was to utilize survey data to determine what sources are most commonly exposing teachers to LST and determine the statistical relationship between the degree to which K–12 teachers have been exposed to LST and teacher adherence to LST.

Learning Styles Theory

Despite the widespread popularity of LST, no single definition or compendium of ideas on learning styles exists. In a review that they did not claim to be comprehensive, Coffield et al. (2004) identified 71 distinct learning styles models. One popular variation of LST is the VARK model, which classifies students as visual, auditory, reading/writing, and kinesthetic learners. Other learning styles advocates follow the VAK model, which recognizes only visual, auditory, and kinesthetic learners (Wininger et al., 2019). Despite the popularity of the VARK and VAK models, untold numbers of models that categorize learners through a wide variety of methods and criteria exist.

Although there is no single theory of learning styles, two core tenets best summarize LST. First is the assumption that every person has an individualized modality with which they most optimally learn regardless of context (Pashler et al., 2009). This tenet has been somewhat weakened by some LST advocates who have seemingly walked back on it by viewing learning styles as preferences rather than concrete categories of learning (Berková et al., 2020; Deale, 2019; Hsieh et al., 2011; Richardson, 2010). This is despite the fact that there is no evidence to suggest that the method of instruction a student prefers is correlated to student performance (An & Carr, 2017; Kirschner, 2017; Knoll et al., 2017; Nancekivell et al., 2020). The second LST tenet is that students' learning will be improved if the instructor can determine this individualized methodology (or preference) and differentiate their instruction accordingly. This is often called the meshing hypothesis (Pashler et al., 2009). These two tenets have widely been used to justify a host of efforts within the field of education, including (but not limited to) academic research, the purchase of learning styles testing materials, rewriting of curricula, and adjustment of instruction.

Advocates of LST claim a wide variety of benefits to its application, including strengthened self-advocacy skills, prolonged concentration, increased motivation, and improved memory and retention (Scott, 2010). If any single educational strategy could provide these benefits, it would be nothing short of revolutionary within the field of education. Unfortunately, little evidence has been provided to support the claims of LST advocates. There are certainly valid nonexperimental methodologies that have the potential to add to our understanding of LST and its impact on education. Within experimental research, however, methodological criteria must be met to support the implementation of LST. First, students must be tested for their learning styles and divided into two or more groups accordingly. Then, students in each group must be randomly assigned into two or more instruction method groups (consisting of students of all tested learning styles). After students have received their respective instruction, all students must receive the same assessment. The results of that assessment must then demonstrate a crossover interaction, suggesting that the optimal learning style of one group is different than that of the other group(s). It should also be noted that robust effect sizes with large sample sizes would be needed to justify the opportunity cost associated with widespread implementation of a new, costly learning strategy like LST (Pashler et al., 2009). Those methodical standards, to date, however, have not been met.

In fact, methodologically sound studies have regularly failed to demonstrate the effectiveness of LST. For example, in one recent study, despite the fact that students predicted that they would do better on assessments in their learning style (verbal vs. visual), no association with their actual performance was demonstrated, leading the authors to conclude that learning styles have "little utility in optimizing learning" (Knoll et al., 2017, p. 560). In a second study, medical students were given differentiated instruction based on their perceived learning styles (intuitive or sensing learners). Again, no significant improvements in learning were demonstrated as a result of differentiation of instruction in one's learning style (Cook et al., 2009). This lack of evidence has led numerous researchers to call into question the existence of learning styles, the effectiveness of differentiating students and their instruction by learning styles, and our ability to accurately assess students' learning styles (Gudnason, 2017; Kirschner, 2017; Newton & Miah, 2017; Pashler et al., 2009; Pomerance et al., 2016; Scott, 2010). While Kirschner (2017) perhaps most colorfully referred to learning styles as an "emperor without clothes," other descriptions of LST have included "myth" (Kirschner, 2017; Nancekivell et al., 2020; Newton, 2015; Riener & Willingham, 2010), "snake oil" (Scott, 2010), "useless for explaining learning or achievement" (An & Carr, 2017), "debunked," and "pseudo-science" (Pomerance et al., 2016).

Even if LST advocates were able to produce methodologically sound, compelling research, the widespread implementation of LST would still come with risks that would need to be considered. In its essence, LST places limitations on students. If a student is labeled a visual learner, it is quite possible that they may

be discouraged from pursuing nonvisual disciplines, given a false sense of security in visually dominant contexts, and be quick to blame teachers or lose motivation when information is presented in nonvisual formats and they do not experience immediate academic success (Wininger et al., 2019). Indeed, any time educators place labels and artificial limitations on students, careful examination should be given as to the potential consequences.

Despite this lack of empirical evidence and potential risks, LST remains widely popular (English, 2021; Seymour, 2020). LST's persistence continues first because its most basic claims are true. Students differ from one another, and teachers should pay attention to those differences (Riener & Willingham, 2010). What is more, presenting material in a variety of formats is an effective teaching strategy (Willingham, 2006). After teaching a lesson with multiple formats, teachers may be quick to credit their students' successes to the merits of LST, falling victim to confirmation bias (Riener & Willingham, 2010). Once a teacher has experienced LST "success," they often resist new information, trusting in-classroom experience over scientific data. As one teacher reported, "even if the research says it [LST] doesn't work, it works" (Seymour, 2020, p. 108).

LST can be found throughout the internet and popular culture in the form of commercial products (largely testing materials) as well as in the academic world (Newton, 2015). Teachers have been widely exposed to LST through K–12 education standards and policy (English, 2020), pedagogy textbooks (Wininger et al., 2019), and higher education instruction (Newton, 2015; Newton & Miah, 2017). Evidence also suggests that teachers' belief in LST is associated with implementation of LST (Murtaugh, 2016). The most common sources from which teachers are exposed to LST and the effects of those exposures, however, are as of yet unclear. This study aimed to determine the sources of K–12 teachers' exposure to LST and the scope of that exposure and if exposure is associated with adherence to, identification with, and implementation of LST.

Methods

The aim of this study was to utilize survey data from K–12 teachers to determine what sources most commonly expose teachers to LST and if there is a correlation between the degree to which a teacher has been exposed to LST and six independent factors: (a) if LST is best for student learning; (b) if implementing LST is essential for effective instruction; (c) if testing students' learning styles is essential for effective instruction; (d) implementation of LST in the classroom; (e) belief that LST is a sound, research-based practice; and (f) identification with a specific learning style.

Sample

This study utilized the snowball sampling (or chain sampling) method, a

convenience sampling method where a first wave of respondents within the target population is contacted, asked to participate, and encouraged to refer the researcher to other members of the population (Stapleton, 2010). The first wave of teachers was contacted through two methods. First, 155 K–12 teachers, all of whom I have professional connections to, were solicited for participation via email and asked to forward the digital survey to other K–12 teachers they knew via email or social media. An additional 71 individuals, including superintendents, administrators, school psychologists, counselors, reading specialists, and professors of education, were also contacted and asked to forward the survey to K–12 teachers. Consequently, a total of 226 emails were sent to potential participants. The recipients of these emails were, however, disproportionally in my geographical region. Therefore, in an effort to expand the geographic representation of the sample, a first wave of participants was also solicited through posting a call for participation on several teacher-specific groups on Facebook. Similarly, teachers were encouraged to distribute the survey to other K–12 teachers

While any convenience sampling method has drawbacks, the snowball sampling method was deemed appropriate and most feasible for this study. First, this methodology was chosen to mirror recent research on learning styles theory in education (Newton & Miah, 2017). Second, because no national database of every K–12 teacher exists, a true random sampling would be problematic, if not impossible. It was also hoped that relying on the personal and professional connections within a given school building and district as teachers solicit other teachers to participate would create a larger sample size than other methodologies. Finally, because teachers in the United States are nearly universally accessible by email and forwarding emails requires only a few seconds of time, it was hoped that a relatively large percentage of participating teachers would oblige in sending the survey on to other teachers they knew.

The primary drawback of the snowball method is that the first wave of participants can have a strong influence on the final sample and its representativeness (Ruel et al., 2016). In this case, because I had a personal connection with all those solicited by email, there are a variety of ways that the first wave, and therefore the sample as a whole, could lack representativeness. Efforts were made to negate this effect by creating as large and diverse of a first wave as possible (Ruel et al., 2016). Of the K–12 teachers solicited, 40 different schools were represented. Of those 40 schools, 32.5% were elementary schools, 17.5% were middle schools, and 50% were high schools. While the nonteacher distribution list did not fit into categories of schools as well (many of them were district-level administrators or professors of education), it was also relatively diverse, with representatives from 10 different school districts and 9 colleges or universities. Despite this relative diversity, all teachers solicited for participation by email in Wave 1 were from my home state. While efforts to broaden the diversity of Wave 1 by posting the survey on teacher-specific Facebook groups were taken, a disproportionate representation in my geographic

region remained, thus calling the representativeness of the sample into question. An additional drawback to the snowball method is that calculating the response rate is impossible, as there is no way of knowing how many teachers from Wave 1 chose to forward the survey on, much less how many teachers in ensuing waves did so. Thus calculating a participation rate is not possible.

Instrument

The survey instrument for this study was created on SurveyMethods, a widely used online survey platform. This was chosen so that the link would be maximally recognizable (and therefore presumably trustworthy) to participants. Both the subject line of the solicitation email and the title of the survey were "K–12 Teaching Methods Survey." Use of the term "learning styles theory" in the email subject and survey title was purposefully avoided both to minimize selection bias by potentially polarizing participation to those who had particularly strong sentiments toward LST and to mirror methods in similar recent research (Newton & Miah, 2017). While it has been demonstrated that LST is prevalent in higher education instruction, K–12 standards, and pedagogy textbooks, it is yet unclear what implications exposure to LST might have for K–12 teachers. Therefore the instrument aimed to quantify the degree to which the participant had been exposed to LST, as measured by the number of different sources that exposed them to LST. Eleven options for sources of exposure to LST were provided with room to add additional sources. A corresponding value was then assigned to each participant based on their number of reported LST exposure sources. Next, a series of 6-point Likert scale questions ranging from 1 (*strongly disagree*) to 6 (*strongly agree*) were asked to determine how, if at all, the participant's exposure to LST had manifested in their classroom. Because of LST's widespread popularity, it was assumed that the overwhelming majority of teachers would have been exposed to this theory at least once. Therefore, a 6-point Likert scale was chosen to eliminate the "neutral" option and require participants to disclose a position on the topic, even if it was subtle. A risk taken with this strategy was, however, that a presumably small number of teachers who had never been exposed to LST may then choose to continue with the survey and would then be reporting a perception of a topic with which they had no previous knowledge. While this was deemed to be a minor risk, a short description of LST was included to give baseline knowledge of the topic to all participants.

On the survey instrument, six Likert scale statements aimed to measure a unique manifestation of LST. See Table 1 for the six LST statements as well as a brief description of their targeted measure.

Once these six measures were determined and questions were written, the survey was piloted to a panel of six educators, including K–12 teachers, administrators, and higher education professors of education. While the survey itself was only open to K–12 teachers, including administrators and professors in the piloting was

Table 1
Description of Likert Scale Survey Statements

Likert scale statement	*Description*
Students learn best when information is presented to them in their individualized learning style.	This statement was intended to measure if the teacher believed LST to be pedagogically ideal in a theatrical sense, void of any logistical or practical complications associated with application in a real-world classroom.
Differentiating instruction based on individual students' learning styles is an essential part of effective instruction.	Contrary to the first statement, this aimed to determine if the teacher found LST to be practically viable to apply in a classroom where at least some theoretically sound practices may not be implementable.
Testing students for their individual learning style is an essential part of effective instruction.	Testing a student's learning style is at the heart of LST. Indeed, if students' learning styles are not determined, differentiating instruction for students would be left to baseless assumptions or (worse yet) stereotypes about a student. Nevertheless, it was potentially useful to determine if there was a correlation between exposure to LST and adherence to testing students for their learning style.
Differentiating instruction based on individual students' learning styles is central to my classroom instruction.	It is entirely possible for a variety of reasons that teachers who have been exposed to LST and believe it to be both theoretically and practically useful may fail actually to implement it in their classrooms. For example, Seymour (2020) demonstrated that many teachers are influenced by other teachers, administrators, students, and parents to implement LST. This measure sought to determine if there was a correlation between exposure to LST and actual implementation of the theory in classrooms.
Differentiating instruction based on individual students' learning styles is a sound, research-based practice in education.	Although little empirical evidence to support LST has been produced, K–12 teachers are often not the target audience of scholarly writing. This measure sought to determine if there is a correlation between degree of exposure to LST LST and belief that it is supported by scholarly research.
I personally identify with a specific learning style.	Contrary to the previous measures, this question sought to determine if teachers internalized LST. Seymour (2020) demonstrated that many teachers persisted with their support of LST even after being presented with contradictory evidence because of their personal identification with a learning style. If a positive correlation (or lack thereof) between degree of exposure to LST and identification with a specific learning style could be determined, it might provide insight as to how and why teachers are receptive to unproven ideas and how we can further improve teacher education and K–12 instruction.

Note. LST = learning styles theory.

deemed useful because of the common vernacular and experiences as compared to K–12 teachers. Additionally, my distribution list contained many administrators and professors, whom I would request that they send the survey on to K–12 teachers. Administrator and professor input was deemed valuable in the assumption that they would likely evaluate the instrument before determining if they would forward it to other teachers. The panel gave valuable feedback as to the wording of questions as well as potential answers regarding sources of exposure to LST.

Results

The survey instrument was left active for 6 weeks. During that time, 245 responses were collected. Although leaving the survey active longer may have led to a slightly larger sample size, the response size was deemed comparable to recent similar research (Dandy & Bendersky, 2014; Newton & Miah, 2017; Palis, 2016) and therefore acceptable. Of the original respondents, five were removed from

Table 2
Demographic Data by State

State	*n*	*%*
Kansas	147	61.25
Oklahoma	40	16.66
North Dakota	9	3.75
California	9	3.75
Ohio	8	3.33
Missouri	5	2.08
Idaho	2	0.83
Michigan	2	0.83
Texas	2	0.83
Arizona	1	0.42
Colorado	1	0.42
Hawaii	1	0.42
Illinois	1	0.42
Indiana	1	0.42
Iowa	1	0.42
Kentucky	1	0.42
Maine	1	0.42
Maryland	1	0.42
Minnesota	1	0.42
New Jersey	1	0.42
New Mexico	1	0.42
Pennsylvania	1	0.42
Utah	1	0.42
Virginia	1	0.42
Wisconsin	1	0.42
Total	240	100

the sample. Two respondents reported multiple exposures to LST as well as "I have never been exposed to this theory," putting the legitimacy of the responses in question. Three other respondents reported that they were not a K–12 teacher. Of the remaining respondents (n = 240), all were from the United States. Twenty-five states were represented, with Kansas (n = 147), Oklahoma (n = 40), North Dakota (n = 9), California (n = 9), and Ohio (n = 8) seeing the largest representation. See Table 2 for demographic data of the sample by state.

All K–12 grade levels were represented within the sample. See Table 3 for demographic data of the sample by grade level. Within Table 3, it is of note that most (72.5%) teachers reported teaching multiple grades, resulting in a total number of grade levels taught greater than the sample size. Of those reporting multiple grade levels taught, most (80%) could broadly be categorized as either elementary (K–6) or secondary (6–12) teachers.

The data were then examined for outliers and nonnormalities, revealing none. Descriptive statistics demonstrated that 100% of respondents had been exposed to LST with a mean of 5.83 categories of exposure (SD = 2.19). Professional development (n = 223), college professor instruction (n = 197), observation/discussion with other teachers (n = 184), and college textbooks (n = 178) were the most commonly reported sources of exposure. See Table 4 for responses to LST exposures.

Although these data demonstrate that teachers are widely exposed to LST, they give no indication if that exposure is positive, negative, or neutral. Descriptive statistics of the six LST measurements demonstrated that LST was widely popular within the sample. The mean scores ranged from 4.43 (testing) to 5.05 (best for learning) on a 6-point Likert scale. See Table 5 for the descriptive statistics of the six LST measurements.

Table 3
Demographic Data by Grade Taught

Grade level	*n*	*%*
K	30	12.35
1	43	17.70
2	45	18.52
3	45	18.52
4	43	17.70
5	49	20.16
6	56	23.05
7	68	27.98
8	74	30.45
9	84	34.57
10	93	38.27
11	101	41.56
12	102	41.98

Pearson's product–moment correlation coefficients were then calculated to determine the correlation between the degree of exposure to LST and the six LST measures (see Table 6). Significant positive correlations were determined between degree of exposure and each of the LST measures. The effect sizes of five of the six measures (best for learning, essential for effective instruction, testing, research-based practice and identification with a specific learning style) were small, while the effect size of LST implementation was medium (Cohen, 1992).

To gain a greater understanding of the role of exposure to LST, respondents were divided into two groups. The first group consisted of teachers who reported having been exposed to LST through six or more sources (n = 126) (denoted as high-exposure teachers). The second group consisted of teachers who reported having been exposed to LST through five or fewer sources (n = 113) (denoted as

Table 4
K–12 Teacher Exposures to LST

Reported sources of exposure to LST	*Respondents reporting exposure*	
	n	*%*
College professor instruction	197	82.08
College textbooks	178	74.17
State standards/policies	115	47.92
Professional development	223	92.92
Independent research	126	52.50
Administration	128	53.33
Observations/discussions with other teachers	184	76.67
Popular culture	67	27.92
Social media	83	34.58
Parents of students	88	36.67
I have never been exposed to this theory	0	0
Other	7	2.92

Note. LST = learning styles theory

Table 5
Descriptive Statistics of Six LST Measurements on a Likert Scale

LST measure	*n*	*Mean score (out of 6.00)*	*SD*
Best for learning	240	5.05	1.08
Essential for effective instruction	240	4.96	1.06
Testing	238	4.43	1.15
Implementation	239	4.44	1.25
Research-based practice	239	4.74	1.18
Identification with a specific learning style	239	4.62	1.19

Note. LST = learning styles theory.

low-exposure teachers). An independent samples *t*-test was conducted to determine if high-exposure teachers ($M = 4.74$, $SD = 1.12$) were statistically more likely to implement LST in their classrooms than low-exposure teachers ($M = 4.12$, $SD = 1.30$). At the $p < .05$ level, significant results were found, $t(237) = 3.98$, $p = < .001$; $d = 0.51$. The Cohen's *d*-test effect size (0.51) exceeds the threshold to be commonly considered a medium effect size (Cohen, 1988; Sawilowsky, 2009). These results suggest that low-exposure teachers were less likely to implement LST in their classrooms than high-exposure teachers.

To determine if teachers' exposure to a perception of LST differed by grade level taught, teachers were grouped into elementary (K–6; $n = 83$) and secondary (7–12; $n = 123$) grade levels. For the purpose of this test, teachers who reported teaching both elementary and secondary grade levels were excluded. An independent samples *t*-test was conducted to determine if secondary teachers ($M = 6.15$, $SD = 2.26$) experienced greater exposure to LST than elementary teachers ($M = 5.42$, $SD = 2.06$). At the $p < .05$ level, significant results were found, $t(204) = -2.34$, $p = .020$; $d = 0.34$. The Cohen's *d*-test effect size (0.34) is commonly considered a small effect size (Cohen, 1988; Sawilowsky, 2009). These results suggest that secondary teachers experience slightly greater exposure to LST than their elementary counterparts.

In concurrence with this greater exposure to LST, secondary teachers also responded more favorably than elementary teachers to each of the six Likert scale measures of LST perception. Independent samples *t*-tests were conducted to determine if any of these differences were statistically significant, revealing one. Secondary teachers ($M = 4.86$, $SD = 1.09$) differed from elementary teachers ($M = 4.48$, $SD = 1.19$) with regard to their identification with a specific learning style. At the $p < .05$ level, significant results were found, $t(203) = -2.35$, $p = .019$; $d = 0.33$. The Cohen's *d*-test effect size (0.33) is commonly considered a small effect size (Cohen, 1988; Sawilowsky, 2009). These results suggest that secondary teachers

Table 6
Pearson Correlation Coefficients (r) Between Degree of Exposure to LST and the Six LST Measures

LST measurement	*r*	*Sig. (2-tailed)*	*df*
Best for learning	.173	.007*	239
Essential for effective instruction	.278	<.001*	239
Testing	.180	.005*	237
Implementation	.330	<.001*	238
Research-based practice	.255	<.001*	238
Identification with a specific learning style	.147	.023*	238

Note. LST = learning styles theory.
*p < .05.

are slightly more likely to identify with a specific learning style than elementary teachers.

It may be helpful to put all these reported effect sizes into context. Researchers have long argued that Cohen's established thresholds of effect sizes, while a useful starting point in interpreting quantitative data, have limited practical value. Kraft (2020) recommended taking several factors into consideration while interpreting an effect size in educational research. Among these were a given initiative's cost. If, for example, implementing a given educational reform represents a low cost, it may be worthwhile even if low effect sizes are expected. Alternatively, large, costly initiatives may not be justifiable even if larger effect sizes are demonstrated in research. Specific to this study, reducing teachers' exposure to LST by phasing it out from teacher education instruction, education methods textbooks, and professional development curricula would require minimum cost and allow for the instruction of other, more research-proven methods. By this standard, efforts to reduce teachers' exposure to LST (at little or no cost) should be prioritized.

Kraft (2020) also recommended considering an intervention's feasibility to scale while interpreting effect sizes. For example, expectations of a study may need to be tempered if implementing its intervention requires broad behavioral changes from a large number of people (and is therefore unlikely to succeed on a large scale). These results would suggest that teachers are exposed to LST from a wide range of sources that are not directly related to each other, making coordinating any effort to reduce LST instruction problematic to scale. Getting individual professors, textbook companies, and those who design professional development curricula to discontinue instruction of LST, particularly when they are profiting from doing so, has already proved difficult. By this standard, the expectations associated with the effect sizes reported here may need to be tempered.

Discussion

Descriptive statistics collected here support previous literature by demonstrating the broad popularity of LST (Dandy & Bendersky, 2014; English, 2020; Newton, 2015; Newton & Miah, 2017; Seymour, 2020; Wininger et al., 2019). For example, 92.92% of teachers reported being exposed to LST through professional development, and 82.08% reported being exposed to LST by their college professors. This exposure was presumably positive, as teachers were overwhelmingly supportive of LST. For example, 93.75% of teachers responded "slightly agree," "agree," or "strongly agree" to the proposition that students learn best when information is presented to them in their individualized learning styles. These results are also supported by previous literature. For example, Seymour (2020) found that 94.5% of surveyed teachers supported the VAK model of LST (n = 576). Additional results indicate that all six LST measures were positively correlated to degree of exposure, and teachers with greater exposure to LST were more likely to implement it in their classrooms.

These results suggest that teachers are exposed to (and encouraged to implement) LST from a variety of sources, including teacher education programs. Nevertheless, it is unclear how much responsibility should be attributed to teacher education programs. Because the focus of this study was on practicing K–12 teachers, it did not consider the perceptions with which preservice teachers come into teacher education programs. The theory of the apprenticeship of observation, first developed by Lortie (1975), contends that the thousands of hours students spend in K–12 classrooms observing their teachers at work heavily influence their perceptions of effective instruction and encourage them to replicate the pedagogical approaches their former teachers utilized. Collectively, this minimizes the effect that teacher education programs can have on preservice teachers and stagnates progressive pedagogy, as teachers (both preservice and in-service) tend to resist moving away from pedagogical strategies observed in their formative years (Lortie, 1975, pp. 66–67). LST research provides some support for the influence of the apprenticeship of observation. Seymour (2020) demonstrated not only that K–12 teachers are sparsely exposed to academic literature but that many teachers resist changing their positions on LST when presented with contradictory evidence. The results produced here, specifically that teachers are exposed to LST from a wide variety of sources before their first year of teaching, in conjunction with Seymour's results, suggest that the apprenticeship of observation may have some effect on LST's continued popularity among K–12 teachers.

Apprenticeship of observation, however, has increasingly come under criticism. Most notable are studies that suggest that teachers bring both positive and negative teaching techniques with them based on their experiences as students (Boyd et al., 2013; Channa, 2020; Gelfuso, 2018; Smagorinsky & Barnes, 2014). In light of these critiques, it is perhaps more unclear than ever how LST can persist. If teachers bring both traditional and progressive teaching techniques with them from their former classrooms, why aren't students adopting more effective strategies from their teachers (and teacher education programs) and moving away from LST? Perhaps it is because LST often seems to be working. Teaching content through a variety of formats and modalities is effective instruction (Willingham, 2006), and many students will learn in a classroom even when content is delivered suboptimally. It is also understandable that when a teacher designs a lesson or unit based on LST and experiences success, they would attribute their success to the merits of LST. Additionally, LST appeals to many teachers' egalitarian views of education. Based on these factors, this differentiated approach might appear novel or memorable to "apprenticing" students, particularly if they found it anecdotally effective. In turn, they would be more likely to replicate it and less receptive to contradictory evidence in the future.

Ultimately, the theory of the apprenticeship of observation and its contemporary critics would seem to mitigate the responsibility of teacher education programs for the continuation of LST. If teachers are heavily influenced by the teaching

techniques they experienced as students (both effective and ineffective), then there is only so much a teacher education program can be expected to do while trying to instill research-based practices into their preservice teachers' repertoire. As a teacher educator, however, this feels like a shallow escape of responsibility and minimalization of the role of teacher education programs. The pedagogical style of a teacher is not deterministic, and teacher educators surely bear at least some of the burden in ensuring that their graduates are capable of implementing sound pedagogical practices. Additionally, research has suggested that teacher education programs are capable of moving preservice teachers away from preconceived beliefs that conflict with research-based methods (Boyd et al., 2013; Moy et al., 2016; Westrick & Morris, 2016). These results suggest that teacher education programs are capable of mitigating the impact of the apprenticeship of observation in at least some contexts and are therefore responsible for doing so.

More broadly, another interpretation of these results is that they are telling to the degree to which teacher education is an academic, research-based field, something that has been under considerable debate for decades. In recent years, many teacher education programs have been criticized by the academic community, policy makers, think tanks, and the general public (Rust, 2010; Zeichner & Conklin, 2016). There have certainly been some advancements in the role of research in teacher education. For example, in the 1990s, the National Board for Professional Standards and Interstate New Teacher Assessment and Support Consortium developed standards and assessments based on a strong body of research that are now used by most accrediting bodies. In 2005, the National Academy of Education assembled a panel of teachers and teacher education scholars, which aimed to assemble the most important educational research into a single work. Its report, *Preparing Teachers for a Changing World: What Teachers Should Learn and Be Able to Do*, was widely used to drive further research in the field and develop conceptual frameworks for teacher education and was used by dozens of universities while redesigning their programs (Darling-Hammond, 2016). These and other steps have been instrumental in advancing the role of research in education and teacher education.

Despite these gains, there is a growing negative perception about both the level of scholarship and the ability to link scholarship to practice in teacher education programs (Hurlbut & Krutka, 2020; Rust, 2010; Zeichner & Conklin, 2016). Many continue to perceive teaching as fundamentally a series of actions a teacher takes in the classroom that can easily be replicated by anyone with the requisite body of content knowledge and a few weeks of training (Tatto et al., 2016). Under this logic, requirements of a traditional teacher education program are unnecessary and unproductive (Darling-Hammond, 2016; Zeichner, 2012; Zeichner & Conklin, 2016). A number of efforts to expand alternative pathways into education, primarily as tools to address teacher shortages and undermine traditional teacher education programs, have become increasingly popular. This is despite the fact that research comparing teachers prepared in traditional teacher education programs to their

peers who trained via alternative pathways is inconclusive (Darling-Hammond et al., 2005; Hurlbut & Krutka, 2020; Zeichner & Conklin, 2016). Regardless, it can definitely be said that alternative pathways to teaching have weakened both the role of research in education and the scholarly reputation of teacher education because the entire philosophy of such programs is that the research-based pedagogical training that preservice teachers should be receiving in teacher education programs is not useful or productive.

This perception of scholarship in teacher education is relevant to the results here most directly in the tools of teacher education (professor instruction and textbooks)—that is, the specific tools that are designed to push teacher education along research-based lines and those that teacher educators can directly control—which were reported to be among the sources giving the highest rates of exposure to LST (82.08% and 74.17%, respectively). Indeed, these were much more commonly reported than social media or popular culture (34.58% and 27.92%, respectively), which would be much more appealing to blame for the continuation of an unsubstantiated theory in education. Furthermore, the degree of exposure to LST (disproportionally from sources like textbooks and college professors) was correlated with implementation of LST. It should be noted that any positive correlation of any effect size here should be of concern. After all, given the absence of empirical evidence to support LST, if teacher education and professional development programs are abreast of current academic literature, exposure to LST (where teachers would ideally be taught why other, research-based strategies are more sound) would be assumed to lead to a negative, rather than positive, correlation. That is, in a best-case scenario, as teachers are taught the lack of evidence to justify the implementation of LST (which would be an exposure), they will be less likely to implement LST in their classrooms.

These results could therefore be interpreted as a call to teacher education programs to combat their recent critiques by ensuring that they are preparing their preservice teachers with research-based methods that will ultimately allow them to run more successful classrooms in the future. Undoubtedly, countless teacher educators across the country are working hard to instill sound pedagogical practices in their students. Nevertheless, these results regarding the role of research in teacher education are concerning. Given the limitations of this study, however, it would be improper to assert broad assumptions about the role of research in general and LST specifically within teacher education programs.

Limitations

Clearly more research is needed. Although this study had a sample size that was comparable to those in previous literature, larger, randomized samples would needed before broad conclusions could be justified. Furthermore, though efforts were taken to mitigate selection bias, the overwhelming majority of participants in

this study were from two states (Kansas and Oklahoma). Teachers from these states could differ from a national sample in a variety of ways that a more comprehensive study would reveal.

Greater disaggregation of data would also be helpful. Although this study did not ask teachers to rank the influence that various sources of exposure to LST had on them, much could be learned by future studies that do so. For example, it would be helpful before making policy changes to know if K–12 teachers perceive college professors or professional development to be more influential on their teaching practices.

Additionally, future research that specifically determines preservice teachers' perceptions of LST before and after entry into their teacher education programs might determine the role that teacher education and the apprenticeship of observation have on the continued persistence of LST. Because this study focused only on practicing K–12 teachers, it is unclear if teachers who responded favorably to LST did so because of the apprenticeship of observation, training they received in their teacher education programs, or other factors.

Finally, these results suggest that secondary teachers may be more exposed to LST and more likely to identify with a specific learning style. As no previous study in this literature review has reported these results, they require replication before conclusions can be drawn.

Conclusion

This study aimed to use survey data to determine how K–12 teachers are exposed to LST and what role those exposures have in their classrooms. Survey respondents reported that they are exposed to LST from a variety of sources, including their teacher education programs, professional development, state policy, and other teachers. Data analysis suggested that teachers who are more exposed to LST are more likely to implement it in their own classrooms and that secondary teachers (Grades 7–12) are more exposed to LST and more likely to identify with a specific learning style.

These results first supported previous research that suggested LST's broad popularity among K–12 teachers, within teacher education programs, and within state standards and policy. Additionally, they highlight the need for additional research on when K–12 teachers' support for LST originates. The theory of the apprenticeship of observation would place much of this responsibility on in-service teachers who implement LST and therefore encourage the next generation of teachers to replicate these strategies. In this view, teacher education programs have a minimal impact on teacher education and are unlikely to "convert" preservice teachers toward research-based practices. This conflicts with existing research and minimizes the role of teacher education to an unsettling level. Alternatively, these results can be seen as a call for teacher education programs to ensure that they are exposing

their students to research-based practices in order to neutralize the impact of the apprenticeship of observation (to whatever extent it is occurring in this specific case) and encourage K–12 education along research-based lines.

References

An, D., & Carr, M. (2017). Learning styles theory fails to explain learning and achievement: Recommendations for alternative approaches. *Personality and Individual Differences, 116*, 410–416. https://doi.org/10.1016/j.paid.2017.04.050

Berková, K., Boravková, J., & Frendlovská, D. (2020). Learning style preferences of university and college students. *Problems of Education in the 21st Century, 78*(4), 486–499. https://doi.org/10.33225/pec/20.78.486

Boyd, A., Gorham, J., Justice, J., & Anderson, J. (2013). Examining the apprenticeship of observation with preservice teachers: The practice of blogging to facilitate autobiographical reflection and critique. *Teacher Education Quarterly, 40*(3), 27–49.

Channa, L. (2020). Agentive apprenticeship of observation and English teacher identity: A Pakistani case of learning to teach English. *Canadian Journal of Applied Linguistics, 23*(1), 117–135. https://doi.org/10.37213/cjal.2020.28736

Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). *Learning styles and pedagogy in post-16 learning: A systematic and critical review*. Learning and Skills Research Centre.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Erlbaum.

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

Cook, D., Thompson, W., Kris, G., & Thomas, M. (2009). Lack of interaction between sensing-intuitive learning styles and problem-first versus information-first instruction: A randomized crossover trial. *Advances in Health Sciences Education, 14*(1), 79–90. https://doi.org/10.1007/s10459-007-9089-8

Dandy, K., & Bendersky, K. (2014). Student and faculty beliefs about learning in higher education: Implications for teaching. *International Journal of Teaching and Learning in Higher Education, 26*(3), 358–380.

Darling-Hammond, L. (2016). Research on teaching and teacher education and its influences on policy and practice. *Educational Researcher, 45*(2), 83–91. https://doi.org/10.3102/0013189X16639597

Darling-Hammond, L., Holtzman, D. J., Gatlin, S. J., & Heilig, J. V. (2005). Does teacher preparation matter? Evidence about teacher certification, Teach for America, and teacher effectiveness. *Education Policy Analysis Archives, 13*(42), 1–48. https://doi.org/10.14507/epaa.v13n42.2005

Deale, C. (2019). Learning preferences instead of learning styles: A case study of hospitality management students' perceptions of how they learn best and implications for teaching and learning. *International Journal for the Scholarship of Teaching and Learning, 13*(2), Article 11. https://doi.org/10.20429/ijsotl.2019.130211

English, A. (2020). Why Kansas can not get over the learning styles myth: A document analysis. *The Advocate, 25*(2). https://doi.org/10.4148/2637-4552.1141

English, A. (2021). The prevalence of learning styles theory in Kansas K–12 classrooms: A statistical analysis. *The Advocate, 26*(2). https://doi.org/10.4148/2637-4552.1156

Gelfuso, A. (2018). "But I don't want to tell them the answer": Preservice teachers' (mis) understandings about literacy instruction. *Teaching and Teacher Education, 74*, 10–20. https://doi.org/10.1016/j.tate.2018.04.007

Gudnason, J. (2017). Learning styles in education: A critique. *BU Journal of Graduate Studies in Education, 9*(2), 19–23. https://doi.org/10.1016/j.compedu.2011.01.004

Hsieh, S., Jang, Y., Hwang, G., & Chen, N. (2011). Effects of teaching and learning styles on students' reflection levels for ubiquitous learning. *Computers and Education, 57*, 1194–1201.

Hurlbut, A., & Krutka, D. (2020). Where do we start? Initiating a practice-based teacher education program around high-leverage practices. *Journal of Teacher Education and Educators, 9*(2), 169–199.

Kirschner, P. (2017). Stop propagating the learning styles myth. *Computers and Education, 106*, 166–171. https://doi.org/10.1016/j.compedu.2016.12.006

Knoll, A., Otani, H., Skeel, R., & Van Horn, K. (2017). Learning style, judgements of learning, and learning of verbal and visual information. *British Journal of Psychology, 108*, 544–563. https://doi.org/10.1111/bjop.12214

Kraft, M. (2020). Interpreting effect sizes of education interventions. *Educational Researcher, 49*(4), 241–253. https://doi.org/10.3102/0013189X20912798

Lortie, D. (1975). *Schoolteacher: A sociological study*. University of Chicago Press.

Moy, B., Renshaw, I., Davids, K., & Brymer, E. (2016). Overcoming acculturation: Physical education recruits' experiences of an alternative pedagogical approach to games teaching. *Physical Education and Sport Pedagogy, 21*(4), 386–406. https://doi.org/10.1080/17408989.2015.1017455

Murtaugh, A. L. (2016). *Myth to reality? The pedagogical connection between neuromyths and classroom instruction* [Unpublished doctoral dissertation]. Johns Hopkins University.

Nancekivell, S., Shah, P., & Gelman, S. (2020). Maybe they're born with it, or maybe it's experience: Toward a deeper understanding of the learning style myth. *Journal of Educational Psychology, 112*(2), 221–235. https://doi.org/10.10fi37/edu0000366

Newton, P. (2015). The learning style myth is thriving in higher education. *Frontiers in Psychology, 6*, 1–5. https://doi.org/10.3389/fpsyg.2015.01908

Newton, P., & Miah, M. (2017). Evidence-based higher education—Is the learning style "myth" important? *Frontiers in Psychology, 8*, 1–9. https://doi.org/10.3389/fpsyg.2017.00444

Palis, L. A. (2016). *The prevalence of neuromyths in community college: Examining community college students' beliefs in learning styles and impacts on perceived academic locus of control* (Publication No. 101408150) [Doctoral dissertation, Grand Canyon University]. ProQuest Dissertations and Theses Global.

Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2009). Learning styles: Concepts and evidence. *Psychological Science in the Public Interest, 9*(3), 105–119. https://doi.org/10.1111/j.1539-6053.2009.01038.x

Pomerance, L., Greenberg, J., & Walsh, K. (2016). *Learning about learning: What every new teacher needs to know*. National Council on Teacher Quality.

Richardson, J. (2010). Approaches to studying, conceptions of learning and learning styles in higher education. *Learning and Individual Differences, 21*, 288–293. https://doi.org/10.1016/j.lindif.2010.11.015

Riener, S., & Willingham, D. (2010, August). The myth of learning styles. *Change: The Magazine of Higher Learning, 42*(5), 32–35. https://doi.org/10.1080/00091383.2010.503139

Ruel, E., Wagner, W., & Gillespie, B. (2016). *The practice of survey research*. Sage.

Rust, F. (2010). Shaping new models for teacher education. *Teacher Education Quarterly, 37*(2), 5–18.

Sawilowsky, S., S. (2009). New effect size rules of thumb. *Journal of Modern Applied Statistical Methods, 8*(2), 597–599. https://doi.org/10.22237/jmasm/1257035100

Scott, C. (2010). The enduring appeal of "learning styles." *Australian Council for Educational Research, 54*(1), 5–17. https://doi.org/10.1177/000494411005400102

Seymour, D. J. (2020). *"Even if the research says it doesn't work, it works": Teachers' epistemic beliefs and enactment* [Unpublished doctoral dissertation]. Mississippi State University.

Smagorinsky, P., & Barnes, M. (2014). Revisiting and revising the apprenticeship of observation. *Teacher Education Quarterly, 41*(4), 29–52.

Stapleton, L. (2010). Survey sampling, administration, and analysis. In G. Hancock & R. Mueller (Eds.), *The reviewer's guide to quantitative methods in the social sciences* (pp. 1–13). Routledge.

Tatto, M., Richmond, G., & Andrews, D. (2016). The research we need in teacher education. *Journal of Teacher Education, 67*(4), 247–250. https://doi.org/10.1177/0022487116663694

Westrick, J., & Morris, G. (2016). Teacher education pedagogy: Disrupting the apprenticeship of observation. *Teaching Education, 27*(2), 156–172. https://doi.org/10.1080/10476210.2015.1059413

Willingham, D. T. (2006). Brain-based learning: More fiction than fact. *American Educator, 30*(3), 30–37.

Wininger, S., Redifer, J., Norman, A., & Ryle, M. (2019). Prevalence of learning styles in educational psychology and introduction to education textbooks: A content analysis. *Psychology Learning and Teaching, 18*(3), 221–243. https://doi.org/10.1177/1475725719830301

Zeichner, K. (2012). The turn once again toward practice-based teacher education. *Journal of Teacher Education, 63*(5), 376–382. https://doi.org/10.1177/0022487112445789

Zeichner, K., & Conklin, H. (2016). Beyond knowledge ventriloquism and echo chambers: Raising the quality of the debate in teacher education. *Teachers College Record, 118*(12), 1–38. https://doi.org/10.1177/016146811611801203