The Prevalence of Learning Styles Theory in Kansas K-12 Classrooms: A Statistical Analysis

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Abstract

Despite a lack of empirical evidence to support its existence, previous literature has demonstrated that Learning Styles Theory (LST) enjoys widespread popularity in education, leading many researchers to refer to it as a "myth". This study utilized original survey data to determine Kansas K-12 teachers' level of predilection for LST. Kansas teachers' responses (n=147) were analyzed in comparison to that of non-Kansas teachers (n=93) in seven independent Learning Styles Theory measures. Results suggested that Kansas teachers responded statistically less-favorably to the prospect that LST is best for student learning, less likely to view LST as essential for effective instruction, and less likely to identify with a specific learning style than non-Kansas teachers (p<.05). Despite these positive trends, LST remained firmly supported by Kansas and non-Kansas teachers alike.

Keywords

Learning Styles Theory; Kansas K-12 education; pedagogy; teacher education

The Prevalence of Learning Styles Theory in Kansas K-12 Classrooms: A Statistical Analysis

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Learning Styles Theory (LST) is among the most persistent myths in education (Kirschner; 2017; Nancekivell et al., 2020; Newton, 2015; Riener & Willingham, 2010). For decades, educators have identified students' learning styles and differentiated the instruction they receive accordingly while researchers have been continually pointing out that there is no empirical evidence to justify doing so and some reason to think that differentiating by learning styles may pose real harm to students (Gudnason, 2017; Kirschner, 2017; Newton & Miah, 2017; Pashler et al., 2009; Pomerance et al., 2016; Scott, 2010). It has been demonstrated that LST is widely popular in K-12 education, teacher education programs, and Kansas state educational standards. What is not yet known, however, is what impact LST is having on Kansas classrooms. The purpose of this study is to utilize original survey data to determine the prevalence and predilection of LST among Kansas K-12 teachers in comparison to that of non-Kansas teachers. In solving any problem, it is often necessary to determine the scope of the problem. It is hoped that this data will determine how entrenched LST is in Kansas classrooms and therefore provide valuable information as all stakeholders seek out avenues to progress Kansas's educational system along research-based lines.

Learning Styles Theory

Learning Styles Theory can broadly be defined as the belief that students have individualized modes of learning that can be categorized and that learning will increase if instruction is differentiated based on each student's identified mode of learning. Although such a broad definition leaves researchers in a state of ambiguity, a more precise definition is impossible because there isn't a single LST but rather dozens of competing theories. Coffield, Moseley, Hall, and Ecclestone (2003) found 71 distinct theories and did not claim their review to be exhaustive. Three of the most popular categorizations of students, however, include the VAK (visual, auditory, and kinesthetic), VARK (visual, auditory, reading/writing, and kinesthetic), and concrete/abstract.

One reason LST has remained entrenched in education is that at its most basic and general level, its claims are true. Any experienced teacher knows that students differ from one another and that those differences can make practical differences in how they best learn. Those differences, however, outside of a learning disability, tend to be small and representative of a student's stage in cognitive development rather than categorization of a static learning style (An & Carr, 2017). It seems likely, however, that well-intended teachers often see these individual differences and fall victim to confirmation bias, seeking out evidence of learning styles everywhere they look (Riener & Willingham, 2010). As learning styles have become increasingly ingrained into the fabric of the culture of education, teachers have also likely fallen victim to the Pygmalion or

Rosenthal effect, where higher expectations lead to increased performance (Kirschner, 2017). These phenomena collectively result in LST being persistently popular among teachers.

Despite these difficulties, an abundance of literature has demonstrated that there is no empirical evidence to support LST (Gudnason, 2017; Kirschner, 2017; Newton & Miah, 2017; Pashler et al., 2009; Pomerance et al., 2016; Scott, 2010). In order to justify the widespread adoption of LST, researchers would need to select a large body of students and test them for their learning style. After being divided into learning style groups, at least two subgroups within each learning style group would need to receive instruction rooted in different learning styles. All students would then need to receive the same post-test. Finally, the results would need to demonstrate a crossover interaction, where students from each respective learning style group demonstrate statistically significant improvement in performance when instructed in the learning style they were categorized into (Pashler et al., 2009). While statistically significance is the hallmark of empirical research, even this would not be sufficient. As the widespread adoption of LST would represent an opportunity cost that would require most school districts to abandon other, presumably research-based initiatives, statistically significant results supporting LST would need to demonstrate strong effect sizes and represented in repeated studies. These results, however, have not been forthcoming.

With this lack of empirical evidence in mind, it may be tempting to disregard LST as a harmless fad that will go away on its own accord. After all, its popularity is at least partly rooted in the fact that it appeals to educators' egalitarian views of students' universal ability to learn if proper learning environments are constructed. Nevertheless, there is reason to think that real harm can come from teachers' application of LST in classrooms. First, LST violates two of the primary approaches concerning how the brain retains information. The first is multiple modalities, which contends that information can be stored for longer amounts of time for processing and encoding if it is presented in multiple formats, such as auditory and visual. The second is dual-coding theory, in which information is retained most effectively when it is presented in both verbal and non-verbal format (Wininger et al., 2019). Effective instruction commonly incorporates a variety of delivery methods, rather than a single one that students are supposedly most adapted to. Not only does this strategy of providing multiple delivery methods have more research to support it, it is more practical in real-world classrooms. Even without explicitly designing it as such, nearly every effective lesson one can design utilizes both auditory, visual, and kinesthetic or both concrete and abstract content. If young students are learning about the letter A, they may hear the sound the letter makes, practice writing the letter, go on a scavenger hunt looking for things that start with A, and enjoy a snack of apples. If older students are learning about the historical changes brought on by WWI, they may read Woodrow Wilson's Fourteen Points, complete a 1914/1919 map activity, and conduct a simulation of the Treaty of Versailles. Unlike the prospect of individualizing each student's instruction to a specific learning style, these lesson designs work in real-world classrooms.

Furthermore, there is reason to think that LST could stagnate students' view of their own potential for growth. Students in a LST classroom, where instruction must be delivered in their individualized learning style are in effect being told that their level of performance is dependent on the mode of instruction and therefore outside of their control (Scott, 2010; Wininger et al., 2019). This environment leaves little room for self-efficacy or motivation for personal growth.

In fact, research has demonstrated that while students do differ in their abilities in particular learning modalities, they can also improve in those areas of weakness with strategically-designed instruction (An & Carr, 2017). Given this, avoiding students' areas of comparative weakness seems to be illogically perpetuating the problem.

One LST system categorizes students as either abstract or concrete learners, which is particularly problematic given that research suggests that abstract learners are more advanced while concrete learners are comparative novices and that concrete learners can progress to increasingly abstract concepts as they approach mastery (An & Carr, 2017). Categorizing a learner as a "concrete" learner, and therefore avoiding abstract concepts, it is feared may delay natural cognitive development.

Despite the lack of research to support LST and the potential harm it poses to students, it has been demonstrated that LST is regularly present in teacher education textbooks (Pomerance et al., 2016; Wininger et al., 2019), higher education instruction (Newton, 2015; Newton & Miah, 2017), and Kansas educational standards (English, 2020). Based on this research, it is clear that Kansas teachers have been exposed to LST. It is yet unclear, however, if Kansas teachers are exposed to LST more or less than non-Kansas teachers and what role LST plays in Kansas classrooms.

Methods

The aim of this research was to determine the role of LST in Kansas classrooms. Toward that end, original survey data was collected among K-12 teachers on seven independent LST measures including:
- The degree to which a teacher has been exposed to LST
- If LST is best for student learning
- If implementing LST is essential for effective instruction
- If testing students' learning styles is essential for effective instruction
- If the teacher implements LST in their classroom
- If the teacher believes LST to be a sound, research-based practice
- If the teacher identifies with a specific learning style

Sample

The snowball (or chain-sampling) method, a convenience sampling method where an initial wave of participants is selected and then utilized to target additional participants was selected for this study (Stapleton, 2010). Any convenience sampling method has drawbacks, the foremost of which is that they lack randomization. Additionally, convenience methods' representativeness is put into question because the first wave of participants can strongly dictate the final sample (Ruel, Wagner, & Gillespie, 2016). Finally, in the snowball sampling method, response rate is often impossible to calculate because the number of potential participants that were contacted after the first wave is often unknown.

Despite these drawbacks, the snowball method was chosen in this case to be most feasible. First, doing so mirrors similar LST research previously conducted (Newton & Miah, 2017). Second,

absent of a national database of K-12 teachers, which does not exist, true randomization would be problematic, if not impossible. Finally, it was hoped that the snowball method would take advantage of interpersonal relationships between teachers, as the first wave of contacts would ask subsequent teachers to take the survey, in effect vouching for its legitimacy and thereby increasing overall participation.

One of the best ways to at least partially offset the drawbacks of a snowball sampling method is to recruit as broad and diverse of a first wave of participants as possible. That was done through two methods. First, an email, requesting survey participation was send out to K-12 teachers that I have professional contact with. While the survey was exclusively for K-12 teachers, people likely to have a large number of teacher contacts (administrators, professors of education, superintendents, school psychologists, etc.) were also emailed. This resulted in a total of 226 email requests for participation (155 K-12 teachers and 71 non-teachers). Of the K-12 teachers contacted, all grade levels and forty different schools were represented. Of those forty schools, 32.5% were elementary schools, 17.5% were middle school, and 50% were high school. Among the non-teacher contacts, ten school districts and nine colleges and universities were represented. Unfortunately, all contacts made through this method were from Kansas. While contacts were encouraged to pass the survey on to subsequent waves of participants, it was unlikely that the first wave would have a sufficient number of non-Kansas contacts to allow for a statistical comparison between Kansas and non-Kansas teachers. In order to recruit more broad geographical participation, an additional first wave was recruited through social media. A request for participation was posted on local and national teacher-specific Facebook pages. Like the email request for participation, participants were encouraged to pass the survey on to other teachers they knew.

Instrument

The survey instrument for this study was created on SurveyMethods, a widely recognized digital survey platform. Both email and social media participants were simply provided a digital link directly to the survey. They could in turn distribute the link to other teachers. It was hoped that utilizing a popular survey platform, as opposed to distributing the instrument and asking participants to digitally return it to me, would increase participation by assuring anonymity and making participation more convenient. Both the email subject line and title of the instrument were, "K-12 Teaching Methods Survey". It was decided to avoid the phrase "Learning Styles Theory" in order to prevent a polarization of participation and to mirror recent similar research (Newton & Miah, 2017).

Based on the wide popularity that previous literature has demonstrated that LST enjoys, it is presumed that Kansas teachers have been widely exposed to it. What is yet, unclear, however, is how Kansas teachers' degree of exposure compares to non-Kansas teachers. Additionally, it is unknown how, if at all Kansas teachers' views toward LST differ to non-Kansas teachers. Therefore, the instrument first attempted to quantify the participant's degree of exposure, as measured by the number of different sources they reported being exposed to LST from. While an extensive list of sources that teachers might have been exposed to was created, it was not presumed to be exhaustive. Space was provided to include additional, unforeseen sources. Additionally, a space for "I have never been exposed to this theory" was provided.

Next, participants were asked a series of six Likert-scale questions. Based on the popularity that previous literature demonstrated LST to have, was decided to utilize a six-point Likert-scale (strongly disagree-strongly agree) and remove the neutral response. While the weakness of such a scale is that it forces participants to take a position on a question they may be ill-informed to answer, it was assumed that the overwhelming majority of teachers would be familiar enough with LST to respond; thus, resulting in more useful data. As a precaution against the small number of teachers who may be unfamiliar with LST and decide to go ahead with completing the survey, a short description of LST was provided to act as a baseline knowledge for all participants.

Each of the Likert-scale questions were aimed at measuring a distinct manifestation of LST and will be briefly discussed below:

Students learn best when information is presented to them in their individualized learning style.

While K-12 teachers work in the practical world, it first seemed necessary to measure if teachers believe LST to be effective in a theoretical sense. That is, in a pedagogical vacuum, void of practical restraints, is it best to differentiate instruction to students' learning styles.

Differentiating instruction based on individual students' learning styles is an essential part of effective instruction.

Unlike the first measure, this question was aimed at being much more practical. While any number of educational strategies might be theoretically effective, they may not be best practice in a real-world classroom.

Testing students for their individual learning style is an essential part of effective instruction.

LST tests have been demonstrated to be unreliable and invalid (Kirschner, 2017). Some teachers may alternatively rely on student's self-reported preference for learning format despite the fact that self-reported learning preference has been demonstrated to be unreliable in predicting student performance (An & Carr, 2017; Knoll et al., 2017; Nancekivell et al., 2020). Still, either of these methods, as unscientific as they might be, are a systematic means of categorizing students, without which LST advocates are left to simply speculate (or worse yet, stereotype) as to how a student best learns. Such practices are clearly abhorrent. It was therefore deemed useful to determine if Kansas teachers are more or less prone to test students' learning styles. If, for example, the results of this study suggested that Kansas teachers were highly favorable to LST but not to testing, it would suggest that LST poses even more of a threat to Kansas classrooms than is currently understood because Kansas teachers are categorizing students by no clear systematic method.

Differentiating instruction based on individual students' learning styles is central to my classroom instruction.

There may be a variety of reasons a teacher believes a learning strategy to be effective and fails to implement it. For example, the teacher may believe another competing strategy to be even more effective. Conversely, there may be a variety of reasons that a teacher believes a strategy to be ineffective and still implements it. For example, they may feel pressure from administration or state standards. Consequentially, this measure aimed to determine if teachers were actively implementing LST in their classrooms.

Differentiating instruction based on individual students' learning styles is a sound, research-based practice in education.

While previous literature has failed to demonstrate any scientific rationale for implementing LST and potential risks in doing so, a weakness in our educational system is that such research is often not targeted toward K-12 teachers. Adding to the complexity for teachers is the abundance of non-scientific testing materials and literature which anecdotally support LST. Such an environment has undoubtedly left K-12 teachers uncertain of what to believe. Consequentially, this measure aimed to determine if teachers believed LST to be supported by empirical research.

I personally identify with a specific learning style.

While previous literature has demonstrated that the majority of college students identify with a specific learning style (Dandy and Bendersky 2014), little is known about K-12 teachers' identification with learning styles. If, for example, if it could be demonstrated that Kansas teachers tend to identify with learning style at a significantly-greater rate that non-Kansas teachers, it might provide insight regarding the message that needs to be delivered to Kansas teachers and how we can improve Kansas's educational system along research-based lines.

Once these LST measures were decided upon and a draft version of the survey instrument was created, it was piloted to a panel of six teachers, professors, and school administrators. Feedback was given regarding potential sources of exposure to LST and precision of verbiage to clarify the instrument. After minor adjustments were made to the survey, email and social media requests for participation were immediately sent out.

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Results

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The survey instrument was left active for six weeks. While leaving it active for a longer duration may have produced a slightly larger sample, at the time of its termination, there had been no participation for several days. Additionally, the sample size (n=245) and duration was comparable to previous, similar research (Dandy & Bendersky, 2014, Newton & Miah, 2017, Palis, 2016). Of the original sample, five responses were thrown out. Of those, three responded that they were not K-12 teachers. Two additional participants reported multiple exposures to LST as well as "I have never been exposed to this theory". Because it was unclear what to make of these confounding responses, it was deemed best to remove them from the sample. The final sample size (n=240) was still deemed to be sufficient and comparable to previous research.

As expected, Kansas was well-represented within the sample (n=147). Oklahoma (n=40), North Dakota (n=9), California (n=9), and Ohio (n=8) saw the largest non-Kansas totals. Additional states that were represented included (in order of response size): Missouri, Idaho, Michigan, Texas, Arizona, Colorado, Hawaii, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Minnesota, New Jersey, New Mexico, Pennsylvania, Utah, Virginia, and Wisconsin.

Descriptive statistics suggested that Kansas teachers are widely exposed to LST. 100% of Kansas teachers reported that they had be exposed to LST before, with a mean of 5.67 sources of exposure (SD = 2.25). The most common sources of exposure to LST include professional development (n=135), college professor instruction (n=120), and observations/discussions with other teachers (n=107). See Figure One for a complete representation of the sample's exposure to LST. Additionally, the Likert-scale questions of LST measures supported previous literature in that Kansas teachers were overwhelmingly supportive of LST. For example, 91.84% of participants responded "slightly agree", "agree", or "strongly agree" to the statement "Students learn best when information is presented to them in their individualized learning style" (n=135). See Figure Two for descriptive data for each of the Likert-scale questions for the six LST measures.

Table 1

Kansas Teachers' Exposures to Learning Styles Theory

Reported sources of exposure to Learning Styles Theory	n	Percentage of respondents that reported this exposure
Professional development	135	91.84
College professor instruction	120	81.63
Observations/discussions with other teachers	107	72.79
College textbooks	106	72.11
Independent research	76	51.70
Administration	76	51.70
State standards/policy	69	46.94
Parents of students	54	36.73
Social media	48	32.65
Popular Culture	38	25.85
I have never been exposed to this theory	0	0.00
Other	5	3.40

Table 2

Kansas Teachers' Responses to LST Measures

LST Measure	n	Mean (out of 6.00)	St. Dev.
Best for learning	147	4.93	1.17
Essential for effective instruction	147	4.84	1.12
Testing	147	4.37	1.13
Implementation	147	4.33	1.23
Research-based practice	147	4.65	1.23
Identification with a learning style	147	4.49	1.21

For greater understanding of how these descriptive results compare to non-Kansas teachers, an independent samples t-test was conducted between Kansas teachers (n=147) and non-Kansas teachers (n=93) to determine if Kansas teachers' degree of exposure to LST (M=5.67, SD=2.25) was significantly different from non-Kansas teachers (M=6.06, SD=2.07). Despite the fact that Kansas teachers reported less sources of exposure to LST, significant results were not found at the $p < .05$ level, t(238) = -1.35, p=1.78.

In order to gain a greater understanding of how Kansas teacher's perception of LST compared to that of non-Kansas teachers, an independent samples t-test was conducted between Kansas teachers (n=147) and non-Kansas teachers (n=93) in each of the six LST measures (best for learning, essential for effective instruction, testing, implementation, research-based practice, and identification with a learning style). Although Kansas teachers responded with a mean score lower in all six of these measures, only three were found to be statistically significant at the $p < .05$ level: best for learning, essential for effective instruction, and identification with a learning style. In calculating effect sizes, Hedges g effect size was chosen due to the presence of unequal sample sizes. All three statistically significant measures (best for learning, essential for effective instruction, and identification with a learning style) had a Hedges' g effect size of .30, which can broadly be interpreted as a small effect (Cohen, 1988; Sawilowsky, 2009). See Table Three for the independent samples t-test results.

Table 3

Independent samples t-test results comparing Kansas to non-Kansas teachers

LST Measurement	n		Mean (out of 6.00)		Std. Deviation		t	Sig. (2-tailed)	Hedges' g effect size
	Kansas	Non-Kansas	Kansas	Non-Kansas	Kansas	Non-Kansas			
Best for learning	147	93	4.93	5.25	1.17	.87	-2.23	.027*	.30
Essential for effective instruction	147	93	4.84	5.15	1.12	.93	-2.20	.029*	.30
Testing	147	91	4.37	4.53	1.13	1.19	-1.00	.319	.14
Implementation	147	92	4.33	4.62	1.23	1.26	-1.74	.084	.23
Research-based practice	147	92	4.65	4.88	1.23	1.10	-1.45	.148	.19
Identification with a specific learning style	147	92	4.49	4.84	1.21	1.13	-2.22	.028*	.30

*p<0.05

Discussion and Conclusion

It is difficult to determine how these results should be interpreted as an assessment of Kansas educators' exposure and adherence to LST. In summation, Kansas teachers reported less sources of exposure to LST, but the results were not statistically significant. Kansas teachers responded less favorably to all six LST measures, but only three were statistically significant. All three statistically significant results produced a small effect size. These results suggest that Kansas teachers are less favorable to the prospect that LST is best for student learning, less likely to view LST as essential for effective instruction, and less likely to identify with a specific learning style than non-Kansas teachers. As LST has widely been called a "myth" (Kirschner; 2017; Nancekivell et al., 2020; Newton, 2015; Riener & Willingham, 2010) and perhaps more colorfully, an "emperor without clothes" (Kirschner, 2017), this is certainly a trend in the correct direction for Kansas educators. We want Kansas's educational system to be in a position of leadership in relation to other states, and had these results been stronger, perhaps it could be concluded that widescale reform to move Kansas teachers away from LST is not necessary.

Nevertheless, these results suggest that Kansas teachers remain firmly supportive of LST. More than 90 percent of Kansas teachers in this sample responded favorably to the prospect that LST was ideal for learning. If, for example, data were produced that debunked myths such as "flat-earth theory" or that vaccinations cause autism enjoyed similar support among Kansas teachers, it would be viewed as a condemnation of the legitimacy of Kansas's educational system, regardless of how it compared to other states. While LST may not be as egregious the above examples, the fact remains that our teachers strongly support an educational theory that current literature suggests is at best a waste of time and resources and at worst, a means of limiting cognitive growth and placing stereotypical labels on our children. Such a threat cannot and should not be ignored.

Adding to the problematic nature of these results is that fact that, speaking as a teacher educator, we have done this to ourselves. The most common sources with which teachers reported here to have been exposed to LST through were: professional development, college professor instruction, college textbooks, and other teachers. These are the very tools we have designed to

empower teachers with effective, research-based strategies. Based on these results, (specific to LST) this does not seem to be happening. It would be much more appealing to see that teachers are largely being exposed to this debunked strategy through social media or popular culture. Teacher educators would be free of condemnation, blame, or responsibility, as this could be viewed as a wider, societal problem. This, however, is not the case. Instead, these results are evidence that widespread reform of the information teachers and pre-service teachers are being given needs to happen.

What then should be done? First, more research must be done. This study, with a relatively small sample size and a convenience sample clearly has its limitations. Similar research, aimed at determining to what extent Kansas teachers implement LST, with larger sample sizes and randomized sampling should be conducted and would more accurately be able to assess the scope of the problem.

Furthermore, while these results suggest that Kansas teachers firmly support LST, little is known about how and why Kansas teachers implement LST and what impact these practices are having on Kansas students. Kansas K-12 teachers that implement LST (which based on this research would be easy to find) could be recruited into participation in case study or grounded theory research. Interview, observation, and artifact data would all be useful toward these ends. These results may further assess the level of threat that LST poses to Kansas's educational system and provide insight as to how researchers, teacher educators, administrators, and state representatives can best progress Kansas's classrooms along research-based lines.

Finally, survey research of Kansas administrators is needed to demonstrate what teaching strategies Kansas teachers are being taught through professional development and who is conducting the training. More than 91% of Kansas teachers surveyed here reported that they had been exposed to LST through professional development, more than any other category of source. If this training is largely being conducted from sources within the schools, such as from administrators, curriculum technologists, or lead teachers, they need to be provided research-based strategies to teach. If outside educational consultants are largely responsible for this training, those contracts should be terminated immediately.

The call for future research, however, should not be misconstrued as inconclusiveness or a justification for inaction. Kansas teachers and pre-service teachers need to be instructed along research-based lines, and these results suggest that (specific to LST) they currently are not. While there are certainly advantages to our relatively decentralized educational system, it can at times stagnate innovation due to the multitude of stakeholders that are needed to be coordinated to bring about any widespread change. Top-down reform efforts are needed, but the pace of such change would likely be generational, as veteran teachers, previously instructed in LST and hesitant to abandon it, eventually leave the profession. In addition to any efforts taken on by our state-level leadership, individual teacher educators, administrators, professional development consultants, mentor teachers, department chairs, and all others with an influence in teacher education must take on the responsibility of staying abreast to current research and adjusting their instruction accordingly.

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