How Do US Teachers Align Instructional Resources to The Common Core State Standards: A Case of Pinterest

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ABSTRACT

Social media has become an emergent phenomenon in education in US. Yet, there is a void in our understanding and research on teachers' professional behaviour within virtual spaces. This paper examines a sample of early career teachers' curation of curriculum materials within Pinterest in the context of a national education policy reform—the adoption of the Common Core State Standards. By aligning the content of the resources that teachers actively seek out online to the Common Core State Standards, we provide an account of the instructional resources accessed and shared as teachers make sense and respond to the policy implementation. Furthermore, by leveraging a novel network approach—Epistemic Network Analysis, we provide a visualization of teachers' conceptualization of varying content and how they relate instruction across content within their curriculum curation. Finally, by comparing networks of teachers from different states, we find evidence of differences in teachers' behaviour patterns as they respond to policy change.

CCS CONCEPTS

- **Social and professional topics** → User characteristics;
- **Networks** → Network types

KEYWORDS

Common Core State Standards, Curriculum Curation, Education Policy in US, Pinterest, Mathematics Teachers

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1 INTRODUCTION

With the advent of the Common Core State Standards (CCSS) in the United States, teachers have been facing many new challenges in preparation to teach mathematics in the classroom. Before the CCSS educational policy, there is no consensus among states with regard to the content coverage in school mathematics. US mathematics curriculum has been criticized by comparative researchers as “a mile wide and an inch deep” [1], suggesting the lack of focus and coherence in the mathematical concepts presented to students. CCSS, as a curriculum-related policy, attempt to address the need to define core content in school mathematics and to identify how different concepts in mathematics connect with each other in a knowledge network. As states sign up for this set of common content guidelines, understanding how to operationalize the alignment between textbook, instruction and assessment against the standards has become the priority. In early stages of the standard implementation, critics consistently raised concerns about the lagging development of textbooks aligned with the standard [2]. Textbook publishers have made great endeavors to revise the existing textbook programs according to content mapping at each grade level as described in CCSS. To date, however, evidence shows that the degree of alignment in the mainstream curriculum still varies widely from program to program (e.g., EdReport.org math series reports [3]). For those eight states that initially chose not to participate in the CCSS reform (e.g., Texas) or withdrew during their transition (e.g., Indiana), school districts may still purchase CCSS-aligned programs available on the market even though it may not be sufficient for their local context and needs.

Teachers were the first to take action in responding to the lack of curricular materials immediately after CCSS adoption, and their behaviors persist. RAND Corporation [4] reported the results from a nationally representative survey of elementary and secondary teachers, and found that the majority of US elementary teachers and secondary teachers turn to online resources, in particular, Pinterest

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and Teachers Pay Teachers for CCSS-aligned resources in mathematics and English Language Arts. In other words, teachers spend a large amount of time and effort seeking out supplemental materials outside district-provided textbooks in response to the curricular reform. Despite teachers' active engagement within social media, it is less understood *what* supplementary resources teachers acquire in efforts to align their teaching to the standards, and *how* teachers organize these resources in order to make sense of the curricular policy.

2 INTERPRETING AND SENSE MAKING POLICY IN DIFFERENT SPACES

Teachers play a central role in transforming policy to actionable practices for students. Research has explored different ways in which teachers internalize and externalize policy into actions, including interpreting policies individually [5, 6] and sense making policy with school-bound social networks [7]. Situated in the social theory of constructing meaning for action, prior research also examined the process of making sense of policy within broader social, professional, and organizational contexts by leveraging formal networks and informal communities [8, 9]. The resulting practices are manifested in formal structures such as grade level meetings or classroom instruction, or informal structures, such as self-imitated conversation with colleagues.

In the context of a national curriculum reform, responses to the policy may also manifest in other teacher practices and in the expanded spaces beyond the school walls. For example, the #CommonCore project [10] found educators across geographical boundaries play various roles in a broader social network, and shape the discourse around CCSS policy. Conversations around the policy incorporate teachers' individual and collective sense making processes through a national lens. This study seeks to examine teachers' instructional planning in response to a national curriculum initiative within Pinterest, a central virtual resource pools to which teachers turn for resources aligned with the CCSS [4]. We argue that national policy like as the CCSS permeates teachers' local and global communities, as teachers individually and collectively make sense of policy impacting their lives in both physical and virtual interactions (see our conceptual framework in Fig. 1). Those sense-making behaviors may take many forms, some more observable than others. Teachers' behaviors within social media provide a window into otherwise hard-to-capture sense making processes, as social media provides a record of activity that contributes to a collection of rich data on their online engagement. In this paper, we focus on teachers' engagement in terms of curating curricular materials that supplement their tools after the CCSS enactment. We conceptualize teachers' active curation of curriculum materials as a response to the curricular policy, and a message detailing both what is expected of in their own instruction and their students' learning. The curated curriculum itself is key to the kinds of learning opportunities students need in teachers' perception.

Figure 1: The permeation of national policy into physical and virtual spaces of teachers.

3. METHOD

In this paper, we characterize teachers' curation of mathematical resources in terms of what domain (e.g., Numbers & Operations, Measurement & Data) and what cluster (a set of related content standards) are they aligned to the CCSS. Additionally, we used Epistemic Network Analysis (ENA) to examine how teachers are sense making and organizing their curation of curricular resources on Pinterest by mathematical content, as delineated in the CCSS.

3.1 Sample

Using a subsample of early career teachers from a National Science Foundation funded research grant studying their planning and enactment of elementary mathematics, we identified and analyzed Pinterest accounts of 29 teachers from four Midwestern states in US. These teachers were in their first four year of teaching at the time of data collection. We confirmed their Pinterest accounts through cross referencing demographic information found in our data, on Pinterest, and other social media websites. The information includes, grade level taught, teaching district, and photo recognition. Coding was applied to these teachers' mathematical resources pinned between the origin of their accounts to November 2016. In total, we coded 1,924 pins coded for instructional content. Future work will expand analysis to a larger sample of both early career teachers and their experienced colleagues, characterizing their curated curriculum within Pinterest.

3.2 Content Coding

For each pin, the coding team first discerned whether the mathematical content in the image was primarily related to one well-defined task and content. Some mathematical pins featured a set of resources in the form of a packet, which we referred to as Content Resource [11]. This type of resource addresses multiple domains and clusters. Hence, we assigned a special code to distinguish mixed resources from others. Similarly, resources that feature organizational tools for teaching (Physical Resources) and "teaching moves" (Pedagogical Processes) [11] are also excluded from further analysis beyond descriptive statistics as they concern

the structure of the classroom and teaching practice rather than content. For the rest of mathematical pins, we coded for the primary and secondary mathematical domain and cluster to which a pin belongs. Given that only 11.3% of the pins have a secondary content code, we focus on the primary categorization of the instructional tasks.

To achieve inter-rater reliability (IRR) for the manual coding process, the teams coded the same set of pins. After reaching at least 80% agreement following two rounds of training and calibration, the researchers coded independently. An IRR check-in process was implemented, double coding 5 pins for every and reviewing any discrepancies. If the agreement percentage fell below 80% in the check-in, the researchers double coded another set of pins and repeated the process until IRR was achieved again. In summary, the IRR was achieved and maintained over the whole process of coding.

3.3 Epistemic Network Analysis

After we applied the CCSS coding to all sampled pins, we used Epistemic Network Analysis (ENA) to map out how content is grouped on teachers’ boards. By examining patterns in curation of instructional content within boards, we expected to observe the manner in which teachers organize their thinking and draw connections across instructional content. ENA is a type of network analysis that models how people connect elements of their discourse in a temporal context in order to demonstrate their cognitive network structure [12]. Within Pinterest, teachers often organize their pins thematically; for example, a board may be titled “math center” and represent a space in which a teacher collects and houses resources on mathematical activities for use in the classroom. In this case, the ENA’s “discourse” is teachers’ curation of pins related to math center resources and the “temporal context” is the board, math center. When teachers curate resources of certain math content in a board organized in a way that is meaningful to them, the co-occurrence of the content contributes to a tie between the two mathematics concepts in CCSS. The more this content pair co-occurs, the thicker the strength of the tie as the counts of co-occurrence accumulate, meaning that teachers are making strong connections between this pair of mathematical content codes. As CCSS emphasize mathematics as a connected subject, by examining how teachers make connections among tasks with different content, we may provide a rich description of how teachers curate mathematical resources in response to their local context, the curriculum, and necessary content to meet curriculum demands for mathematics instruction.

4 PRELIMINARY RESULTS AND DISCUSSION

4.1 Instructional Resources Acquired Across Mathematics Domains

Fig. 2 displays the frequency of each domain in the sample of instructional resources within Pinterest. Most of the pins that teachers curate are Content Resources, which are aligned to multiple Common Core content domains. Moreover, teachers tend to seek out instructional resources in the domain of Operations & Algebraic Thinking (21.1%), followed by Measurement & Data (14.1%) and Numbers and Operations in Base 10 (13.8%).

Figure 2: Frequency of Each Domain in Teachers’ Curation of Instructional Resources within Pinterest.

The predominance of Content Resources as found in teachers’ collection of instructional resources suggests teachers may need a variety of supplemental curriculum materials. Moreover, certain domains are more salient than others, particularly domains related to number sense, including numbers and operations. This may point to potential area of work for curriculum developers and textbook publishers, as teachers have demonstrated their need of instructional resources in these subject areas within mathematics.

4.2 Instructional Resources Acquired Across Concept Mastery as Defined by Mathematics Cluster

Table 1 shows the most frequent clusters in the sample (with threshold set at 50 pins). Developing the conceptualization of addition and subtraction through “putting together” and “taking away” is the most popular content sought after by sampled teachers, followed by activities on time and money. Additionally, the large number of non-CCSS content acquired within Pinterest is also worth noting. Examples of content that is not specified in the standards include reading calendar months and dates by week and asking an appropriate statistical question before conducting surveys. Despite the fact that this national policy of curriculum varies in its timeline for implementation across states, many teachers still feel the need to access and curate certain topics that they regard as critical mathematics curriculum for their students.

Table 1: Frequency of Top Clusters in Teachers' Curation of Instructional Resources within Pinterest.

Comparison	Frequency	Percentage
Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from	112	5.77%
Work with time and money	83	4.32%
Non-CCSS Content	78	4.06%
Develop understanding of fractions as numbers	75	3.90%
Understand place value (2 places)	71	3.69%
Use place value understanding and properties of operations to add and subtract	68	3.54%
Understand place value (3 places)	65	3.38%
Know number names and the count sequence	57	2.96%
Count to tell the number of objects	53	2.76%

Identify and describe shapes	51	2.65%
Add and subtract within 20	50	2.60%

4.3 Are There Any Salient Differences In Teachers' Curated Resources Across States?

Sampled teachers are from four different states in US. One of the states—Indiana, repealed the CCSS one year after implementation and replaced it with their own state standard in March 2013. Many people claim that the two sets of standards largely overlap. As the organization of content and connections emphasized by the standards have shifted, teachers in Indiana have demonstrated different behavior patterns in their Pinterest curation than other teachers in our sample. **Fig. 3** shows two groups of subtracted networks in terms of how teachers (Indiana versus CCSS states) make connections among content differently on their boards. The red lines represent more connections among certain domains made by Indiana teachers when they seek out and curate instructional resources, while the purple line represents more connections made among another set of domains amongst those teachers in CCSS states. We set the threshold at 0.1 for tie strength loading to highlight those salient differences between the two networks.

Figure 3: The subtracted network of two groups of teachers, in which the connections made by teachers in Indiana are subtracted from the connections made by teachers in other CCSS States.

As shown in the network structure comparison, Indiana teachers, when acquiring instructional resources for their mathematics instruction, tend to conceptualize content in the domain of

Measurement & Data together with Operations & Algebraic Thinking and/or Counting & Cardinality, as evidenced by the thick red ties displaying in the graph. By contrast, teachers in CCSS states tend to connect two domains concerning the number senses, such as, Numbers & Operations and Counting & Cardinality, as evidenced by the thick purple ties in the graph. The differences in these two networks are significant along the y axis ($p = 0.050$), suggesting there are systematic differences in teachers' sense making of curriculum as it relates to their educational context. When we restricted the pins analyzed to those pinned after March 2013, when CCSS was paused and replaced by other curricular policy in Indiana, we found a similar and yet more salient difference between Indiana teachers and CCSS teachers ($p = 0.00$, with effect size Cohen's $d = 1.52$). This further supports our hypothesis that the local policy context may interact with teachers' sense-making of a previously adopted national curriculum and how teachers respond to changes in policy accordingly, as evidenced in their access and sharing of curricular materials.

Lastly, since the raw counts and proportions for the two nodes that drove the difference between Indiana teachers and other states' teachers is quite different, we also further validated the two ENA models by controlling for chance co-occurrence in using the expected value ENA models. We found the same significant results about the network differences in both cases, suggesting that the variations in teachers' curation behavior are not due to chance.

5 CONCLUSIONS

In summary, we have coded a sample of early career teachers' mathematical resources accessed and shared within Pinterest in an effort to better understand how teachers make sense of a national policy. We performed Epistemic Network Analysis to investigate variations in sense making patterns as teachers respond to curriculum policy given the different statewide contexts. The results suggest a national policy is received by teachers differently in different spaces given the local policy context. Our work also characterizes an emergent space for teachers to drive their classroom curriculum and professional trajectory. Real time observations of teachers' behaviors within online spaces may provide a narrative on teachers' professional engagement online as it relates to policy change. Future work will leverage a larger sample of teachers who are more representative of the teacher population in the US, and further illuminate teachers' sense making of educational policy in their curriculum curation online.

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