Evaluation and Program Planning 28 (2005) 257–269

EVALUATION and PROGRAM PLANNING

www.elsevier.com/locate/evalprogplan

Concept mapping methodology: A catalyst for organizational learning

Stephanie Sutherland[a,*], Steven Katz[b]

[a]Learning Research and Development Center, University of Pittsburgh, 3939 O'Hara Street, 803 LRDC, Pittsburgh, PA 15206-5189, USA
[b]Ontario Institute for Studies in Education of the University of Toronto, Toronto, Ont., Canada

Abstract

In this paper, concept mapping is suggested as a methodological catalyst for organizational learning. Concept mapping, by virtue of its psychological and sociological foundations, offers a way to simultaneously understand complex systems in terms of both intra- and inter-personal relationships. We posit that key stakeholders, when taken together, represent the organization as a bounded unit and set the stage for the interaction between evaluation practice and organizational learning. We illustrate this argument by reference to an evaluation study in which concept mapping was used by two stakeholder groups as a process of structured conceptualization. Ultimately, the methodology facilitated the development of a jointly authored conceptual framework to be used in future program planning, development, and evaluation.

1. Introduction

In this paper, we illustrate how concept mapping can be viewed as a transformative process that has the ability to bring together diverse views and values of multiple stakeholders to conceptualize and represent complex constructs in a clear and systematic manner. In this way, we discuss how concept mapping can be used as a potential methodological catalyst for organizational learning. We posit that key stakeholders, when taken together, represent the organization as a bounded unit and set the stage for the interaction between evaluation practice and organizational learning. Organizations devote considerable energy in developing collective understandings of events. It is the interpretations of events (or constructs) within a structured 'meaning making' environment whereby learning can occur (Daft & Weick, 1984). We illustrate this argument by reference to an evaluation study in which concept two stakeholder groups used mapping as a process of structured conceptualization.

2. The context

The Manitoba School Improvement Program (MSIP) provides the context for this research. MSIP is a non-governmental agency that has been operating in Manitoba, Canada for 10 years and came into being as a result of the of the Walter and Duncan Gordon Foundation (WDGF). The Foundation sought to support school-based improvement projects designed to help students at risk remain in school and fulfill their individual potential. The central goal of MSIP has been to improve the learning experiences and outcomes of secondary school students by building school level (i.e. capacity of administration, teachers and students) capacity to enhance student engagement and learning. In addition to receiving multi-year grants, MSIP schools receive professional and technical support from the program for skill building, including support for program evaluation. MSIP has always believed that thoughtful reflection based on data helps build a school's capacity to sustain improvement. As part of their involvement in MSIP, the schools must agree to produce annual evaluation reports (Lee, 1999).

3. The challenge

An emerging body of research has sought to link the two explicit goals of MSIP-school improvement and student engagement. Such studies seek to understand the relationship between school characteristics and student engagement and learning (Davidson, 1996; Smith, Butler-Kisber, Portelli, Shields, Sparkes, & Vibert, 1998; Whelage, Rutter, Smith, Lesko, & Fernandez, 1989; Wilson & Corbett, 2001). Defining student engagement, however, has proved

* Tel.: +1 412 624 7489; fax: +1 412 624 2662.
E-mail address: stephs@pitt.edu (S. Sutherland).

0149-7189/$ - see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.evalprogplan.2005.04.017

problematic (Smith et al., 1998) with there being little agreement amongst researchers about both scope and content of the construct. For some, student engagement has been about links to learning (Newman, Wehlage, & Lamborn, 1992), for others it concerns participation and identification with the life of the school (Finn, 1989; Finn & Cox, 1992; Leithwood & Jantzi, 1997). And still for others, it is more closely linked to social interactions within the school (Covington, 1992; Woods, 1996). That said, regardless of the peculiarities of the definition that one chooses to accept what is clear from an evaluation standpoint is that the views of the primary stakeholders are recognized and represented—specifically those of students and teachers.

While it is not unusual for the experiences and views of teachers to be represented in scholarly research (Cullingford, 1995; Fullan & Hargreaves, 1992), less evident are studies in which the views of students are solicited (Davidson, 1996; Morgan & Morris, 1999; Rudduck, Chaplain, & Wallace, 1996; Wilson & Corbett, 2001). Prior school improvement research has generally separated students' perspectives from those of their teachers. Some studies have emphasized teachers' behavior in the classroom (Bossert, 1988; Coleman & Collinge, 1993), while others have focused on clearly defined goals for the education of students, comprehensive curricula, instructional leadership, rewards to the students and high expectations (Hallinger & Murphy, 1986; Mortimore, 1991; Reynolds, Sammons, Stoll, Barber, & Hillman, 1996; Schreerens & Creemers, 1996; Stringfield & Herman, 1996). What is missing in this corpus is a comparative orientation that addresses both the teacher and student perceptions of student engagement within a singular context.

One promising pathway towards the necessary comparative orientation comes to us by way of advances in thinking about the nature and purpose of methodology. From an evaluation standpoint, transformative methodological designs (Greene & Caracelli, 1997; Greene, Caracelli, & Graham, 1989) emphasize the value commitments of different stakeholders (and traditions) for better representation of multiple interests. The purpose of this study is to examine the efficacy by which one such transformative methodology—concept mapping (Trochim, 1989)–allows for the emergence of a co-constructed definition of the slippery concept of student engagement. That is, participants are afforded the opportunity to 'think together', thereby creating the possibility of creating a shared 'picture of the future'.

4. Concept mapping methodology: an overview

The literature describes the use of concept mapping in two ways: that related to student learning and curriculum development; and that related to program evaluation and planning. Concept mapping is a graphic technique for promoting social interaction and exchange by creating the conditions for the understanding of thoughts and how they might be linked with each other (Khattri & Miles, 1994). In other words, concept mapping is a type of structured conceptualization which can be used by groups to develop a conceptual framework which can be used for program planning and development, as well as for evaluation purposes (Trochim, 1989).

To construct the map, 'ideas first have to be described or generated, and the relationships between them articulated' (Trochim, 1989, p. 1). This step is accomplished via a focus group or a series of interviews. Once the ideas have been generated they are subsequently sorted and rated, then entered into the concept mapping software for multidimensional scaling and cluster analysis. Hence, both qualitative and quantitative methodologies are combined. The main difference between Trochim's concept mapping (used in this illustration) and other mapping processes is the former is particularly appropriate for group use. Specifically, it generates a group map that makes it attractive for use with different stakeholders in a single evaluation.

The use of concept mapping for student learning and curriculum development emerged out of a debate in science education that focused on whether or not children could fully understand abstract concepts (e.g. matter, infinity, energy). Mapping is a theory of meaningful learning. According to Wandersee (1990, p. 927), concept mapping 'relates directly to such theoretical principles as prior knowledge, subsumption, progressive differentiation, cognitive bridging, and integrative reconciliation'. In education, concept mapping has become an important tool to help students learn meaningfully, and to help teachers become more effective teachers (Novak, 1990).

Concept mapping is an effective method for building capacity amongst key stakeholders as the entire process is premised on group understanding. The final step in the mapping process entails having a group discussion on how the final concept map might be used to enhance either planning or evaluation. In this way, the procedure can work well in assisting stakeholder groups (i.e. teachers and students) come to a clearer understanding of key concepts and their practical utility and effectiveness in practice.

5. Theoretical foundations of concept mapping methodology

An understanding of the psychological and sociological origins of the concept mapping process is critical to the use of its application. We consider each of these broad evolutionary tenets in turn.

5.1. Psychological foundations

Work in cognitive theory by Ausubel (1968) played a key role in establishing the psychological foundations from which contemporary concept mapping theory and methods evolved. Concept mapping produces a visual representation of accessible information from a specific orientation. Generally, theory in cognitive mapping emphasizes humans' systematic acquisition, storage, access and utilization of knowledge (Golledge, 1986). In schemata theory, discussed by Milligan (1979) and Sholl (1987), concept mapping processes directly parallel the schema system.

Schema systems are evolving mental representative structure or understandings of something learned (Smilkstein, 1991). Concept mapping technologies are embedded in cognitive learning theory. In general, the acquisition and storage of knowledge delineated in cognitive learning theory directly parallels the concept mapping steps defined by Trochim (1989). In learning theory, learners are stimulated to activate related knowledge (schemata) in a particular area. Similarly, participants in concept mapping processes are encouraged to access related knowledge on the area under focus during the brainstorming phase (Rizzo-Michelin, 1998). The cognitive learning processes of guiding learners to develop new structures or knowledge about the structures are represented by the processes of generating and developing items and interconnections in concept mapping.

Like cognitive learning theory, concept-mapping processes consolidate new structures and knowledge. In cognitive learning theory, under appropriate conditions, learners acquire a more unified, complex understanding of the phenomena in question. In concept mapping the consolidation of information is demonstrated by the aggregation of information displayed using individual or group maps. These maps help participants develop broader, common understandings of the information displayed. Opportunities to encourage the creative use of this knowledge are of core significance in cognitive learning theory and concept mapping methodology.

5.2. Sociological foundations

While cognitive theory provides the mental structure for the perceived acquisition and integration of knowledge, sociological principles provide the processes for understanding the connections in terms of 'social processing' (Garling, 1984). Huberman (1990) contends that the acquisition of knowledge is an interactive process between and within the environment. It is these interactive networks that are precisely the foundations on which concept mapping variations rely. In other words, group and individual constructs are established during an interactive process in conjunction with individual experiences and strategies. Concept mapping relies heavily on these interactions in creating construct maps that reflect these communications. This position is consistent with a long line of psycho-sociological research emphasizing the importance of socially constructed thoughts that make learning at both individual and group levels possible (Bandura, 1986).

In social processing, the acknowledgement and rationalization of thought construction is defined through the interactions of people. Similarly, in concept mapping, knowledge is constructed through an interactive link between participants. Open discussions, interviews and focus groups generate the items to be used in the application. People construct and understand the concept maps as networks among thoughts of individuals within groups. In essence, the final group map, as we will see, is a visual representation and acknowledgement of thoughts constructed through social interactions between people.

6. Organizational learning

Thus far, we have alluded to the utility of the concept mapping methodology as a catalyst for providing opportunities for multiple stakeholder groups to jointly author a summative and formative conceptual framework. Such stakeholders, when taken together, represent the organization as a distinct whole or 'system'. Structured conceptualization processes like concept mapping, then, hold the potential to contribute to systems thinking which, in turn, supports organizational learning.

The route to organizational learning can be either non-deliberative or deliberative (Robinson, 2002). In both cases three main patterns are observed (Gronn, 2002). First, collaborative forms of engagement arise. Second, emergent interpersonal synergies solidify as part of the development of close working relations among colleagues. Finally, there are a variety of structural relations and institutionalized structures that constitute attempts to regularize the distributed actions.

The deliberative approach to organizational learning aligns with that which is the subject of the present paper. As the name implies, it has the potential to be planned and intentional in its focus. Senge (2000) 'five disciplines' for creating a 'learning community' govern organizational learning that is deliberative and intentional:

1. Building a Shared Vision—the practice of creating a shared 'picture of the future' that fosters genuine commitment;
2. Personal Mastery—the skill of continually clarifying and deepening personal vision;
3. Mental Models—the ability to become aware of our mental representations, to examine them, and to expose them to the influence of others;
4. Team Learning—the capacity to 'think together' which is gained through the practice of discourse;
5. Systems Thinking—the methodology that integrates the others, fusing them into a coherent body of theory and practice.

As we will see, concept mapping provides a methodological catalyst for the intentional advancement of the five aforementioned disciplines.

7. The study

7.1. Purpose

The concept mapping procedure was used to empirically define the conceptual understanding of the student engagement concept using input from both teacher and student groups. Consensus pattern matching was used to compare and quantify (using correlation coefficients) perceived student engagement similarities and/or differences among the groups.

7.2. Sample

The sample of student and teacher participants was drawn from two MSIP secondary schools. Both schools have been involved with MSIP for approximately 6 years. The student group was subdivided to ensure representation from both grade 10 and grade 12 students. Students in grade 10 were selected because they are at the legal age whereby they must remain in school. Grade 12 was used because these students, for one reason or another, have made a choice to stay in school. Based on an analysis of 38 concept mapping studies, Trochim (1993) found a range of between 6 and 33 participants and noted that the typically recommended sample size for concept mapping projects be 15 people. For the purposes of the current study, two distinct stakeholder groups were identified: (1) teachers and (2) students. Due to the desired make-up of the focus groups—teachers representing different grade levels and course expertise, and students in both grades 10 and 12—a mix of random, purposive, and self-selection was used to obtain a final sample of 32 participants. Thus, the final sample consisted of a total of 32 participants arranged in equal groups of eight (one student and one teacher group of eight from each school).

7.3. Instruments and procedures

The preliminary concept mapping activity required members of each group to generate statements in response to a focus instruction regarding their own definition(s) of student engagement. The first author facilitated four sessions, two at each school, and met with the respective groups to conduct this preliminary concept mapping activity.[1] A single focus-statement was used by all groups. This was a concise instruction directed to the groups to stimulate brainstorming: generate statements (short phrases or sentences) that relate to [teacher/student] perceptions of student engagement. The facilitator's role during this session was to keep individuals on task, and to record all statements generated. Participants were instructed to follow a typical brainstorming protocol with open and free flowing ideas, saying what came to mind. After each of the four initial focus groups was complete, the two-student brainstormed lists and the two-teacher brainstormed lists were merged into a single, master list. The facilitator accomplished this task by removing any similarities and redundancies contained within the initial lists.

The initial brainstorming sessions yielded a relatively large number of raw statements. Specifically, there were 152 unedited statements (43 from students at Arctic Ice High, 27 from teachers at Arctic Ice High, 46 from students at Prairie Spirit High School, and 46 from teachers at Prairie Spirit High School). These statements were entered into a database and tagged according to which group (student or teacher) generated the statement. This raw statement set was edited down to a final set of 60 statements. This editing procedure (conducted by the first author) involved a combination process to (1) remove any obvious redundancies, (2) clarify and produce consistent terminology, and (3) correct spelling and grammar. Throughout this editing and reduction process, the proportionality of the original set of raw statements was preserved so that approximately a quarter of the 60 statements came from each of the four groups.

Next the statements were entered into the Concept System software package to produce decks of cards representing the list of statements. Participant groups were asked to independently read each statement and sort them 'in a way that makes sense to you'. Once the statements were sorted, participants were asked to rate each statement on a five-point scale in terms of its importance to their own view of what student engagement means.[2] The sorted, rated cards were then placed in sealed packages and subsequently entered into the concept mapping software.

7.4. Analysis

All sorting and rating data provided by each of the 32 respondents were analyzed as a single project using Concept Systems Software. The software provided a convenient means to perform the statistical calculations used to generate the initial concept maps, the refined maps based on stakeholder input, and to generate the pattern matches. The major calculations performed by the software include data aggregating, multi-dimensional scaling, cluster analysis, bridging analysis, and sort pile label analysis. One could feasibly use various other statistical software packages such as SPSS or SAS to perform these analyses. As previously mentioned, the intent of this study is not to focus on the statistical properties of the method, but rather to highlight one way in which stakeholders can collaboratively

[1] Due to scheduling/logistical constraints, the teacher and student brainstorming sessions were conducted separately. A total of four sessions (two at each school) were held at each of the two participating high schools. Each session lasted approximately 60 min and were audio recorded.

[2] The sorting and rating process ran smoothly for all groups. Only one teacher had difficulty in sorting her cards. She continually wanted to overlay (as opposed to sort into piles) various cards that she felt were 'interrelated'.

engage in this type of process. That being said, the aforementioned statistical procedures—multi-dimensional scaling (MDS) and cluster analysis—and the application of such concept mapping techniques have been well described elsewhere (see, Anderberg, 1973; Davison, 1983; Everitt, 1980; Gans, 2000; Kruskal & Wish, 1978; Trochim, 1989)

Each individual's sort data is used to generate all of the Concept Map results in the Concept System. First, each participant's unstructured similarity sort piles are converted into a binary matrix that is as large as the statement set itself. In this case, there were 60 statements in the set, so the matrix was 60 rows by 60 columns. If two statements were grouped together into a pile the corresponding row and column intersection has the entry '1' to indicate the relationship. Otherwise, a '0' is place into the row–column intersection to indicate that there is no relationship. The matrix is perfectly symmetrical along the diagonal axis because each statement must be sorted with itself. By transforming a participant's sort data into a binary square similarity matrix, a common data structure is created that can be replicated for all participants. This allows each participant's sort data to be aggregated with other project participants.

Using hierarchical cluster analysis procedures, the Concept Systems Software initially produces a concept map with a default number of six clusters. All hierarchical cluster analysis procedures give as many possible cluster solutions as there are statements. According to Trochim (1989), these clustering methods begin by considering each statement to be its own cluster (i.e. an *N*-cluster solution). At each stage in the analysis, the algorithm combines two clusters until, at the end, all of the statements are in a single cluster. The task for the analyst is to decide how many clusters the statements should be grouped into for the final solution. There is no simple way to accomplish this task. Essentially, the analyst must use discretion in examining different cluster solutions to decide on which makes sense for the case at hand. In this study, the total number of statements equalled 60, thus all cluster solutions from about 20–3 were initially considered (Gans, 2000; Trochim, 1989). The goal is to examine which statements make sense in the various groupings. Gans (2000) explains that it is useful to picture a tree where the twigs at the end of the branch are representative of points from the map and the trunk is a single cluster that contains all points. The idea is to begin with each point as its own cluster and move from twig to branch to trunk until there are fewer and fewer clusters ultimately ending in only one. Due to time and distance constraints, the decision to use a nine-cluster solution was made by the facilitator.

The next step in the data analysis was to incorporate the rating information into the map. Until this point, the only data used as input for the analysis was each participant's sort data. This sort data enabled the Concept Systems to generate two-dimensional representations of the brainstormed statement set. The rating information provided depth to those two-dimensional graphics. As described earlier, each participant rated each statement in the brainstormed statement set on a Likert scale. Specifically, the rating measured importance on a 1–5 scale where 1 represented relatively unimportant and 5 represented extremely important. This information was averaged for each statement in the set and translated into a 'point rating' map. As Gans (2000) explains, this ultimately enhances the interpretation sessions and orients participants to the next graphic, the 'cluster rating' map.

The cluster-rating map shows the final cluster solution and adds the same depth provided by the rating data in a similar manner to the point-rating map. The rating value for a cluster is the average rating across all the statement ratings in the cluster. The cluster rating is represented as layers varying in height from 1 to 5. Each rating constitutes a rating range whose value is reported in the legend. The point cluster-rating map presented an image that had a noticeable impact on the groups during the interpretation session.

The final analysis performed was the pattern match, which is essentially a graphic comparison of the cluster rating maps for two demographic sub-groups—in this case students and teachers. Pattern matching is powerful in its implications, particularly as a measure of stakeholder consensus regarding their views of statement importance within specific map clusters. The results of a pattern match are represented both graphically (as a ladder graph) and numerically (as a correlation coefficient) between measures. The ladder graph is comprised of two vertical scales, one for each stakeholder group and is joined by sloping lines each corresponding to a labeled concept map cluster. The correlation coefficient associated with each pattern match ranges between -1 and $+1$. Values near 0 indicate the absence of a match; values closer to either pole indicate stronger matches. Negative values imply an inverse relationship (when one measure is high, the other is low and vice versa). Positive values imply a synchronic relationship (high with high and low with low).

8. Findings

The constructed maps are presented in order of increasing complexity and detail. Table 1 represents a listing of the total 60-statement list generated previously by students and teachers with the various cluster labels inserted. In addition to generating the statements to describe their perceptions of student engagement, students and teachers also rated the relative importance of each item. Importance ratings allowed for pattern matching analyses to be performed between the two groups. The results of these analyses illustrated in Table 2 are the average ratings and the bridging index scale. The bridging index scale is from 0.0 to 1.0. Lower values imply that a statement is sorted primarily with statements that are close to it on the maps and therefore more similar. It is useful to keep Table 2 on hand when examining the maps that follow.

Table 1
Combined teacher and student items

Student engagement brainstorming items (teachers and students)	
1. Guidance support	31. High teacher expectations of students
2. Parental involvement	32. School safety
3. Timely grading/assessment of student work	33. Need for student space
4. Opportunities for student leadership	34. Compromise
5. Active role in classroom discussions	35. School spirit
6. Teacher as friend	36. Doing work in groups
7. Teacher is passionate about teaching	37. Student ownership in learning
8. Lots of program/course options	38. Balance of teacher and student ideas
9. Student independence in learning	39. Community involvement
10. Variety in teaching style	40. Different types of school involvement
11. Relevance of class material	41. School policies
12. Incentives to promote student learning	42. Teacher job satisfaction
13. Extra-curricular activities	43. Student input into learning
14. Changes in regular timetable	44. Trust
15. Small classes	45. Having the same teacher/student more than once
16. Involvement in student council	46. Competition
17. Hiring of younger teachers	47. Student attitudes/interest in classes
18. School reputation	48. Have fun in class
19. Feel comfortable at school	49. Experience success in learning
20. Teachers' reputation	50. Different assessment methods
21. Importance of friends/socializing	51. Student motivation to learn
22. Changes in administration	52. Demanding curriculum
23. Student–teacher relationships	53. Opportunities for teacher–student decision-making
24. Teacher professional development	54. Teacher is entertaining/interesting
25. School is accepting of different social groups	55. Mixed ability classes
26. School is multi-cultural	56. Challenging class projects
27. Support for student ideas	57. Respect for others
28. Effective communication	58. Supportive principal/vice-principal
29. Interesting classes	59. Smiling
30. Involvement in sports	60. Being recognized

The above items were generated by teacher and student brainstorming sessions. Next, these items were combined to create a master list. Care was taken to ensure equal representation from each of the groups (teachers and students).

The first map that the concept mapping software generates is the Point Map (see Fig. 1). The numbered point map illustrates the sixty statements as they are placed by multi-dimensional scaling. Fig. 1 illustrates that statements that were sorted together more frequently by participants (students and teachers) appear closer to each other on the map. For example, looking at the bottom right corner of the map one sees several statements that have been sorted in a similar manner by participants. For example, statement numbers 5 'active role in classroom discussions', 7 'teacher is passionate about teaching', 9 'student independence in learning', 11 'relevance of class material', 29 'interesting classes', 37 'student ownership in learning', 38 'balance of teacher and student ideas', 54 'teacher is entertaining/interesting', and 56 'challenging class projects' are located in close proximity to one another.

In contrast, looking at the far left side of the map, there are statements such as 2 'parental involvement', 40 'different types of school involvement', and 4 'opportunities for student leadership' that remain quite isolated indicating that these statements were not sorted in a similar manner by participants.

The Concept Mapping software also organizes the points into conceptual clusters as represented by Fig. 2. The nine-solution cluster map visually portrays the same clustering relationship that appears on the point map in Fig. 1. Like the points on the point map, the smaller clusters contain statements that are, from the participants' perspective, conceptually similar while clusters that are farther apart reflect conceptual difference. The closer the clusters are together on the map, the more similar respondents felt the items to be. The clusters located at the bottom left side of Fig. 2 'Students at the center', 'engagement as a habit of mind', and 'student–teacher interactions' are good illustrations of clusters that participants perceive to be similar. The size of the cluster also indicates how conceptually similar or dissimilar the individual statements were perceived to be by the study participants. For example, larger, more elongated clusters (see for example, 'Professional educators') indicate that both students and teachers did not think that many of the items (i.e. (1 'guidance support', (8 'lots of program/course options, (17 'hiring of younger teachers, (20 'teachers' reputation', (24 'teacher professional development', (42 'teacher job satisfaction' and (58 'supportive principal/vice-principal') were conceptually similar. Conversely, the cluster labeled 'diversity and belonging' is relatively compact, indicating that both students and teachers perceived

Table 2
Student and teacher statements by cluster name

Cluster name	Statement	Average rating	Bridging index[a]
Aspects of pedagogy	3) Timely grading/assessment of student work	3.83	0.65
	10) Variety in teaching style	4.04	0.95
	15) Small classes	3.65	0.20
	28) Effective communication	4.30	0.07
	31) High teacher expectations of students	3.70	0.47
	50) Different assessment methods	3.65	0.20
	52) Demanding curriculum	3.00	0.30
	Cluster average	3.74	0.28
Professional educators	1) Guidance support	3.60	0.74
	8) Lots of program/course options	3.70	0.47
	17) Hiring of younger teachers	2.91	0.39
	20) Teachers' reputation	3.30	0.43
	24) Teacher professional development	4.13	0.58
	42) Teacher job satisfaction	3.83	0.65
	58) Supportive principal/vice-principal	3.74	0.65
	Cluster average	3.60	0.56
Variety in school policy/structure	2) Parental involvement	3.52	1.00
	14) Changes in regular timetable	2.78	0.64
	22) Changes in administration	2.22	0.47
	40) Different type of school involvement	4.04	0.95
	Cluster average	3.14	0.77
Beyond the classroom	4) Opportunities for student leadership	3.83	0.54
	13) Extra-curricular activities	4.00	0.50
	16) Involvement in student council	3.04	0.52
	18) School reputation	3.52	0.45
	30) Involvement in sports	3.17	0.53
	35) School spirit	4.09	0.38
	39) Community involvement	3.52	0.75
	41) School policies	3.52	0.42
	Cluster average	3.59	0.51
Diversity belonging	21) Importance of friends/socializing	4.04	0.54
	25) School is accepting of different social groups	4.61	0.39
	26) School is multi-cultural	3.83	0.42
	32) School safety	4.43	0.43
	33) Need for student space	3.52	0.44
	Cluster average	4.09	0.44
Student–teacher interactions	5) Active role in classroom discussions	3.74	0.11
	7) Teacher is passionate about teaching	4.65	0.21
	9) Student independence in learning	4.00	0.13
	11) Relevance of class material	4.43	0.00
	29) Interesting classes	4.17	0.04
	37) Student ownership in learning	4.04	0.12
	38) Balance of teacher and student ideas	3.52	0.06
	54) Teacher is entertaining/interesting	4.00	0.06
	56) Challenging class projects	3.74	0.09
	Cluster average	4.03	0.09
Students at the center	12) Incentives to promote student learning	4.04	0.11
	27) Support for student ideas	4.00	0.09
	43) Student input into learning	3.35	0.16
	45) Having the same teacher/student more than once	3.17	0.06
	55) Mixed ability classes	2.96	0.16
	Cluster average	3.50	0.11
Engagement as a habit of mind	36) Doing work in groups	3.35	0.22
	47) Student attitudes/interest in classes	4.39	0.21
	48) Having fun in class	3.91	0.21
	49) Experience success in learning	4.30	0.07
	51) Student motivation to learn	4.09	0.16
	53) Opportunities for teacher–student decision-making	3.65	0.20
	Cluster average	3.95	0.18

Table 2 (*continued*)

Cluster name	Statement	Average rating	Bridging index[a]
Emotions	6) Teacher as friend	3.35	0.42
	19) Feel comfortable at school	4.70	0.56
	23) Student–teacher relationships	4.26	0.48
	34) Compromise	3.65	0.50
	44) Trust	4.48	0.34
	46) Competition	2.91	0.52
	57) Respect for others	4.74	0.34
	59) Smiling	3.78	0.36
	60) Being recognized	3.83	0.54
	Cluster average	3.97	0.45

(*continued on next page*)

[a] The bridging index scale is from 0.0 to 1.0. Lower values imply that a statement is sorted primarily with statements that are close to it on the map and therefore are more similar. From a quick scan of the table, it is apparent that there is an inverse relationship between the rating and the bridging index.

the items (i.e. (21 ‘importance of friends/socializing’, (25 ‘school is accepting of different social groups’, (26 ‘school is multi-cultural’, (32 ‘school safety, and (33 ‘need for student space’) within this grouping to be similar.

The next set of maps integrates participant rating data into graphic outputs. The point-rating map in Fig. 3 illustrates the average item ratings by all respondents. The square ‘piles’ beside each of the item numbers indicates average importance assigned to that item by participants. Recall that statements were to be sorted from one (not very important) to five (very important). Items such as 57 ‘respect for others’ and 19 ‘feel comfortable at school’ were perceived to be very important for student engagement by both students and teachers. Conversely, items 22 ‘changes in administration’ and 52 ‘demanding curriculum’ were not perceived by participants to be of central importance for student engagement.

Fig. 4 displays the same data as Fig. 3 in a two-dimensional visual cluster format. Similar to the point-rating map, this graphic illustrates the average ratings by all respondents in a cluster format. The legend on Fig. 4 indicates that the lowest rated items (i.e. 3.14–3.33) are denoted by a single layer. Conversely, the highest rated items (i.e. 3.90–4.09) are denoted with five layers. The highest rated cluster by student and teacher groups was ‘Diversity/Belonging’ (cluster rating = 4.09), followed closely by ‘student–teacher interactions’ (cluster rating = 4.03). Conversely, the lowest rated clusters were ‘variety in school policy/structure’ (cluster rating average = 3.14) and ‘students at the center’ (cluster rating average = 3.50). Referring back to Senge (2000) ‘five disciplines’, the data contained in Figs. 1–4 represent the foundation for the stakeholder groups to build a shared foundation. That is, both groups had input into defining what student engagement mean to them. Throughout these processes, both teachers and students (within their respective groups) gained a sharpened understanding of their own orientation to student engagement by virtue of having to explain their thinking to others, and at the same time being exposed to the views of others.

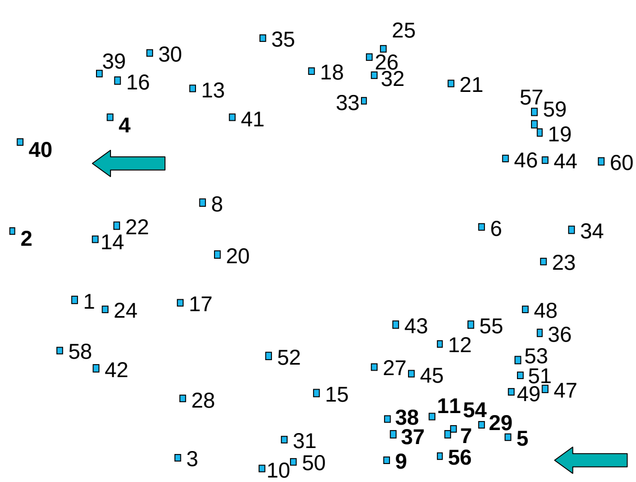

Fig. 1. Point Map.

During the interpretation sessions, the student and teacher groups, with the assistance of the first author, identified two broad ‘discourse regions’ of similarity—see Fig. 5[3] The clusters labeled ‘diversity/belonging’, ‘emotions’, ‘students at the center’, ‘engagement as a habit of mind’, and ‘student–teacher interactions’ were referred to by the students and teachers as ‘intrinsic characteristics of student engagement’. Clusters labeled ‘beyond the classroom’, ‘variety in school policy/structure’, ‘professional educators’, and ‘aspects of pedagogy’ were

[3] After the maps were produced, the first author met with the participant (teacher and student) groups again. During this meeting, participants were given a chance to examine the maps that they had produced. At this time they were able to ask questions, and ultimately were asked to give each cluster a label (name). The facilitator assisted in the cluster naming process. That is, when students had difficulty coming to a consensus on a given cluster name the facilitator would offer various names as suggestions only. This meeting is often called an ‘interpretation session’ for it gives the participants an opportunity to think about, and discuss their maps. Ideally, when conducting an interpretation session the facilitator would invite the respective stakeholder groups to meet together. Unfortunately, due to time constraints, only the two student groups were able to undertake this naming task. Teachers, however, when presented (at a later meeting) with the named maps agreed and endorsed the student labels.

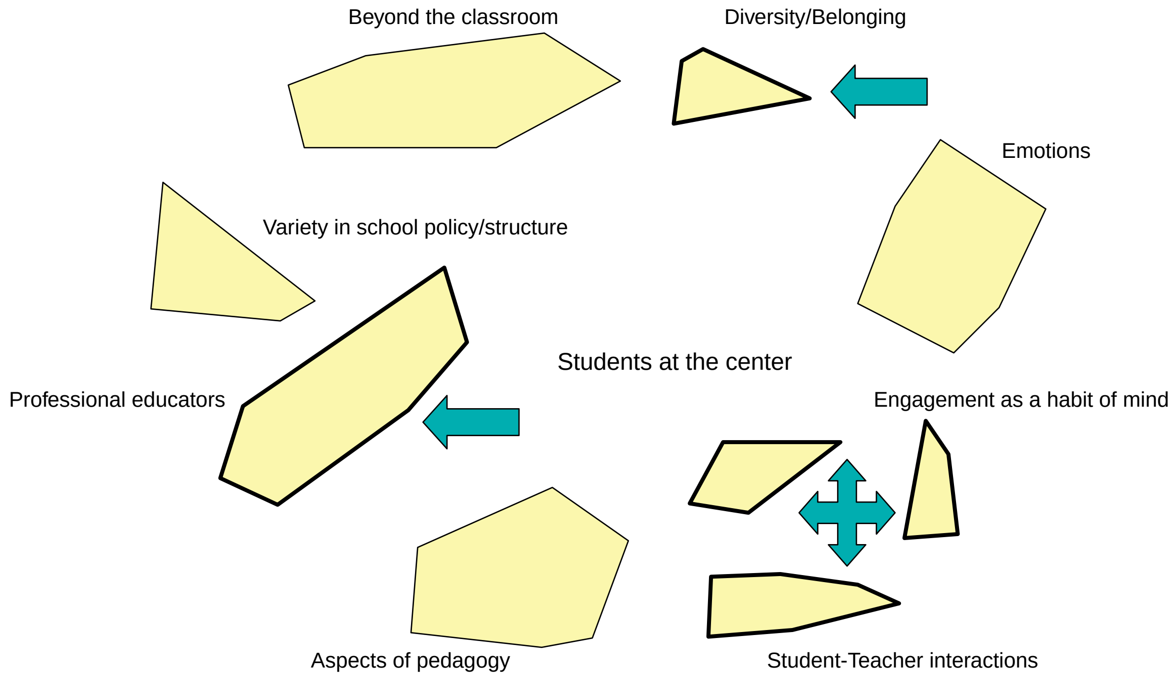

Fig. 2. Conceptual cluster map.

referred to as ‘extrinsic characteristics of student engagement’. If we look at the item and cluster ratings of the entire map, what becomes apparent is that the items/clusters within the extrinsic characteristics discourse region in Fig. 5 are rated lower than those items/clusters within the intrinsic characteristics discourse region. As well, the clusters in the former region are typically larger and elongated, thus indicating that they were less conceptually clear in the minds of students and teachers than the clusters on the latter region. Aligned with Senge (2000) disciplines, these interpretation sessions could be thought of as ‘team learning’. That is, students and teachers had the ability to think together through shared discourse.

Perhaps the pivotal question arising in the context of the present study is the extent to which students’ and teachers’ views about student engagement converge. Do students’ and teachers’ perceptions of student engagement differ? The final graphic output is the pattern match (see Fig. 6), which represents a direct comparison of the student and teacher group ratings of the statement clusters. This pattern matching technique permitted the identification of consensus and disagreement among the two stakeholder groups.

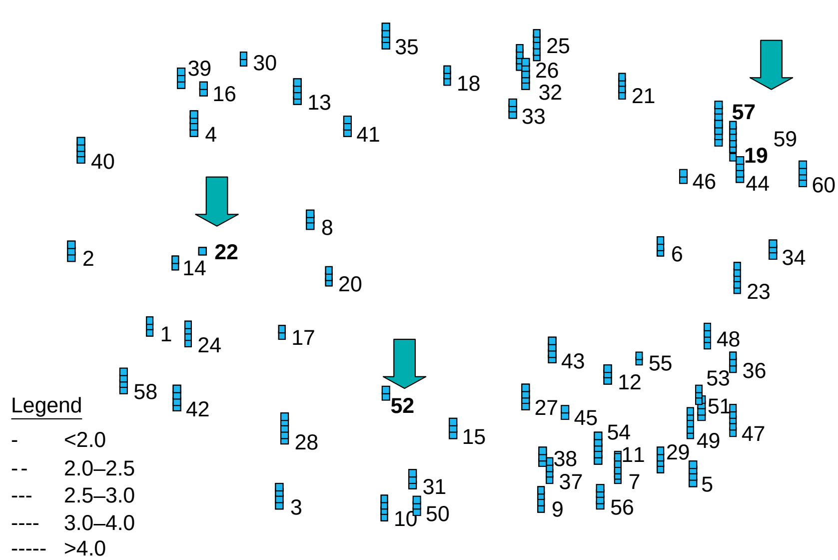

Fig. 3. Point rating map.

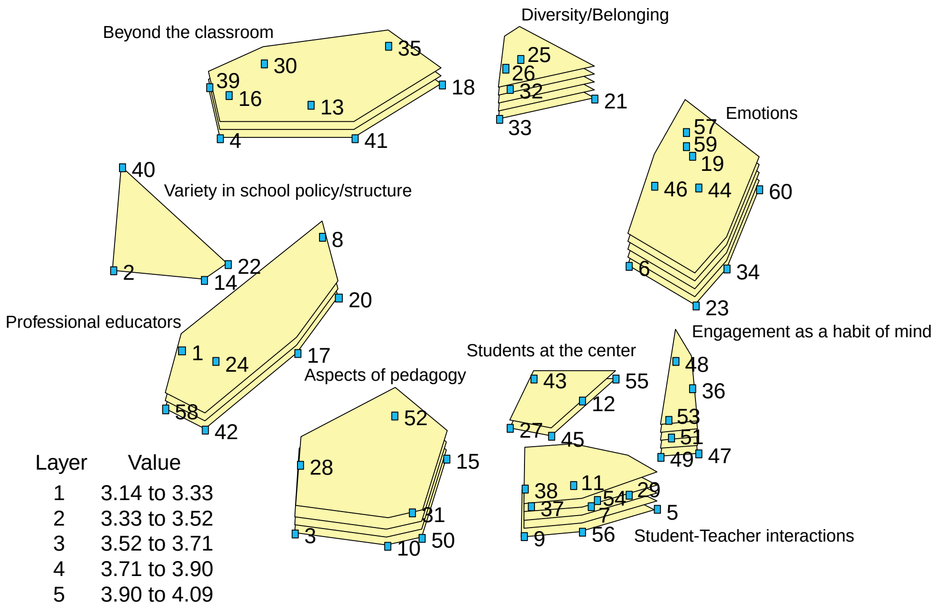

Fig. 4. Two-dimensional cluster map.

Fig. 6 shows fairly strong agreement between students and teachers ($r=8$) on the general importance ratings of the student engagement items. The clusters that were considered to be most important for student engagement by students and teachers were ones that related to the individual, or those that were previously noted as 'intrinsic'.

With respect to student engagement, both stakeholder groups rated the same three clusters as being most important, although in a slightly different order. The students rated 'diversity/belonging' as highest, followed by 'student–teacher interactions' and 'engagement as a habit of mind'. Similarly, the teachers rated the same three clusters as being most important, however, 'engagement as a habit of mind' was viewed as slightly more important than 'student–teacher interactions'. In addition, students and teachers were similar in their views with respect to items that related to 'beyond the classroom'. These 'beyond the classroom' items were rated as relatively important by both groups, but the teacher group rated this cluster as slightly less important that did the students. Another area of stakeholder convergence centered on the 'variety in school policy/structure' items. Teachers gave this cluster an average rating of 3.27, while the students gave it a 3.02.

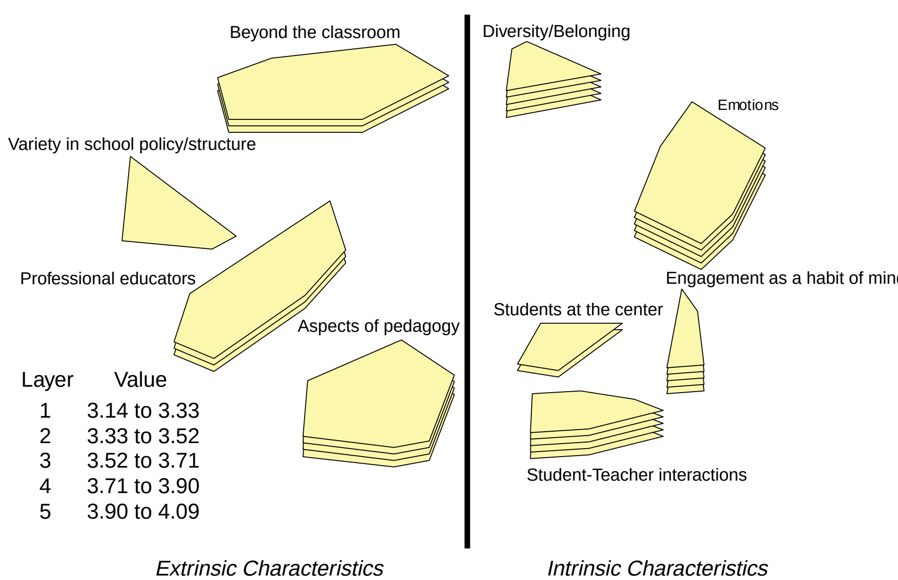

Fig. 5. Discourse region map.

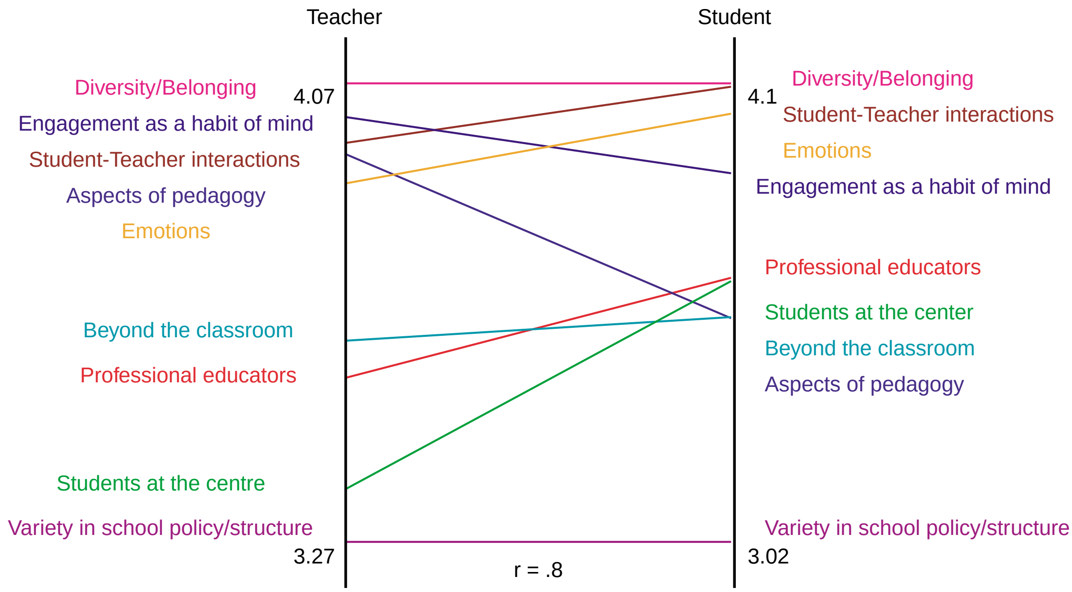

Fig. 6. Pattern match.

Where there was divergence between the two stakeholder groups, it was most evident within the 'aspects of pedagogy', 'students at the center', and 'professional educators' clusters.

9. Discussion/conclusion

The Manitoba School Improvement Program (MSIP) functions as a natural experiment within which to investigate the efficacy of using a transformative methodology to co-construct a definition of student engagement. Student engagement, as noted earlier, is often held out as a key goal of school improvement efforts. MSIP, being a school improvement organization with student engagement as an espoused outcome, provided a ready-made context within which concept mapping as a participatory method could be employed.

Participatory evaluation endeavors strive to provide a shared knowledge base through the direct involvement of stakeholders in the evaluation process. They build on a fundamental insight that in order to transform an organization, the people affected by the change must be involved in creating that change. Participation and collaboration have been found to produce a long-term commitment to use the evaluation process and techniques thereby building a culture of learning among those involved (Cousins and Earl, 1995). Participatory evaluation advances the notion of a collaborative approach to the research decision-making process as distinct from externally controlled alternatives. In particular, such designs offer a powerful approach to organizational improvement by creating learning systems that lead to better-informed decisions.

At the heart of any evaluation endeavor lies the need to answer the question, 'what counts as success?' Within a participatory framework, stakeholders are charged with the responsibility of defining program goals and outcomes. Such a task is, first and foremost, definitional. And as we have seen in the case of the present student engagement example, much definitional ambiguity colors the landscape of school improvement.

Participatory evaluation advocates for the active involvement of key stakeholders in all facets of the process with the intention of cultivating an ownership that will ultimately translate into evaluation utilization. In the context of the present example, it is difficult to conceive of successful school improvement in the absence of intentional efforts to build capacity and foster ownership of the improvement agenda among students and their teachers. Or, to put it another way, you cannot mandate what matters.

Cultivating the necessary degree of ownership, then, is the promise of a participatory approach. MSIP, as a school improvement initiative, must hold as central the participation of its students and teachers in fostering the development of the espoused student engagement outcome. Our aim in this paper has been to demonstrate how concept mapping-as a transformative methodology—holds the potential to both foster ownership and build capacity in students and teachers. Specifically, the concept mapping process as it has been described here encourages the relevant stakeholders (students and teachers) to assume active postures in the social activity of 'meaning making' (Penny, 2002) or, to put it slightly differently, in arriving at a co-constructed definition of student engagement.

While it is not our intent to discuss the content specifics of the co-constructed definition of student engagement in this paper, it is our intent to illustrate the utility of concept mapping in the *process* of definitional co-construction. We saw earlier, in Table 1, the way in which the brainstorming phases of concept mapping contributed to the development of a jointly authored list of definitional constituents of the student engagement construct. Table 2 and Figs. 2–5 offered evidence of how the participants clustered the individual items into higher order concepts and then made judgments about their relative importance. The graphic representations in Figs. 2–5 also illustrated the participants' *relational* understanding of the concepts. In these ways, the concept mapping process provides evidence driven suggestions for both policy and practice developments. The findings illustrated in Fig. 4, for example, prompt questions such as, why is diversity important for these teachers and students? Is the school diverse? Is the community diverse? Is the city diverse? Alternatively, school members and policy makers alike may be interested in why variety in school policy/structure does not elicit more interest from teachers and students? Or, is there a perceived lack of input into school policy?

Beyond functioning as a catalyst for explicating the architecture of student engagement in eyes of the two key stakeholder groups of students and teachers, we have also seen that concept mapping, as a participatory methodology, has the potential to encourage those all important inter-subjective interchanges *between* the key stakeholders. Specifically, we are referring here to the pattern matching analysis and corresponding graphical representation as illustrated in Fig. 6. It is pattern matching that identifies those issues that are most amenable to action or further exploration insofar as there is a meeting or alternatively, a missing, of the minds. Fig. 6, for example, communicates the former in that both students and their teachers see issues of 'diversity and belonging' as pivotal, while variations in 'school and policy structure' are much less so. Alternatively, the latter missing of the minds is evident in the divergent perceptions of importance of 'aspects of pedagogy' and 'students at the center' (as reflected in the steep slope of the lines).

We have seen, then, that concept mapping as a transformative methodology begins with the individual developing a sense of personal vision with respect to a concept (in this case student engagement), becoming aware of this mental representation, and then exposing it to the influence of others. Thereafter, the capacity to 'think together' is promoted through the intentionally structured practice of discourse. Such focused discourse opportunities allow for the creation of a shared 'picture of the future' that fosters genuine commitment by virtue of the practice of key stakeholders, as participants in the process, developing ownership over the vision. And it is the systemic approach of concept mapping that fuses all of these elements into a coherent body of theory and practice. The unfolding of events as characterized in this paragraph should strike readers as familiar. Specifically, the developmental trajectory is one reviewed earlier in connection to Senge (2000) 'five disciplines'. These 'five disciplines' are well regarded as hallmarks of a deliberative and intentionally developed 'learning community'. And it is in this way that concept mapping methodology functions as a catalyst for organizational learning.

10. Lessons learned

This section is meant to provide advise to other evaluators concerning various elements of the processes and outcomes of this study

1. In an attempt to increase the utilization of these findings among various stakeholders involved (teachers and students within the two high schools), copies of the interpretation session materials along with a brief report were forwarded to each of the principals in the hope that they would distribute them amongst staff and students. In addition, the first author had a web site constructed to house the findings. Ideally, follow up visits (i.e. giving brief presentations and holding smaller working groups) to the site would have been beneficial in further increasing the use of the findings.
2. It would have been ideal to hold the interpretation sessions (see endnote (3) in a whole group (both students and teachers) setting. Incidentally, this is the process recommended by Trochim (1989). Unfortunately, time and logistical constraints did not permit this whole 'group think' process to occur. To overcome barriers of time and location, the developers of Concept Systems now have a web-based version available. Of course, one would have to take the necessary steps to ensure all participants had access and capacity to utilize such software.
3. Concept mapping proved to be an effective vehicle to bridge the, often familiar, gap between theory and practice. Like other complex constructs, a study of student engagement demanded a methodology that was creative in engaging study participants, while at the same time being theoretically sound in its applications. Overall, this study offers an example of how concept mapping can be used as a transformative process that can bring together diverse views/values of multiple stakeholders to conceptualize and represent complex constructs.

References

Anderberg, M. R. (1973). *Cluster analysis for applications*. New York: Academic Press.

Ausubel, R. (1968). *Cognitive learning theory*. Beverly Hills, CA: Sage.

Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice Hall.

Bossert, S. (1988). School effects. In N. J. Boyan (Ed.), *Handbook of research on education administration: A project of the American educational research association* (pp. 341–352). New York: Longman, 341–352.

Coleman, P., & Collinge, J. (1993). Seeking the levers of change: Participant attitudes and school improvement. *School Effectiveness and School Improvement*, *vol. 2*, 262–285.

Cousins, J. B., & Earl, L. M. (Eds.), (1995). *Participatory evaluation in education: Studies in use and organizational learning*. London: Falmer.

Covington, M. V. (1992). *Making the grade: A self-worth perspective on motivation and school reform*. New York: Cambridge University Press.

Cullingford, C. (1995). *The effective teacher*. London: Cassell.

Daft, R. L., & Weick, K. E. (1984). Toward a model of organizations as interpretation systems. *Academy of Management Review*, *9*, 284–295.

Davidson, A. L. (1996). *Making and molding identity in schools: Student narratives on race, gender, and academic engagement*. Albany, NY: State University of New York Press.

Davison, M. L. (1983). *Multidimensional scaling*. New York: Wiley.

Everitt, B. (1980). *Cluster analysis (2nd)*. New York: Halsted Press.

Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research*, *59*(2), 117–142.

Finn, J. D., & Cox, D. (1992). Participation and withdrawal among fourth grade pupils. *American Educational Research Journal*, *29*(1), 141–162.

Fullan, M., & Hargreaves, A. (Eds.). (1992). *Teacher development and educational change*. London: Falmer.

Gans, J. (2000). *Doctoral dissertation*. Ithaca, NY: Cornell University.

Garling, A. (1984). Cognitive mapping. *Environment and Behaviour* , 1–34.

Golledge, R. (1986). *Multidimensional analysis*. New York: Plenum Press.

Greene, J. C., & Caracelli, V. J. (1997). Defining and describing the paradigm issue in mixed-method evaluation. *New Directions for Evaluation*, *74*(2), 5–17.

Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989). Towards a conceptual framework for mixed-method evaluation designs. *Educational Evaluation and Policy Analysis*, *11*(3), 255–274.

Gronn, P. (2002). Distributed leadership. In K. Leithwood, & P. Hallinger (Eds.), *Second international handbook of educational leadership and administration* (pp. 653–696). London: Kluwer, 653–696.

Hallinger, P., & Murphy, J. F. (1986). The social context of effective schools. *American Journal of Education*, *94*, 328–355.

Huberman, M. (1990). Linkage between researchers and practitioners: A qualitative study. *American Educational Research Journal*, *27*(2), 363–391.

Khattri, N., & Miles, M. B. (1994). *Cognitive mapping: A review and working guide*. Sparkhill, NY: Center for Policy Research.

Kruskal, J. B., & Wish, M. (1978). *Multidimensional scaling*. Beverly Hills, CA: Sage.

Lee, L. E. (1999). Building capacity for school improvement through evaluation: Experiences of the Manitoba School Improvement Program, Inc.. *The Canadian Journal of Evaluation* , 155–178.

Leithwood, K., & Jantzi, D. (1997). *The effects of transformational leadership on organizational conditions and student engagement with school*. Paper presented at the annual meeting of the American Educational Research Association, Montreal, QC.

Milligan, J. (1979). Schema learning theory: An approach to perceptual learning. *Review of Educational Research*, *49*(2), 197–207.

Morgan, C., & Morris, G. (1999). *Good teaching and learning: Pupils and teachers speak*. Buckingham: Open Books.

Mortimore, P. (1991). The nature and findings of research on school effectiveness in the primary sector. In S. Riddell, & S. Brown (Eds.), *School effectiveness research: Its messages for school improvement* (pp. 9–19). London: HMSO, 9–19.

Newman, F. M., Whelage, G. G., & Lamborn, S. D. (1992). The significance and sources of student engagement. In Fred M. Newman (Ed.), *Student engagement and achievement in American secondary schools* (pp. 11–39). New York: Teachers College Press, 11–39.

Novak, J. (1990). Concept mapping: a useful tool for science education. *Journal of Research in Science Teaching*, *27*(10), 937–949.

Penny, N. E. (2002). *Creating selection criteria for a teen center intervention program: A concept mapping/pattern matching study*. Paper presented at the annual American Evaluation Association Conference, Washington, DC.

Reynolds, D., Sammons, P., Stoll, L., Barber, M., & Hillman, J. (1996). School effectiveness and school improvement in the United Kingdom. *School Effectiveness and School Improvement*, *7*, 133–158.

Rizzo-Michelin, L. L. (1998). *Concept mapping in evaluation practice and theory: A synthesis of current empirical research*. Unpublished Master's Thesis. Canada: University of Ottawa.

Robinson, V. (2002). Organizational learning, organizational problem solving, and models of mind. In K. Leithwood, & P. Hallinger (Eds.), *Second international handbook of educational leadership and administration* (pp. 775–814). London: Kluwer, 775–814.

Rudduck, J., Chaplain, R., & Wallace, G. (Eds.). (1996). *School improvement: What can pupils tell us?*. London: David Fulton Publishers.

Schreerens, J., & Creemers, B. P. M. (1996). School effectiveness in the Netherlands: The modest influence of a research program. *School Effectiveness and School Improvement*, *7*, 181–195.

Senge, P. (2000). *Schools that learn: A fifth discipline fieldbook for educators, parents, and everyone who cares about education*. New York: Doubleday Dell Publishing Group, Inc..

Sholl, J. (1987). Cognitive maps as orienting schemata. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *13*(4), 615–628.

Smilkstein, R. (1991). A natural teaching method based on learning theory. *Gamut*, *36*, 12–15.

Smith, W. J., Butler-Kisber, L., Portelli, J. P., Shields, C. M., Sparkes, C. S., & Vibert, B. (1998). *Student engagement in learning and school life: National project report*. Montreal, QC: Office of Research on Educational Policy, McGill University.

Stringfield, S., & Herman, R. (1996). Assessment of the state of school effectiveness research in the United States of America. *School Effectiveness and School Improvement*, *7*(2), 159–180.

Trochim, W. (1989). An introduction to concept mapping for planning and evaluation. *Evaluation and Program Planning*, *12*(1), 1–16.

Trochim, W. (1993). *The reliability of concept mapping*. Paper presented at the annual meeting of the American Evaluation Association, Dallas, TX.

Wandersee, J. (1990). Concept mapping and the cartography of cognition. *Journal of Research in Science Teaching*, *27*(10), 923–936.

Whelage, G. C., Rutter, R. A., Smith, G. A., Lesko, N., & Fernandez, R. R. (1989). *Reducing the risk: Schools as communities of support*. London: Falmer Press.

Wilson, B. L., & Corbett, H. D. (2001). *Listening to urban kids: School improvement and the teachers they want*. Albany, NY: State University of New York Press.

Woods, P. (1996). Critical students: Breakthroughs in learning. *International Studies in Sociology of Education*, *4*(2), 123–146.