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Ritchie, S.M., Mackay, G. and Rigano, D.L. (2006) Individual and collective leadership in school science departments.
Research in Science Education, 36 (3). pp. 141-161.

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Manuscript prepared for submission to

Research in Science Education

Individual and Collective Leadership in School Science Departments

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REVISED VERSION

RISE 153-04

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Individual and Collective Leadership in School Science Departments

Abstract

Given that the subject department is recognised by subject specialist teachers as the central and immediate unit of organization in secondary schools it is surprising that so little attention has been paid by researchers to the leadership dynamics within science departments. The leadership dynamics within the science departments of two contrasting school contexts were explored dialectically in this study. The structure | agency and individual | collective dialectics guided our interpretation of data from lesson observations, interviews and questionnaire responses, especially as they related to teachers' preparation of units of work (i.e., planned curriculum). As well as recognising thin coherence in teachers' responses we identify contradictions in teachers' perceived and enacted leadership roles, and perceptions of influences on curriculum planning and teaming within the two science departments. Throughout the article we disrupt traditional individualistic leadership discourses and suggest possibilities for more widespread application of an individual | collective leadership dialectic in school science departments.

The activities of secondary science teachers are coordinated typically through departments chaired by a designated or appointed teacher leader (i.e., head of department) (Busher & Harris, with Wise, 2000; Dinham & Green, 2003; Siskin, 1994). Although there are variations in the management and status of subject departments, they are by far the most influential units or structures within secondary schools “when it comes to decisions about the goals and content of education, the choice of teaching material and the nature and intensity of student evaluation” (Witziers, Slegers, & Imants, 1999, p. 295). Furthermore, subject specialist teachers recognise the department rather than the school as the central and immediate unit of organization (Busher & Harris, 1999).

Within the complex leadership matrix of secondary schools, heads of departments¹ are starting to be acknowledged as key figures (Bollington, 2004; Brundrett, 2004; Busher et al., 2000). Generally, “recent research has shown that a substantial proportion of the variation in effectiveness among schools is due to variation within schools, particularly between different subject areas”, and these differences can be attributed to the differential leadership of department coordinators (Busher et al., 2000, p. 184). It is precisely at this middle management level within schools, however, that systemic reform efforts can get bogged down. Dinham and Scott (2002) referred to these sticking points in school reform – where change might be less well managed by department coordinators – as pressure points. They argued that greater pressure for educational change impacts at this level, possibly resulting in “less change of a desired nature, [and] with more dysfunctional and unintended changes emerging in their place” (p. 50).

¹ Heads of departments are teachers who are also designated as the coordinators of the department. Different titles for heads of departments are used in various States and countries. To avoid confusion, the term coordinator will be used for head of department unless the more general term is more appropriate.

A common thread among the variety of definitions for leadership is that it involves the exercise of *influence* over others (Christie & Lingard, 2001). For example, Nahavandi (in Sather, 1999) defines a leader as “any person who influences individuals and groups within an organization, helps them in the establishment of goals, and guides them toward achievement of those goals, thereby allowing them to be effective” (p. 512). In relation to teacher leadership specifically, teacher leaders are those who “lead within and beyond the classroom, influence others towards improved educational practice, and identify with and contribute to a community of teacher leaders” (Katzenmeyer & Moller in Howe & Stubbs, 2003, p. 284). According to Hales (1993), influence is “the process of attempting to modify others’ behaviour through the mobilisation of power resources” (p. 18). Here, the concept of power resources refers to the possession of something the other person lacks (Busher et al., 2000). In schools, power resources could include control over financial resources like budgets for equipment, expertise in subject disciplines (e.g., chemistry) and teaching practices (e.g., management of open-ended inquiries), and knowledge of curriculum trends and initiatives. Principals and subject department coordinators are influential personnel because they have access to power resources (i.e., they would usually have access to economic, social and cultural capital; cf. Bourdieu, 1990). However, teachers who complete tasks like the design of a new unit of work or assessment protocol can influence colleagues through the mobilisation of these power resources. Depending on which resources are activated by whom in complex interactions between actors, staff can be mutually influential as curriculum resources are reshaped.

Even though there has been sporadic interest shown by science education researchers in studying leadership within departments (Rigano & Ritchie, 2003;

Ritchie & Rigano, 2003; Wallace & Wildy, 1995; Wallace & Louden, 2000), there is a dearth of published research into the curriculum leadership enacted within secondary science departments. Because subject departments separately and collectively have the potential to influence whole school development, and designated leaders of subject departments have little empirically based literature to inform their practice, the leadership dynamics within science departments was the focus of the present study.

Dialectical Approaches to the Study of Curriculum Leadership

Referring to Dewey and his contemporaries, Prawat (1998) argued that all dualisms (e.g., powerful-powerless, dominance-resistance, leader-follower) were problematic for two major reasons. First, from an ontological perspective, Prawat argued that dualisms wrongly emphasised the origins of knowledge over its consequences. Instead of focussing on the mental representation aspects of knowledge, the true test of an idea, he claimed, rested “in its ability to open up new aspects of the world, in a cognitive-perceptual sense, for the inquirer” (Prawat, 1998, p. 201). The second problem with dualisms was that they tend to be inherently antagonistic in that one party is elevated over the other. As Prawat observed, this tendency has led to many unsatisfactory either-or educational debates giving rise to several ineffective fads in public education. Challenging the appearance of inevitability of belonging to one or the other category in a binary pair like leader-follower can create a source of possibilities for emancipatory action by teachers (Davies, 1996; Scheurich, 1997). As noted by Harris (2003), when leadership is viewed from a distributed perspective, the categorisation of leaders and followers becomes redundant because leadership is a fluid and emergent phenomenon where tasks and practices are stretched over personnel and other resources within the school.

Interestingly, while Spillane, Halverson and Diamond (2001, 2004) persist with their use of the leader-follower dualism in their conceptualisation of distributed leadership theory, they describe the relationship between “leaders” and “followers” in terms of interdependencies between these mutually influential actors: “leaders not only influence followers, but are also influenced by them” (2004, p. 19).

In contrast to the either-or categorisation in binaries, the application of dialectical approaches to sociology and social psychology focuses on the recursive and constitutive nature of associated constructs. In relation to the agency | structure dialectic, for example, there is no agency without structure, and no structure without agency. As Musolf (2003, p. 10) argued, “to say that humans are both shaped and shapers means that structure and agency construct each other,” and more generally, “social life is a dialectical struggle between structure and agency” (p. 8). The term structure refers to the social arrangements, relations and practices that exert power and constraint over our lives while agency refers to social actions by individuals and groups that question, challenge, resist or oppose the “normality” of the given order and their part in it (Osterkamp, 1999). Through social interactions each action reproduces and produces structures that become resources for possible actions of participants. These resources can then provide opportunities that enable, or restraints that hinder, future actions.

Agency characterises all persons; it is both collective and individual even though the extent to which agency is exercised by individual persons depends on their positions within collective organizations (Sewell, 1992). The position of a designated leader affords greater agency to the leader to bind the department as a collective than someone who is not formally recognised as the leader. Accordingly, it might be more difficult for observers to identify agency in the concrete actions of individuals and

groups at lower levels of hierarchically structured organizations; or as Spillane et al. (2004) noted: “the prevailing ‘egg-carton’ organization of schools isolates teachers in their classrooms” (p. 26), providing them with fewer opportunities to disseminate ideas and influence their peers.

Ritchie, Tobin, Roth and Carambo (in press) recently studied the tension or dynamic between individual and collective actions (i.e., individual | collective dialectic) for collective leadership to be realised within a US school academy (school within a school) where the curriculum was centred on the disciplines of science, mathematics and engineering. They extended the concept of distributed leadership and descriptions of collective leading, involving multiple leaders working together, advanced by Spillane et al. (2004), to describe collective leadership as that which involves the shared responsibility of actors for the enactment of structures that afford agency to stakeholders to act in ways that will facilitate rather than constrain cultural transformation of a field like an academy or department. Furthermore, they argued that collective leadership not only manifests in the practices of joint action of actors (e.g., cogenerative dialogues²), but also as solidarity³ among participants, where successful interactions between participants generally lead to the production of positive emotional energy or “a feeling of confidence, elation, strength, enthusiasm, and initiative in taking action” (Collins, 2004, p. 49) in individuals and collective effervescence from the group. The implications for designated leaders like science

² Cogenerative dialogues are theory-building conversations among participants about shared experiences for the purpose of changing praxis. The purpose of cogenerative dialogues is to “cogenerate” collective resolutions in regard to issues such as outcomes, roles, resources, and rule structures. Accordingly, a cogenerative dialogue can provide opportunities for creating and enacting collective leadership (Fletcher and Käufer 2003).

³ Solidarity is a feeling of membership or belonging to a group of interlocutors, where “our sense of solidarity is strongest when those with whom solidarity is expressed are thought of as “one of us”” as opposed to “one of them” (Rorty, 1989, p. 191).

coordinators from this work is that they need to participate in successful interaction chains to foster solidarity with staff and students, establish a climate for sharing visions, and negotiate structures with stakeholders to produce positive emotional energy. There is an interesting tension or dynamic between individual and collective actions for collective leadership to be realised: the actions of individuals generate resources for collective leadership to emerge and collective leadership empowers stakeholders to act in the interests of the collective.

Methodology

We continue to investigate the dynamics of curriculum leadership within science departments with reference to the agency | structure and individual | collective dialectics using a multiple case studies design (e.g., cross-case analysis). Case studies of the leadership dynamics within subject departments are not only significant in their own right (Busher et al., 2000; Spillane et al., 2004, Witziers et al., 1999), but also the present study is the first to take-up the recommendation by Ritchie et al. (in press) to apply the individual | collective dialectic to leadership within actual school science departments. The fundamental research question addressed in the study was: How do the curriculum leadership dynamics between two high school science departments compare?

Yin (1989) detailed procedures for the design and conduct of multiple case studies largely consistent with a positivist paradigm (Bassegy, 1999). For the purposes of this study we adopted procedures that are better situated within the participatory (Lincoln & Guba, 2000) or interpretive (Bassegy, 1999) paradigm. From this paradigm, interpretive researchers reject the positivists' view that the social world can be understood in terms of grand narratives or general statements about human actions. Instead, descriptions of actions are based on shared social meanings that change as

people, even researchers within the same team, change through social interactions. Dilthey ([1900] 1976) referred to this constantly changing level of understanding through research as hermeneutic circle. Hermeneutic approaches view the knower and known as interrelated where “the interpreter’s perspective and understanding initially shapes his (sic) interpretation of a given phenomenon, but the interpretation is open to revision and elaboration as it interacts with the phenomenon in question” (Tappan, 2001, p. 50). Validity and truth of claims from this perspective are established through agreement, rather than empirical tests: “if the members of an interpretive community agree on what a text means, based on their jointly shared biases, assumptions, prejudices, and values, then that interpretation is considered to be ‘true’ or ‘valid’ – unless and until a new interpretation is offered that members of that community agree is better” (Tappan, 2001, p. 52). Interpretive researchers also adopt a different ontological stance than positivists. As Bassey explained:

People perceive and so construe the world in ways which are often *similar* but not necessarily the *same*. So there can be different understandings of what is real. Concepts of reality can vary from one person to another. Instead of reality being ‘out there’, it is the observers who are ‘out there’. They are part of the world which they are observing and so, by observing, may change what they are trying to observe. (1999, p. 43)

Before discussing our interpretations, we provide descriptions of the contexts and research procedures for the study.

Contexts

In our previous studies of change and leadership within science departments (Rigano & Ritchie, 2003; Ritchie & Rigano, 2003) the designated coordinators were men. One school was a rural government high school while the other was a co-

educational independent school situated in a suburb of a large regional city in north Queensland, Australia. To balance these contexts in the present study, we approached principals of schools whose science departments were coordinated by women, both of whom were known to us as dynamic and innovative teachers. One school was a government (co-educational) high school (Palm High) while the other was a Catholic girls high school (Saint Stephens). For reporting purposes, names for schools and teachers are pseudonyms.

Palm High was a relatively new school. Its 550 students predominantly came from a middle-to-low socio-economic background. Dianne was the designated coordinator of science at Palm High that had seven science teachers. She had been teaching junior science and senior chemistry for 15 years, three of which she had served at Palm High – all as science coordinator. Mostly enthusiastic beginning teachers with just a few experienced teachers (i.e., > 5 years) staffed the science department. It was school policy to disperse subject specialists across the three staffrooms to maximise opportunities for cross-curricular planning. Despite the lack of experience among most science teachers, the Principal praised the department, and Dianne in particular:

The staff is pretty young and they like to do new things and be pretty innovative. They don't like sitting at the same desk for 30 years and doing the same things for 30 years. And I have a particularly creative and intelligent science coordinator, that's Dianne. She's a very talented person and also creative. I like that creative flair.

Jane was the coordinator of both science and mathematics at Saint Stephens where she had taught for her entire career of 23 years. Like Dianne, Jane also taught senior chemistry and junior science. Since taking up the science coordinator's

position two years earlier, Jane admitted to transforming the science curriculum intentionally. While the principal praised Jane's extraordinary efforts and acknowledged the obvious benefits to the school, she also recognised that initial tensions had eased gradually. The principal declared:

Jane is a very dynamic in-your-face person and a lot of people don't like that... There has been a lot of tension and a lot of anxiety... There has been a real effort over the last couple of years of building up a team spirit, a perception of the department as being dynamic and changing... She also works probably 500 percent more than she should. She works constantly. There's no such thing as holidays, weekends. Everything is work focussed. From the point of view of the principal, it's great.

Demand for student enrolments at Saint Stephens exceeded its capacity of about 600. Since Jane's appointment as science coordinator there had been close to a 100% turnover of science staff. Through retirements, deliberate internal movement of staff and active recruitment of enthusiastic beginning teachers, teachers in the science department wanted to be there: "I think people are working in that department have asked to be there. I think that makes a difference to people's attitudes too" (Principal). Three of the women science teachers were in their first or second year at the school. The two men on staff were very experienced, as were the other women science teachers (i.e., > 15 years). All seven science teachers were placed within the school's single staff room.

Both Dianne and Jane had curriculum leadership positions beyond the boundaries of their schools. Dianne had been a District panel chair⁴ in senior

⁴ Since the abolition of external examinations in Queensland in 1973, the task of moderating grades awarded by schools was given to panels of selected educators at District and State levels.

chemistry before taking up a role on the State panel for chemistry. Jane succeeded Dianne as the Chair of the District panel. At the time of the study, new context-based trial-pilot syllabuses in senior chemistry and physics had been released for limited trial and a relatively new outcomes-based syllabus for Years 1-10 science (Queensland School Curriculum Council, 1999) was in the process of being phased in to all Queensland schools.

Research Procedures

A total of 15 staff volunteered to participate in the study – eight from Saint Stephens (Principal, Jane, Curriculum Coordinator, and five science teachers) and seven from Palm High (Principal, Dianne, and five science teachers). Data were created from a variety of sources; namely, staff survey responses, interviews, lesson observations, and relevant documents.

Before interviewing teachers, each was invited to complete a survey (Science Teacher Leadership Survey). The survey design was influenced by those used by Spillane et al. (2001) which required respondents to identify and rank the most influential people and resources for each significant educational issue they had encountered recently. This helped with the identification of possible nodes within networks of influence. For example, Jane listed assessment as a major issue at her school, and she identified that she had accessed syllabus documents and attended a workshop external to the school. Of the staff listed, Jane identified one of the early career teachers as the most influential. From this information, interview questions were designed to encourage elaboration of the interactions listed as well as ensuring that influential staff members were invited to participate in the study. This is why the Curriculum Coordinator was included in the study at Saint Stephens – several science teachers in their responses to the survey listed her name.

Each teacher interview began by clarifying personal details and educational issues identified in the survey. Our aim here was to understand the teacher's professional interactions within the science department from his or her perspective. Rather than following a rigid interview protocol we encouraged the teachers to talk about how the work of the science department gets done. For example, a typical question posed to most teachers was: "I'm interested in the dynamics within the department. Can you tell me something about how things get done in the department?" Our follow-up questions sought clarification and elaboration with the occasional probe. For example, a follow-up question to the one above was: "Can you tell me about those actions that made an impact on the department to cause a change in practices?" Typically, conversations centred on the development and implementation of units of work to satisfy the requirements of the new science syllabus (Queensland School Curriculum Council, 1999). Related to this issue was assessment of student achievement for each unit, especially designing and monitoring assessment criteria that were indicative of specified student outcomes. All teachers were interviewed once, each taking between 30 and 60 minutes; all interviews were audio-taped.

Unlike the teachers, both Dianne and Jane were each interviewed on five occasions to gain a sense of how particular issues impacted on the department across the period of our visits to the schools. Their first interview was conducted in the manner described above. Each of the next three interviews was conducted immediately after we had observed a lesson. This helped us develop a better understanding of the contexts in which the teachers worked and how particular issues identified in the interviews might have affected classroom actions. These interviews were conducted in much the same way as our previous research (e.g., Ritchie &

Rigano, 2001; Rigano & Ritchie, 2003); that is, they focussed on the teacher's classroom actions, especially as they related to previously expressed beliefs and goals. Typically, each interview was initiated by asking, "What went well during that lesson?" The teacher's responses were probed further with follow-up questions that helped us make connections between what we had seen and what the teacher had intended to achieve by those actions (i.e., identify consistencies and discrepancies between espoused and enacted theory/action). As well, these actions and their justification could be related more easily to what we had heard during our interviews with the other teachers. The fifth and final interview for each coordinator was conducted at the conclusion of each case study. This culminating interview allowed us to review key issues and clarify events or issues raised by other teachers.

Both principals were interviewed to comment on the dynamics of each department from their unique perspectives as well as to provide a broader context for the study. As mentioned earlier, the curriculum coordinator at Saint Stephens was interviewed to comment on the influence of the science department across the curriculum at the school.

We observed three lessons each from Jane and Dianne's classes. In particular two grade 8 science lessons and one grade 11 chemistry lesson for Jane and one lesson each from Dianne's grade 8, grade 10 science, and grade 11 chemistry classes were observed. During the lessons our attention was given to tasks and strategies that had been identified in the surveys or previous interviews. Artefacts of relevance to these lessons (e.g., worksheets, assessment criteria) were copied for later reference.

Steve and Donna teamed up to complete the case study at Saint Stephens while Gail and Donna worked together on the case study at Palm High. Both members of each team observed lessons and interviewed teachers. Donna transcribed

all audio-taped interviews. These transcripts were distributed to team members for discussion and returned to interviewees for checking.

Leadership Dynamics: Similarities and Differences

Leadership is a complex field of study with competing theoretical and practical stances appearing in the literature. Accepting the complexity of leadership as practised in schools, Lingard et al. (2003) argued the case to “work with” theoretical constructs – rather than accepting the limitations of researching within a particular theoretical framework – by “brushing together” concepts. In this particular study we attempt to brush together the individual | collective and agency | structure dialectics in our cross-case analysis, typically foregrounding the individual | collective nature of leadership practices wherever possible to extend the work of Ritchie et al. (in press). We now work with these dialectics as we consider teachers’ perceptions of enacted leadership roles, influences on curriculum planning, and teamwork at the two study sites. This analysis shows that the designated leaders accepted individual leadership roles to improve outcomes for the benefit of the collective and these roles were perceived differently by staff members who occupied different positions within the schools. Teachers were influenced by both internal and external resources in the preparation of units of work for collective use in the departments and team structures facilitated and constrained this work.

We accept that designated leaders have privileges not afforded to other teachers, and this impacts on the leadership dynamics within the organizational sub-unit (e.g., science department). For example, department coordinators are generally the nominated teachers to attend curriculum meetings outside of the school. The information they receive from these meetings and the networks they establish from the meetings increases their potential for agency and influence within their schools.

This differential agency impacts on the structures within the departments. In relation to assessment practices, for example, teachers at both schools designed assessment tasks individually for collective use. As they exercised agency in constructing the tasks, they influenced the structures for monitoring assessment, but the coordinators' responses to these tasks (through their accepted individual leadership role of monitoring standards) influenced the design of subsequent assessment tasks.

Identification of the recursive nature of the leadership dynamics enacted at the two sites was facilitated through our consideration of the individual | collective and agency | structure dialectics.

Leadership Roles

Both coordinators shared a common set of individual leadership roles they enacted as science coordinators in their schools. These included: monitoring assessment tasks and standards, modelling desired practices that were consistent with their articulated visions for science education, introducing new ideas located externally for consideration and possible action within their departments, and convening staff meetings. They also acknowledged the value of accessing the collective resources to which they had access in their respective departments from individual teachers, especially in the design and implementation of shared units of work. While it is possible to list other roles for heads of departments, it should not surprise readers that the teachers and coordinators at the two schools identified leadership roles that impacted most on their daily activities and interactions, as well as important within-department strategic plans (see also, Witziers et al., 1999).

In relation to the preparation of units of work for collective application across classes in particular year levels at Saint Stephens, Jane admitted:

I'm finding a lot of staff make suggestions, we show each other work, we say no we don't like that, we reflect on it. But I'm always modelling that... If I have to ask them to set units of work I have to model that. I have to model and handle criticism. Not criticism of me personally, but criticism of the stuff I do produce, that I do present.

You have to recognise the team, it's not about me, it's about us... I can't have it if I don't have a good team. [You've] got to recognise the value of what you've got, have variety of it. I've got one [teacher] who is procedural (e.g., filing resources) – we've analysed ourselves – we might have someone else who does this (e.g., creates interesting and novel activities). *I might match them because together they are stronger than separate.*

Jane's last comment (in italics) was congruent with Spillane et al. (2004) who asserted "that the collective cognitive properties of a group of (teacher) leaders working together to enact a particular task leads to the evolution of a leadership practice that is potentially more than the sum of each individual's practice" (pp. 18-19). Her other comments demonstrate that Jane recognised the need for her to model desirable practices (individual leadership role) so that her staff might engage in similar practices in order to produce high quality materials for the benefit of the collective. It also shows Jane's belief in improving the outcome for the collective by depending on individual contributions to the collective and her role to elicit such contributions; namely, to match individuals with complementary skills. This view was repeated later, as the following excerpt shows:

Steve I think you said there was some conflict initially between you and the two male teachers and you opted to leave them alone.

Jane I don't want them uncomfortable. That's not my role.

Steve So you feel as if they were uncomfortable?

Jane I think one has made a little bit of headway just recently.

Steve Okay... So have you attempted to influence them in different ways recently?

Jane One [teacher] I won't [try to influence]. [The other] one I'm going through another staff member. I have them in teams now.

Steve Tell me more about that.

Jane I have them in teams now and I might change the team that's working together from [year] 9 to 10... Every year I think about who I'm going to team them (i.e., teachers within the science department) with. I'm thinking I might change the team a little bit in grade 9 next year. If all the teachers are on the same thing I've got a new strategy for next year that I might team a particular staff member with someone else=⁵

Steve: =and work through another person with whom you already have established=

Jane: =a good rapport.

Steve: So are you expecting that to be a bit more successful?

Jane: Well it's another way. *Isn't that my job, to find out different ways and means of doing it?* It's not good me going in and challenging them.

In this particular interview excerpt, Jane is talking about her perceived individual role or "job" to match a trusted "progressive" teacher whose beliefs and practices align closely with her own in a team with a teacher whose views are less progressive (i.e., one of the experienced male teachers with whom she encountered some conflict early in her role as coordinator), in the hope that this less progressive

⁵ This convention (=) signifies a continuous flow of speech from one actor to the next without any discernible pause.

teacher might be influenced positively by the ideas and practices of the other. This statement shows the plan to implement a subtle interventionist strategy that avoids a possible confrontation with the traditional teacher who might resist more direct means of effecting change, as well as to change the dynamics and resourcefulness of the collective. It relies on accessing the potential influence of one teacher on another in the same team.

This same disposition was observed in one of the Year 8 lessons where students were undertaking group-tasks that would then contribute to the whole-class (or collective) project in a forensic science investigation. Commenting after the lesson, Jane said: “Oh yes, we’ve got to maintain the group. If we don’t maintain the group, I tell them (i.e., her students), we can’t all perform well because you’ve got to push your (individual) results up”.

Jane was just as proactive maximising individual staff contributions to the collective as she was with her students. Monitoring assessment standards of students’ work across classes was one of those roles that Jane took on in her capacity as designated leader: “I have to check on them, I demand assessment (tasks), I need to check it first. There’s a few things I need to have, that’s my role”.

Dianne also identified modelling and monitoring assessment tasks and standards as significant individual leadership practices at Palm High: “I don’t ask staff to do anything unless I have done it myself, or am doing it”. As one of the teachers noted: “she (i.e., Dianne) doesn’t ask anything of the staff that she doesn’t do herself... [so] when she asks things of you, you are quite happy to do whatever she asks of you”. Two other teachers suggested that while the department structures afforded them the agency to vary shared units of work individually during implementation, they would need to seek Dianne’s approval when setting assessment

tasks or making permanent changes to particular units. For example, an early career teacher explained: “But if I find something in a unit that I’d like to change, I’ll give it a go and if I’d like to make it more permanent, I’ll speak to Dianne and she’s usually really helpful.”

Like Saint Stephens’ staff, teachers at Palm High individually or in teams prepared units of work for collective use. How individuals contributed to these collective resources was articulated by one of the more experienced teachers at Palm High as follows:

It was, “okay what are you interested in?” “Okay, I’ll do something on sports science and I’ll do one on plants”. So I was given those topics and made some units up with resources that I had. And any other resources people had we would stick into folders just so we had something for everyone else to use.

While this demonstrates that teachers took on important curriculum planning responsibilities, the structures in place within the science department afforded teachers the opportunity to influence the work done across year levels by making individual contributions; that is, power resources from subject specialists through subject expertise were mobilised in this structure (cf. Hales, 1993). Yet the teacher was not in fact “given” the task of preparing these particular tasks by Dianne even though there was an expectation that such a contribution was essential for the collective good. Rather, teachers self-selected units (and teams) to prepare, following consensus reached at year-level discussions.

This seemed consistent with Dianne’s metaphor for describing her role in curriculum planning; namely, *the secretary*. Throughout our discussions with Dianne, she expressed discomfort with terms like leadership and influence to describe her relationship with science staff: “I see myself more as a secretary. I do the running

around and making sure that things happen, a bit of problem solving there”. Yet teachers appeared to look to Dianne for guidance and approval – clearly recognising her role as much more significant than secretarial. Furthermore, Dianne’s commitment to curricular change in the senior chemistry program (i.e., an emphasis on contexts) shaped the framework for unit planning at the junior level, suggesting a much more influential role than her secretary metaphor. The principal best expressed the contrasting images of Dianne’s leadership roles we were getting from the interviews:

There’s a continuum of leadership. Depending on which you operate in and depending on the circumstances and sometimes you have to say no and Dianne can do that. She’s a very strong person. Ideally I think she likes to operate on a consensus style of leadership with delegating specific tasks to people. But she is prepared to take a stand and she is prepared to say this is the way it will be. She certainly appreciates people who will take on new ideas, who take responsibility. She certainly appreciates people who are reliable.

Clearly, Dianne was much more transformational than her articulated role of curriculum leader “on the side who can give assistance rather than driving it” (Dianne).

In contrast to Dianne’s preferred articulated role, Jane’s main metaphor for leadership was *the salesperson*. “I’m a seller”, she declared. In relation to student selection of science in the upper grades, Jane argued: “If you want them to study science in grade 11, I believe that you’ve got to start selling it in grade 8”. Jane’s role as salesperson was acknowledged in different ways by staff, suggesting it depended on how well one’s beliefs aligned with Jane’s as to whether this role was perceived

positively or negatively. We should expect variation in the relationships between individuals within the team due largely to differences in resources each brings to bear in their interactions (cf. Spillane et al., 2004); that is, a person who exercises greater agency in a relationship with a leader is likely to perceive interactions differently from a teacher who is afforded less agency in a particular structure.

We are working from Jane's interpretation of those documents; not necessarily those documents themselves, or even a shared interpretation of what the documents mean (Early Career Teacher).

She's not a person who will want to dictate. She will discuss and she obviously comes up with ideas and stuff and then she shares and says what do you think and we tell her (Experienced Teacher and closest colleague).

[Some staff feel] that they have been railroaded by (the Experienced Teacher, as above) and Jane... It's not an intentional thing but it's the personalities of the people involved (Principal).

Influences on Curriculum Planning

Another important leadership role both Jane and Dianne demonstrated was filtering external information for application in curriculum planning within their schools. Because schools in Queensland were subjected to increasing pressures from government and quasi-government departments/agencies to design curricular responses to new policies in middle schooling, post-compulsory schooling, and changes in various science syllabuses, the science coordinators selected relevant information for discussion and action within their departments. This protected beginning staff from too much design work while developing classroom behaviour management skills and assuaged resistance from experienced staff who might have developed a level of cynicism from constantly changing policy. As one of the early

career teachers at Palm High put it: “She shields us from a lot of stuff outside of our control. So I think she gets bombarded with a lot more stuff than what she filters through to us”.

Rather than simply filtering policy changes to which schools were required to respond, both coordinators actively sought information and ideas that could be applied in their respective contexts. Both had established extensive external professional networks to help clarify their ideas and provide a constant source of support for innovative applications of policy documents. Through their elevated positions within and outside school (i.e., symbolic capital), both coordinators had greater agency than their respective staffs to access (i.e., power resources) and select information that would influence the structures within their departments.

For Dianne:

I tend to have different groups for different things... There were very few people that were common to all of them... mainly from outside the school.

For Jane:

I have a very big network... that influence me, and I love being with them because they're positive like me... They inspire me because we're still positive about children and about learning and science.

These networks helped each coordinator develop professionally at an individual level but when filtered through to their departments, ideas became resources for the collective to work with for the benefit of their respective schools.

Ideas also filtered externally through to schools in the form of staff renewal. Both coordinators recognised the value of fresh ideas from new staff and actively recruited new graduates. “The young ones tend to bring ideas in”, acknowledged Dianne. She continued:

I love getting graduates out because they've got such great ideas. And when they are in 2nd or 3rd year, confident with the way that their behaviour management is going, they start firing. So all that stuff you do with them at uni actually comes to the fore. Most of them by that stage are actually quite willing to offer ideas and put their hands up for stuff.

Even one of the early career teachers at Saint Stephens recognised the important contribution made by early career teachers in her science department: "they bring fresh ideas, in terms of how we might approach things that are already in place".

Not all ideas for curricular change originated from outside the schools.

Student feedback was accessed both formally and informally as a means of improving units of work at both schools. For example, at Saint Stephens, Jane explained:

We asked them (i.e., students) specifically what they liked about the Mars unit, what they didn't like about it, what we could improve. For instance, it was fascinating because some of the things they commented on with me that they didn't like, they liked with another teacher. So it meant that maybe I didn't do them as well as someone else, or had a different approach. But overall we knew we had a seller because it was an overall positive response.

Once again Jane highlighted the importance of selling science to students. More importantly, student responses to their learning experiences in planned units became resources for collective curricular decisions as well as providing resources for individual teachers to reflect about their implementation of the packages. Informal feedback from students at Palm High also partially informed Dianne about the implementation of various units. In Dianne's words: "I know most of the kids at this school and I usually have little chats with them as I am wandering around and you get some feedback. But teachers also give me feedback about things as they go". In light

of recent research elsewhere (Ritchie et al., in press), valuing students' contributions to curricular decisions and designing structures that enable students to contribute to the improvement of department-wide practices are crucial components of the enactment of collective leadership.

Teaming Within Departments

As noted previously, small teams of teachers at Palm High self-selected each other for the purposes of co-designing units of work, where these were not individually prepared. This was particularly noticeable in the upper school curricula where biology teachers consulted with each other, as did chemistry teachers. Science department structures that fostered this practice seemed to be consistent with Dianne's secretary metaphor, where she would support groups and individual teachers from the side in the redesign of units and programs. These practices contrasted sharply with those observed at Saint Stephens. As we have shown previously, Jane intentionally manipulated teams of teachers each year.

Interestingly, given the metaphorical referent that described Dianne's teaming practice, one might have expected Dianne to take a lower profile in setting the agenda, convening, and chairing staff meetings than reports of such practices by teachers suggested. The distribution of the science teachers at Palm High across the three school staffrooms meant there was little opportunity for informal conversations between science teachers as a collective. Instead, teachers within the staffrooms tended to team up where they shared teaching areas or year levels. Formal staff meetings were difficult to convene because teachers taught across year levels and there was an overlap between sets of timetables for upper and lower schools such that the science staff as a collective did not share even a common lunch break. Accordingly, staff meetings were convened before school once every three weeks.

The agenda for these meetings was typically rushed with little time for open discussions on issues of mutual concern. In contrast to how a secretary might act, Dianne controlled the meetings in order to get through the agenda that was also set by her – “Probably the vast majority of issues I bring to the table”. “It is not a good situation for a discussion”, she admitted. Despite Dianne finding some merit for the three-staffroom structure for enhancing the possibility for cross-curricular planning, teachers generally did not share her optimistic forecast. For one experienced teacher, communication with Dianne was mostly limited to emails, “that’s the only time I get to talk to her”. For one of the early career teachers, these department and school-wide structures interfered with communication and hampered science curriculum planning.

I prefer to be in a science staff room. The whole concept of the 3 cross curricular staff rooms was to allow for cross curricular discussion and planning but we don’t get the opportunity to do cross curricular planning, there’s no dedicated time for that. I guess they assume we do that while we’re eating our lunch, I don’t know... If I wanted to see [the other biology teacher] I would have to walk all the way to X (staffroom), hopefully she will be there. If not I would leave a note on the desk and when she sees that she has to try and find me. And then finally I get her answers, then I can go to Z (staffroom) to see Dianne so what might take me 5 minutes over the lunch table might take 2 days before I catch up with them. I don’t think they realise the logistical barriers it puts in for departmental planning. That’s the purpose of the KLA (Key Learning Area or subject discipline) meetings, that’s why we have these KLA meetings but we don’t have them often enough for them to be effective.

The only science teacher who could identify some merit in the staffroom structures was allocated fortuitously to the same staffroom as Dianne:

So it's a lot easier for me than say the science staff over in X because that's a long way. And I think it possibly makes a difference because I just see more of her (i.e., Dianne) and I've got more contact. She can do things for me because I get up from my desk, I walk into her office and say "Help", whereas for other people it's somewhat harder.

Communication and management of small teams was much simpler at Saint Stephens where all teachers shared the same staffroom. The structure afforded teachers greater access to each other during the day, and the school provided staff with a common meeting time on Friday afternoons free of teaching or supervision responsibilities when students were sent home. Each faculty group (e.g., science) could meet formally every third week for quite intensive discussions. In contrast to Dianne's rushed agenda at Palm High, Jane had sufficient time to map out topics for detailed discussion with input from key teachers, and even to share chairing responsibilities. Jane recounted one successful meeting on testing that gave her ideas for designing the subsequent meeting.

I'll target the things that they are interested in. They've given me some ideas so next meeting I'll get different people to present some things. [Early Career Teacher] will do something on tests, and someone else might do something else, and then I'll talk about what I want to talk about. They (teachers) are offering a lot to the meeting.

So it would seem that the different school structures impacted on, but not necessarily determined, teaming arrangements at the two schools. Staff at Saint Stephens experienced structures that encouraged co-planning of science units while the

structures in place at Palm High might have supported better cross-curricular planning, but did little to foster co-planning of science units – even though all relevant Palm High teachers could exercise individual agency when it came time to implement the unit. Under these constraints, science curriculum planning was better suited to individuals working alone, but co-planning did take place as small groups of teachers shared ideas and units with each other at Palm High. While different contexts shaped the activities of teachers, teachers created new ways to produce and contribute collectively to the units implemented.

Leading Science Departments – Leading Research

Even though the study was conducted in two contrasting school contexts, each department depended on the collective resources produced by individual and small teams of teachers for the benefit of their respective staff and students. The science coordinators acknowledged the importance of drawing on these internal resources as well as utilising selected external resources for the purpose of improving practices within their schools. The coordinators exercised individual leadership roles while accepting influence from their staff, particularly in relation to the preparation of units of work by teachers. In this sense, the department structures enabled multiple leaders to influence each other mutually for the collective good, weakening the realisation of a possible leader-follower binary, as argued by Harris (2003). In many ways, both coordinators enacted collective leadership practices where teachers were empowered to lead, releasing “the collective energies and talents of a team” (Bollington, 2004, p. 123). Several actions by the coordinators described here model how heads of departments might enact distributed or collective leadership practices without ignoring important individual leadership roles in schools.

While we did not intend to speak directly to school leaders like science coordinators and principals through this article, there are several implications of this research and related studies for practitioners. First, it would be helpful for the attainment of productive and cohesive school departments if designated school leaders could accept that leadership is not embodied within individuals but manifests in the actions of individuals and collectives through social interactions. The coordinators and teachers acknowledged the importance of modelling desired practices and engaging in effective communication within their departments, despite uneven reports about how these practices were actually implemented. Coordinators and teachers should actively seek opportunities for teachers to contribute to important discussions about policy and practice. In these forums individuals could share and access the collective human resources (e.g., ideas and resources for units of work) for the benefit of both individuals and the collective. Second, successful face-to-face interactions between teachers within discussion forums are likely to encourage subsequent contributions by individuals, leading to positive emotional energy and solidarity within the department (cf. Ritchie et al., in press). For this reason, it is important for coordinators to create opportunities for and engage in face-to-face meetings with teachers, rather than relying too heavily on electronic communication. This is particularly crucial in those schools (e.g., Palm High) where science teachers are dispersed across multiple staff rooms. Third, where school size or structures constrain the frequency of whole science department meetings and forums, the creation of structures that involve smaller teams of teachers might nevertheless encourage the exercise of individual and collective agency within the department. Fourth, where conflict exists between teachers within departments (e.g., Saint Stephens) coordinators could consider resolving contradictions through the enactment

of structures like cogenerative dialogues where individuals could exercise their agency to refine structures for the collective good.

Both science coordinators expressed transformative goals for science education in their schools yet they interacted differently with teachers within their departments. This might be explained in part by the different structures in both contexts that provided differential constraints for efficient communication and preparation of shared curriculum units. Another possibility is that the coordinators referred to very different metaphors⁶ to describe their leadership practices, even though their actual practices were not consistently compliant with these metaphors. The coordinators expressed definite visions of science education for their schools and, although expressing preferred roles and strategies for tasks like unit planning, were prepared to modify or adapt their practices; they did not stick to a script or blueprint for heading a department. This suggests that designated leaders should be prepared to acknowledge the interdependence of teachers within their departments and be open to the mutual influence of external and internal educators and other resources.

As individualised leadership discourses give way to collective leadership discourses such as the distributed perspective of leadership in the literature (e.g., Spillane et al., 2004), it could be timely to consider the usefulness of analysing data dialectically. In the current study we emphasised the individual | collective dialectic while also considering the agency | structure dialectic. In doing so, we avoided the constraints of interpreting data through only one lens, providing the flexibility to bring multiple perspectives to bear in studying leadership. Similarly, Lingard et al. (2003) argued a case for studying leadership from different theoretical perspectives simultaneously, or “brushing together” theoretical orientations to avoid creating

⁶ The literature is replete with evidence of metaphors guiding practice (e.g., Aubusson, Harrison, & Ritchie, 2005).

“theoretical theory” (p. 61) as they put it; and from our experience, there seems to be considerable merit in doing so. Furthermore, it might even be productive for school leaders to view their own practices dialectically to capture adequately the complexity of school leadership. This position would disrupt over-reliance on simplistic blueprints for practice that sometimes might appear in popular professional publications.

Understanding how science coordinators enact leadership practices appears to be a worthy pursuit in its own right, given the limited attention to it by researchers (Spillane et al., 2004). Now departments are becoming more complex management structures as shifting policy impacts on practices, and shortages of particular subject specialists impact on staff recruitment and constrain allocation of teaching responsibilities. In the current study we found that both coordinators contributed heavily to cross-curricular planning as their schools grappled with the issue of middle schooling. We can no longer assume that science departments will be insulated from other curricular developments and innovations. Even though the two schools had not formalised a commitment to whole-school cross-curricular planning (e.g., the development of Rich Tasks or assessment tasks that require integration of subject specialist knowledge and practices), there seemed to be some acceptance of the inevitable shift to this position, and some science teachers at both schools were proactive in introducing small-scale curricular changes in this direction. With this trend in mind, researchers might begin to focus on leadership practices within middle management structures that transcend discipline boundaries. Studies in the US (Ritchie et al., in press) and Europe (Imants, Slegers, & Witziers, 2001) might evoke subsequent research questions and help school leaders imagine the impact on their

leadership practices and ultimately the effects on student learning of different sets of organizational structures.

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