

Sensemaking in Statewide College Mathematics Curriculum Reform

Matthew Wilson
Oklahoma State University

Michael Oehrtman
Oklahoma State University

We draw on the theory of sensemaking and sensegiving to characterize the social cognitive aspects of transformative organizational change in the context of statewide college mathematics curriculum reform efforts with the goal to understand the barriers to implementing the forms. In order to further understand the change process and the challenges these changes present, we conducted interviews with institutional, state, and national leaders of these efforts.

Keywords: Sensemaking, Corequisite Remediation, Math Pathways, Faculty Change

The public institutions of higher education in Oklahoma are currently in the process of designing and implementing corequisite remediation and mathematics pathways. The goal of these efforts is increased student success in introductory mathematics courses and, ultimately, increased persistence to certificate and degree completion. In contrast to the traditional remediation model which places underserved students into non-credit barring courses, corequisite remediation places underprepared students directly into college-level courses with assistance. The goal of math pathways is to create alternatives to the college algebra/calculus sequence to better serve students in primarily non-STEM degree programs. The alternative pathways provide students with mathematics courses which are more applicable to these other majors, incorporating relevant skills and applications. Preliminary data show promising results from these reforms (Wilson & Oehrtman, 2017). In this paper, we aim to characterize the social cognitive aspects of the reform process drawing on constructs of sensemaking and sensegiving in order to characterize the barriers or challenges in implementing systemic reforms.

Theoretical Perceptive

In this section, we give a brief overview of the theory of organizational change. Van de Ven and Poole (1995) define organizational change as, “an empirical observation of difference in form, quality, or state over time in an organizational entity” (p. 512). However, as Kezar (2001) notes, this characterization ignores the individual’s perception, which can be just as important. Therefore, we use Kezar’s definition that amends Van de Ven and Poole’s definition to include, a perceived “difference in form, quality, or state over time in an organizational entity.” We define *a change process* to be a series of change events. An individual attempting to invoke or direct a change process is called a *change agent*.

Organizations are continually changing. The question is, to what degree or to what scale is that change occurring. First-order change or organization development is continual change or change within normal operating practices. First-order change does not require a substantive shift in participants’ beliefs. However, second-order change (transformational change or deep change) does require a substantive shift in beliefs or values of the members of the organization. Second-order change is a substantive divergence from previous operating practices. As such change requires a shift in beliefs, the process is often studied by using theories that emphasize cultural or social cognitive aspects. (Kezar, 2014).

One such theory is *sensemaking*, so-named by Weick in 1979, which has been employed by many theorists and researchers throughout a large body of interdisciplinary literature.

Sensemaking is how individuals continually create and understand their reality and role in the organization. Sensemaking is inherently both an individual and social process. Organizations are made up of individuals who have to make sense of their reality which is, in-turn, shaped by their social context in the organization. Therefore, the organization changes as a response to the sensemaking activities of its members then members must then make sense of new realities. Through such a dialectic, Weick (1993) explained, “the basic idea of sensemaking is that reality is an ongoing accomplishment that emerges from efforts to create order and make retrospective sense of what occurs” (p. 635). The key to sensemaking is its retrospective nature (Weick, 1995). In a transformational change process, sensemaking is used to plan for the future by reflecting on “errors” of the past, “tight implications formed in hindsight, are wrong because the future is actually indeterminate, unpredictable” (Weick, 1995, p. 28). Weick goes on to say that, “the past has been reconstructed knowing the outcome.” That is, any errors of the past are only errors now that we know the outcome. For individuals involved in a change process, “sensemaking is about understanding a change and making it meaningful” (Kezar, 2013, p. 775). In summary, sensemaking is how individuals involved in a change understand the change, in particular how they make sense of their role in the changing organization and how they understand and interpret past events.

Often, sensemaking is studied in conjunction with the idea of *sensegiving* from Gioia and Chittipeddi (1991). Sensegiving describes how the change is disseminated and framed to those involved or affected by the change. That is, sensegiving is done to help others engage in sensemaking. Kezar (2013, p. 763) defines sensegiving as “influencing the outcomes” of a change strategy. Gioia and Chittipeddi, (1991) developed a four-stage process for change linking, sensemaking and sensegiving. The stages are envisioning (an aspect of sensemaking), signaling (sensegiving), re-envisioning (sensemaking), and energizing (sensegiving). In the envisioning phase, change agents develop a strategic vision for the change. Overlapping the envisioning phase, *signaling* involves communication about the change by its agents to those it affects. The individuals affected by the change process voice feedback stemming from either support or opposition in the re-envisioning phase, which may cause a modification of the change process. Finally, in the energizing stage of effective large-scale reform, a broad coalition is built as the changes begin to be implemented.

Gioia and Chittipeddi describe these phases in terms of cogitation and action. Sensemaking is a mental understanding that one must engage in while sensegiving is an action that one does to affect or influence the change.

In 2013, Kezar found that, when looking at a campus wide-effort to implement interdisciplinary learning, the change process did not follow a linear path. In particular, they found that change agents must transition back and forth between the sensemaking and sensegiving often when implementing the change process.

Methods

As discussed in the previous section, the purpose of the study is to understand the change process as well as the challenges in implementing corequisite remediation and mathematics pathways. In order to answer this question we conducted semi-structured interviews with institutional, state, and national leaders involved in the Oklahoma effort. The purpose of conducting the interviews was to understand the affordances and barriers in implementing the reforms in Oklahoma, including obstacles faced by faculty, mathematics departments, and institutions. The aim was not only to situate the reforms in a national context, but to understand how the efforts of different states across the country can inform the efforts here in Oklahoma.

The participants of the study were individuals involved in the reforms in Oklahoma and individuals involved in the national reforms who were engaged in supporting the Oklahoma reform efforts. Interviewees consisted of co-chairs from state task-forces on corequisite remediation and math pathways, instructors involved in implementing pilot courses at OSU, and administrators/faculty at institutions across the state. The interviews were conducted during the spring of 2017 which included a total of 10 participants. The interviews were conducted in person or over the phone and were audio recorded. Each of these participants has a unique perspective from their role in the change efforts.

The interviews were transcribed and coded using open coding. The aim was to understand the barriers to implementation and analyze the change process. Therefore, in coding we looked for challenges that change agents faced in the process of implementing the reforms and how the participants engaged in sensemaking through the barriers. That is, we looked for instances where change agents would be engaged in sensemaking, in particular, where one would try to make retrospective sense of past events or engage in envisioning changes. Narratives describing the challenges for each corequisite remediation and math pathways are given in the results sections as well as a characterization of the change process through the lens of sensemaking.

Findings

Over the course of conducting the interviews, several themes emerged. First, we discuss the change process using the sensemaking perspective and then discuss the challenges unique to each of these change efforts.

Change Process

The change process began in 2011 when the state signed on to CCA's agenda and specified the following three goals through the state regent's office: (1) improve mathematics preparation of students entering college, (2) reform mathematics remediation to be more effective and (3) strengthen mathematics preparation for all majors.

In order to address the second goal, in April of 2012, the Oklahoma State Regents held the first of several statewide meetings, *The Remedial Reform Summit*. This summit, facilitated by presentations from individuals outside the state, included discussions about the current remedial landscape. This summit led to the regents holding the *Mathematics Faculty Conference* in September of 2012 with 150 mathematics faculty and administrators to identify "a systemwide strategic approach of encouraging and implementing innovation to improve student success" (Oklahoma State Regents for Higher Education, 2015, p. 5). One of the outcomes was the creation of the working group called the *Math Success Group*. The Math Success Group held a planning meeting in September of 2013, which led to strategies to address three goals. One of the strategies to address the second goal was to offer corequisite courses.

The *Math Pathways Taskforce*, formed in 2014 following Oklahoma joining the Charles A. Dana Center's New Math Pathway's Project, consists of mathematics faculty from each public institution. The taskforce published recommendations in February of 2017. In March 2016, CCA and OSRHE hosted the Corequisite at Scale Conference. In April of 2017, the Dana Center and the OSRHE hosted the math pathways meeting.

These meetings allowed for collaboration and for attendees to engage in sensemaking as a social activity. In particular, attendees were able to engage with the idea of corequisite remediation reflecting on the past remediation model.

The taskforce and workshop attendees are able to gather information and envision the changes while engaging with other attendees. As one of the faculty members and co-chair noted:

I think one of the challenges is to make every feel that they have a voice at the table that they are involved. I think the workshops are tremendous in that... everybody expresses what their opinion, their idea is of what we're doing, and then it's discussed and then things are sorted. And tables get together and pick these particular topics. And then tables discuss them in small groups all the topics get discussed. Then the tables report back and that's refined over a period of time. And so you get a lot of buy-in, because everybody's had a voice and a chance to say what they think is important what the challenges are and how they think it should be addressed and sit there and discuss with other people.

Another faculty member had similar sentiment:

We've gone through such a slow and deliberate process where we've engaged everybody in the conversation and it's clearly not been a conversation 'you do this and that' right it's been even from the beginning let's clearly identify what problems we're trying to solve right and what we think are promising solutions and explore those...

Moreover, the process and open-ended nature of the workshops afforded attendees the opportunity to engage in sensemaking and construct their own sense for the changes. In particular, the attendees can understand the change and envision the change on their campus and what the challenges will be for their particular campus. As each of these campuses has a unique mission and goals, its challenges will be unique as well. Statewide meetings can facilitate understanding the challenges entailed in these changes, which was highlighted by one faculty member:

And so there's a little bit of kinda mismatch of perspective right when you think of the goals of each institution what they're trying to implement. That's required some navigating and frankly just even understanding. You know we don't even know there are issues like that until we all sit down at the table together and say 'why are you trying to do this?', well because our students have these needs and they don't already have a stat course right. Oh that's not even part of our perspective because we're not dealing with associates degrees.

After the workshop, the attendees were able to return to their campuses to engage in sensegiving with others, helping others understand what the change will entail on their individual campuses and creating buy-in. In the language of Gioia and Chittipeddi (1991), these meetings constituted an envisioning phase of the reform, laying the ground work for what the change will entail across the state. In a signaling phase, the taskforce presented recommendations and engage others on at their institutions in the change process. On their respective campuses, faculty and administrators can engage in the re-envisioning phase by framing the reforms in the context of their campus. The institutions then began to implement these changes in the energizing phase. The process here is iterative as the implementation has involved pilot programs.

Challenges in Corequisite Remediation

In the efforts to implement corequisite remediation, many of the challenges are related to policy and implementation. One of challenges articulated by the participants of this study was assessment and placement of entering students. The goal is to place students into mathematics courses in which they will succeed without unnecessarily extending their sequence of required courses. In order to place students, an assessment mechanism is needed, however, some are costly. As one community faculty member noted, "I know that [one of the research institutions] uses ALEKS but that's little cost prohibitive for us." One administrator noted,

The fact that we have the placement test with the online learning modules that's something that we are big enough that we have an economy of scale we can pay for by imposing fees

and we have an apparatus to deal with it with the testing center... Having that large apparatus and this large infrastructure makes those sorts of things easier in some respect.

These challenges highlight the different experiences between two-year and four-year institutions. Additionally, there are logistical challenges of placing students in corequisite sections. These logistical challenges are highly localized. For example, the implementation at the research institution was so that the course did not appear any different on the transcript between corequisite and non-corequisite students. As the administrator responsible for implementing the corequisite course at the institution noted:

Our big challenge right now [the enrollment management system] can't really test for this population of students. So we have the corequisite sections set up as department permission only.

Because of this, the department had to manually add each of the students in the corequisite courses. The administrator continued,

That's a labor intensive sort of thing, I haven't figured out a better way to do it. It's worth it to me to use that labor to help the students.

While the model had its challenges, the university did not want to offer 0-credit hour courses nor did it want to give students five credits for the course. Using a 0-credit hour course in some form to deliver the supplemental instruction also comes with its own challenges. Depending on whether the instructor is the same for the regular course as for the supplemental course can lead to challenges either way. If the instructor is the same, scheduling can be difficult. However, the benefit can be that the instructor is familiar with where the students are at and what they know. These challenges in scheduling lead one community college to attempt to intermix the students. That is allowing students regardless of preparation to enroll in any college algebra section and using 0-credit hour supplement course which are not tied to any particular section. However, this approach introduces its own challenges with communication and as faculty member at the college noted "making sure students get enrolled in both," which is particularly challenging as the course is not linked to a supplement course. Moreover, not all the students in the college algebra sections need to enroll in a supplemental section as some are college ready.

Challenges in Math Pathways

The most prevalent challenge to emerge concerning math pathways was on course transferability, particularly from two-year to four-year institutions. The issue is ensuring courses with the same or equivalent content transfer between institutions, so students who transfer are not taking duplicate courses. In Oklahoma, the *Course Equivalency Project* or CEP¹ is a matrix, which codifies course transfer between public Oklahoma Institutions. That is, the matrix guaranties that a course *will* transfer and *how* the course transfers. Currently, College Algebra transfers between every public institution as it is listed on the CEP, and the course can be used to satisfy the degree requirements. However, course transfer is not guaranteed for alternative pathways. The focus of the change agents and change leaders to address this challenge is to add the new pathways to the CEP. By adding these alternative pathways to the CEP, students taking for example the course for the modeling pathway at an Oklahoma institution will transfer to any other institution as the equivalent modeling course.

¹ The CEP matrix can be found <http://www.okhighered.org/transfer-students/course-transfer.shtml>

The issue of course transferability is particularly relevant to the two-year colleges where students intend to transfer to a four-year university. Faculty at a two-year college explained they will not offer a course until they can know it transfers, that is until it appears in the CEP matrix, We've also got a new modeling course, but I haven't put it in the schedule yet because I'm not sure it's going to transfer. Once we get that pathway developed and in the matrix, I'll put it in the schedule.

Also, important for course transferability is ensuring the course satisfies the desired degree requirements at the transfer institution, otherwise a student would need to take another mathematics course. This issue came up in context of the statistics pathway:

...when talking about statistics pathways right, so our two-year schools their associates in something like psychology currently has no statistics in it, so adding statistics as part of the pathway kinda makes sense for them, cause they are giving them some content and experience that's useful. Now at four-year school where the bachelors program in psychology students are taking already have lots of statistics built in adding another statistics course that repeats some of the most of the content maybe at a lower level that's already in their program. It doesn't really help right. You're trying to put a course in there they've already got.

Solving the transfer problem and offering courses is only the first challenge. One also has to get students enrolled in these courses. This change has multiple parts, one needs to get the degree programs to allow alternative pathways and have advisors place the students into the courses:

These are real challenges. The client disciplines getting them on board and doing it. The math departments may be on board, but you've got to get the client disciplines on board. Then you've got to get the advisors on board. The advisors are going to be the one that when you come in say what you want to be, they're going to tell you which pathway to go to. Well a lot of them are scared. Cause they've always told people you better take college algebra, it transfers anywhere. If you take modeling, you may not be able to transfer that and get your requirement, so you'll have to take college algebra when you get there, and so that's a real problem.

Mathematics departments will need to engage other departments and advisors in sensegiving. Specifically, they will have to help client departments and the advisors make sense of the College Algebra alternative and what these courses would mean for their students. Advisors need to understand the goals of each student and which course will best help the students achieve those goals. This challenge is compounded by the fact that many students enter college without a declared major. Placing these students into the correct course can be particularly challenging. However, the pathways are intended for broad groups of majors, hereby enabling students to select a field instead of a more specific major when entering.

Conclusion

The change process to design and implement statewide reform of corequisite remediation and new mathematics pathways is multileveled and highly collaborative, involving individuals from the regent's office to campus administrators to advisors to mathematics faculty, with many of these individuals involved in leading and shaping the change efforts. The numerous participant meetings, workshops, and taskforces helped to facilitate and guide the change process. The statewide meetings helped attendees to engage in sensemaking and sensegiving activities which enabled broader buy-in. Additionally, the statewide meetings helped others make sense of the implementation process on their campus, but also allowed individuals to see the changes faced by other institutions.

In this paper, we have identified a few important challenges; however, there are many more challenges. Some of these may be implementation or institution specific. Additionally, there will undoubtedly be challenges in the classroom.

References

- Gioia, D., & Chittipeddi, K. (1991). Sensemaking and sensegiving in strategic change initiation. *Strategic Management Journal*, 12(6), 433-448.
- Kezar, A. (2001). Understanding and facilitating organizational change in the 21st century. *ASHE-ERIC higher education report*, 28(4), 147.
- Kezar, A. (2013). Understanding sensemaking/sensegiving in transformational change processes from the bottom up. *Higher Education*, 65(6), 761-780.
- Kezar, A. (2014). *How Colleges Change*. New York: Taylor & Francis.
- Oklahoma State Regents for Higher Education. (2015). *Mathematics success initiative Status report*. Oklahoma City, OK.
- Van de Ven, A. H., & Poole, M. S. (1995). Explaining development and change in organizations. *Academy of management review*, 20(3), 510-540.
- Weick, K. (1979). *The social psychology of organizing (Topics in social psychology series)*.
- Weick, K. (1993). The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative science quarterly*, 628-652.
- Weick, K. E. (1995). *Sensemaking in organizations*. Thousand Oaks: Sage Publications.
- Wilson, M. & Oehrtman, M (2017). Corequisite Remediation and Mathematics Pathways in Oklahoma. *Proceedings of the 20th Annual Conference on Research in Undergraduate Mathematics Education*. San Diego, CA: San Diego State University/University of California at San Diego.