

# Science Instructional Leadership: The Role of the Department Chair

## Abstract

With science teachers facing comprehensive curriculum reform that will shape science education for decades to come, high school department chairs represent a critical resource for instructional leadership and teacher support. While the historical literature on the department chair indicates that chairs are in prime positions to provide instructional leadership, it is also clear that chairs' ability to provide such leadership is limited by lack of line authority, time, role conflict, and ambiguity. Yet the literature and practical experience indicates that department chairs can exert a positive and important influence on instruction and learning within high school science classrooms. Drawing on a historical review of the literature on high school department chairs and on recent literature in science education and instructional leadership, this article presents a conceptual model of science instructional leadership for high school department chairs and discusses implications for researchers and practitioners. The model includes four interdependent leadership capabilities for science instructional leaders: (1) science leadership content knowledge, (2) negotiating context and solving problems, (3) building a collegial learning environment, and (4) advocating for science and science education.

## Introduction

With the publication of *A Framework for K-12 Science Education* (National Research Council [NRC], 2012) and release of the Next Generation Science Standards (Achieve, 2013), science teachers face a comprehensive curriculum reform that will shape science education for decades to come. The *Framework* lays out

a vision for science education in which all students “actively engage in scientific and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas in these fields” (pp. 8-9). Alongside this national standards movement, the state and local contexts for science education are constantly shifting in response to political and social pressures, economic realities, student needs, and science and education research findings.

To provide science teachers with any hope of thriving in this complex environment and achieving the NRC's vision, science education leaders must provide ongoing, targeted support. High school science teachers strongly identify with their academic departments (Siskin, 1994). In fact, science teachers may experience a greater connection to the field of science education than to local school improvement issues (Melville, Hardy, & Bartley, 2011), and science departments represent communities of science educators as much as they do organizational units of schools (Melville & Wallace, 2007). As leaders within these communities, high school science department chairs represent an important resource for instructional leadership. Unfortunately, chair leadership is under-researched and under-used in schools (Weller, 2001).

An empirical answer to the question of how chairs can effectively act as instructional leaders within their schools represents a gap in the science education literature. However, existing literature provides a useful framework for ongoing research and professional practice in this area. This article (1) presents a synthesis of historical literature on the high school department chair highlighting the challenges, contexts, and practices of chairs enacting instructional leadership and (2) proposes a conceptual model of science instructional leadership informed by the

historical review and by the recent literature in science education and instructional leadership. Aimed at practitioners and researchers, the goals of this work are to enhance our understanding of chairs' instructional leadership practice and to highlight the role chairs can play in science curriculum reform.

## The High School Department Chair: “A race horse with plow-horse duties”\*

While early publications were largely anecdotal, a historical review of academic writing on high school department chairs dating from 1910 reveals a surprisingly consistent picture of the position. Early writings, published though 1959, provide a useful historical perspective on the topic, while empirical studies published since 1960 illuminate major themes that must inform current research.

### Early Writings (1910-1959)

In the earliest publication found on the topic, Meriwether (1910) reported chairs experienced “ambiguities and inconsistencies” (p. 276) from the very inception of the role. Other authors (e.g. Heinmiller, 1921) described the multifaceted nature of the role, including responsibilities for pedagogy, supervision, and administration. The first empirical study in the field, Koch's 1930 survey of superintendents, principals, and chairs, revealed qualifications, selection procedures, and compensation for chairs varied widely, and he suggested chairs' effectiveness was limited by “routine obligations” (Koch, 1930a, p. 263). While Koch (1930b) argued a key role of a chair was to “close the gap between the classroom and the principal's office” (p. 340), survey respondents reported this function was severely limited by the time available to visit the classrooms of other teachers. Koch (1930b) concluded,

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“the department headship is in confusion” (pp. 348-349) with little agreement on the function of the position or the criteria for selection of chairs.

Authors writing in the 1940s and 1950s delivered a familiar message. Invoking the colorful analogy that heads this section, Axley (1947) referred to the chair as “a race horse with plow-horse duties” (p. 1)\* in arguing many schools failed to take advantage of chairs’ specialized skills. Axley’s (1947) survey indicated chairs were too busy with teaching and “petty details” (p. 1) to focus on their main function of instructional supervision and many chairs were not consulted on personnel issues affecting their team of teachers (Axley, 1947). After analyzing the specific duties expected of chairs, Novak (1950) suggested a lack of specialized training left “few, if any, who feel equal to all of the requirements” (p. 91). Rinker (1950) suggested chairs should maintain simultaneous focus on supporting students and teachers and on links to the academic, professional, and school communities while also performing clerical duties. Foreshadowing a later theme, Rinker also argued chairs should be advocates of change rather than protectors of the status quo.

These early articles preview three themes that must continue to inform any research on the department chair position. First, chairs were expected to play an important role in the ongoing improvement of teaching within their departments. Second, multiplicity and ambiguity defined the chair’s role as they were tasked with instructional improvement in addition clerical, administrative, managerial, and extracurricular duties. Finally, the role ambiguity mentioned above, the need for specialized leadership skills, and the lack of release time, appropriate compensation, and line authority severely limited chairs’ ability to fulfill their promise as instructional leaders.

#### **Empirical Studies (1960-2012)**

Empirical research in the field began in earnest with King and Moon’s (1960) survey, which was the first of 11 studies of chairs’ roles and responsibilities

conducted during the 1960s and 1970s. Beginning in the 1980s, researchers diversified their approaches by employing a wide range of qualitative and quantitative methods to provide in-depth descriptions of chairs’ work in schools and to analyze relationships among specific factors affecting chairs’ leadership efforts. The school reform movement that began in the 1980s also influenced research topics, leading to an increased focus on instructional leadership and school change (Hallinger, 2005) and on distributed leadership (Spillane, Halverson, & Diamond, 2001). International scholars also began to take up this topic with studies conducted in at least nine countries outside the United States. While individual studies exhibit strengths and weaknesses, the consistency of findings paints a reliable portrait of the chair as a professional who is asked to do too much in too little time and with too few resources. However beyond these limitations, several important themes emerge from the literature that point to the potential for the chair to act as an instructional leader in the high school.

**Barriers to leadership.** King and Moon (1960) concluded that while the status of the role had been in flux for 30 years, chairs could play an important role in instructional improvement. Likewise, Weller (2001) suggested “chairs are in an ideal position to facilitate instructional improvement because of their daily contact with teachers and their own instructional expertise” (p. 74). However, the most dominant theme in the literature highlights the barriers chairs face as a result of the ambiguous and multifaceted nature of their role. Survey research (e.g., Berrier, 1974; Manlove & Buser, 1966) conducted during the 1960s and 1970s revealed chairs were engaging in a combination of administrative, supervisory, curricular, and instructional duties similar to those described in earlier publications. According to these studies, the lack of official job descriptions, release time, and authority were the factors that most limited chairs’ effectiveness. Verchota (1971) was the first

author to invoke role theory, a perspective that would dominate department chair research beginning in the 1980s, in his analysis of the position. Verchota concluded chairs experience role conflict because they are expected simultaneously to take the narrow view of a teacher-specialist and the school-wide view of an administrator-manager. Despite this, Verchota found chairs exerted greater influence over teachers than did school administrators.

From 1980 through 2012, researchers published 30 studies (Table 1) on chairs’ general roles and responsibilities. These studies represent over 30 years of research in schools across the United States and in four other nations (i.e., Australia, Canada, Malaysia, and the United Kingdom), and methods vary from surveys of hundreds of educators to self-studies of single department chairs. Across this diversity, five themes emerge clearly and consistently. First, chairs are expected to carry out a variety of administrative, managerial, supervisory, curricular, and instructional responsibilities. Second, chairs experience role conflict as a result of their positioning between teacher and administrator. Third, unclear expectations and lack of time and other resources lead to role ambiguity. Fourth, chairs, administrators, and teachers agree chairs should increase their focus on instructional improvement. Fifth, schools can improve chairs’ effectiveness by providing release time and remuneration, delegating more formal authority, and providing targeted professional learning for chairs. Even in the face of these barriers, chairs can play a role in instructional leadership (Anderson, 1987), and existing literature can inform our understanding of the practices and contexts that are important as chairs enact such leadership.

**Leadership context.** Department chair leadership is highly context-dependent and is influenced by chairs’ experience and personal qualities, teacher characteristics, departmental cohesion and shared vision, leadership approach, subject-related issues, school administration, school and community contexts,

**Table 1: Summary of Research on the Roles and Responsibilities of Department Chairs, 1980-2010**

Reference	Key Findings
Kottkamp & Mansfield, 1985	<ul style="list-style-type: none"> <li>• Role conflict and role ambiguity are related to powerlessness.</li> <li>• Role ambiguity, and to a lesser extent role conflict, are also related to perceived burnout.</li> <li>• Chairs reported low rates of burnout.</li> </ul>
Pellicer & Stevenson, 1983	<ul style="list-style-type: none"> <li>• Most districts did not have job descriptions or provide additional compensation or time.</li> <li>• Roles most often identified as important for the chair were selecting instructional materials, designing and revising curriculum, assisting teachers in improving instruction, providing inservice training, and coordinating the instructional efforts of the department.</li> </ul>
Girard, 1984	<ul style="list-style-type: none"> <li>• Chairs conducted managerial, supervisory, curriculum, teaching, and administrative activities.</li> <li>• These activities led to role conflict and uncertainty.</li> <li>• The most prominent conflicts were inadequate time and remuneration, too many clerical duties, lack of teacher preparation and resources, staff morale problems, and lack of support.</li> </ul>
Shimeall, 1987	<ul style="list-style-type: none"> <li>• Chairs receive little release time and no secretarial help.</li> <li>• Administrative and clerical functions were perceived as most important.</li> <li>• Teacher evaluation was less important.</li> <li>• There was agreement between functions and selection criteria.</li> </ul>
Busher, 1988	<ul style="list-style-type: none"> <li>• Chair reported reduction in role overload and positive affective results for teachers after delegating departmental duties while providing appropriate support in these delegated duties.</li> </ul>
DeRoche, Kujawa, & Hunsaker, 1988	<ul style="list-style-type: none"> <li>• Most schools did not have formal selection or evaluation procedures.</li> <li>• Most chairs did not have release time.</li> <li>• Most important perceived areas of responsibility were budgets, goals and objectives, curriculum, textbooks, and scheduling.</li> <li>• Chairs were perceived as leaders in schools and in their departments.</li> </ul>
Hulsey, 1988	<ul style="list-style-type: none"> <li>• Chairs would prefer more involvement in school decision-making.</li> <li>• Three factors contributed to higher role perceptions of chairs: departments of 10 or more teachers, formal selection by boards of education, and annual remuneration of at least \$1000.</li> </ul>
Orris, 1988	<ul style="list-style-type: none"> <li>• Groups agreed as to how chairs spend their time, but disagreed on the amount of time spent.</li> <li>• Principals and chairs perceived chairs spent more time on tasks than did teachers.</li> <li>• Chairs spent greatest time on management and communication tasks.</li> <li>• Groups agreed that the chair role should be expanded to increase responsibilities in management, communications, personnel, and curriculum.</li> <li>• Principals and chairs favored expansion of the staff development role.</li> <li>• Principals reported greater support for expanding supervision role than chairs or teachers.</li> </ul>
Adduci, Woods-Houston, & Webb, 1990	<ul style="list-style-type: none"> <li>• Identified six determinants of the chair role: job description, dual functions of curriculum/instruction and administration, chairs' goals, agreement by role senders, professional learning opportunities, and resources.</li> <li>• Job description, goals, agreement among role senders, and professional learning are sources of role ambiguity.</li> <li>• Functions and resources are sources of role strain.</li> </ul>
Fletcher, 1991	<ul style="list-style-type: none"> <li>• Chairs spent the majority of their time on managerial tasks.</li> <li>• All groups agreed that chairs should focus more on "encouraging, stimulating, and motivating teachers" (Abstract).</li> </ul>
Kaminski, 1991	<ul style="list-style-type: none"> <li>• Chairs reported that the most important competency was serving as a link between teachers and the administration.</li> <li>• Chairs and teachers agreed that the least important competencies related to supervision and evaluation of instruction.</li> </ul>
Worner & Brown, 1993	<ul style="list-style-type: none"> <li>• Principals and chairs disagreed on the extent to which principals shared decision-making.</li> <li>• Principals and chairs agreed on the following major responsibilities of chairs: conducting department meetings, setting department goals and objectives, selecting materials and supplies, maintaining an inventory of materials and supplies, serving as departmental spokesperson, representing the department as adviser to the principal, and administering the department budget.</li> <li>• Principals also identified the following three as important: ensuring departmental consistency, recommending the department budget, and informing the department members of new developments in the field.</li> <li>• Principals indicated that chairs should also take more responsibility for monitoring departmental goals and objectives, implementing curriculum change, developing school policies, stimulating professional growth of department members, handling departmental public relations, and promoting instructional change.</li> </ul>
Bliss, Fahrney, & Steffy, 1996	<ul style="list-style-type: none"> <li>• Chairs reported the rank of responsibilities as administrative, communication, and instruction.</li> <li>• Chairs identified the roles of administrator, facilitator, instructional leader, and transitional. English and math chairs were inclined toward facilitation and instructional leadership, while science and social studies chairs reported more emphasis on administration.</li> <li>• Nearly one-third of chairs aspired to greater instructional leadership.</li> <li>• Teachers perceived chairs to provide moderate level of instructional leadership and reported preference for chairs to increase emphasis on instructional improvement and assessment.</li> <li>• There was no clear connection between chair reported roles and teacher perceptions of IL. No connection between chair roles and collegiality.</li> </ul>

Table 1: Contd.,

Reference	Key Findings
R. Korach, 1996	<ul style="list-style-type: none"> <li>• Chairs perceived themselves to spend more time on their role than did teachers.</li> <li>• Teachers placed more importance than did chairs on protecting instructional time and supporting teachers' professional learning.</li> </ul>
W. Korach, 1996	<ul style="list-style-type: none"> <li>• Administrators placed higher value on the supervisory role while chairs placed higher value on the management role.</li> </ul>
Brown & Rutherford, 1998	<ul style="list-style-type: none"> <li>• Chairs enacted all five approaches (i.e. servant leader, organizational architect, moral educator, social architect, and leading professional) in the leadership typology.</li> <li>• Leadership is enacted within practical constraints and local contexts.</li> <li>• The majority of chairs' time was spent on teaching, modeling good practice, and managing their departments with little time left for improving teaching and learning.</li> </ul>
Abolghasemi, McCormick, & Conners, 1999	<ul style="list-style-type: none"> <li>• Chairs -principal congruence was a better predictor of teacher support of school vision than was principals' visionary behaviors or structural coupling.</li> </ul>
Glover & Miller, 1999b	<ul style="list-style-type: none"> <li>• Principals influence teachers directly, but the influence is stronger when mediated by chairs.</li> <li>• Chairs in schools whose management structures were focused on teaching and learning were more likely to spend time on leadership activities.</li> </ul>
Wise & Bush, 1999	<ul style="list-style-type: none"> <li>• Department meetings and student support consumed almost half of chairs' non-teaching time.</li> <li>• Many chairs were interrupted during class time to address issues or support other teachers.</li> <li>• Chairs assumed a larger role in school management as a result of national education reforms.</li> <li>• Chair decisions influenced primarily by department members, followed administration.</li> <li>• Chairs had inadequate time to carry out all of their responsibilities.</li> </ul>
Schmidt, 2000	<ul style="list-style-type: none"> <li>• Transition from teacher to chair was characterized by negative emotions resulting from role ambiguity, feelings of powerlessness, shortfalls in goal attainment, and strained relationships with teachers and students.</li> <li>• Chairs coped with these emotions by viewing their leadership role as an extension of their teaching role rather than a result of a formal title.</li> </ul>
James, 2001	<ul style="list-style-type: none"> <li>• Chairs who received release time and compensation experienced less role ambiguity, less role conflict, and less concern regarding resource adequacy. They also had more positive perceptions of the chair role.</li> <li>• There were two distinct role configurations, evaluating administrator and program improver, for chairs in various schools.</li> </ul>
Weller, 2001	<ul style="list-style-type: none"> <li>• Lack of training, line authority, and voice in schoolwide decisions all limit chair effectiveness.</li> <li>• Essential knowledge and skills for chairs include human relations, communication, leadership, group dynamics, flexibility, diplomacy, teaching practices, and subject knowledge.</li> <li>• Most did not list instructional supervision or curriculum development because of lack of time and responsibility.</li> </ul>
Collier, Dinham, Brennan, Deece, & Mulford, 2002	<ul style="list-style-type: none"> <li>• 85% believed chairs should be more involved in curriculum and instructional improvement.</li> <li>• Chairs' initial expectations for the role did not match the reality.</li> <li>• Administrative duties constituted a greater portion of chairs workload than duties related to curriculum and instruction.</li> <li>• Chairs recommended reducing their teaching load and administrative duties to free time to spend with teachers.</li> <li>• Chairs perceived working with teachers and contributing to school change as the most positive aspects of their role.</li> <li>• Chairs cited lack of time, workload, external pressures, being caught between administrators and teachers, and dealing with under-performing teachers as negative aspects of the position.</li> </ul>
Marotta, 2002	<ul style="list-style-type: none"> <li>• Administrators and chairs perceived management, supervision, human relations, organization, and programming all to be very important, but chairs assigned greater importance than did teachers.</li> </ul>
Skinner, 2007	<ul style="list-style-type: none"> <li>• Principals perceived the chair role to be supervisory while teachers perceived it to be administrative.</li> <li>• The chair role is constantly enacted and negotiated and is characterized by "complexity and contingency" (p. 184);</li> <li>• The role can be characterized by the concept of heteroglossia (i.e. tensions within language that lead to meaning).</li> <li>• Reflective practice and self-study rather than fixed professional development is the most appropriate approach to make sense of and improve one's practice in the chair role.</li> </ul>
Surash, 2007	<ul style="list-style-type: none"> <li>• Chairs need skills to address vision, climate, management, community, citizenship, and larger community context.</li> </ul>
Onn, 2010	<ul style="list-style-type: none"> <li>• Chairs perceived themselves to have a high competency level in interpersonal relations and moderate competency levels in department administration, curriculum development, supervision and mentoring of teachers, and professional development.</li> </ul>
Willis, 2010	<ul style="list-style-type: none"> <li>• Chairs identity constructed through stakeholder interactions within complex school context.</li> <li>• Chairs functioned within the school hierarchy to serve as conduits, nurturers, department clerks, and resource managers.</li> </ul>

and lack of time (James & Aubrey-Hopkins, 2003; Ryan, 1999). Within these contexts, chair leadership is dynamic and socially constructed, and chairs' internal sense of authority moderates these factors (James & Aubrey-Hopkins, 2003). Clarke (1980) found teachers, principals, and chairs held different expectations for chairs' supervisory behaviors and that chairs generally followed their own expectations or modified them to better align to principal expectations. The wider literature indicates the most salient contextual factors are school leadership structure, school change, and academic subject.

#### ***Leadership structure.***

Existing literature indicates school leadership structure is the most important factor influencing chairs' practice and often contributes to role ambiguity. Johnson (1990) and Glover and Miller (1999a) reported school leadership structure influenced how chairs balanced various leadership styles (e.g., transactional vs. transformational and collegial vs. managerial). Chairs tended to act as initiators, rather than inhibitors, of change in schools that provided appropriate professional learning and involved chairs in curriculum planning and development and in school planning and policy making (Glover & Miller, 1999a). Johnson (1990) also found the ambiguity of chairs' dual roles as teachers and administrators provided "productive tension" (p. 177) for some chairs and a major challenge for others. Chairs in Zepeda and Kruskamp's (2007) study practiced instructional supervision in an intuitive and differentiated manner because they received neither direction from the school principal nor appropriate professional learning. Todd's (2006) survey of school administrators and department chairs revealed principals' and assistant principals', but not department chairs', instructional leadership behaviors correlated with student achievement. Todd (2006) suggested further research is needed to determine whether there is an indirect link between department chair instructional leadership and student achievement.

Several researchers have concluded chairs enjoy their greatest influence in schools that promote distributed leadership and collegiality. Wyeth (1992) found formal structures for shared decision making, delegation of authority by the principal, and evaluation of teachers by department chairs supported chairs' influence. Similarly Brown, Boyle, and Boyle (1998, 1999) concluded chairs were most effective in schools with collegial management structures characterized by collaboration among departments, alignment between departmental and school priorities, and involvement of chairs and teachers in school decision making. Along with supporting chairs' influence, Numeroff (2005) found collegiality reduces teacher uncertainty and stress, improves instructional effectiveness, and supports student achievement. Principals in Klar's (2012) case study fostered chair's instructional leadership capacity through professional learning, inclusion of chairs in schoolwide decision making, provision of support and resources, and long-term commitment to distributed leadership. The important relationship between the chair and the principal is dynamic and influenced by both parties' personal histories and by the school context (Klar, 2012; Symonds, 1982).

Unfortunately, researchers have found this ideal of distributed leadership often goes unrealized. In his network analysis of Portuguese subject departments, de Lima (2008) found most chairs were not successful in fostering collaborative environments within their departments. Truly distributed leadership, de Lima concluded, must be embedded in everyday practice rather than simply codified in formal titles, such as department chair. Brown, Rutherford, and Boyle (2000) found many chairs were simply being asked to take on responsibilities previously held by school administrators. Researchers have found time, curriculum changes, need for professional learning, lack of vision, lack of communication, a narrow conception of leadership, and lack of specific leadership skills limited chairs' enactment of distributed leadership (Aronow, 2006; Brown, Rutherford,

& Boyle, 2000; Feeney, 2009). In particular, chairs in Feeney's (2009) study described their role in managerial terms and viewed leadership as a series of activities they did for, not with, teachers and administrators.

#### ***School change.***

A number of researchers have investigated, with mixed findings, the role chairs play in school change. Hall and Guzman (1984) found the impetus for change generally came from a source outside the school and that chairs generally did not serve as facilitators of change. The actual roles of department chairs were unclear and were determined by the school principal. Hord and Murphy (Hord, 1984; Hord & Murphy, 1985) concluded that facilitating change is a viable role for the chair but that they are limited by school policy, compensation, and lack of time. Brown (1993) found principals and department chairs provided the most visible leadership for change by employing practices associated with transformational leadership. Henderson's (1993) case study revealed chairs who were effective in supporting school change were goal-oriented, were able to influence school administration, used a combination of interpersonal skills and technical expertise to assist teachers, and facilitated teacher collaboration within teams. Hannay, Smeltzer Erb, and Ross (2001) concluded that while chairs can support school change, it is best facilitated when the school structure is reorganized into a more horizontal leadership structure. In Mayers and Zepeda's (2002) case study, chairs had to manage the multiple learning curves of restructuring their departmental work and their own teaching while supporting teachers' transition to the block schedule. A lack of sufficient professional learning, role conflict and ambiguity, and a decrease in release time hindered these efforts.

Two international case studies illuminate how chairs facilitate subject-specific curriculum change. An Australian science department chair facilitated change by creating discomfort with the status quo among teachers, providing support teachers needed to change, modeling

changing practices, and acknowledging difficulties and compromises that were part of the change process (Rigano & Ritchie, 2003). In implementing this curriculum change, the chair overcame the conservative background of department teachers, school structures aimed at preserving public image, and lack of an inquiry community among department teachers. Tam (2010) found a language department chair in Hong Kong used personal charisma, shared vision building, teacher empowerment, changing beliefs and enhancing the capacity of teachers, and fostering collegiality among teachers to overcome teachers' low receptivity to school-based curriculum development. As Rinker suggested in 1950, chairs can facilitate change in their schools, but doing so requires a favorable organizational environment, specific leadership skills, and sufficient time to support teachers.

#### **Academic subject.**

While Leslie (1980) found school climate perceptions were stable across departments, other authors have found academic subject represents an important factor in the study of chair leadership. Turner (2003) found the mix and priority of themes affecting instruction in academic departments in the United Kingdom were unique to the subject area, with science chairs reporting that perceptions of science, the nature and accountability context of the science curriculum, and the everyday relevance of science influenced their leadership decisions. Bolam and Turner (2003) found the structure (e.g., science being taught as distinct biology, chemistry, and physics courses) but not the cognitive content of the subject affected chairs' leadership practice. Bliss et al. (1996) found English and mathematics chairs were more inclined toward the roles of facilitation and instructional leadership, while science and social studies chairs placed more emphasis on their administrative role. Thus while chairs in different subjects share similar responsibilities, they enact these responsibilities in different ways within different working contexts.

**Leadership practices.** While understanding the barriers and contexts influencing chair leadership is important, it is equally important to understand the specific practices that allow effective chairs to influence teaching and learning within their departments. Drawing on a combination of quantitative and qualitative research, Table 2 summarizes the findings of 15 studies related to department chair characteristics and practices associated with effective instructional leadership. Personal characteristics such as subject matter expertise, professional credibility, and trustworthiness provide a foundation for leadership, but instructional leadership is enacted primarily through ongoing social interactions with teachers and administrators. The most commonly cited strategies for instructional leadership were facilitating collegiality, cooperation, and shared decision making; promoting clear, common instructional vision and shared values; and promoting collaboration in planning, instruction, and assessment. Thus while a school environment of collegiality and distributed leadership supports chairs' influence, effective chairs promote this same environment within their departments.

Beyond suggesting specific leadership strategies, the following studies illuminate how these practices affect teaching and learning within a department. Bliss (1989) and King (1991) established that chairs, particularly when supported by the principal, could influence teachers' instructional decisions. Supporting this assertion, Bliss et al. (1996) found teachers perceived their chairs to be providing instructional leadership and that teachers preferred their chairs to place more emphasis on this role. Ritchie, Mackay, and Rigano (2005) concluded two Australian science chairs enacted leadership through a combination of individual and collective actions. While both expressed transformative goals, these chairs enacted leadership differently based on their contexts and personal metaphors—secretary versus salesperson—for leadership. In contrast to the transformational view of leadership, Wettersten (1993; 1994) found

chairs in her case study facilitated innovations within their departments through social exchange transactions in which they consciously delivered “services and rewards to members of their departments and the administration” (Wettersten, 1993, p. 2).

#### **Summary**

Across more than a century of scholarship, there is apparent consensus among administrators, chairs, and teachers that instructional leadership and school improvement should be the chair's primary role. There is also considerable evidence that when chairs are afforded appropriate resources and professional learning in a supportive school environment, chairs can effectively enact instructional leadership through practices focused on collegiality, collaboration, and social interaction. Unfortunately, there is also consensus that schools are not utilizing chairs to their full potential for a variety of reasons. Further, while department chairs face many similar challenges, the literature indicates each academic subject presents unique issues. Thus while the existing literature provides an important foundation for research on science department chair instructional leadership, this area is ripe for additional work directly targeting the issue of how chairs can effectively enact science instructional leadership in support of the massive curriculum reform represented by the Next Generation Science Standards (Achieve, 2013).

#### **Conceptual Model of Science Instructional Leadership**

##### **Rationale**

Chairs enact leadership within a complex social environment shaped by multiple factors which can be represented by a visual conceptual model displaying the complex, dynamic, unique, and obscure nature of this social phenomenon (Jaccard & Jacoby, 2010). Although Briggs (2007) argued models are under-used in educational management research, there are existing models that address concepts in principal instructional leadership, teacher leadership, or science education.

Interestingly, four existing models deal directly with chair leadership. Based on a survey in Hong Kong schools, Au, Wright, and, Botton (2003) constructed structural equation models of links among chair leadership behaviors, teacher collaboration, and perceived student performance. The models revealed relationships that were considerably more complex than those hypothesized by the authors and revealed differences in perceptions of chair leadership, with administrators holding more linear views and teachers holding more complex and reciprocal views. Bolam and Turner's (2003) model identified eight sets of factors—national/local, school, subject, departmental, personal characteristics, tasks, methods, and teaching/learning outcomes—that influenced chairs' leadership practice in the United Kingdom. Based on case studies with four chairs identified as exemplary instructional leaders, Wettersten (1993, 1994) developed an exchange-based model that illustrated how chairs influence teachers and administrators by providing

resources or services to each group. Wettersten's model effectively visualized the chairs' position as a bridge between teachers and administrators. Finally, Klar (2012) presented a visual model of the conceptual framework for his study of how principals foster the development of chairs' instructional leadership capacity through direct interactions and participation in a school leadership team, thereby providing important context, while not being specifically focused on either instructional leadership practices or science education.

### Model Development and Explanation

A review of more than 175 articles, chapters, and dissertations, led to compiled lists of practices, qualities, skills, and dispositions reported in the literature as contributing to instructional leadership. Applying a constant comparative approach (Charmaz, 2006), findings were compared across studies and lists of focused concepts that contribute to instructional leadership were subsequently

developed. Table 2 presents the concepts generated from the department chair literature, while Table 3 presents concepts gleaned from sources on science education leadership and principal instructional leadership.

Leadership capabilities represent the “seamless and dynamic integration of knowledge, skills, and personal qualities [required for a] practical endeavor such as school leadership” (Robinson, 2010, p. 3). Robinson (2010) argued that “fine-grained specification” (p. 1) of these inclusive capabilities is less desirable than encouraging their development in leaders and further that any attempt to separate the components of a capability leads to “an immediate disjunction...between the leadership specification and the integrated reality of leadership practice” (p. 3). Further, Kennedy (2010) suggested that researchers typically overestimate the influence of personal characteristics in studies of teacher quality and that “it is what teachers actually *do* that is most relevant” (p. 591, italics in original). Extending this notion to instructional

Table 2: Department Chair Leadership Concepts Integrated into Model of Science Instructional Leadership

Science Leadership Content Knowledge	Advocating for Science & Science Education	Building a Collegial Learning Environment	Negotiating Context & Solving Problems
<ul style="list-style-type: none"> <li>• Subject matter expertise (Bliss, 1989; Wettersten, 1992)</li> <li>• Professional credibility as a good teacher (Bolam &amp; Turner, 2003; Wettersten, 1992)</li> <li>• Teaching multiple levels of classes (Flores &amp; Roberts, 2008)</li> <li>• Monitoring teacher practice and student achievement (Benedict, 2009; Harris, Jamieson, &amp; Russ, 1995; Hofman, Hofman, &amp; Guldernond, 2001)</li> <li>• Direct involvement in instructional program (Flores &amp; Roberts, 2008; King, 1991)</li> </ul>	<ul style="list-style-type: none"> <li>• Promoting climate for change (Harris et al., 1995)</li> <li>• Promoting teachers' familiarity with local, state, and national standards (Kaur, Ferrucci, &amp; Carter, 2004)</li> </ul>	<ul style="list-style-type: none"> <li>• Facilitating collegiality and shared leadership (Au, Wright, &amp; Botton, 2003; Bliss, 1989; Harris et al., 1995; Hofman et al., 2001; Printy, 2008; Wettersten, 1992)</li> <li>• Promoting collaboration in planning, instruction, and assessment (Aubrey-Hopkins &amp; James, 2002; Bolam &amp; Turner, 2003; Flores &amp; Roberts, 2008; King, 1991)</li> <li>• Building a shared culture and vision for student learning and continuous improvement (Benedict, 2009; Bolam &amp; Turner, 2003; Harris et al., 1995; Hofman et al., 2001; Kaur et al., 2004; King, 1991)</li> <li>• Promoting collaborative, school-based professional learning (Hindman, 1990; Flores &amp; Roberts, 2008; Hofman et al., 2001)</li> <li>• Promoting effective use of material and human resources (Au et al., 2003; Aubrey-Hopkins &amp; James, 2002; Harris et al., 1995)</li> <li>• Providing feedback to teachers (Aubrey-Hopkins &amp; James, 2002)</li> <li>• Establishing mentoring relationships (Aubrey-Hopkins &amp; James, 2002)</li> </ul>	<ul style="list-style-type: none"> <li>• Representing the department and serve as a liaison between teachers and administration (Duke, 1990; Hindman, 1990; Wettersten, 1992; Wettersten, 1993)</li> <li>• Problem solving and reflective visioning (Au et al., 2003; Hindman, 1990)</li> <li>• Using formal and informal department processes to support instructional improvement (Aubrey-Hopkins &amp; James, 2002)</li> <li>• Dedicating time outside of school day to instructional issues (Kaur et al., 2004)</li> <li>• Modeling desired teacher behaviors (Benedict, 2009)</li> <li>• Trustworthiness (Wettersten, 1992)</li> </ul>

**Table 3: Instructional Leadership and Science Education Leadership Concepts Integrated into Model of Science Instructional Leadership**

Science Leadership Content Knowledge	Advocating for Science & Science Education	Building a Collegial Learning Environment	Negotiating Context & Solving Problems
<ul style="list-style-type: none"> <li>• Leadership content knowledge (Stein &amp; Nelson, 2003)</li> <li>• Pedagogical content knowledge (Park &amp; Oliver, 2008)</li> <li>• Focus on student achievement (Hallinger, 2005; Hoy, Tarter, &amp; Hoy, 2006)</li> <li>• Focus on the educational core (Bybee, 2006, 2010)</li> </ul>	<ul style="list-style-type: none"> <li>• Advocating for science literacy (Bybee, 2006, 2010; Gess-Newsome &amp; Austin, 2010)</li> <li>• Understanding and supporting reforms (Bybee, 2006, 2010; Gess-Newsome &amp; Austin, 2010)</li> <li>• Orientation to teaching science and inquiry (Bybee, 2006, 2010; Park &amp; Oliver, 2008)</li> </ul>	<ul style="list-style-type: none"> <li>• Communities of practice (Printy, 2008)</li> <li>• Developing communities of support (Gess-Newsome &amp; Austin, 2010)</li> <li>• Supporting teachers through school structures and decision making (McGuigan &amp; Hoy, 2006)</li> <li>• Organizational management (Hornig &amp; Loeb, 2010)</li> <li>• Shared purpose and a culture of high expectations and continuous improvement (Hallinger, 2005)</li> <li>• Leading through modeling desired values (Hallinger, 2005)</li> </ul>	<ul style="list-style-type: none"> <li>• Complex problem solving (Robinson, 2010)</li> <li>• Building relational trust (Robinson, 2010)</li> <li>• Academic optimism (Hoy et al., 2006)</li> <li>• Distributed leadership (Glickman, Gordon, &amp; Ross-Gordon, 2010; Marzano, 2003; Spillane, Halverson, &amp; Diamond, 2001)</li> <li>• Role of science department chairs in distributed leadership: culture of trust and respect, working for collective benefit, cogenerative dialogues, and building solidarity (Ritchie, 2006)</li> <li>• Principal support for teacher leadership (Landel &amp; Miller, 2010)</li> <li>• Influencing through relationships (York-Barr &amp; Duke, 2004)</li> </ul>

leadership and drawing on Robinson’s (2010) concept of leadership capabilities, the list of focused concepts were synthesized into four core leadership capabilities contributing to science instructional leadership: (1) science leadership content knowledge, (2) advocating for science and science education, (3) building a collegial learning environment, and (4) negotiating context and solving problems.

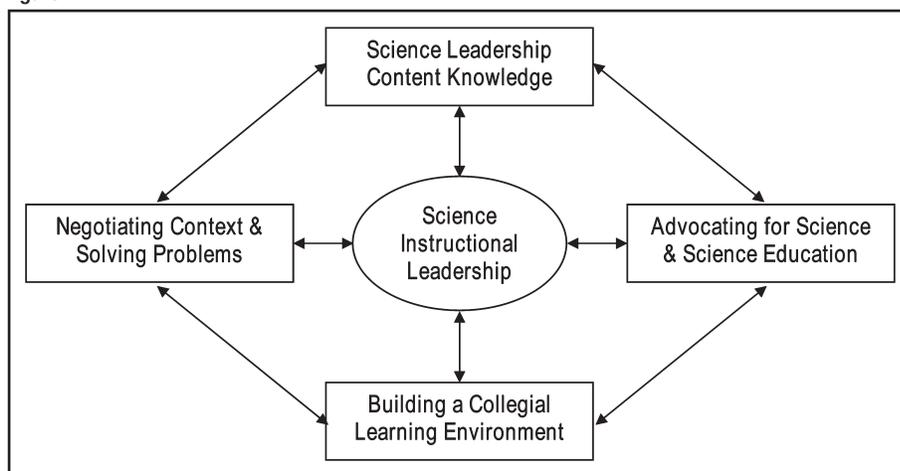
The result of the analytic process summarized above is presented in the model of science instructional leadership for high school department chairs found in Figure 1. This model takes into account the knowledge, skills, dispositions, and activities suggested by many authors, but the leadership capabilities focus attention on the major practices required for successful science instructional leadership. Following Robinson’s (2010) argument, the leadership capabilities below should be viewed as inclusive and interdependent, as indicated by the interconnection of all model components by bidirectional arrows. The heading for each capability draws on a concept from the supporting literature that is central to the meaning of the category. While the four capabilities are considered to carry equal importance, the arrangement of the components in the model is intentional. The role of

subject-specific leadership is generally under-represented in the literature. Therefore, science leadership content knowledge is prominently placed at the top of the model, followed clockwise with advocating for science and science education.

**Science leadership content knowledge.** One of a chair’s greatest assets is the ability to apply deep knowledge of teaching and learning in science, what Stein and Nelson (2003) referred to as leadership content knowledge (LCK), to the goal of influencing curriculum and instructional decisions. Stein and Nelson

(2003) further argued instructional leaders must possess the ability to facilitate teachers’ development of subject-specific pedagogical content knowledge (PCK). Park and Oliver (2008) defined science PCK as “teachers’ understanding and enactment of how to help a group of students understand specific subject matter using multiple instructional strategies, representations, and assessments while working within the contextual, cultural, and social limitations in the learning environment” (p. 264). PCK comprises a cycle of integration and reflection combined with understandings of curriculum, instruction, assessment,

**Figure 1**



**Figure 1: Conceptual model of leadership capabilities contributing to science instructional leadership.**

and student learning in science (Park and Oliver, 2008). This capability also incorporates Bybee's (2006, 2010) notion of centering on the educational core, which takes into account issues of curriculum, instruction, and assessment and is built on a research-based understanding of student learning in science. If a chair hopes to be an effective instructional leader, then the chair must judge every decision against the criterion of improving student learning in the science classroom (McGuigan & Hoy, 2006). Many authors address aspects of curriculum, instruction, and assessment comprising the educational core. An effective instructional leader must have expertise in content, inquiry and nature of science, pedagogical content knowledge, advanced instructional strategies, curriculum development, processes of student learning, and design of appropriate assessments. More importantly, the leader must draw on this expertise to influence curriculum and instructional decisions at the school, department, and classroom levels.

**Advocating for science and science education.** Consistent with the NRC's (2012) vision, the chair's primary goal should be "to make sure that all students have adequate and appropriate opportunities to learn science" (Bybee, 2006, p. 149). Further, chairs should serve as advocates for science as an important way of understanding the natural world and for public understanding of the nature and major concepts of science (Bybee, 2006, 2010). This capability encompasses the notion of orientation to science teaching included in Park and Oliver's (2008) model of PCK and Gess-Newsome and Austin's (2010) recommendation that science education leaders act as advocates for science learning and for science teachers. Melville et al. (2011) articulated this capability as "the cultivation of a critical moral view" (p. 2279) in which a chair intentionally advocates for and models the goals of science education reform, including teaching science as inquiry. As such, chairs provide a critical link between science education

reform efforts and broader school improvement efforts.

**Building a collegial learning environment.** In his review of instructional leadership research, Hallinger (2005) echoed the department chair literature in stressing the importance of building a collaborative learning community with a shared focus on continuous improvement of student achievement. Printy (2008) suggested effective learning communities encourage teachers to take responsibility for all students' learning and to adopt reform-based instruction and that chairs play an important role in shaping these communities. Stein and Nelson (2003) also incorporated learning communities into their LCK model. Chairs should strive to create a learning environment that builds academic emphasis and collective efficacy among teachers (Hoy, Tarter, and Hoy, 2006) and that supports and empowers teachers. Chairs should also act to influence school structures with the goal of providing teachers with the assignments, resources, and time needed to be successful with their students (McGuigan & Hoy, 2006; Horng & Loeb, 2010). An important aspect of this approach is shielding teachers from unnecessary administrative tasks that divert time and attention from instruction. In specific circumstances, chairs may also provide direct support to teachers through instructional supervision, mentoring, or coaching.

**Negotiating context and solving problems.** Science department chairs work within complex political, social, and economic contexts influenced by national, state, and local policies (Bybee, 2010). Ultimately, though, effective instructional leadership depends on negotiating productive interpersonal relationships (Marzano, 2003) in an environment of distributed leadership (Ritchie, 2006; Spillane, Halverson, & Diamond, 2001). Within the department, the chair must negotiate the dual metaphors of the department as an organizational unit and as a community of science educators (Melville & Wallace, 2007). The relationship with the school

principal is of particular importance given the principal's key role in supporting distributed leadership (Landel & Miller, 2010). Relationships within the school and with external stakeholders must be characterized by trust, respect, and a sense of working for a collective benefit (Glickman, Gordon, & Ross-Gordon, 2010; Hoy et al., 2006; Ritchie, 2006; Robinson, 2010; York-Barr & Duke, 2004). Within the complex school context, the chair constantly encounters problems large and small. These range from helping teachers troubleshoot lessons to mediating disputes between teachers. The chair must take a creative and practical approach that draws on individual and collective resources to solve each problem (Robinson, 2010).

### Summary

Neither the four leadership capabilities included in this model nor the underlying practices should be considered a leadership checklist for science department chairs. Rather, science instructional leadership by a chair is constantly negotiated and enacted through social interactions with teachers, administrators, and other school stakeholders. As Ritchie et al. (2005) stated, "leadership is not embodied within individuals but manifests in the actions of individuals and collectives through social interactions" (p. 157). Across these leadership capabilities, chairs draw on the practices revealed in the literature but lead primarily in an informal manner through modeling (Hallinger, 2005; Hoy, et al., 2006). This informal leadership is strengthened by perceived expertise, interpersonal skills, and access to needed resources (Printy, 2008; York-Barr and Duke, 2004). Chairs enact these leadership capabilities in an integrated manner as they seek to improve student learning by influencing schoolwide, departmental, and classroom decisions around issues of curriculum, instruction, and assessment.

Any model is a limited representation of the world, and model users must consider these limitations as they apply a model. This model of science instructional leadership is intended to define the

concept in a manner that provides a useful point of departure for researchers and practitioners, but this model does not account for the myriad contextual factors that shape the practice of instructional leadership in schools. Additionally while the model builds on a wide base of research, very few studies directly address chairs' instructional leadership in science. Thus, the model may largely represent what chairs' practice *should be* rather than what it *actually is* in the field. Additional research is warranted to determine how science department chairs' instructional leadership practice compares to the model presented here.

### Conclusions and Implications

Sergiovanni (1984) argued instructional leadership "legitimizes and justifies the chairperson role" (p. 311). The literature reviewed above highlights this legitimizing role and outlines the barriers, contexts, and practices that shape such leadership. The proposed conceptual model synthesizes a wide range of research in order to highlight the core leadership capabilities that contribute to science instructional leadership, to provide a guide for future research, and to provide a point of departure for reflection on professional practice in this area.

While the existing literature provides a rich account of the challenges faced by department chairs, additional research is needed on the specific role of science department chairs in instructional leadership. Several studies (de Lima, 2008; O'Neill, 2000; Ritchie et al., 2005; Skinner, 2007; Willis, 2010; Zepeda & Kruskamp, 2007) indicate the need to move beyond the strict application of Role Theory to explore chair leadership in terms of the social interactions through which that leadership is enacted. A few researchers (Au et al., 2003; Bolam & Turner, 2003; Wettersten, 1993, 1994; and Klar, 2012) have proposed conceptual models describing the work of the high school department chair, but this area of research is underdeveloped. Such conceptual models may be important in unifying research on department chairs and in informing their professional practice. The model proposed here synthesizes

a great deal of related research around the concept of science instructional leadership into a framework that can be compared to empirical research that directly addresses the question of how science department chairs enact instructional leadership.

The historical review of literature on the high school department chair points educational leaders to the obstacles to department chair instructional leadership and to the conditions needed to overcome these obstacles. To the extent principals and district leaders can foster these conditions—including distributed leadership, targeted professional learning, and sufficient time and resources—they can begin to unlock the potential that department chairs represent for improving teaching and learning in science. The proposed model provides chairs and other leaders with a preliminary guide for practice, reflection, and professional learning. This guide would be greatly enhanced by further qualitative research that would provide a rich picture of science department chairs effectively enacting instructional leadership within schools. The burden of professional learning and teacher support involved in widespread implementation of the Next Generation Science Standards is such that the science education community cannot afford to leave any resource untapped. Science department chairs represent one critical resource in this effort.

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