
Leading Learning: Science Departments and the Chair

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In this article, we have considered the role of the chair in leading the learning necessary for a department to become effective in the teaching and learning of science from a reformed perspective. We conceptualize the phrase “leading learning” to mean the chair’s constitution of influence, power, and authority to intentionally impact the conceptual, pedagogical, cultural, and political aspects of teachers’ work. The data for this article are based on our ongoing work with one science department, over the past nine years, and have been woven into a longitudinal narrative study of a chair who has led the learning of an effective department since 2000. In considering the data, we can reach two major conclusions. First, for a chair to lead learning is to build a professional commitment to a vision of science education, not a particular program. Second, in leading learning, chairs afford opportunities for teacher empowerment. This affordance, however, is only half the issue. It is commitment to a vision that drives a desire to take advantage of opportunities as they arise. In leading learning that reflects changes in the broader science education community, learning opportunities are opened beyond the department.

As a feature of secondary schools, subject departments are almost ubiquitous. Researchers have noted their importance, but it is only in the last two decades that the extent of their influence has started to be systematically examined, and increasingly, understood. Since appearing in their modern form in the early years of the 20th century, departments have been the administrative units into which secondary schools are divided. In her seminal 1994 work, Siskin defined four aspects of subject departments that she believed were crucial to understanding their importance. For Siskin, departments are administrative units formed along strong disciplinary boundaries and are the primary places for teachers’ social interaction. They also have considerable power over what, and how, teachers teach and finally, they judge what is considered acceptable in terms of teaching and learning for the discipline.

Given these defining aspects of the department, how is the role of the chair, or head of department in some jurisdictions, actually defined? The short answer is that the role is largely undefined, although work in the United States, the United Kingdom, and Australia reveals three common themes. First, chairs are expected to lead learning within their departments. Second, there is an ambiguity as to the actual functions of the role, which apart from leading learning can include clerical, administrative, managerial, and extracurricular duties. Finally, the need for leadership skills, the lack of release time and/or appropriate compensation, and confused lines of authority often limit chairs’ ability to fulfil their roles.

The work of Bennett, Newton, Wise, Woods, and Economou (2003), and subsequent work by Ribbins (2007), identifies several gaps in the literature pertaining to the capacity of chairs to lead learning. It is the purpose of this article to begin to address one of these gaps, an amalgam of two gaps identified by Bennett et al. (2003): “studies of middle leaders who are deemed to be effective will help us understand how [effective departments are] achieved . . . [and] Longitudinal studies of middle leaders, as opposed to departmental or school effectiveness, should be undertaken” (pp. 18, 19). In defining the word “effective” for our work, we will use the definition offered by Bennett (2006), where the effective leader works “to create a culture of trust within their departmental teams that will make it possible to discuss issues of practice rather than sustaining these as individual matters” (p. 12).

Working with a science department in a public secondary school in a small city in Ontario, Canada, we are interested in the work of the chair in leading learning. Through a longitudinal study into the past 15 years into the life of the department, we are interested in two key questions. First, how has the chair been instrumental in leading learning that supports teaching and learning that is aligned with contemporary reforms in science education? These reforms can be summarized as those practices that afford students the capacity to use scientific knowledge when dealing with complex issues, and thus enabled to act as informed citizens (Roberts, 2011). Second, how has the exercise of that leadership changed over the past 15 years?

The Chair as Leader

Leadership is one of those phrases with as many descriptions and definitions as there are authors in the field. For our work, we accept leadership to be a moral undertaking through which a leader harnesses, liberates, empowers, and aligns a community toward a common purpose (Harris & Lambert, 2003). Starrett (1999, p. 26) suggests that such leadership is a dynamic process that moves between transactional leadership, transitional leadership, and transformational leadership. Transactional leadership involves the leader understanding where teachers are in their professional (and to some extent in their personal) lives, their understanding of teaching and learning, and their learning needs. It also involves establishing the ground rules for conversations around teaching and learning. The importance of transactional leadership is that it sets the foundations for the shift from individual to corporate learning. To draw on the abilities of teachers to create new standards of expertise and collegiality, shared values and beliefs, and a shared commitment to the work of the community is to engage in transitional leadership. This leadership also opens opportunities for teacher empowerment: “the gradual embracing of responsibility for one’s actions. It involves autonomous individuals in the choice to be active, rather than passive” (Starratt, 1999, p. 29). Sustained over a period of time, transitional leadership can take on aspects of transformational leadership, in which teachers are seen as being united in the pursuit of a common interest and are motivated in their work by values such as excellence, equity and freedom. Our two research questions fit within Starrett’s descriptions of the processes of leadership, as we see features of each form in the work of this department and chair.

If we are to use a phrase such as “leading learning” in describing the leadership of the chair, then we are automatically into the problematic area of defining what we mean. In working through the literature, three common threads emerge: leading learning appears to be skein together by the threads of influence, power, and authority (Jarvis, 2012; Møller, 2009).

Influence

For a chair to influence the learning of a department means going beyond instructional matters: it indicates an intention to effect change across the “conceptual, pedagogical, cultural, and political aspects of teachers’ work” (Windschitl, 2002). In terms of the forms of leadership discussed earlier, a chair who is seeking to influence learning is working to transform the department into one in which learning is placed at the centre of all activities, existing practices are challenged, and reforms are

critiqued in relation to their perceived benefits to teaching and learning. As Fitzgerald and Gunter (2006) define it:

Leading learning at any level in a school involves the act of influencing and working with others in a highly collaborative, collegial and supportive environment that encourages risk and innovation and which places learning at the centre of all activities. (p. 8)

A key capacity for a chair seeking to exert influence is the ability to mobilize “power resources in order to modify the behaviour of others” (Jarvis, 2012, p. 483). Contemporary science education operates as a culture of power with a prescribed view as to what “good” science teaching looks like, and that view is not easily challenged (Calabrese Barton & Yang, 2000). Consequently, any attempt to reframe the form, meaning, or substance of departmental conditions and lead learning in response to reform efforts raises issues of power—the second thread.

Power

Power is another of those terms that defies a clear definition. In this article, we are using a Foucaultian perspective that stresses that “Power must be analysed as something which circulates . . . Power is employed and exercised through a net-like organisation . . . Individuals are the vehicles of power, not its points of application” (Foucault, 1980, p. 98). Further, Foucault (2001) sees power as undifferentiated from knowledge: power can come from “possessing a certain knowledge that was superior in its efficacy to that of others” (p. 29). Hence, in order to lead learning, a chair may derive power from their practical knowledge of how reforms are operationalized within a classroom, and the ability to share that credibility within the department. Our earlier work also indicates that access to formal power, such as that granted to chairs by virtue of their position, is a precondition for shaping a department in which teachers are willing to challenge their current practices and engage with reforms (Melville & Bartley, 2013). We are also using the word challenge deliberately, understanding that contemporary science education can be characterized as a “political way of maintaining or modifying the appropriation of discourses, along with the knowledge and powers that they carry” (Foucault, 1980, p. 64). Power by itself, however, is insufficient to lead learning: the chair must also possess authority—the third thread.

Authority

While power facilitates influence, authority confers legitimacy to the actions of the chair in leading learning, based as it is on “socialization—the internalization of

cultural norms and values” (Allan, 2013, p. 199). Authority is critical if a department is to be shaped as a place in which reformed practices can be developed, given that leading learning is predicated on a high level of trust, autonomy, and respect for teachers’ professionalism (Fitzgerald & Gunter, 2006). In considering authority, Weber (see Allen, 2013) has made the distinction between three forms that are of interest in the context of leading learning: charismatic authority in which people believe in the particular calling of the leader; traditional authority in which people believe in institutional positions; and, rational authority in which people believe in evidence and/or correct procedure (Allan, 2013). Both traditional and rational authority promote the status quo in any social setting; it is only charismatic authority that can drive social change (Allan, 2013). Charismatic authority, however, being reliant on the individual is also ephemeral. In order to continue, that authority must become routinized by eventually appealing to either traditional or rational authority (Allan, 2013). For Jarvis (2010), the form of authority that a chair possesses also sets the parameters for leadership, as it will “determine the level of influence he or she has and this, in turn, will define the type of power being projected” (p. 65).

Methodology and Method

For this article we developed a longitudinal narrative study of a chair who has led the learning of an effective department since 2000. This study is based on our ongoing work with one science department and school administrators over the past nine years. A longitudinal narrative study makes it possible to investigate the direction(s) in which a chair may lead learning, and the processes by which learning develops (Hellden, 2005).

The data presented here mainly relates to four white, middle class teachers (including the chair) who have spent a considerable number of years working in the department since 2000 and been engaged in a range of research activities since 2006. The four teachers whom we have worked with for this article include Doug (the third author), who has taught since 1983, has been the chair since 2000, and originally qualified as a physical education teacher; Cathy, who has taught since 1999, taught at the school from 2001 until 2012, and originally qualified as a physical education teacher; James, who taught for two years before joining the department in 2001 and originally qualified as a chemistry teacher; and Lindsay, who joined the department in 2003 as a beginning teacher. She originally qualified as a chemistry teacher, and has held a number of science teaching positions in different schools in response to changing student enrolments and staffing needs.

The narrative was built from a variety of data sources, including semistructured interviews with the chair, teachers, and school administrators, teacher storylines, publications produced in collaboration with the chair and teachers, and a range of teacher artifacts. These include field notes, timetables, and lesson plans. Within the narrative, the data source and date is included. The semistructured interviews are drawn from two earlier research projects. The first, conducted in 2007, centered on how teachers were reforming their teaching in order to make it more inquiry-based, and provided us with a strategy for understanding the teachers’ development, both “personal—reflecting a person’s life history [and] social—reflecting the milieu, the contexts in which teachers live” (Connelly & Clandinin, 1999, p. 2). The second, done in 2011, was conducted with school administrators (including the principal) that focused on leadership and organizational change. Other interviews and conversations have been conducted with individual teachers, such as James in 2012 as part of a research project involving timelines, and with Doug in 2014 as part of his contributions to a co-authored book (see Melville, Jones, & Campbell, 2015; Melville & Pilot, 2012). In each instance, the questions were provided to the participants before the interviews in order to give them an opportunity to consider their responses. In the case of any semistructured interviews, these generally lasted for approximately one hour. All resulting transcripts were made available to the participants for member checking and clarification where needed.

In our interpretation of the range of data, we relied on the analysis of narratives strategy described by Polkinghorne (1995). Using this strategy, the range of data was interrogated using “concepts derived from previous theory or logical possibilities and are applied to the data to determine whether instances of these concepts are to be found” (p. 13). For this article, we were particularly interested in applying the notion of leading learning, and more particularly, the threads of influence, power, and authority. To code for these threads, the first and second author worked through the materials, specifically looking for phrases or instances that were indicative of each thread, and the context in which it occurred. These searches were then compared, with similarities being noted and differences being argued as to their value. In addition, we sought to look for how the threads developed over time, both between the various participants and through the department as a whole. In this way, we were able to consider how the chair was leading learning toward the reform of teaching and learning and how that leadership changed over time.

In our analysis, we have generally maintained the participant's verbatim responses, only making changes to improve readability. Participants were given an opportunity to provide feedback on both the preliminary analyses, and the drafts of this article. Pseudonyms have been used all third parties throughout the article. We also appreciate that research of this type requires a substantive amount of interpretation, especially as we are dealing with substantial time periods in the lives of these teachers, administrators, and department.

Context and Effectiveness

The science department is located within a public secondary school of 1,100 students in a small city in Ontario, and serves a wide range of socioeconomic groups. Within the student body, approximately two-thirds are enrolled in the applied/college stream, a quarter are enrolled in the university stream, and the remainder are in the essential/workplace stream. Long-term trends are seeing increases in applied/college enrolments, and a growth in the Aboriginal population to around 20% of the student body.

Ontario public secondary schools are expected to adhere to the relevant curriculum and assessment documents provided by the Ontario Ministry of Education, but this expectation is not enforced. Teachers have a great deal of autonomy in interpreting those documents within their departments, and chairs are generally expected to act as instructional leaders. There can exist, however, a great variation in the level of leadership, even within the same school, as will be evidenced later by the words of the principal.

In terms of justifying this department as effective, and by implication having an effective chair, we believe that this department has, for several years, been one in which it is "possible to discuss issues of practice rather than sustaining these as individual matters" (Bennett, 2006, p. 12). As evidence of the quality of these discussions, and the extent to which the department has built a reputation for teaching from a reformed perspective, members of the department have presented on their work to other school boards across Ontario, been used as an exemplar in assessment practices by the Ontario Ministry of Education, presented at conferences of the Science Teachers Association of Ontario, the National Science Teachers Association (NSTA), and the Association for Science Teacher Education. Further, members of the department have published book chapters and a book with NSTA, and published in professional and academic journals in North America, the United Kingdom, and Australia.

Narrative and Analysis

In seeking to understand the role of the chair in leading learning within a department, we have considered the work of one chair and his department over a period of 15 years. By considering the work over this period of time, we are attempting to comprehend how the chair's influence, power, and authority are constituted in a way that leads to an effective department. Further, we can now also consider how that leadership has changed over the past 15 years. A capacity to lead learning is critical, especially given that science teaching has remained "relatively unchanged, at least in its official guise, for the last half-century at least" (Tytler, 2007, p. 3).

There appear to be two crucial areas in which the influence, power, and authority of the chair combine to lead learning within the department. These areas also have strong links to the processes of leadership described by Starratt (1999). Our analysis indicates that chairs lead learning by promoting a professional commitment to a reformed vision of science education, and opening opportunities for teacher empowerment that arise in tandem with the development of that commitment.

Professional Commitment

Professional commitment can be defined as "the relative strength of identification with and involvement in one's profession" (Morrow & Wirth, 1989, p. 41). Within science education there is a tension between the shift to a reformed vision of science education and the hegemonic authority of the traditional science curriculum, which though "designed principally to train young people as a preparation for entering the science discipline, is the very instrument that is turning them away from science" (Tytler, 2007, p. 18). Historically, science teachers have identified with the status and power of the traditional curriculum; attempts at curriculum reform have only served to prove the resilience of that curriculum.

From his appointment by the Board to the position of chair in 2000, Doug worked to influence the department by shaping conditions conducive to teacher learning. First, he worked to refine his understandings and practice of science as inquiry. In doing this, he was engaging in transactional leadership in two important ways. First, he demonstrated an awareness of the power and resilience of the traditional science curriculum on the teachers' practice. Lindsay's experience in science education is indicative of all the teachers we worked with when she described her early teaching in these terms:

I was so used to the lectures, chalk-and-talk and really focusing on the curriculum—that's basically what I did.

And, my labs were the usual follow this, do these procedures, and here are a couple of questions. It was very traditional ... I taught the way I was taught. (Jones, Kaplanis, Melville, & Bartley, 2009, p. 153)

Second, he was developing the expertise necessary to lead teacher learning. Expertise builds credibility and gives teachers concrete examples of reform-based instruction to consider. Further, credibility gives the chair greater authority to influence curriculum, instruction and assessment decisions. By developing confidence in his own expertise, Doug was in a position to sharing his practice with teachers through conversations about his work:

There was no set out an agenda or timeline ... I continued doing what I was doing with my classes. I remember passing around inquiries to the other teachers in the department, and saying: "look at this work, isn't it extraordinary," and leaving it at that. At some point you have to give them credit for picking up and reading the student work, and then thinking, "how could I do that?" [In the early conversations] there was a sort of resistance, but it was more like "convince me," as opposed to "that won't work" or "I can't do that." From there, the conversations centered on why inquiry was more useful, and how we could get through the curriculum if we were doing inquiry? Eventually, the conversations turned to the question "if I wanted to try this, then how would I start?" (Interview, November 28, 2007)

Doug's influence was built on the credibility engendered by these conversations and other strategies such as the sharing of research readings and non-evaluative classroom observations. In 2000, Cathy, a newly qualified teacher, joined the department:

He helped me with meetings where we would sit and talk about the structure and how I would go about it ... I could also come into his class and observe him doing the lesson and that helped me tremendously. And reading journals and articles about inquiry-based science, he would share those with everybody. (Interview, December 23, 2007)

From these beginnings, the teachers in the department have developed a long-term professional commitment to the reform of their practice. This commitment incorporates a willingness to stay current with ideas in science education, the generation and sharing of new knowledge and a continual engagement with other science educators

through work with the education ministry, mentoring, and membership in professional organizations. The work of James is an example of this commitment.

In response to provincial changes in the area of environmental education, James was invited, in 2008, to participate in the provincial working group. This group was charged with preparing a new provincial Environmental Science course for introduction in 2009. This experience led to James being the lead author in a National Science Teachers Association (NSTA) book chapter on inquiry and environmental science (Pilot, Jones, Melville, & Bartley, 2010). In this book, he described the value of teaching from a reformed perspective:

The use of these strategies has helped many of our students to consider, and actively pursue, science based careers at both the university and college levels ... For students to be able to discuss issues with business and industry groups, educational institutions and the media indicates that they [have] the capacity to "engage intelligently in public discourse and debate about matters of scientific and technological concern." (Pilot et al., 2010, p. 226)

At the board level, James has also been heavily involved in designing and implementing teacher professional learning opportunities for *Growing Success*, a major overhaul of Ontario's provincial assessment policies (Ontario Ministry of Education, 2012). From this experience James has become the board authority on assessment and classroom practice, and in 2013 he took on a board position as an Education Officer, with particular responsibility for assessment:

From 2006 to 2008, I was catching my stride in terms of course delivery and the [assessment] training ... now I am leading the assessment and evaluation training ... [it] is an excellent opportunity to network, observe, and develop my understanding and technique. (Melville & Pilot, 2014, p. 359)

He plans to return to the classroom in 2016, at the completion of his two-year secondment. James acknowledges that Doug and the department have contributed greatly to his current position by giving him the "years needed to experiment with techniques for all types of learners" (Interview, March 12, 2012).

In part, that "experiment" has involved the building of long-term trust and capacity to support teacher collaboration. Strategies that have contributed to

collaboration include collegial in-class observation, co-planned assessments, and service on end-of-term interdisciplinary science department committees (e.g., the chemistry teacher on a committee with a biology and physics teacher) to assess culminating activities. During a visit in 2012, a meeting was observed between Doug and a new teacher to discuss the teacher's plans for end-of-term assessments. This involved a conversation about the use of exemplars and the development of assessments that aligned with learning goals, as required by the *Growing Success* assessment document. The commitment that the teachers have to pursuing the reformed vision is closely aligned to the notion that teachers should be the taking responsibility for facilitating their own learning, rather than being the targets for learning proscribed by others (Yager, 2005).

In line with this responsibility, Doug is adamant that he is responsible for the day-to-day management of the department, but the focus of management is to support the leadership that promotes teacher, and student, learning. A Foucaultian view of power is central to understanding this subtle interplay between power and influence and authority, a subtlety nicely summarized by Doug:

In my department I hold no power, or at least that's been the perception. I don't run around telling people what they should and shouldn't be doing. It's just a set of conversations, so I don't think anyone feels threatened. They see me as a colleague that has to manage some of the departmental work, but also see me as a curriculum leader. In some instances they're maybe willing to put up with deficiencies in departmental management. I think I hold all kinds of power, although I would never use that word. I have influence . . . over the past ten years I've realized how powerful that is. In conversations with other Chairs they ask me how I get my department to do what they do. I try to get them to look at their management styles and get them to give up some control. (Interview, November 28, 2007)

As a chair, Doug does possess a level of formal power, affording him the opportunity to constitute an environment conducive to learning. Formal power alone, however, is incapable of building commitment, as Doug recognizes in his comment that other chairs need to "give up some control." Doug stated that he had "no agenda or timeline." and that he consistently worked to involve teachers (but not initially the department as an organization) in a series of "conversations" around reforming science education. This is interesting in that it shows Doug engaging in micropolitics as described by Hoyle (1982): "characterized

more by coalitions than by departments, by strategies rather than by enacted rules, by influence rather than by power, and by knowledge rather than by status" (p. 88). The prominence of influence in this definition is significant in that it reinforces the notion that "collegiality is not necessarily the first choice for subject leaders, but an inherent condition of their leadership" (Jarvis, 2012, p. 490). Doug built influence, and projected his power, by actively engaging teachers in building a consensus around the reforms and their enactment in the classroom.

In challenging the status quo with a reformed vision of science education, Doug relied on a mix of charismatic and rational authority. Doug was available to work with teachers, and this was something that was appreciated. For example, Lindsay firmly believes that the mentoring relationship between her and Doug was based on trust and credibility, and was essential to her becoming a reform-minded teacher: "He's trusting . . . and shares his struggles [consequently] I have very strong opinions on inquiry and how important it is. I talk to teachers [in other schools] about inquiry and its benefits, and they consider me as an inquiry-based science teacher" (Interview, September 13, 2007). In challenging the status quo, communicating credibility is important, and over time the teachers have come to see that the reformed vision of science translated into success for their students. Indeed, there is evidence that the reforms have become routinized. In 2014, Doug summed up his vision of science for science education, and how he believed that teachers had responded to it:

Teachers must use their conceptual knowledge and pedagogical expertise to: ask questions, solicit answers, coach critical thinking, problem solve, develop collaborative work skills, facilitate the design/construct/use knowledge process, and most importantly provide formative assessments of both process and product. It's no wonder I often hear that a reformed vision of science education won't work in my classroom or department because of budget, time, personnel, the pressure of the curriculum, standardized tests or the fact that I already do experiments. Every teacher in my department could counter those roadblocks with evidence of visible, positive benefits to the student. It's not harder work, it's teaching and assessing in a different way. (Email communication, December 12, 2014)

The fact that the teachers are now taking the lead in promoting a reformed vision of science education indicates a high level of professional commitment. The commitment, and the manner in which the teachers are now leading learning themselves, would appear to suggest that Doug has

shifted from being an authority “over” the teachers to being an authority “with” the teachers (Hales, 1993). In short, Doug’s leading learning has opened opportunities for teacher empowerment.

Empowerment

Broadly defined, empowerment involves the enhancement of “an individual’s or group’s capacity to make choices and transform those choices into desired actions and outcomes” (Alsop & Heinsohn, 2005, p. 5). Marks and Louis (1999) make the argument that unless teachers “move beyond preoccupation with power and toward issues of shared vision and inquiry, collectively held models, and increased (professional) mastery of work, they will consistently arrive at the wrong solutions to the wrong problems” (p. 711). Constituting a commitment to the reformed vision of science education implicitly demands that teachers are empowered, for the acquisition of the knowledge, skills, and attitudes to teach from a reformed perspective is primarily not an individualistic pursuit: “Some aspects of inquiry are individual efforts, but many are not, and teachers need to experience the value and benefits of cooperative work as well as the struggles and tensions that it can produce” (National Research Council, 1996, p. 61).

This quote shares a similar refrain to a passage in a book written by Doug and Cathy in 2006:

[Science] can’t be just knowledge. We must model the ways and understandings of scientific inquiry; we must teach those ways and understandings; we must practice those ways and understandings; we must provide an opportunity to experience those ways and understandings in novel and authentic contexts; and finally we must provide quality assessments in order to improve performance of those ways and understandings. (Jones & Kaplanis, 2006, p. ii)

If we are interested in understanding how the leading of the chair can afford opportunities for teacher empowerment, then our analysis leads us to consider our data in the light of the phases of empowerment proposed by Hobbs and Moreland (2009).

The first phase, “initiating empowerment,” covers the first three years of a teacher’s career, and incorporates teachers’ experiences such as a lack of teaching preparation and a consequent lack of awareness of professional development opportunities, early experiences with decision-making, and increasing confidence that accompanies student success. In our narrative, we see Doug influencing teachers through a series of strategies: “we

would sit and talk . . . I could observe him . . . reading journals and articles, he would share those.” Charismatic authority, leavened with a commitment to rational authority, saw Doug both project, and concomitantly distribute, power. As an example, after teaching in other schools for two years, James joined the department in 2001. By 2003, James was mentoring a new teacher, Lindsey, who reported that:

James gave me resources and different ideas on how to teach the kids the skills that they need for scientific inquiry. He was really helpful at the beginning; because he knew I really had no experience with scientific inquiry. I remember him saying: “For the first semester just start getting comfortable with it, and I’ll help you at any time. When you’re comfortable with it try two of them, or if you’re more comfortable, maybe try three.” He would always ask me how things were going, and give me some really good feedback and suggestions. (Interview, September 13, 2007)

Doug trusted his teachers to work together for the benefit of all, noting how teachers had taken upon themselves the role of mentoring new members of the department. Reflecting on the experiences of Lindsey, he said:

. . . it was the entire development that helped her, and that’s a credit to the department. They can take an incoming teacher like Lindsey and work with her in a long-term way. The mentoring role isn’t just mine anymore, it is the department’s. (Interview, November 28, 2007)

Such a statement is an endorsement of an effective leader (Bennett, 2006).

Cathy made a similar observation in 2007, commenting on how teachers actively supported beginning teachers in reforming their practice:

When you start in this department you just assume that everyone you’re working with is an inquiry-minded teacher, and they’re going to tackle subjects that way. There are some teachers that, as soon as you ask them a question, they’re getting their binder out and they’re showing you exactly how they do it, or they’re going to find an exemplar for you. (Interview, December 23, 2007)

In these activities, we see a shift from transactional leadership to transitional leadership. Doug initially

established the learning needs of the teachers and the ground rules for engagement with the reforms, but increasingly teachers took on the task developing the departmental understanding of expertise and collaboration.

The second phase of Hobbs and Moreland's model, the "growth of empowerment" covers years four to eight of a teacher's career. This phase incorporates teachers actively seeking professional growth opportunities, a greater sense of self-efficacy and a greater sense of autonomy through involvement in decision-making. While Doug still clearly influences the department, he is also moving firmly toward a rational form of authority: a form based on evidence. In the words of the principal in 2011:

The science department is very well established as a high-functioning department—cohesive, articulate, committed—and that would be every member of the department. The science department has an outstanding instructional leader who is comfortable having those professional conversations. There are other departments that would not be ready to stride forward into this level of engagement and this level of discomfort. (Interview, April 19, 2011)

In our narrative, that evidence is explicit in the work of the teachers. Cathy had co-authored a book that reflects a sophisticated view of the reformed science education. Lindsay was seen by other teachers as working from a reformed perspective, and was promoting the benefits of reform in the school she was transferred to. James had developed his practice to the extent that he was leading at both the department, board, and provincial levels. By building a consensus around the reformed vision, and "giving up control" Doug has routinized the reforms, and is leading a transformed department, thus setting the conditions for Hobbs and Moreland's third phase of teacher empowerment, that of sustaining empowerment.

This phase, which covers teachers' careers from nine years on, involves them redefining their self-efficacy, building stronger relationships with their peers, and making an impact in the profession beyond their own department. As we have seen, James is now leading assessment training, and also engaging in writing for the NSTA. Cathy was second author in a NSTA book chapter on inquiry (Jones et al., 2009), and Doug described her work in 2011 as:

... continuing to expand her own knowledge around inquiry and is looking outside of the department to find that and bring it back to the department. In a sense this sharing is completing the circle, a lot of what she does

in her practice is available for other teachers to look at. (Interview, March 18, 2011)

Lindsay has moved to another school in the city, and is promoting reform teaching in there (see Melville & Bartley, 2013). Doug himself has just co-authored a book (Melville et al., 2015) on the work of the chair for NSTA. He may be close to retirement, but his influence is reaching well beyond his department.

Conclusions and Implications

In this article, we have considered the role of the chair in leading the learning necessary for a department to become effective in the teaching and learning of science from a reformed perspective. In considering the data, we can reach two major conclusions. First, for a chair to lead learning is to build a professional commitment to a vision of science education, not a particular program. To build such a commitment requires a chair to lead "through processes of debate, dialogue, and interaction between individuals and collectivities, leading to the implementation of some values and perspectives rather than others" (Brundrett & Terrell, 2004, p. 17). In our narrative, these processes required Doug to share his own expertise (thus making the reform credible), to encourage teachers to be part of professional conversations, and to trust teachers as they began to develop authority and influence. By leading, and then routinizing a reformed vision of science, the teachers developed, and refined, both the necessary epistemic knowledge resources and "the dispositions (commitment, capacity and resilience) to persist [and] integrate the functional and the personal" (Leithwood, Harris, & Hopkins 2008, p. 30).

Second, in leading learning, and moving from transactional to transitional to transformational leadership, chairs afford opportunities for teacher empowerment. This affordance, however, is only half the issue. Teachers must have a desire to take advantage of the opportunities: teachers can be presented with opportunities but not accept them. It is commitment to a vision that drives a desire to take advantage of opportunities as they arise. Doug was certainly purposeful in what he wanted to achieve, but was not tied to following an "agenda or timeline." Doug was able to incorporate the needs of the teachers into learning opportunities that were very specifically tied to the needs of the individual. Consequently, teachers developed a commitment to the reform vision, but also increasingly saw themselves as empowered in the pursuit of the vision. In turn, the teachers began to lead learning in the broader science education community. This expansion of potential

learning horizons is important in forming “a critical mass of empowered teachers with the capacity to renew schools on a continual basis” (Hobbs & Moreland, 2009, p. 9). Or, as we saw with Lindsay, take reformed practices into other schools.

Implications

Drawing from the experiences of this department, there are three implications for chairs seeking to leading learning in departments. The first is the need for chairs to be more than content specialists—they must *also* be learned generalists with the capacity to link science to the world in which they, and their students, live. They need to possess, or develop, and constantly refine, their reformed-based expertise in science content, the teaching and learning of science, instructional strategies, curriculum, and assessment.

Second, to lead learning, chairs need to be actively engaged with developments in science education. Engagement allows reasoned judgements to be made as to the professional learning needs of the department relative to reforms such as the *Next Generation Science Standards*. Without an understanding of reform documents, and the alternatives to current practice, it may be difficult to move beyond more pressing immediate concerns. The result will be the truncation of professional learning.

Third, chairs need to lead in the development of departments that share the responsibility for continuous improvements in student achievement. Doing this requires a focus on both teachers’ content and pedagogical knowledge and students’ ways of learning content. From this focus, strategies need to be developed for supporting teacher learning, such as mutual observation and critique, the collaborative implementation of innovations, and opportunities to review student work and assessment. In establishing these strategies, chairs need to be mindful of what teachers already know, and working from that point, move deliberately toward the ideals of relevant reform documents.

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