Facilitating Change in Undergraduate Science Instruction: Synthesis of Change Strategies across Disciplines

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Recent decades have seen increasing calls for fundamental change in the teaching of Science, Technology, Engineering, and Mathematics (STEM). National commissions, state panels, university administrators, and individual researchers have expressed concern that the United States will lose its role as a leader in science and technology fields due to outdated and inappropriate instructional practices (e.g., Center for Science, Mathematics, and Engineering Education, 1999). The wider higher education conversation has been dominated by the need to fundamentally shift the entire undergraduate education paradigm from instructional or teacher centered to learning or student centered (e.g, Barr & Tagg, 1995; Guskin, 1994). These concerns have led to significant expenditures of time and money on research into improving teaching and learning.

Scholars in at least three fields have engaged in research that can inform fundamental change in teaching and learning in STEM fields. *Disciplinary-based STEM Education Researchers* (SER) are generally housed in STEM disciplines within colleges of Arts and Sciences or Engineering and have largely focused on change in curricula and pedagogical materials meant to help students learn disciplinary content (e.g., National Science Foundation, 2005; Redish, 2003; Seymour, 2001). *Faculty Development Researchers* (FDR) tend to be connected with centers for teaching and learning or Colleges of Education, and have traditionally focused on providing faculty with pedagogical skills and on motivating and empowering them to focus on instructional improvement, or studying that process (e.g., Bess, 1977, 1997, 1998; Menges, 1997, 2000; Menges & Weimer, 1996; Weimer, 1990, 2002). *Higher Education Researchers* (HER) are generally housed in Colleges of Education, and often study and discuss how cultural norms, organizational structures, and state and national environments and policy influence the higher education practices (e.g., Austin, 1994, 1996; Blackburn & Lawrence, 1995; Braxton, 1995; Braxton,

Eimers, & Bayer, 1996; Colbeck, 2002; Peterson, Cameron, Mets, Jones, & Ettington, 1986). Efforts in

all areas, despite significant funding and study, have met with only modest success (Bok, 2006;

Boyer Commission on Undergraduates in the Research Universities, 1998; Handelsman, et al., 2004;

Kezar, 2001; Seymour, 2001). In addition, although the fields share an overriding goal, the research

generated by each rarely "crosses over" to inform the others.

We see a need for interdisciplinary research on STEM instructional improvement that

draws from the knowledge and experiences of all of these research communities. In this research

project, we critically review, integrate, and align the research literatures and perspectives of the

SER, FDR, and HER communities to identify the change strategies that have the most promise

for future work. This study seeks to articulate processes for promoting fundamental changes in

STEM instructional practices in higher education that are consistent with available empirical and

historical evidence as well as theoretical perspectives about human and organizational change.

The ultimate aim of the project is to support the development of an interdisciplinary research and

practice agenda for STEM instructional improvement.

The research questions driving this study are:

1) What core strategies to promote changes in instructional practices are used in

   undergraduate STEM education?

2) What evidence is available to support the effectiveness of these strategies?

3) What common ideas about instructional change are evident in the literature?

4) How is the broader change literature (e.g., individual and organizational change theories)

   used by authors to frame their use or study of change strategies?

Methods

The literature used in this analysis was selected through a succession of inclusion and exclusion criteria. First, the most productive indexes were identified for initial searching: Web of Science and ERIC. We set the window for inclusion at 1995 to the present. Then, we determined that the combination of "instructional", "change" and "college" or "university" yielded a tight enough set of hits to further explore. Abstracts were scanned for indications that the article did indeed address instruction or change from the perspective of faculty practice outcomes rather than student learning outcomes. This decision was based on the plethora of articles that measure changes in student learning based on changes in instructional approach or medium (e.g., online or hybrid environments vs. face-to-face classrooms) that do not focus on or discuss in any depth the approaches necessary to help faculty beyond the experimenters adopt or adapt different teaching practices. Multiple scans of the literature indexed in these databases were undertaken with different combinations of terms related to change, teaching, instruction and higher education. We then specifically examined the journals that appeared to produce the greatest number of articles that fit our inclusion criteria to ensure that we had gleaned all the relevant literature they offered. Finally, we examined the reference lists of the articles identified as most closely fitting our inclusion criteria, to capture foundational works published prior to 1995, influential or novel conference proceedings or white papers, or works not directly related to instructional change, but related to organizational change in higher education. The final database contains 295 journal articles and 45 books.

Analysis Procedures

For the study reported here, we undertook an initial examination of 130 randomly chosen articles from the set of 295 identified as relevant. We used an inductive analysis process that involved reading and initial coding of articles (by overlapping sets of the research team) to identify the research community of the authors, the focus of the change approach, the "level" at which the change described is being aimed (individual, group, institutional, cross institutional), the apparent role of the change agent if discernable, and the degree of specificity of the outcome intended. The research team then met several times in person and by phone conference to discuss what we had learned from our initial reading of the chosen articles, ways to define the patterns and themes we saw emerging from the articles, and how we saw those patterns coming together to form potentially useful categories. From these initial coding approaches emerged two guiding questions that, when combined, form four categories of change strategies. We then re-reviewed the 130 articles and placed them within the categories developed.

In a second analysis round, we selected 10 articles from each of four categories for more qualitative examination, looking for other elements of the articles that might be convergent or divergent. That second round of reading produced data on the core change idea(s) either explicitly or implicitly evident in the change process described in the articles, the degree to which the authors grounded their work in established change theories or literature, barriers to change noted by authors that were either noted in literature or rooted in the results of the change process, and recommendations made by authors. Those data were collected in narrative form in summaries of each article, analyzed for patterns, and arranged in word tables. One member of the research team completed the first analysis of the articles within a particular category. This work was then examined and modified by another member of the research team, often with

significant discussion.   As a result of this closer analysis, several articles were moved from their initial categories. A total of 43 articles were ultimately analyzed in this second round.

Results

The analysis described above led to the creation of four core change strategies. Each of these core change strategies is consistent within itself in terms of the way the change process is envisioned and the assumptions behind it. In this section, each of the four core change strategies is presented and described. Following that discussion, the results of the more detailed investigation of the core strategies is described.

Four Core Change Strategies

The four proposed categories of change strategies are based on the answers to two fundamental questions that were arrived at through multiple rounds of initial coding and discussion. The first question was, "What is the primary aspect of the system that the change approach seeks to directly impact?" We identified two discreet answers to this question – individuals or environments and structures. Table 1 presents the definitions we developed for each response, and the underlying assumption about change that we saw driving each definition. For Individuals, the change seeks to address such factors as the beliefs and behaviors of instructors, assuming that they act of their own volition. Moving beyond individuals to environments and structures, the change seeks to impact the environments that are assumed to influence the actions of individuals.

Table 1

Individuals vs. Environments

Question: What is the primary aspect of the system that the change approach seeks to directly impact?	
Individuals	**Environments and Structures**
Definition: The change intends to directly impact personal characteristics of single individuals, such as beliefs, knowledge, behaviors, etc.	Definition: The change intends to directly impact characteristics of the system that are external to single individuals, such as rules, physical characteristics of the environment (e.g., room layout, technology), norms, etc.
Implicit Assumption: Individuals' actions are primarily influenced by their own volition	Implicit Assumption: Individuals' actions are primarily influenced by external environments

The second fundamental guiding question was, "To what extent is the intended outcome for the individual or environment known in advance?" We identified two responses we labeled prescribed and emergent. For prescribed outcomes, the change agent knows upon initiating a change process what kind of behavior or mental states in individuals or groups are expected and sought, driven by the assumption that the change agent(s) have the key knowledge needed to define the outcomes. For emergent outcomes, the end state in terms of behaviors or mental states is determined as part of change process, with the assumption that those involved in the change have important information needed to define the outcomes. Table 2 presents the definitions we developed for each response, and the underlying assumption about change that we saw driving each definition.

Table 2

Prescribed vs. Emergent

Question: To what extent is the intended outcome for the individual or environment known in advance?	
Prescribed	**Emergent**
Definition: The desired final state for the individual or environment is known at the beginning of the change process.	Definition: The desired final state for the individual or environment is developed as part of the change process.
Implicit Assumption: Important knowledge relevant to change outcome is known to a few people (e.g., experts). Therefore a small group should determine the intended outcome.	Implicit Assumption: Important knowledge relevant to change outcome exists in individuals throughout the system. Therefore a variety of stakeholders should be involved in determining the intended outcome.

Based on the possible combinations of responses to the two guiding questions, we

developed a four-square typology of change strategies. Each category carries an underlying

definition and assumption. An overarching assumption about all categories is that they focus on

development – the change they seek is developmental in nature, motivated by limitations seen in

current practices. This overarching assumption emerged from all of the articles coded. The

categories are explained in the text below and a graphical depiction of them presented in Table 3.

Table 3
Core Strategies for Instructional Change

	Aspect of System to Be changed: Individuals		
Intended Outcome: Prescribed	I. Developing: CURRICULUM & PEDAGOGY (39 –30% of articles) Subcategories: 1) Disseminate Best Practices (7 articles). 2) Modify Instructor Conceptions (4 articles). 3) Provide Individualized Diagnosis and Support (1 article).	II. Developing: REFLECTIVE TEACHERS (40 – 31% of articles) Subcategories: 1) Individual Curriculum Development (4 articles). 2) Collaborative Action Research (3 articles). 3) Provide information to help faculty make informed decisions (3 articles). 4) Departmentally-Based Faculty Development Specialists (1 article).	Intended Outcome: Emergent
	III. Developing: POLICY (18 –14% of articles)	IV. Developing: SHARED VISION (6 – 5% of articles)	

	Subcategories: 1. Systemic Alignment (6 articles). 2. Institutionalization of quality assurance measures (4 articles). 3. Directed Incentives (3 articles).	Subcategories: 1. Institutional-Level Actions (3 articles). 2. Externally initiated department level collaboration (2 articles). 3. Internally initiated department level collaboration (1 article).	
	Aspect of System to Be changed: Environments and Structures		

Of the 130 articles randomly chosen for initial analysis, we determined that 14 were not relevant to our analysis and removed them. Several were curriculum development articles focused only on student learning outcomes (one of our exclusion criteria) or were focused on K-12 education. Nine articles were classified "background" reading. They do not directly fit the search criteria, but are relevant in some way and are particularly well-written or comprehensive. Four articles clearly spanned more than one category, with multiple change foci or significant combination of both prescribed and emergent outcomes. All four of these were review articles that did not present and discuss specific change interventions, but discussed a range of issues regarding instructional change. We are keeping careful track of these articles for further analysis at a later time. Of the remaining 111 articles, there was an almost even split between the number that fell into either the Curriculum & Pedagogy and Reflective Teachers categories, and far fewer that fit into the Policy or Shared Vision categories. These numbers do reflect the adjustments we made in categorization while undertaking the further analysis.

Individual/Prescribed. Within this category, the change lever is developing curriculum/pedagogy. The focus of this type of strategy is on communicating the change agent's vision of good teaching to instructors. The emphasis is on the curriculum materials, instructional strategy, and/or associated instructor knowledge/conceptions. The change agent has a particular instructional strategy or conception about teaching and learning that they hope individual instructors will adopt. Change agents typically inform instructors about the target instructional

strategy or conception and provide motivation for the instructor to adopt it. Varying levels of

support are offered to assist in adoption. The primary change agent roles are to teach and/or sell.

An ideal example would be someone external to an instructor's institution (e.g., a curriculum

developer) telling him/her about a new and better way to teach relevant content in the

instructor's discipline. Specific sub-categories that emerged through analysis include: 1)

Disseminating Best Practices (7 articles). Change agent seeks to disseminate (and, perhaps

develop or compile) a set of "best practices" instructional strategies or materials. 2) *Modifying*

Instructor Conceptions (4 articles). Change agent seeks to promote adoption of a set of

instructional conceptions that are "best practices." 3) *Providing Individualized Diagnosis and*

Support (1 article). Change agent works with individual instructors to identify and improve

instructional difficulties

Individual/Emergent. Within this category, the change lever is developing teachers. The

focus of this type of strategy is on encouraging teachers to use their own knowledge/ experience/

skill to improve their instructional practices. Information about various instructional strategies

and materials may be provided, but this is not the main focus of the intervention. The change

agent typically has a particular activity (e.g., action research) that they hope instructors or groups

of instructors will engage in to develop new (at least to them) instructional strategies or

conceptions. Varying levels of change agent support and control of the process are provided.

The primary change agent role is to encourage faculty to reach their full potential. An ideal

example: A faculty developer within an instructor's institution invites him/her to a join a faculty

learning community that will meet every other week to discuss instructor-initiated action

research projects. Specific subcategories identified were: 1) *Support for Individual Curriculum*

Development (4 articles). Individuals reflect on teaching and develop, test, and refine new

instructional ideas. 2) *Collaborative Action Research* (3 articles). Teams of faculty (often from multiple disciplines) work together to develop, test, and refine aspects of a particular course. 3) *Helping Faculty Make Informed Decisions* (3 articles). An external change agent introduces faculty to a wide set of new pedagogical ideas and encourages faculty to use their expertise to reflect on and adapt the ideas to their own teaching situations (there is no explicit action-reflection phase). 4) *Departmentally-Based Faculty Development Specialists* (1 article). A faculty member within a department is given release time to address local faculty development needs.

 Environments/Prescribed. Within this category, the change lever is on developing policy. The focus of this type of strategy is on developing appropriate environments (e.g., rules, reward systems, reporting requirements) to ensure that instructors engage in desired activities. The change agent has a particular vision towards which he/she wishes to require instructors to work towards. Typically this means that an instructor must adopt a particular activity, strategy, conception, or outcome. While, in the strategies that focus on individuals, internal motivation is the primary mechanism to control instructor compliance with change agent wishes, here significant incentives or requirements are used. The primary change agent role is to set requirements or make rules. An ideal example would involve an administrator at an institution concerned that instructors primarily use low-level test questions. The administrator decides to require that instructors document their use of higher-order questions on tests. The following subcategories were identified: 1) *Systemic Alignment* (6 articles). Top-down change initiatives are used, with the caveat that they must be consistent with key aspects of the system. 2) *Institutionalization of Quality Assurance Measures* (4 articles). Assessment of learning or other quality improvement measures are used to induce instructional change on a large scale. 3)

Directed Incentives (3 articles). Presidents, chairs, and deans influence change by offering incentives or recognition.

   Environments/Emergent. Within this category, the change lever is developing shared vision. The focus of this type of strategy is on developing a new culture for the department, institutional unit, or institution (and, on occasion, even supra-institutional entities) that will support new modes of instruction. Stakeholders are involved to help shape this new culture and help determine what types of environments will be necessary to support the new culture. The change agent works with instructor (and typically other) stakeholders to develop a shared vision and to design new environments that are consistent with this vision. The primary change agent role is to empower stakeholders or catalyze action. An ideal example would involve a department chair, concerned about student learning outcomes in the department, inviting a consultant to work with the department over a semester to identify current weaknesses in undergraduate teaching and identify a strategy to improve them.

   Several articles that appeared upon initial review to address shared vision were found upon deeper scrutiny to address how culture serves as a barrier or a variable in policy implementation. Such articles were moved to the policy category. The following subcategories were identified: 1) *Institutional-Level Actions* (3 articles). Change agents work across entire institution. 2) *Externally Initiated Department Collaboration* (2 articles). Change agents work at the departmental level. 3) *Internally Initiated Department Collaboration* (1 article). Change in the department is initiated from within.

   Overall, change strategies described in the articles were much more likely to focus on changing individual faculty (61% of all 130 articles) than on changing environments or structures (19%). The articles were more evenly divided between working towards prescribed

outcomes (44%) and emergent outcomes (36%). We conclude that change agents frequently

work at the individual level, rather than at extra-individual levels that involve environments or

structures. Although the number of articles published may not be a perfect proxy for the

activities of change agents, we expect a high correlation between the two since we are dealing

with academic communities who place a premium on publishing their work.

<center>Detailed Investigation of Core Strategies</center>

A major goal of the analysis was to determine the nature and strength of evidence offered

by authors in support of the change ideas and strategies they present. This is an inherently

subjective process, and much discussion went into defining what constitutes strong, moderate,

weak, and little or no support – the scale by which we ranked articles.

Of the 43 articles analyzed, 13 did not present a specific change strategy about which one

would expect to see evidence of success. Some of these articles offered research that examined

issues important to change, such as teacher beliefs and departmental norms. Others offered

opinions, experiences, and reviews of the literature. Of the 30 remaining articles, we judged 12

to have at least moderate evidence supporting their assertions of success or lack of success of a

change strategy. Five articles were judged to offer weak support, and 11 offered little or no

evidence in support of their claims of success or lack of success. No articles were judged to have

strong evidence supporting the success of a change intervention. This may be due to the difficult

nature of studying and documenting a complex process within a complex environment.

Within the Curriculum and Pedagogy category, five of 12 articles were labeled as having

at least moderate evidence, one was seen as having little evidence, and 6 did not present a

specific change strategy. As such, this category presented the greatest number of articles with at

least moderate levels of evidence for success or lack thereof, and was the category most likely to

have articles that reported and examined lack of success as much as success. The evidence offered in the five articles was a mix of (mostly) quantitative survey and qualitative interview data.

Within the category of Reflective Teachers, one article was judged to have at least moderate evidence, six were labeled as having weak evidence, four had little evidence, and one did not present a specific change strategy. A common pattern with articles in this category is to describe an intervention, present weak evidence of success and then recommend the features of the intervention to other change agents. The one article (Schneider & Pickett, 2006) that reports limited success of the studied change strategy, does not question the change strategy, but rather suggests that more time is needed for meaningful change to occur. The evidence offered in the moderately supported article (Kember & McKay, 1996) came from an action research project over a five year period. The evidence offered in the articles with weak or little evidence was developed through a variety of means – surveys and questionnaires, action research, case study, auto-ethnography – but often did not present enough data to support their assertions, or reported implications and recommendations that were not connected to any data beyond anecdotal evidence.

Among the Policy articles, three were judged to have at least moderate support and six to have little support. Four articles did not present specific change strategies. Of the three articles that presented at least moderate support, two were case studies that collected and triangulated data from multiple sources, and one used existing data. In all three, the conclusions and recommendations were supported by the data presented. Among the articles offering little evidence, the methods were varied – surveys, interviews, case study – but again offered little evidence from those methods that connected with their claims. The number of "travelogue"

articles in this grouping was high – leaders of a change effort, writing in retrospect, celebrate

success of their effort through anecdotes but provide little or no systematically collected data.

The Shared Vision category had three articles with at least moderate evidence, one with

little evidence, and two that did not present specific change strategies. The three moderately

supported articles were all case studies that used multiple sources of data and presented

conclusions and recommendations clearly aligned with the case study data presented. The article

offering little evidence described the process of change and some anecdotes about how

participants felt, but no systematically collected data.

Overall, the articles, across categories, that did present at least moderate support for the

success (or lack of) of the change strategy studied, or of the conclusions and recommendations

offered, followed a pattern of systematic data collection – either quantitative or qualitative, or

both – and coherently tied their conclusions and recommendations to the data they present. In

addition, many informed their change strategies from the literature. Those articles that were

weaker often had data collected in a similar manner to the stronger articles, but did not present

the data effectively or in depth, and offered conclusions and recommendations that were not

supported by the data presented. Those articles with little evidence were often personal accounts

of change that relied on anecdote.

Common Ideas about Instructional Change

Another major goal of the further analysis of articles was to identify ideas about the

nature and process of change either explicitly stated or implicit within the change strategy or the

article's conclusions and recommendations. When looking within and across categories, several

interesting patterns emerge.

Twenty-five separate change statements were identified across the four categories. When examined more closely, six distinct foci emerged that encompassed the separate statements: 1) institutional structures, 2) individual faculty, 3) diffusion of innovations, 4) departments as the locus of change, 5) collective decision-making, and 6) multi-level buy-in. These will each be discussed.

Institutional structures included 9 change statements mentioned by 23 articles and were found in all four categories. These were often presented as structural barriers to change, particularly in the Curriculum and Pedagogy and Reflective Teachers categories. Statements about institutional structures dominated the Policy category. These were generally positively or proactively framed, and ranged from stating the need for institutions to support faculty development to noting the complex systems that need to be considered in change processes. Individual faculty factors included 7 change statements mentioned by 17 articles across two categories: Curriculum and Pedagogy and Reflective Teachers. Statements were often in the form of barriers to change. The most commonly cited ideas were that faculty lack knowledge about student-centered teaching, faculty are skeptical of new approaches, and change takes substantial faculty effort. Within the Curriculum and Pedagogy category, all individual faculty-related statements noted barriers to change. Within the Reflective Teachers category, these statements were more neutral, noting that teaching is context dependent and requires individual faculty adaptation, and that the typical faculty development advisor/client approach is not ideal for faculty change.

Ideas about the diffusion of innovation and change were found in three statements mentioned by 5 articles in the Curriculum and Pedagogy and Reflective Teachers categories. The overall idea expressed is an expectation that changes initiated by one or a few members of

an academic group (such as a department) would spread to others in that group once the changes are demonstrated to be successful. Some articles concluded that this does not commonly happen.

The department as the locus for change includes three change statements mentioned by 8 articles in three change categories (Reflective Teachers, Policy, and Shared Vision). The overall idea expressed by these statements is that the department is the power unit in universities, and the best (and sometimes only) place from which change can successfully start.

Collective decision-making is unique to the Shared Vision category, with two statements mentioned by 2 articles. The idea expressed was that those whom a change affects must be involved in creating that change, and that collective or collaborative processes used for other work can (and should) be brought to bear on instructional change.

A final focus – Multi-level Buy-in – was mentioned by only one article in one change category (Shared Vision), but was the sole statement examined that did not fit within the other five foci described above. The idea expressed in this statement is that successful change requires both faculty and administrative buy-in. One or the other will not suffice.

It is interesting to note that the most prevalent change statements within the Curriculum and Pedagogy and Reflective Teachers categories focus more on individual and structural barriers to change than on support processes. Statements within the Policy and Shared Vision categories do not typically address individuals. They do address structures, but less as barriers and more as factors to be considered and harnessed for change. Articles within these two categories also mention organizational cultures as important more frequently than do articles in the individually oriented categories.

Connections between Instructional Change Literature and Broader Change Literature

The final goal of the further analysis was to identify how the articles used, if at all, the broader change literature. We purposely left the definition of "change literature" very open and liberal, in order to capture the full range of literature and ideas being used by authors to either develop and justify the change strategies they describe in the articles, or to apply as a lens for studying change strategies. Therefore, our conception of "change literature" encompasses literature on ideas such as reflection, action research, diffusion of innovation, organizational culture, organizational policy, organizational theory, as well as other social science theories. We were also interested in how many articles drew from common literatures.

The most important finding is that less than half (20/43) of the articles cited literature that we could label "change literature" despite our broad definition. Those that did not fit within our assessment of using change literature typically not only failed to ground their selected change strategy in the change literature, but also failed to justify their choice of change strategy in any way.

Considering the four categories, the Curriculum and Pedagogy category used ideas of teacher beliefs and decision-making, as well as some use of culture. Hativa's (1995) study of faculty development efforts in a science department presented a change intervention based on a previously published change strategy. Within the Reflective Teachers category, the articles cite literature on reflective practice, action research, collaboration, and faculty learning circles, all emanating from FDR authors. The most sophisticated use of the change literature was found in subcategory 1 of the Policy category "Systemic Alignment," the theme of which was the need to align change strategies with cultural and operational norms within an institution. The authors of this subcategory all used theories as lenses through which to examine change. Interestingly, the

four articles used different change theories (contingency theory, conformity, HER organizational change, HER cultures) and differed from other articles within the Policy category, which called on leadership and organizational culture and change literature (e.g., Bennis, Senge, Schein). Reflective practice was also mentioned by a few authors within the Policy category. Within the category of Shared Vision, two of the six authors cite HER literature on departmental cultures, as well as FDR literature on teaching improvement.

Overall, there was little overlap across categories in the kind of literature used. The exceptions were ideas of reflective practice (sometimes with citations, sometimes not), and department and higher education cultures, which were cited with both Policy and Shared Vision articles. As more articles are added to the analysis, it will be interesting to see whether they continue with the pattern of discontinuity found thus far, or if we find use of common change literature that has not yet emerged in our analysis.

Discussion and Conclusions

Our analysis points to four core categories of change strategies that change agents use to promote change in the teaching practices used in undergraduate STEM instruction. These four core strategies can be identified by answering two questions from the perspective of the change agents. We were quite surprised that there were only a few articles that could not be easily categorized into one of the four categories. Further examination of the articles in each grouping elicited a lack of grounding in change literature, and a general lack of strong evidence for the success of strategies described. Many of the articles did not present convincing evidence to support the conclusions drawn and many articles did not build arguments and change strategies from the research literature. One possible reason for this situation is that, since the literature is distributed in a wide variety of locations (the 295 articles in our database represent 108 distinct

journals), it is difficult for authors in this area to find out about previously published work. This finding suggests that there is substantial need for synthesis work such as the work represented by this project. It also suggests that there is substantial need for work and effort focused on producing high quality studies that build on previous work.

A more in-depth discussion of our findings, including a list of all literature identified as relevant, can be found in Henderson, Beach, Finkelstein, & Larson (2008) at http://www.wmich.edu/science/facilitating-change/PreliminaryCategorization.pdf. Coding and analysis of articles and books in ongoing, and results are being incorporated continuously until this project is complete. Although the categories and trends identified in this research have been robust to this point, they may change as more resources are reviewed. These findings, therefore, should be considered preliminary.

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