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A Proposed Typology of Improvement Science in State ESSA Plans

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Abstract: This study aims to illustrate how states include an improvement science approach to educational improvement in their Every Student Succeeds Act (ESSA) state plan. Through a qualitative content analysis of 52 state ESSA plans, we propose an introductory organizational typology to categorize states based on their explicit inclusion of improvement science-related terminology in their plan. Our typology included three categories: Non-Presence, Emergent Presence, and Presence. Our findings suggest that states varied in how much improvement science language was included in their state plans. Findings also show there is little evidence of geographic diffusion of improvement science policy. This research connects a practice to policy gap highlighting educational stakeholders including educational professionals are increasingly using improvement science to address pressing problems of practice in their contexts in service of making the educational system more equitable; however, improvement science language is rarely included through the formalized state ESSA plans.

Keywords: education policy; educational improvement; ESSA; improvement science

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Una tipología propuesta del enfoque de los estados en la mejora de la ciencia en planes ESSA
Resumen: Este estudio tiene como objetivo ilustrar cómo los estados incluyen un enfoque científico de mejora para la mejora educativa en su plan estatal de la *Every Student Succeeds Act* (ESSA). A través de un análisis de contenido cualitativo de 52 planes ESSA estatales, proponemos una tipología organizacional introductoria para clasificar los estados en función de su inclusión explícita de terminología relacionada con la ciencia de la mejora en su plan. Nuestra tipología incluía tres categorías: No Presencia, Presencia Emergente y Presencia. Nuestros hallazgos sugieren que los estados variaron en la cantidad de mejoras que se incluyeron en el lenguaje científico en sus planes estatales. Los hallazgos también muestran que hay poca evidencia de difusión geográfica de la política científica de mejora. Esta investigación destaca una brecha entre la práctica y la política, ya que las partes interesadas en la educación, incluidos los profesionales de la educación, utilizan cada vez más la ciencia de la mejora para abordar problemas apremiantes de la práctica en sus contextos al servicio de hacer que el sistema educativo sea más equitativo; sin embargo, el lenguaje científico de mejora rara vez se incluye a través de los planes ESSA estatales formalizados.
Palabras-clave: política educativa; mejora educativa; ESSA; ciencia de la mejora

Uma tipologia proposta de foco dos estados na ciência da melhoria em planos de ESSA
Resumo: Este estudo tem como objetivo ilustrar como os estados incluem uma abordagem científica de melhoria para a melhoria educacional em seu plano estadual *Every Student Succeeds Act* (ESSA). Por meio de uma análise de conteúdo qualitativa de 52 planos estaduais da ESSA, propomos uma tipologia organizacional introdutória para categorizar os estados com base em sua inclusão explícita de terminologia relacionada à ciência de melhoria em seu plano. Nossa tipologia incluiu três categorias: Não Presença, Presença Emergente e Presença. Nossas descobertas sugerem que os estados variaram em quanto a linguagem científica de melhoria foi incluída em seus planos estaduais. Os resultados também mostram que há pouca evidência de difusão geográfica da política de ciência de melhoria. Esta pesquisa destaca uma lacuna entre a prática e a política, uma vez que as partes interessadas na educação, incluindo profissionais da educação, estão usando cada vez mais a ciência da melhoria para abordar problemas prementes da prática em seus contextos a serviço de tornar o sistema educacional mais equitativo; no entanto, a linguagem científica de melhoria raramente é incluída nos planos estatais formalizados da ESSA.
Palavras-chave: política educacional; melhoria educacional; ESSA; ciência da melhoria

A Proposed Typology of States' Improvement Science Focus in their State ESSA Plans

Improvement science is an approach aimed at solving complex and systematic problems of practice. The use of improvement science is gaining momentum in the field of education, and educational stakeholders are accepting the approach as a viable and effective way to address persistent challenges. Three questions ground an improvement science approach: (a) What is the specific problem I am trying to solve? (b) What change might I introduce to solve it (and why)? and How will I know that change is an improvement? (Bryk et al., 2015, p. 9; Hinnant-Crawford, 2020, p. 1). These questions drive an examination of the system that is leading to a problem in order to

design and conduct iterative testing cycles of appropriate change ideas for the systematic scaling of improvement. Improvement science demonstrates promise in shifting education reform away from the tendency to implement practices that ultimately fall flat and are subsequently abandoned (Bryk et al., 2015; Rohanna, 2017).

Beyond its promise in efficiency, improvement science yields promising advances toward educational equity. Oftentimes, inequities in schooling are embedded in the systems within the school; improvement science focuses on seeing the system which produces the results (Bryk et al., 2015). This leads to opportunities for improvement to help dismantle processes which perpetuate inequitable school environments. For instance, Bryk's (2020) work details the success of the Fresno Unified School District in increasing college attainment for those students who hold underrepresented identities. In this case, administration was able to identify where attrition was occurring in the system. The underlying causes were identified through the team's use of improvement science—causes that were often missed in the past when more traditional approaches to reform were used. Evidence from settings like Fresno adds credence to the relevant contribution of this study as one of our goals is to better understand the use of improvement science in education policy since it offers an approach to work toward educational equity and improvement.

Because research and reports suggest there is an increased number of educational organizations using improvement science (LeMahieu et al., 2015), we are interested in examining if a formalized policy conversation was present in tandem with practice. We aimed to learn the degree to which states promoted an improvement science approach to educational improvement in formalized education policy. We qualitatively examined the federally-approved plans that all 50 states, Washington D.C., and Puerto Rico ($N = 52$) submitted to the United States Department of Education (U.S. DOE) in compliance with the *Every Student Succeeds Act* (ESSA) (2015). This study aims to answer: (1) To what degree do states' ESSA plans show a presence of improvement science language? (2) What evidence of policy diffusion of improvement science exists?

This examination is part of a larger study that analyzes ESSA state plans to discover how and to what extent continuous improvement and improvement science are present and emphasized in federal and state policy. Our first inquiry examined the U.S. Department of Education-provided policy tools given to states: The Consolidated Plan State Template and the Peer Review Criteria to learn how and if federal policy tools encourage state-level policymakers to use continuous improvement and improvement science and a guiding framework for educational improvement (Osworth & Cunningham, in press). Our second inquiry revealed broad themes in how states conceptualized and included continuous improvement and improvement science (Cunningham & Osworth, manuscript submitted for publication). In this study, we further examine states' improvement science terminology to organize the degree to which improvement science is articulated. Using a similar approach to Fuller and colleagues (2017), we offer an organizational typology to categorize states based on their explicit inclusion of improvement science-related language in their state ESSA plan; we utilize three categories for interpretation and organization: Presence, Emergent Presence, Non-Presence. Our typology approach allowed us to examine states' inclusion of improvement science, while also signaling potential trends. In the remainder of this paper, we first offer a description of the conceptual framework that helped guide our process. Then, we review literature on the topics of typologies in education, policy diffusion, and improvement science in education. Following, we describe our methods for gathering and coding the state plans and the approach to typology development. In our findings, we suggest a working categorization of states based on the degree of improvement science terminology included in their plans. Finally, we conclude with implications related to practice, research, and policy.

Conceptual Framework

Bryk (2009) and Park and colleagues (2013) describe improvement as efforts focused on: (a) processes, (b) part of regular practice, and (c) interrogating the system(s) where the improvement areas exist. Park and colleagues (2013) argue:

> Quality improvement and continuous improvement paints a portrait of a rigorous and exacting practice that is not all that common in educational organizations, and does not correlate highly with much of what currently passes as 'continuous improvement' in education. For example...Strategic plans fall short because they are nearly universally focused on measuring system outcomes, and spend little time identifying processes, devising means to measure them, or attempting to situate outcomes and processes within a system. (p. 6)

Their descriptions capture the importance of not limiting improvement to outcome indicators, but to also recognize the processes and systems that lead to outcomes, as the aforementioned Fresno Unified School District did in their improvement work (Bryk, 2020). We argue it is important to highlight what is and is not included in this definition of continuous improvement: that continuous improvement encompasses more than outcome data (e.g., student assessment data); to also include the practices, processes, and systems that lead to the observed outcome data and how those components influence outcomes.

The use of improvement science in education is documented to lead to effective and systematic changes. Bryk and colleagues (2015) provided six principles that make up the improvement paradigm: 1) be problem-focused and user-focused, 2) attend to variability, 3) see the system, 4) embrace measurement, 5) learn through disciplined inquiry, and 6) learn across improvement networks (p. 9). We highlight three marquee actions or structures that improvement science typically includes (see Bryk et al., 2015; Hannan et al., 2015; Hinnant-Crawford, 2020). First, improvers dedicate time to understand the problem of practice and the system where the improvement area is situated with particular attention to discovering the root cause(s) of the problem. Understanding the problem and its root causes is captured through strategies such as conducting empathy interviews with stakeholders, reviewing literature, fishbone diagramming, and gathering local quantitative and qualitative data (Bryk et al., 2015; Hinnant-Crawford, 2020).

Second, is the inclusion of iterative, small-scale testing. The plan-do-study-act (PDSA) cycle is often the strategy improvers use to carry out the iterative, small-scale tests and helps organize what is learned about change ideas they are trying (Hinnant-Crawford, 2020). When engaged in PDSA cycles, improvers plan something to change in the system (P), implement (i.e., do) the change planned for (D), study what happened in the system from implementing the change, including comparing what the improver thought was going to happen (i.e., their change hypothesis) to what actually happened (S), and then act where improvers decide if they are going to adopt the change and scale it, adapt the change idea and re-test, or abandon the change to then try a different change idea (A). As Langley and colleagues (2009) noted, "the PDSA Cycle is a vehicle for learning and action," (p. 99). The PDSA, as a backbone of the improvement paradigm (Bryk, 2020), helps to distinguish education reform from traditional approaches which may result in abandoning a reform (Bryk et al., 2015) instead of a systematic testing, analysis, adjusting, and testing again that includes the testing of scaling the change idea in varied contexts.

A third marquee component of an improvement science approach is the use of networked improvement communities (NICs; Bryk, 2020). A NIC is seen as a vital way to improve and scale improvements across multiple contexts and systems (Bryk et al., 2015). Bryk and colleagues (2015)

explain that a NIC serves as a structure for improvers to capture individual and organizational learning. They write that, "when many more individuals, operating across diverse contexts, are drawn together in a shared learning enterprise, the capacity grows exponentially" (p. 143). The word "networked" connotes the connection of professionals across contexts to collaborate and learn from others who are addressing the same problem of practice. This level of networked learning provides an important opportunity for improvement teams operating in different schools or organizations to learn from one another, building upon existing knowledge and expertise, while also being astutely aware of the contextual differences and how those could impact implementation of an intervention at scale (Hinnant-Crawford, 2020).

The six principles of improvement along with the three specific improvement science approaches described above, shape the conceptualization of our introductory typology described in our findings. While some terminology, such as assessment, standards, or testing can be applicable or connected to several fields. Other terms, especially when included simultaneously, indicate field-specificity. When nuanced field-specific terminology is present in language, it offers a proxy of that specific field. For instance, terms such as centric relation, TMJ, and occlusal would signal a focus on the field of dentistry. In a similar way, terms such as root cause analysis, iterative testing, and NICs indicate that improvement science is the focus area. These marquee areas of the improvement science paradigm are our indicators for organizing Consolidated State Plans (i.e., state plans or plans) in the typology and help us to both better understand how improvement science is being used in the implementation of ESSA and also offer a starting point to engage with the data.

Literature Review

The U.S. education policy ESSA was passed in 2015. Part of the policy required all states, Washington D.C., and Puerto Rico to develop and submit their state education plans for federal approval. States were provided a template from the U.S. DOE that guided state-level policy makers in what to include and prioritize in their plans. Likely due to the relative recency of ESSA adoption, there is limited research available on how states developed and implemented ESSA plans. In one study, Portz and Beauchamp (2020) examined state accountability systems under ESSA by conducting a comparative analysis of state plans. They established three clusters that organized state accountability systems based on their similarities. Hackman and colleagues (2019) examined state plans to determine the presence of career and college readiness in implementation of ESSA. They noted that the template heavily dictated where state education agencies (SEAs) placed value in their state plans. Fuller and colleagues (2017) concluded from their analysis that there was not enough of an emphasis in states' plans on addressing the inequitable distribution of principles nor the effect that has on teacher turnover. In related studies (Cunningham & Osworth, manuscript submitted for publication; Osworth & Cunningham, in press), findings suggested that while many state plans were formulaic and followed the requirements in the template closely, in the aggregate, the resulting plans prioritized accountability for outcomes and less so on supporting the improvement of the system that led to the outcomes.

Typology in Education

Typologies are often effective organizational and explanatory tools to better understand phenomena within policy (Smith, 2002). Typologies are utilized in a variety of educational areas to provide greater context to the problem on which the study is focused. For example, studies have utilized typology for understanding teacher practice and preparation like Jay and Johnson's (2002) utilization of a typology of three dimensions to better capture teacher reflective practices within a

preparation program. Urick and Bowers (2014), through their use of typology from a quantitative analysis, garnered a deeper understanding of principal and school contexts that result in specific principal leadership styles. Arneback and Jämte (2021) developed a typology that identified ways teachers in Sweden engaged in anti-racist education, focusing on both systematic and individualized racism in educational and broader social contexts. In practical utility, typologies helped research further refine preparation programs (Jay & Johnson, 2002) as well as inform teacher practice to tackle societal problems (Arneback & Jämte, 2021).

The use of typology can expand beyond practice to understand political movement within education. Typology provided an effective understanding of the roles of policy actors in helping to spread a school reform movement (Scott & DiMartino, 2009) as well as revealing the disconnect that may exist between a policy and its implementation (Brower et al., 2017). Typology has been specifically applied to education policy and programs to study teacher staffing (Rice et al., 2009), accountability and monitoring systems (Richards, 1988), and higher education enrollment programs (Perna et al., 2008). In their study on teacher retention and staffing, Rice and colleagues (2009) presented a three-dimensional typology centered on policy in various contexts (federal, state, and district), categorized the policy approach, and applied it to the problems of practice facing teacher staffing. Perna and colleagues (2008) similarly utilized a complex multidimensional tool to categorize programs with raw and weighted scores. In utilizing a multidimensional approach, Rice and colleagues (2009) found that "policy makers across levels of the education system simultaneously draw on policies from these categories, resulting in complex sets of policy 'packages'" (pp. 517-518). In contrast, Richards's (1988) typology contained a single dimension which sorted state educational monitoring systems into one of three categories.

Typology has functioned as a vital way to organize the complex and varied pieces of education policy (Perna et al., 2008; Rice et al., 2009; Richards, 1988). Each typology developed and subsequently employed helped researchers better understand their data since the typologies revealed a potential to make policy adoption recommendations for states (Richards, 1988) or to allow policy actors to better understand how different policy approaches tackle facets of a larger policy problem (Rice et al., 2009). While typologies are indeed limited and may not provide an exhaustive picture, they can be effective tools in bridging the gap between research and future policy creation, adoption, implementation, and evaluation (Smith, 2002).

Policy Diffusion

Policy diffusion refers to how policies are spread and adopted across contexts. Gray (1973) wrote that, "observers of state governments point out that decision makers emulate or take cues from legislation passed by other states," (p. 1176). This aligns with Shipan and Volden's (2012) assertions that similar states often share similar policies. These states may or may not be geographically close to each other. Gray (1973) also explained that,

> There are compelling reasons, however, why every state will not be susceptible to adopting a particular law: Hard-to-amend limitations in the state's constitution or values of the political subculture might cause a state's leaders to be practically immune to diffusion from interaction. (p. 1176)

Gray (1973) noted that as policy is adopted by more states, increased pressure on non-conforming states to adopt a policy results, this interaction effect can be seen in education policy across state lines. This phenomenon was observed by Cohen-Vogel and Ingle (2007), where policy actors felt pressure from voters who showcased favorable responses to merit-based aid policies in neighboring states. Shipan and Volden (2012) explained that diffusion is not always effective because it may

result in policy imitation that lacks nuance compared to the policy innovation in the original jurisdiction. Therefore, the policy may be reflected in similar language but dissimilar results.

Policy diffusion is not as simple as the proximity to neighbors. While there may be regional trends of policy adoption (Cohen-Vogel & Ingle, 2007; Gray 1973; Ingle et al., 2007), Shipan and Volden (2012) illustrated that when neighboring states do not exhibit similar policy environments this adoption may not occur, and there are multiple factors that play a role in adoption of policy innovation across various state contexts (Kingdon, 2003).

Improvement Science and Education

The use of improvement science in educational practice is relatively new. A notable example comes from the Building Teacher Effectiveness Network (BTEN), which utilized improvement science frameworks to better support new teachers in schools to increase teacher retention (Bryk et al., 2015). Hannan and colleagues (2015) found that two participating schools exhibited effective usage of iterative cycles. The authors illustrated how these well documented PDSA cycles of inquiry were essential to, "the learning across the network," (p. 503). The BTEN is also referenced as a case in Russell and colleagues' research (2017) that examined how the NIC structure supports improvement. Russell and colleagues (2017) described the use of NICs in other educational contexts, such as the Community College Pathways (CCP) program where the NIC was vital in tackling the low success rate in developmental math courses that were impacting the overall graduation rates of students. Bryk (2020) illustrated the use of improvement science in the Fresno Unified School District where the approach led to the identification of the primary drivers that led to undermatching for college bound high school students.

Improvement science in educational practice is still in a nascent stage with limited literature. Our study of how improvement science connects to policy or policy implementation helps contribute to this growing body of research. Lewis (2015) called for more research centering on the promise of improvement science, and while this call is being addressed in studies of educational practice, it remains absent from educational policy studies.

Methods

This paper is part of a larger study that analyzes ESSA state plans to examine how and to what extent improvement science, a type of continuous improvement, is present and emphasized in federal and state policy. A qualitative analysis method guided our data collection and analysis (Merriam & Tisdell, 2016; Saldaña, 2016; Yin, 2011). We utilized publicly available policy documents developed by each state, Washington D.C., and Puerto Rico. Each state outlines their ESSA implementation plan for the state level. A benefit to using existing documents—such as ESSA state plans—as a source is that the data are "nonreactive—that is, unaffected by the research process. They are a product of the context in which they were produced and therefore grounded in the real world" (Merriam & Tisdell, 2016, p. 183). Further, in a content analysis of existing policy documents, the data sources are fixed and not shaped or influenced by the researcher (Merriam & Tisdell, 2016).

Data Sources

ESSA required each SEA to submit a state plan for review and federal approval. Plans describe how SEAs will meet the requirements of ESSA based on the Revised State Template for the Consolidated State Plan provided by the U.S. Department of Education, reviewed by peer reviewers using a consistent feedback rubric, and then granted approval by the U.S. DOE after

criteria are sufficiently addressed. Every state went through the same process, which creates consistency across each and allows for our systematic comparison. We collected 52 publicly available state plans (i.e., 50 states, Washington, D.C., and Puerto Rico) from the U.S. DOE or states' departments of education websites and uploaded PDFs of each into the qualitative analysis software NVivo 12 to code.

Analysis and Categorization

The purpose of our overarching study is to analyze and categorize state policies' inclusion of improvement science in their plans. We used what Saldaña (2016) describes as "protocol coding" which uses a "pre-established" system (p. 175). We derived an a priori list of 80 key terms related to continuous improvement and improvement science. Two seminal improvement science texts guided the term selection: Hinnant-Crawford's (2020) book, *Improvement Science in Education: A Primer* and Langley and colleague's 2009 book, *The Improvement Guide*. Key improvement science-specific terms that the two texts bolded or defined were included in our a priori coding list. The terms helped signal a presence of improvement science in state plans.

We first coded five state plans: Illinois, Massachusetts, New Mexico, South Carolina, and Washington. Each state represented different geographic regions in the United States (i.e., Midwest, Northeast, Northwest, Southwest, and Southeast). In addition, the states represent different levels of "rankings" of education across states (U.S. News and World Report, n.d.) and/or authors' familiarity with the state policies. During this first phase, we coded, discussed in depth to reach consensus in code determinations, and refined our coding to establish consistency among the researchers. The plans were then divided between us and coded in NVivo 12. Throughout coding, we met regularly to maintain consistency and to capture emergent themes.

Coding Interpretation and Organization: Three Categories

Building upon the (1) literature and evidence from our prior studies and (2) the principles of improvement (Bryk et al., 2015) with specific attention given to marquee improvement elements (i.e., root cause analysis, iterative cycles, and NICs), we noticed different amounts of improvement science terminology presence in plans on which to evaluate and organize states. Three categories were constructed by identifying a representative or "ideal" type for each category (Stapley et al., 2022). Ideal-typology allows for the presentation of comprehensive qualitative data (e.g., 52 state plans) to distill and organize findings based on certain differences and similarities into a set of categories (Halkier, 2011). For this exploratory typology, we offer three categories: (1) *Non-Presence* States in this category submitted ESSA plans that do not include terminology specific to improvement science. States may use the term "continuous improvement", but the use is interpreted to be focused directly on results (e.g., increased test scores is the outcome) and does not include a focus on process or systems leading to improvement. (2) *Emergent Presence*: States in this category submitted ESSA plans that include language specific to improvement science. References to improvement illustrate a limited or developing conceptualization of improvement science as an approach to improving and/or the references to improvement science are seemingly tangential to the core operations espoused in the plan. (3) *Presence:* States in this category submitted ESSA plans that include language specific to cornerstones of improvement (e.g., root causes, PDSA, NIC) and are clearly connected to improvement science. Improvement, in alignment with our utilized conceptual framework, is present in multiple places throughout the plan and demonstrates encouragement for using improvement science as a framework for educational improvement.

Following coding, states were categorized within a matrix in Microsoft Excel. The matrix included states' geographic regions according to the U.S. Census bureau, an initial determination of

presence (i.e., typology categorization). Rationales with evidence from plans to support the typology categorization were identified. Each state's categorization was not finalized until a detailed conversation of their evidence and placement relative to the other state plans took place. We clarified categorization rationale criteria and came to consensus on the categorization for each plan.

Findings

The qualitative content analysis of the plans yielded several results related to the development of the typology itself and to what degree states included improvement science terminology—with particular attention given to root cause analysis, iterative cycles, and networked improvement communities. While we note that policy diffusion can be geographic or not, the scope of our analysis can only suggest evidence related to geographic diffusion.

When coding the plans, we observed that states demonstrated varying degrees to which they evidenced inclusion of continuous improvement in line with improvement science scholars' definition (i.e., Bryk, 2009; Hinnant-Crawford, 2020; Langley et al., 2009; Park et al., 2013). Using our a priori codes, we were able to compare policies between and among states, noticing how some states included and/or framed improvement terms in certain ways while others included and/or framed improvement in different ways and to different degrees. These differences were noted, and categorization began into an organizational schema (i.e., typology) to capture and categorize states' levels of evidential commitment of improvement. Smith (2002) argued, "typologies create useful heuristics and provide a systematic basis for comparison," (p. 381). We utilized what Schwandt (2015) described as an analyst constructed typology which relies, "on terms the analyst chooses to make explicit patterns that appear to exist," (p. 312). This systematic approach allows for analysis along with increased confidence in the comparison.

This study aims to answer the following research questions: (1) To what degree do states' ESSA plans show a presence of improvement science language? (2) What evidence of policy diffusion of improvement science exists? We organized the states into the three categories that capture the degree to which states' policy demonstrated a presence of improvement science language. This approach offered a tangible framework and visual depiction from which to notice further policy trends (e.g., regional characteristics). In the remainder of this section, we include our organization, examples of supporting evidence, and two ways to illustrate our typology. Our findings show how three marquee improvement science components (i.e., root cause analysis, iterative testing, and NICs) were included across the data and allowed us to notice potential areas of geographic policy diffusion.

States' Categorization and Organization within the Typology

In this section we describe our findings using an approach much like an hourglass: we start broad, move to specific findings, then end with an overall geographic representation of the typology. First, we present which states demonstrate language inclusion of improvement science terminology. Then, we offer a more granular look at specific observations from state plans that align with the marquee indicators of an improvement science approach. Finally, we transfer the results of the typology to a map to capture where improvement science is well-documented across the United States.

Evidence Informing States' Typology Categorization

Using the delineations of Non-Presence, Emergent Presence, and Presence, states are organized and presented in Table 1.

Table 1

Typology of ESSA Plans

Non-Presence (*n* = 35)	Emergent Presence (*n* = 10)	Presence (*n* = 7)
Alabama	Arkansas	Hawaii
Alaska	Delaware	Georgia
Arizona	Illinois	Montana
California	Michigan	Oklahoma
Colorado	Minnesota	Tennessee
Connecticut	New York	Washington
Florida	North Dakota	Wisconsin
Idaho	Pennsylvania	
Indiana	Vermont	
Iowa	West Virginia	
Kansas		
Kentucky		
Louisiana		
Maine		
Maryland		
Massachusetts		
Mississippi		
Missouri		
Nebraska		
Nevada		
New Hampshire		
New Jersey		
New Mexico		
North Carolina		
Ohio		
Oregon		
Puerto Rico		
Rhode Island		
South Carolina		
South Dakota		
Texas		
Utah		
Virginia		
Washington, D. C.		
Wyoming		

Analysis resulted in seven states placed in the Presence category. Each of these states included multiple elements of improvement science and the elements were included in different areas of their plans, indicating that the inclusion of improvement science language was not a "one-off", but rather included in multiple places. Ten states demonstrated an Emergent Presence of improvement science. We note that this group of states demonstrate different degrees of Emergent

Presence, where some show preliminary hints of improvement science in their policy (e.g., New York, West Virginia), while others are closely approaching the Presence categorization (e.g., Arkansas, Vermont). The remaining states were categorized as Non-Presence as they did not include improvement science language. While improvement science is a branch of continuous improvement and the term "continuous improvement" was coded in all 52 state plans, the majority were classified as Non-Presence. This aligns with Bryk's (2020) assertion that, "the idea of continuous improvement might be easy to say but harder to do (well)" (p. 14), and is considered in how we conceptualized this categorization. Due to space limitations, we offer nine example categorizations (three per categorization) and a sample of the evidence used to make organizational determinations in Table 2.

Table 2

Sample of Typology Categorization with Evidence

State Name	Typology Categorization	Evidence
Tennessee	Presence	Mentions improvement science specifically as well as NICs, problems of practice, local context; root cause analysis is mentioned multiple times; sometimes a systems view seemed to be used (and other times not as much); mentions lagging indicator; connects theory of improvement to NICs; provides examples of NIC work; mentions direct partnership with Carnegie Foundation and continuous improvement cycles
Hawaii	Presence	PDCA (i.e., Plan-Do-Check-Act) is utilized at the state, local, and school level to drive improvement; Evidence of NICs; Moving toward NICs
Oklahoma	Presence	Mentions fishbone diagram to examine root causes; includes continuous improvement cycles; Mentions networked (and network) improvement communities and connects the work to implementation science (not improvement science). Makes explicit connection to the Carnegie Foundation for the Advancement of Teaching: "Consistent with the NIC model, the partnership embraces variation rather than trying to 'control' improvement, as is common in traditional educational research, to study how interventions might be responsive to differing conditions. Interventions can spread across the network as they are tested and refined. Moreover, the structure of the network allows a 'divide and conquer' approach in which subsets of teams can address different problem areas, thereby accelerating the progress" (p. 104); Names lesson study as an example of improvement activities; theory of change language included

State Name	Typology Categorization	Evidence
Arkansas	Emergent Presence	PDCA is integrated in their approach to school improvement; Communities of practice and evidence of emergent network improvement communities
Vermont	Emergent Presence	Mentions improvement science, but does not include signature improvement science approaches to address systematic improvements
Minnesota	Emergent Presence	Brief mentions of PDCA, implementation science, and a user-centered approach to improving English language learning
Arizona	Non-Presence	High focus on accountability; Improvement is conceptualized as services and test scores
South Dakota	Non-Presence	Continuous improvement focused on achievement data; not process
Missouri	Non-Presence	A lack of NIC inclusion and where coded does not point to emergence like with other states' plans; Only one brief mention of cycles was coded; Improvement science not used as a framework; Several instances of coding measurement for improvement but not compelling enough to move into emergent as most of it was coupled with measures of accountability.

The samples in Table 2 capture our observation that states are located in a typology continuum, meaning there is range within each category. Further, while there are common expectations within the policy as required by ESSA, there is variability in how these policies are captured related to plans of action within the state plans. Next, we offer evidence related to the three improvement science features of interest: root cause analysis, iterative cycles, and networked improvement communities.

Root Cause Analysis

Root cause analysis should be a component of the improvement science process as it aligns with improvement principle one: be problem-focused and user-centered (Bryk, 2015); it invites exploration of the problem to help deepen understanding of the problem. Root cause analyses, however, are not unique only to improvement science and are also frequently used for work outside of an improvement science approach. As we analyzed the data, we recognized that the presence of root cause analyses was not always indicative of improvement science. However, the presence of root cause analysis along with other improvement terminology (e.g., iterative cycles and network communities) or alignment with Bryk and associates' (2015) improvement principles offered

stronger evidence that indeed, states were conceptualizing improvement in line with how improvement science scholars would likely define it. For instance, Oklahoma included using root cause analysis and specifically named utilizing a fishbone diagram to flush out areas connected to identified problems of practice. In Part A of their plan, Oklahoma policymakers reference how root causes analysis will be applied to addressing the problem of practice of chronic absenteeism. They write, "Identifying root causes can then begin the conversation on how to use what is within the control of the school to address these root causes and decrease the number of students chronically absent." This statement offers evidence that aligns with an improvement principle that suggests improvers "see the system" and then address something in the system within their sphere of control. Montana's plan suggests that root causes will be identified by "consulting with stakeholders, collecting and analyzing data" connected to addressing and closing equity gaps. Their engagement of stakeholders to inform the identification of root causes aligns with the improvement principle of being user centered (Bryk et al., 2015). This alignment contributed to the rationale for Montana to be categorized as a Presence state.

Iterative Cycles

Engaging in iterative cycles is a signature component of using an improvement science framework (Langley et al., 2009). Iterative cycles, such as PDSAs or the similar plan-do-check-act (PDCA) cycle, are the driving force behind the fifth principle of improvement of "learning through disciplined inquiry" (Bryk, 2020; Bryk et al., 2015). The term iterative cycles, therefore, was an indicator of focus for identification of the inclusion of improvement science. Specifically the PDCA and PDSA, were given specific space in several Presence states in our study. In Hawaii, the PDCA was outlined as a driving force for approaching school improvement. While we classified Hawaii as Presence in our study, Minnesota also made mention of the PDCA being used in the state. Minnesota was placed in the Emergent Presence category because of their framing of the integration of the PDCA. From our analysis, we did not observe Minnesota outlining in detail (nor to the same extent as their Presence peers in Hawaii) the way iterative cycles were to be used. Without inclusion of the disciplined inquiry element of the iterative cycle approach, there lacked evidence related to the integration of the principles of improvement framework.

Network Improvement Communities

Bryk (2020) and Bryk and colleagues (2015) argue that NICs are a foundational part of the successful use of improvement science to drive educational reform. Bryk and colleagues (2015) wrote that, "NICs are intentionally designed social organizations, and participants have distinct roles, responsibilities, and norms for membership," (p. 144). NICs are included within the sixth principle (Bryk, 2020; Bryk et al., 2015) (i.e., organize as networks) and by design, allow improvement to diffuse across contexts because improvers can learn fast as they implement change and share important knowledge across the network (Bryk et al., 2015). Sorting individual state plans into the typology brought to our attention how NICs were included. Tennessee, for instance, included NIC language that suggested improvement science will be utilized. Tennessee's policymakers wrote:

> Currently, our CORE offices are continuing to support innovation and empowerment by extending their reach and partnering with other regions on an identified problem of practice. Networked Improvement Communities (NICs) were initiated as part of the District Empowerment priority in TDOE's strategic plan to pioneer a fundamentally new way of learning and improving, and to see a new way for the state and districts to partner in problem-solving…This approach joins the discipline of improvement

> science with the capacities of networks to foster innovation and social learning in an effort to improve student outcomes. An intentional part of a NIC is that participating districts become empowered by building their own capacity to problem solve, finding better solutions to challenges they face, and improving student achievement in their own unique, local contexts. (p. 136)

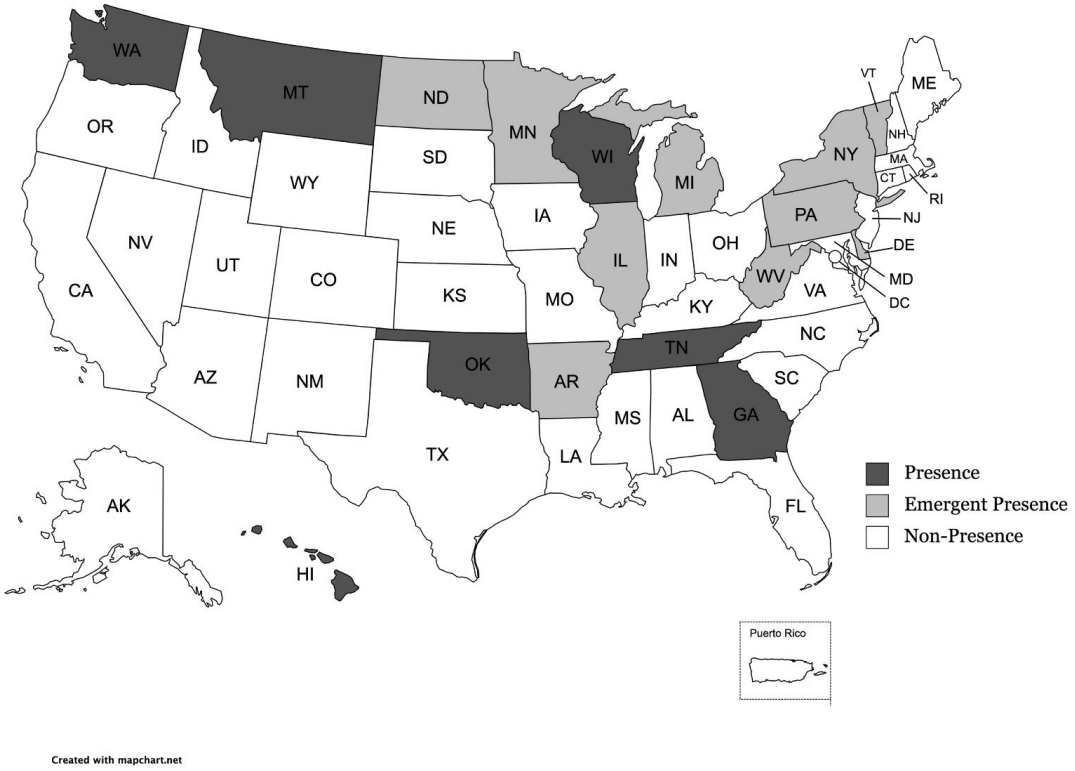
Tennessee captured problems of practice, NICs, improvement science, and the importance of local context in this passage. Their explicit promotion of NICs, coupled with other improvement science terminology, placed Tennessee in the Presence category. Georgia utilized NICs as well. Their policymakers wrote about strategies to improve literacy stating, "the networks will also coordinate the curation of statewide assets and conduct networked improvement communities that utilize data to drive toward higher achievement levels," (p. 81). We classified Georgia as Presence, albeit on the low end of this category due to less evidence of some other improvement indicators. In other states NICs were hinted at—emerging more as communities of practice or professional learning networks. While these are not a NIC in explicit naming, perhaps these other network structures will be a foray into future improvement science in the state's implementation of ESSA.

Geographic Depiction of Overall Typology Categorization

To address our second research question (i.e., policy diffusion), we translated our typology matrix into a map to observe geographic patterns, signaling a potential for policy diffusion. We used a publicly available website to help develop this map by color-coding the different states' levels of improvement science terminology presence (i.e., www.mapchart.net; see Figure 1).

Figure 1

Geographic Map Display of the Categorization of State Plans



While the scholarly community continues to engage in debate of whether proximity to other states impacts the adoption of policy and policy innovations (Gray, 1973; Shipan & Volden, 2012), our study points toward some geographic considerations illustrated in Figure 1. Across the north, states from Washington to Michigan have a high number of both Presence and Emergent Presence state plans. There is a band of Emergent Presence state plans spanning from the top of the South Atlantic, through the Mid-Atlantic and into New England with states such as West Virginia, Delaware, Pennsylvania, New York, and Vermont. Another concentration of mixed Presence and Emergent Presence is found in the South with Oklahoma, Arkansas, Tennessee, and Georgia. We are able to identify clusters where improvement science in ESSA language is present. In fact, in all states, with the exception of Hawaii, where improvement science was present there was either a direct bordering state or, like in the case of Washington that has another state in close proximity (i.e., Montana), that exhibited either Emergent Presence or Presence.

In line with what the literature on policy diffusion suggests, these states may have unique state policy environments which invite the opportunity to navigate policy requirements differently than their neighbors (Shipan & Volden, 2012). Shippen and Volden (2012) argued that when political environments are not similar policy innovation may not diffuse across state lines. We note that the general political affiliations in typology organization range from blue, to purple, to red (Political Dictionary, 2021). Further research in exploring the nuances and contextual differences within these states hold promise in illuminating how and why certain states embrace improvement as defined by improvement scholars such as Bryk and colleagues (2015), Hinnant-Crawford (2020), and Park and colleagues (2013).

Limitations

We recognize there are limitations regarding our typology approach. Because we have not come across existing research that analyzes states' improvement science language presence, this is the first schematic developed for this particular policy discussion. Thus, we approach our analysis in alignment with a common saying in improvement science: we acknowledge that we are "possibly wrong and definitely incomplete" (Doctor & Parkerson, 2017). In this paper, we suggest this initial typology and encourage education and policy researchers to more deeply examine how improvement science is understood and diffused.

Relatedly, a limitation exists in the approach itself as Smith (2002) highlighted; typologies are limited because of their subjective nature. We recognize that while a list of states is included for each category, categorization does not capture the nuances and variation that inevitably exist within each category, nor policy changes over time. For instance, while Minnesota and Vermont are both in the Emergent Presence category, the evidence suggests Minnesota is closer to the Presence category than Vermont. While our coding scheme provided direction to our coding and analysis, the a priori list focused on the identification of specific word choices opens up the possibility that we missed indirect or implicit references or presence of improvement concepts. Finally, while we aimed to successfully extract then organize the extent to which language in the plans aligned with an actual improvement paradigm, from our methods, we are unable to determine if the policy reflects educational practice and we echo the concerns that Bryk (2020) expressed: while improvement science terms are being touted, "sometimes it is not clear that the fundamental changes in thinking and action that the improvement paradigm demands are actually taking place," (p. 16).

Implications

In the practice of taking a conceptual problem and applying a practical lens we offer implications for policy, practice, and research.

Implications for Policy

Improvement science holds promise for driving quality change in education (Bryk, 2020; Hinnant-Crawford, 2020), specifically ameliorating when the cycle of the reform movement which often leads to mixed success and damaging morale of educators is problematic (Bryk et al., 2015; Rohanna, 2017). In our findings, we focus on three marquee improvement science elements that reveal evidence of commitment across multiple state plans: root cause analysis, iterative cycles, and NICs. They served as a litmus test to indicate state's inclusion of improvement science language in their ESSA implementation plans. These three areas are also critical in effectively engaging with the six principles of improvement (Bryk et al., 2015). Policy actors might consider how policy language invites and offers support (e.g., communication, capacity building, resources) for utilizing improvement science approaches into education reform.

Our findings highlight specific states where ESSA implementation suggest a level of buy-in to improvement science. This identification could invite interested policy actors in states with Non- or Emergent Presence, who want to deepen their improvement science inclusion, to create meaningful communication and/or partnerships with Presence states. Intentionality in choosing partner states that share similar contextual factors is recommended since research demonstrates there is greater success in adapting policy that comes from a similar context than from ones in environments that are dissimilar (Shipan & Volden, 2012). Partnerships could create capacity among SEAs to incorporate improvement science methods into their approach to educational reform. By learning from the Presence states, there could be potential for collaboration and additional policy diffusion of improvement science.

Implications for Practice

In a similar vein as our implications for policy, education professionals (e.g., school and district leaders, teachers) could explore this policy space in service of improving educational opportunities and outcomes for students since improvement science research has revealed success in driving meaningful and equitable improvement in educational contexts (e.g., Ganga & Mazzariello, 2018; Hannan, 2015). Education professionals first and foremost may benefit from examining their own state plan to establish an understanding of the current policy environment within their context. If interested in engaging in improvement science approaches, educators could identify entry points to incorporate and establish conditions for engaging in root cause analyses, iterative cycles, and designing NIC structures in their districts and schools, and partnering with improvement coaches can help in this area (Anderson et al., in press). There are opportunities to utilize these approaches to meet the expectations of SEAs while supporting an improvement science-based approach for systematic improvements.

Implications for Future Research

Findings reveal there is inconsistent use of improvement science terminology or improvement science principles. Because Georgia, Hawaii, Oklahoma, Montana, Tennessee, Washington, and Wisconsin combined multiple improvement concepts within their state plans, we hypothesize that state policy makers are purposefully encouraging improvement science methods. We are curious to understand more about how the inclusion of improvement science practices came

to be. We are left asking, from where did policymakers learn about or experience improvement science and why are they committed to including improvement language in their state plans? Since the data sources analyzed in this study are limited to policy documents collected at a particular time point, we do not have insights or interpretations from policymakers themselves. While there are most likely a combination of factors influencing the adoption of improvement science into ESSA implementation, further research can help identify what contributes to the diffusion of this policy innovation. Our observations led us to seek some preliminary postulations of why certain states are including policy language in line with improvement science approaches. Notably, the Carnegie Foundation for the Advancement of Teaching has organized several improvement science initiatives over the past several years. Hawaii, for example, has had educators connected to the Foundation in the Pacific Regional Education Laboratory (Carnegie Foundation for the Advancement of Teaching, 2021a) and their state plan indicates a Presence of improvement science language, suggesting a potential connection between those who practice improvement science and those who craft policy. Wisconsin is home to a well-known school district in the improvement science field. The former superintendent of Menomonee Falls, Wisconsin fostered an improvement science focused district, and their work is highlighted on Carnegie's website (2021b) as well as the AASA, The School Superintendents Association's website (see Golla, 2019). More investigation will help the field understand how connections to foundations might influence state policy development.

Further, we notice that even with active connections to foundations such as the Carnegie Foundation for the Advancement of Teaching or Gates Foundation, or being home to improvement scholars, it does not always correlate to inclusion of improvement in policy documents. When scanning across improvement initiatives and improvement research, states like California, Colorado, Oregon, Maryland, North Carolina, Pennsylvania, Virginia, and South Carolina, for instance, all have educational professionals and/or improvement scholars in their state who have engaged in improvement work with these foundations or independently. However, their state's ESSA plan does not indicate the presence of improvement science terminology. In other words, while improvement scholars are increasingly using or researching improvement science in educational spaces, our qualitative content analysis suggests improvement practice is happening in the absence of specific policy directives associated with the practice. Future research related to the practice-policy gap could reveal factors contributing to this gap and how the gap might be addressed.

As noted above, typologies provide a useful tool to compare different policies, or in this case to compare the implementation of ESSA across states. With improvement science showing promising results in education (Bryk et al., 2015; Hinnant-Crawford, 2020; Rohanna, 2017), garnering a stronger understanding of its use in state and federal education policy may help deepen the field's understanding of improvement science's utility and use. The categorization of states on their presence levels of improvement science concepts reveals avenues for future research to determine the impact of elements such as external factors (e.g., specific institutions, researchers) on policy in states. Future inquiry should focus on how a strong presence to improvement science in policies have developed in specific locations.

Conclusion

In this study we addressed the following research questions: (1) To what degree do states' ESSA plans show a presence of improvement science language? (2) What evidence of policy diffusion of improvement science exists? We conducted a qualitative content analysis of state plans developed as part of compliance to ESSA (2015). Our analysis resulted in an introductory three-category typology to capture the saturation of improvement science language in states' policies. We

found that states demonstrated presence levels of improvement science terminology to varying degrees. Our results suggest there is some degree of policy diffusion happening in this field and highlight the need for further exploration of the topic, such as policymakers' awareness of attitudes toward continuous improvement and improvement science and examining the contextual consideration for improvement science for educational advancement as policy spreads. This research identified a practice to policy gap since educational stakeholders including educational professionals are increasingly using improvement science to address pressing problems of practice.

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