

High School Redesign: Carnegie Unit as a Catalyst for Change

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Abstract

Researchers examined seven schools in Alberta undergoing high school redesign, including the removal of the Carnegie Unit, a time-based metric for awarding course credits. A mixed methods convergent parallel design was used to gather data from leadership teams in the schools and to examine evidence of the impact on student learning. Qualitative and quantitative data were analyzed concurrently and then merged for the analysis. Findings illustrate that the removal of the Carnegie Unit was a catalyst for redesign and learning improvements. Five constitutive factors enable high school redesign, including: (1) a collective disposition as a learning community; (2) a focus on relationship building; (3) student input; (4) collaboration; (5) and changes to learning tasks and assessment practices. The findings provide insight into the ways in which leadership teams formed complex adaptive systems to enable change and may serve to inform practitioners and school leaders, schools and systems, and those who study policy changes in schools.

Keywords: school reform, high school, redesign, Carnegie Unit, collaborative inquiry

Introduction

High school redesign initiatives are less about architectural changes and more about improving student achievement, engagement, well-being, curriculum, and graduation rates. As such, high school redesign is not new. Sizer's research (1984, 1996, 2013) contributed to shaping high school reform efforts for over 40 years. In many ways, the problems Sizer identified in 1984 are still as relevant today; in fact, it appears that efforts at high school reform may only have served to make matters worse (Willms, Friesen, & Milton, 2009; Evan et al., 2006; Yonezawa, Jones, & Joselowsky, 2009). Those involved in high school redesign initiatives continue to argue that standardized high school models, with routine curriculum and structures, are not meeting the needs of today's students and result in low performing schools where students are underachieving and fail to master sufficient requisite knowledge and skills (Farrington, 2014; Kutash, Nico, Gorin, Rahmatullah, & Tallent, 2010).

Despite many failed attempts at high school reform, efforts continue in many parts of the world and with encouraging results. Curriculum reform in secondary schools in China, the world's largest education system, termed "quality-oriented education," involved numerous changes to educational paradigms and practices including a shift from traditional practice to learner-centered, inquiry-oriented approaches (Tan & Hiron, 2016; Yan, 2012). Promising findings from a study in the United States (U.S.) involving eleven high schools in a large urban district show a strong positive relationship between the high school redesign project and teacher grading practices, classroom impact, and student achievement of students at-risk of dropping out (Baete, Burks, Pollio, & Hochbein, 2015; Baete & Hochbein, 2014). Strategies for improving high school achievement at a system level vary across the globe; common aims are to increase

competencies through flexibility and autonomy, and to support all students to complete high school and prepare for life beyond secondary school.

Led by the Ministry of Education and local educational authorities, Alberta is considered a global leader in education when compared with other high performing school systems, such as Ontario, Singapore, and Finland (Hargreaves & Shirley, 2012). Reports often highlight the Alberta Initiative for School Improvement (AISI) initiative to demonstrate success from projects occurring over a decade ago (Hargreaves et al., 2009; Parsons, McRae, & Taylor, 2006). Similar to other high performing countries, Alberta's education system continues to adapt to meet the challenges of complexity and change occurring at a global level. In particular, the Ministry of Education has sought high school improvement through redesign efforts. The research reported in this paper addresses the following research question: What conditions and factors within the school enabled high school redesign?

Research in Canadian Context Demonstrates High Schools Need to Change

Building on a Canada-wide study, Willms (2012) conducted research on student engagement in Alberta that included 178 middle and secondary schools. Student engagement is defined as social engagement, academic engagement, and intellectual engagement (Willms et al., 2009; Willms, 2012). In the 2012 study, Willms further defined academic engagement as institutional engagement. Four key findings were reported in Willms' study: (a) levels of engagement decline from Grade 7 through to Grade 12; (b) there are large inequalities in engagement outcomes associated with students; (c) in socioeconomic background and First Nation, Métis, and Inuit status, schools vary considerably in measured levels of student engagement; and (d) levels of student engagement are related to 5 key drivers of schooling outcomes: quality instruction, teacher-student relations, classroom learning climate, expectations for success, and student advocacy. Willms (2012) concluded that structural features of schools need change.

In 2012, a mixed-methods case study in Alberta focused on exploring ways innovative strategies, which included the use of learning technologies, could be used to improve student engagement and success in high schools (Daniels, Friesen, Jacobsen, & Varnhagen, 2012). The researchers examined a number of the initiative's aspects including the impact of technology on student engagement and success in school and the extent to which local and provincial goals were achieved. Study findings were consistent with Willms' (2012) findings: (a) most of the 294 participating high school teachers were in the early phases of adopting learner-centered instructional approaches, (b) most school districts were at the very beginning levels of providing comprehensive professional learning focused on learner-centered approaches, and (c) there was little evidence of change within the schools or school districts over the two years of the research initiative.

The need for high school redesign in Alberta is apparent even though this Canadian province is internationally recognized for excellence in education and innovation (Hargreaves & Shirley, 2012). With 374 school authorities spanning a large geographical area of 225,200 square miles, over 785 high schools were eligible to engage in a high school redesign initiative led by the Ministry of Education. The focus of the high school redesign initiative, which started in 2008, was defined as supporting high schools with improving overall student engagement, student achievement, and well-being. A key part of this initiative was the removal of the Carnegie Unit, a time-based metric used to calculate the required hours for each credit earned that has been part of higher education (Silva & White, 2015; Silva, White, & Toch, 2015) and high school structures in North America for the last century. Alberta's Ministry of Education took the unprecedented step in removing the requirement for credit unit hours for credentialing from high schools involved in the redesign initiative.

Established during a time in the early 20th century when the quest for efficiency was paramount, the Carnegie Unit became a way to determine not only the value of different subjects, but also the amount of time needed for each subject, the percentage of output a student should acquire based on the number of contact hours, the cost of running a school, a teacher's salary, and the amount of funding a school should receive to be considered an efficient school. Carroll's (1994) description of the model from over two decades ago accurately describes the current structure in many high schools using the Carnegie Unit (also called credit hours in some schools):

Under the Carnegie structure, teachers typically teach five classes, each approximately 45 minutes in length, and thus deal with about 125 students each day.... In a typical high school,

which has seven periods plus a home room and lunch period, students will be in nine different locations pursuing nine very different activities during the course of an approximately 6 1/2 hour school day. Regardless of the subject, the students are taught in classes lasting approximately 45 minutes.... A student may go through an entire day – or several days without having a meaningful interaction with a teacher. (p. 106)

Why does this structure continue to persist in today's high schools? What does it take to change such a pervasive, taken-for-granted orientation? The Carnegie Foundation for the Advancement of Teaching endorses improvement initiatives aimed at greater flexibility (Silva et al., 2015). In the past, alternative plans and schedules, such as the Copernican model (Carroll, 1990; Gee, 1997) challenged the use of the Carnegie Unit. In the Copernican model, classes are taught for longer periods and for only part of the school year. For example, smaller classes could be held for two hours a day for one third of the school year. Harvard's education team (Carroll, 1994) found student achievement increased in seven high schools participating in a study using the Copernican model; increases in academic mastery were reported ranging from 0% to 46% and the median increase was 18% (p. 112). While the Copernican model may appear to be an improvement over the Carnegie Unit, it merely divides time in a different way leaving the fundamental basis for such temporal division unchallenged.

Alberta's Ministry of Education took the unprecedented step in removing the mandated credit unit hours for credentialing and funding from high schools involved in the redesign initiative. The removal of a standard time requirement for learning recognizes that individual students may need more or less time to complete course work. Teachers and school leaders involved in the redesign proposed how removing the Carnegie Unit would impact their context and how their redesign initiatives would be guided by nine foundational principles established by the ministry (Alberta Education, 2012). All high schools in Alberta were invited to participate in high school redesign and remove the credit hour requirement. Currently, there are over 200 high schools in 51 school authorities in Alberta that are moving forward with high school redesign. This study contributes to an understanding of the conditions that enable high school redesign.

Theoretical Framework

We drew upon complexity theory applied to educational contexts (Davis & Sumara, 2006; Davis, Sumara, & Luce-Kapler, 2008; Davis, Sumara, & D'Amour, 2012; Phelps & Hase, 2002; Newell, 2008; Uhl-Bein, Marion, & McKelvey, 2007) as the theoretical framework to study leadership teams in schools engaged in high school redesign. Complexity theory, in general terms, is commonly described as a theory associated with non-linear and adaptive systems and acknowledges the system is greater than the sum of its parts. Complex systems consist of multiple interconnected components. Complex adaptive systems can be described as the aggregate behaviours that are not simply derived from the actions of the multiple components of a system, but from the mechanisms that allow the system to adapt and learn (Holland, 2006). The focus here is on processes of learning and adapting to changing conditions and constitutive factors.

Complex adaptive systems, both natural and social, emerge and re-assemble through the self-organizing efforts of localized elements within the system (Gell-Mann, 1994; Holland, 1998; Marchi, Erdmann, & Rodriguez, 2014). Current knowledge and theory about complex adaptive systems mainly originates from studying artificial and natural systems and then applying these insights to complex social organizations. Complex adaptive systems exhibit common characteristics and principles: (1) complex systems have necessary conditions and factors, (2) complex systems undergo processes of adaptation and change, and (3) complex systems learn. However, social systems are highly context specific and do not respond in the same way to the same stimulus at different times and circumstances (Holland, 1998). Specifically applied to education, Stanley (2009) describe learning in a system as follows: "A diverse collection of students and teachers, and activities and ideas [that] afford the possibility of novel or creative prospects and the capacity to adapt" (p. 2). Recent work in complexity studies in education has provided educational researchers with new approaches that help produce accounts of phenomena and situations that do justice to the emergent, contingent, and unpredictable character of social interactions within school systems (where innumerable agencies, intentions, adaptive processes and types of participation can be included). The resulting accounts offer a view of school systems quite different from predominant reductionist approaches that describe schools as static institutions. By contrast, complexity

approaches reveal processes of how individuals operate, how new forms of organization and practice come about, and how they are or can be negotiated by diverse actors and can adapt (Coppeters, 2005).

Drawing upon a complexity framework, in our exploration of high school redesign initiatives, we consider schools undergoing a redesign as a complex adaptive system where learning occurs supported by enabling conditions. In this study, we considered principles of complex adaptive systems as a lens for our analysis to study leadership teams in seven redesigned high schools in Alberta. These principles, or foundational sources of information, included: (1) identification of the necessary conditions and factors of complex school systems (2) identification of the processes of adaptation and change, and (3) learning mechanisms in school systems.

Methodology

A convergent parallel mixed-methods design (Creswell, 2014) was used as an approach to collecting, analyzing, and comparing both quantitative and qualitative data. This research design allowed us to collect both quantitative and qualitative data from leadership teams (teachers, assistant/vice principals, and principals), analyze them separately, and then compare the results to determine how they compared. Data provided information and insight into how leadership teams engaged in the work of redesign as part of the ongoing transformation within each school. In order to identify the mechanisms of change and adaptation within the complex systems of high schools undergoing redesign, we sorted, analyzed and interpreted both data sets seeking accounts and instances of change and adaptation described by the teachers, assistant/vice principals, and principals.

Research sites. The seven high schools in this study were selected from the initial 16 self-selected schools that were part of the High School Flexibility Enhancement Pilot Project during 2008-2013 and the 11 additional schools that joined the project in 2011. This initial pilot was designed to explore the question: What would happen if the government removed the Carnegie Unit requirement and allowed high schools to have increased flexibility in how they timetabled? This pilot project became “Moving Forward with High School Redesign” in 2013, as more high schools across the province requested to be involved. The research team identified 12 schools from the 27 schools in the pilot identified through research reports submitted by the school and the government as having made significant changes and improvements within their schools. The research team contacted all 12 schools to determine the nature of the changes and improvements that had been made. Eight schools were selected, however, one declined participation. Thus, seven schools across six school districts participated in the study. Each of the schools participating in the study was deemed to have made significant changes and improvements as a result of removing the Carnegie Unit. All of the schools were bound by a common strategic framework called “Moving Forward with High School Redesign” focusing on school culture, school leadership, school pedagogy, and school structures. This framework was developed by the ministry. The nine foundational principles guiding change included: mastery learning; rigorous and relevant curriculum; personalization; flexible learning environments; educator roles and professional development; meaningful relationships; home, and community involvement; assessment; and welcoming, caring, respectful, and safe learning environments (Alberta Education, 2012). As part of the effort to redesign high schools, each of these schools was permitted to remove the requirement for 25 hours of face-to-face instruction as a measure to determine every credit earned in high school. Removing this requirement was intended to provide flexibility for students who might need more or less time to meet learning outcomes. The schools in this study were also bound by a common purpose and desire for redesigning high school and building the learning capacity for all learners. Principals from the seven schools provided contact information for members of the teams that led the initiatives in their school. Roles of the team members who agreed to participate in individual interviews or team focus groups and surveys are summarized in Table 1.

Table 1
Data Collection by Role

	Interviews/Focus Groups	Surveys
Teachers	36	23
Principals	7	7
Assistant /Vice Principal		3
Total	43	33

Data collection. All data sources were collected concurrently and in one single phase of the study to examine the conditions and factors within the school that enabled high school redesign, to identify the processes of adaptation and change, and learning mechanisms in the school. Qualitative data sources included focus groups with teachers and principal interviews to gather perspectives from members of teams leading the high school redesign initiatives in each respective school (site). Quantitative data sources included teacher surveys, principal surveys, school accountability reports, Tell Them From Me™ student engagement data, and school plans. The number of participants from each of the seven schools and number of documents provided by participants are summarized in Table 2. Leadership teams participating in the study ranged from three members in smaller schools to ten members in larger schools.

Table 2
Number of Participants and Documents by Site

Data Collection Method	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Total
Survey Participants	3	4	9	4	1	6	6	33
Interview Participants	1	1	1	1	1	1	1	7
Focus Group Participants	2	3	9	4	4	6	8	36
Documents *	2	1	1	3	0	1	2	10

*Denotes number of printed artifacts provided by participants (pdf, ppt, jpeg, doc digital formats) in addition to online sites and achievement data.

Survey. Principals and teachers completed an online survey and responded to 22 questions about the pervasiveness of the changes and improvements within the school relative to the principles that guided high school redesign. As the principles of high school redesign were reflected in the principles of effective teaching practice (Friesen, 2009), the survey design was guided by both documents. The survey included questions about the pervasiveness of teaching practices implemented in the school, student work, assessment, student engagement, and collaboration. The response rate for the online survey was 77% (n=33).

Interviews and focus groups. Interviews and focus groups were also used to collect in-depth responses from participants (n=43) about teaching and learning in their schools. Interviews and focus groups sought to determine the nature of the redesign that occurred, ways in which teachers needed to learn new pedagogies and assessment practices, and ways teachers went about learning to make those changes. Principals were asked how they went about leading teacher learning, and how they went about their own learning in relation to high school redesign. Using an interview protocol with semi-structured questions, participants were interviewed either individually or in focus group at each site. Interview questions were related to teaching practices, adult and student learning in the school, and evidence of success in high school redesign.

Documents. In addition, participants shared online sites and documents, including school account-

ability reports, Tell Them From Me™ student engagement data, and school planning documents related to high school redesign and school improvement. Additional documents included artifacts, such as stakeholder presentations, school brochures, and school achievement data.

Data analysis. Survey data, interview/focus group transcripts with teachers and principals, and documents were prioritized equally and analyzed independently by the research team using a side-by-side comparison. The researchers created a table to directly link each research question with the data source and the type of analysis that would be conducted. Various visualization techniques were used to connect the link between the data analysis and the theoretical framework. Data were designated with letters associated with the type of data collected and the site number as listed in Table 2 (i.e., F-2 denotes a respondent involved in the Focus Group with Site 2; I-2 denotes an interview response in Site 2). We used principles of complex adaptive systems from our theoretical framework as a lens for our analysis to study leadership teams in seven redesigned high schools in Alberta. Reliability in this study was promoted through intra- and inter-coder agreement (Miles, Huberman, & Saldaña, 2014). We made several passes through the data using first and second cycle coding (Miles, Huberman, & Saldaña, 2014). First, cycle coding consisted of descriptive and process coding. This process required multiple passes through the data to maintain consistency in using the coding methods and to collectively make decisions about any disagreements in coding. In the second cycle of coding, the research team generated and identified pattern codes. The survey data were analyzed using descriptive statistical analysis using statistical software.

In summary, a convergent parallel mixed methods design (Creswell, 2014) was used to examine leadership teams undergoing high school redesign. Despite the differences among the schools studied, there were common elements of support for principals and teachers provided by the leadership teams that pointed to processes of change and adaptation. We considered these common processes as *constitutive* factors that enabled high school redesign and facilitated the mechanisms that allow the system to adapt, change, and learn.

Findings

When the Carnegie Unit and length of time for learning was no longer standardized, participants enabled changes and adaptive processes in the seven high schools. In this section, we use principles of complex adaptive systems as a lens to describe how leadership teams affect change and adaptation in seven redesigned high schools in Alberta. We discuss five *constitutive* factors that enabled high school redesign and enabled the mechanisms that allow the system to adapt, change and learn. The descriptions that follow, operate within complex systems principles or foundational sources of information: (1) identification of the necessary conditions and factors of complex school systems (2) identification of the processes of adaptation and change, and (3) learning mechanisms in school systems.

A process of change and adaptation require leadership teams to have a collective disposition and commitment to learning. One constitutive element for redesign to occur was the collective disposition of the community as a community of learners and openness to change. This collective disposition was described by participants as a collaborative approach to co-evolve with all members taking collective responsibility in working towards adaptive outcomes. Participants recognized the strengths of colleagues and the importance of their collective efforts and commitment to learning. Participants in the study consistently discussed how the learning community was adaptive. In an interview, one participant explained, “We talk about what we’re going to improve and what we’re going to change ... you have to all agree that we are going to do this better” (I-4). A common theme that emerged from the interview and focus group transcripts was an openness to adapting to change. For example, one focus group participant described how data was continually gathered throughout the year resulting in immediate changes even though the school was accustomed to making changes only at the beginning of the school year:

Even though my brain said, ‘If you are on September, it cannot change until next September because you have a set system in place.’ But, no, we changed in the middle [of the school year] and we said okay well actually the rule is now gone and this is the new expectation. (F-6)

Another focus group participant, echoed this sentiment and described a process of continual reflection and improvements, “We’re open to change all the time...we are on that ever searching quest of how can we make it better ... we want to be able to be reflective and then reactive enough to make it better”

(F-5).

Similarly, in an interview, a participant described the changes as iterative:

We use the word ‘iteration’ in this school a lot...there are very few things in here that are finished documents. Some are a little bit further along than others, but for the most part everything we are willing to look at again. (I-2)

One of the high school principals shared how unpredictable and non-linear complex systems are and the value of the community learning together:

Over time it turned out to be the domino kind of effect. We moved one thing and quickly realized now we need to change and it hasn’t stopped. High school redesign is a lot of chaos. I talked with my staff a lot initially about change. We did a lot of work on change theory and change because it is going to get mucky and going to get chaotic ... I think that’s what appealed to the teachers too – learning with us. They are bringing their experience and expertise, but at the same time, they didn’t have all the answers. (I-7)

Researchers noted a collective disposition, and commitment to learning and adapting to change when conducting interviews and focus groups with members of the leadership team.

Building strong relationships with students facilitates a process of change and adaptation.

Participants emphasized the significance of interactions and having strong teacher-student relationships throughout a student’s high-school experience. Participants described the student-teacher relationships as a partnership: “It’s more like a partnership between teacher and the student instead of an authority figure telling them this is what you have to do” (F-7).

One consistent strategy described by all of the schools to improve trusting relationships was the configuration of smaller student groupings or learning communities. This strategy was intended to ensure each student would have a significant adult to interact with each day. The schools involved in the study provided a variety of names for smaller student groupings (Teacher Advisory, TA, learning communities, student success grouping, etc.); however, the intent was similar across all of the schools. Student groups offered opportunities for increasing teacher-student interactions. Participants noted students could “remain unnoticed and in the background until a test comes around” (F-5). This common observation in the schools prompted redesign around student groupings aimed to increase interactions and strengthen relationships.

One group of teachers referred to the teacher advisory program as a pillar of change aimed to work on personalization, relationships between staff and students, and also build enhanced student supports (F-3). In this school, each student was placed in a teacher advisory class consisting of approximately 16-19 students from Grades 9-12. This move required all personnel in the school to help lead the smaller groupings, including administrators, librarians, and school counselors. Students remained with the same teacher advisor and grouping throughout high school. The teacher advisor role was described as a mentor or facilitator to provide academic guidance, personal supports, and to help meet the unique needs of every student for success.

A smaller rural school configured student groups in small cross-grade groupings that met with one teacher advisor for 20 minutes, two times per week. Another school organized similar groups who met for a brief period on a daily basis. An interview participant shared, “We are going to have a learning community where there are adults involved in their life and making contact with them” (I-4). Regardless of the amount of time or occurrences of these cross-graded groupings, the teachers expressed similar ideas about the value in having consistent groupings to increase interactions and build trusting relationships with the students. Student attendance and retention were consistently reported as improvements in the schools when participants reflected on evidence of success with the teacher advisory program. For example, in one school, there was an increase of attendance from 66% to 99% over the years since the school started focusing on high school redesign. Developing these tight trust groups ensured no student was unnoticed and at least one adult knew each student well to help guide their learning.

Seeking input from students regarding high school redesign through consistent instruments enables and facilitates scaling up processes of change and adaptation. In assessing whether the changes being implemented were working, teachers and administrators focused their attention on gathering feedback from students in their respective schools. In all the schools, the participants noted the importance of continually seeking student input regarding high school redesign. Administering school-wide surveys (i.e., Tell Them From Me Survey™) was one specific strategy all schools in the study

used for gathering student input. Participants also described how changes were implemented once the students provided their survey responses. For example, in one school, participants described how student input was used to inform scheduling changes: “We’ve actually made changes to our timetable based on student requests. We were talking about our Flex block, if we should move them to the morning or afternoon” (F-3). School-wide surveys were often administered more than one time during the school year. Hence, Tell Them From Me™ student engagement survey results also provided current information about changes to student experience throughout the school year.

All of the schools participating in the study provided examples of how school-wide survey responses informed changes for high school redesign. Results were also compared year-to-year when analyzing high school redesign changes. For example, in one site (Table 3), 76% of students reported they were intellectually engaged. This was a 30% increase from the previous year. Furthermore, over 95% of the feedback provided by students in the open-ended questions were positive comments. Analysis of the results also indicated the school surpassed Canadian norms in most categories. The survey results demonstrated an overall increase in student experience across all categories including a decline in truancy rates. This information was important to the school leadership team to help inform the impact of changes made year-to-year.

Table 3

School-wide Student Engagement Survey Results (Tell Them From Me™ Survey - Site 1)

Category	Result
Intellectual Engagement	+30%
Interested and Motivated	+16%
Students that Value School Outcomes	+13%
Relevance	+12%
Effective Learning Time	+12%
Effort	+11%
Planning to Finish High School	+11%
Rigor	+10%
Positive Homework Behaviours	+8%
Truancy Rates	Minus 4%

The Tell Them From Me™ student engagement surveys using a consistent instrument and repeated throughout the year was an important strategy used by the schools to inform strategic planning and actions within the school. The schools in this study reported their students regularly provided feedback and were consulted in developing ideas for high school redesign. The schools also noted how they shared the results from the survey with students and also shared any plans for changes on a regular basis so students could recognize how their input was put into action. Learning systems need to regularly seek and act-on input from students.

Collaborative interactions are central to system change and adaptation. It is evident that the seven schools we studied had found ways to work collaboratively within their sites and with other school schools involved in high school redesign initiatives to improve learning. We noted that leadership teams questioned existing approaches, examined new conceptions of learning in high schools and provided mutual support. Changes required all members of the learning system to work together in collaboration. In one school, a teacher described the benefit in being paired with another teacher teaching the same subject for weekly non-instructional time. This weekly time, previously referred to as “prep time,” or time for individual teachers to prepare for their classes, was now referred to as collaborative time by the teachers in the study:

We are getting together to look at what are good summative assessments to use. What would

we consider so we have the same standard for excellence, proficiency and adequacy. That is something that we were working on this year. (F-1)

In another school, the principal described a rotating department shutdown. In this case, each department would take a turn shutting down (closed for instruction for a block of time) to allow for extra collaborative time.

As shown in Figure 1, the majority of survey respondents (n=24, 80%) indicated that most teachers (75-100% of teachers) work in collaboration with others to design robust learning tasks and obtain feedback about instructional planning and day-to-day teaching from colleagues and mentors.

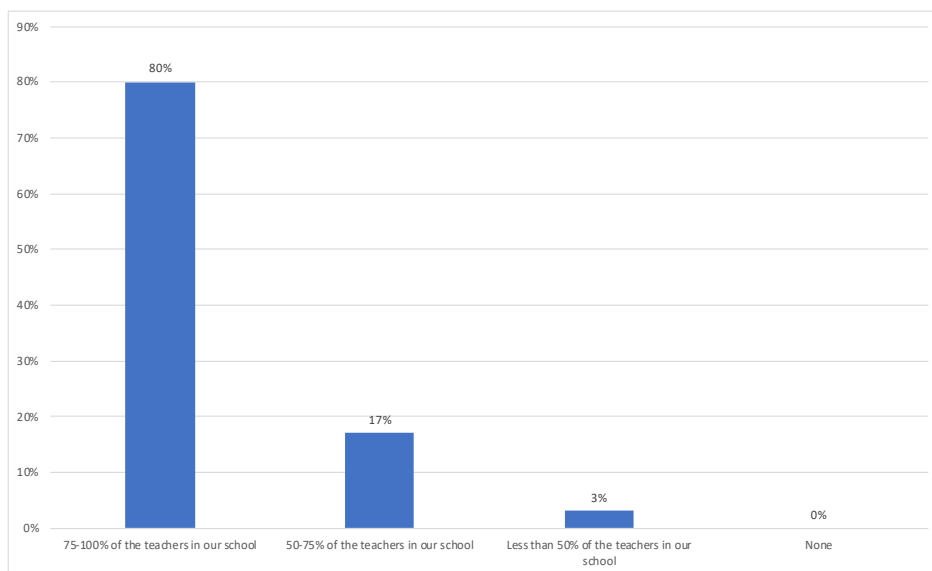


Figure 1. Number of teachers designing in collaboration in seven redesigned high schools

Participants indicated teacher collaboration also allowed for flexible and innovative approaches to high school timetables, schedules, and acquisition of resources. Lack of time is often cited as a barrier for change; however, in this study, flexible use of time and collaboration was a stimulus for redesign and providing students with a range of learning options. Principals indicated that organizational structures, such as staff meetings, were driven by pedagogical changes and used for collaboration and connection among teaching colleagues within and across discipline areas. Professional learning for teachers was ongoing, embedded in a collaborative environment of learners, and extending within the network of schools. It is clear, collaboration is important for moving forward with high school redesign.

Redesign of learning tasks and assessment supports mastery learning. Survey Respondents were asked questions to determine the pervasiveness of design principles enacted across the school as shown in table 4.

Table 4
Survey Questions and Mean Responses

Teaching Practices	Mean	Standard Deviation
Teachers have an exceptional understanding of the core concepts within the disciplines they teach.	4.83	0.38
Teachers have an exceptional understanding of the outcomes as articulated within the Programs of Study.	4.77	0.43

Teaching Practices	Mean	Standard Deviation
Teachers work in collaboration with others to design robust learning tasks and obtain feedback about instructional planning from colleagues and mentors.	4.77	0.50
Students have opportunities to collaborate with one another to build collective understanding of their work.	4.67	0.61
Assessment criteria are made explicit to students prior to the work they undertake.	4.63	0.56
Teachers design tasks that are meaningful to students.	4.60	0.50
Students receive ongoing, specific feedback to enable them to increasingly monitor and direct their own learning.	4.57	0.57
Teachers share their thinking processes with students to help them learn and to make their work progress during their learning rather than at the end.	4.57	0.50
Teachers have an exceptional understanding of how students learn.	4.53	0.51
Teachers intentionally design strong robust, authentic tasks that focus on issues, questions or problems central to the discipline.	4.50	0.63
Teachers design tasks that connect students to the world outside of school.	4.40	0.56
Teachers design learning experiences that engage their students in undertaking work that requires distinct ways of thinking and acting resonant with the ways in which the respective and relevant disciplines work	4.30	0.95
The work students undertake is authentic fostering deep understanding of important ideas.	4.30	0.79
The work students undertake resembles the type of knowledge that evolves in real world contexts.	4.20	0.92
Assessment criteria reflect authentic real-world standards for high quality work.	4.10	1.03
Students are deeply engaged in their work and know why it matters to them, to the discipline and/or world beyond the classroom.	4.10	0.96
Students collaborate in an understanding that each member has a significant role in the knowledge advancement of the entire team.	3.90	0.99
Students are emotionally and intellectually invested in the work (spend extra time and effort).	3.83	0.95
Assessment criteria are collaboratively designed with students.	3.30	1.18

A majority of respondents (83%, n=25) estimated 75-100% of the teachers in their school have exceptional understanding of the core concepts within the disciplines they teach. Similarly, respondents (77%, n=23) estimated 75-100% of the teachers have an exceptional understanding of the outcomes as articulated within the Programs of Study. The participants in this study indicated their colleagues demonstrate an exceptional understanding of both core disciplinary concepts and the outcomes articulated in the Programs of Study.

Participants (53%, n=16) estimated that 75-100% of the teachers within their school had an exceptional understanding of how students learn. In terms of task design, participants (57%, n=17) estimated

that 75-100% of the teachers: designed robust, authentic tasks; (60%, n=18) estimated that 75-100% of the teachers designed tasks that were meaningful to the students; and (43%, n=13) estimated that 75-100% of the teachers designed tasks that connected students to the world outside of the school. Figure 2 captures how the respondents described the pervasiveness of learning designs being utilized within their respective schools.

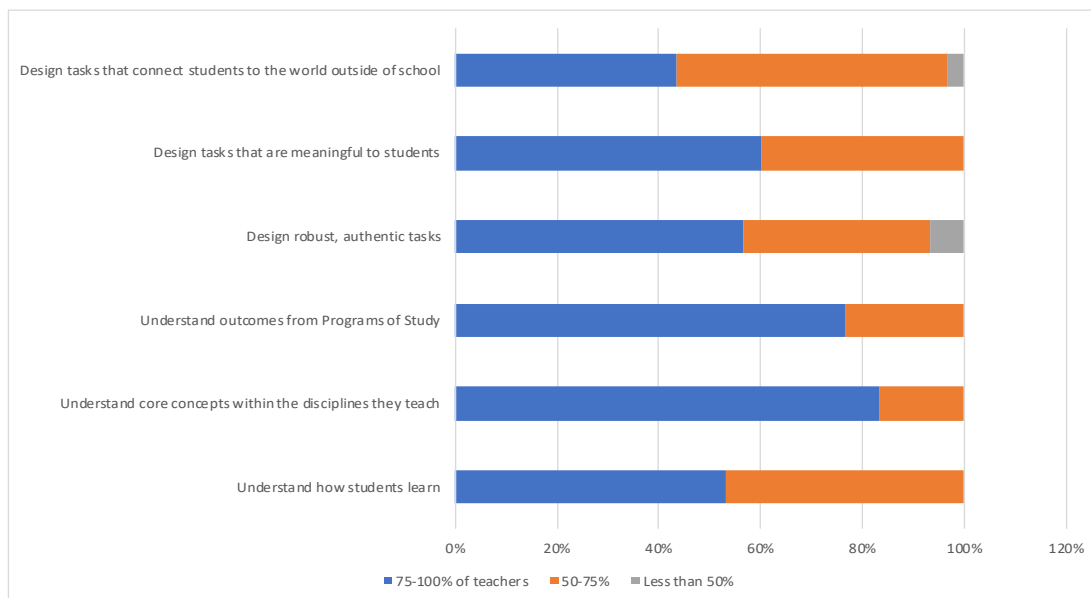


Figure 2. Percent of teachers in schools who design meaningful tasks, understand programs of study and disciplines they teach, and how students learn

We noted, schools were committed to providing high quality learning and assessment processes, and teachers had a common focus on mastery learning when designing learning and assessments. All students were expected to exhibit mastery and provide evidence of high-quality learning in high school. Participants described how adaptive changes to internal structures for assessment supported mastery learning. Strategies were used in the schools to help students achieve mastery, such as, making provisions for re-submitting assignments, separating grades from behaviours, using competency or outcome-based assessment, and providing multiple opportunities for learning and demonstrating learning.

According to the standardized achievement measures (i.e., Accountability Reports), schools showed positive results in diploma exams at the acceptable level and excellence level. Overall, schools were either maintaining or improving results in diploma exams and participation rates. Classroom assessment practices were developing with an increase in formative assessment practices where students received ongoing feedback and opportunities to improve work. In the survey, 57% of respondents agreed most of the teachers' learning designs allowed for students to receive ongoing, specific feedback that enabled them to increasingly monitor and direct their own learning. Participants also shared changes in reporting practices. For example, one principal reported student-led conferences increased 5-80% in parent involvement over the years the school has been involved in high school redesign. Participants discussed how redesigning learning and assessment practices in high schools served to deepen their understanding of the challenging and engaging curricula. In these schools, the overall expectations for student learning and demonstrating learning were set to high standards for all learners.

Removing the standardized Carnegie Unit and length of time for learning led to changes in high schools in Alberta. The following five constitutive factors were drawn from the data gathered from leadership teams involved in high school redesign in the seven high schools participating in this study and enabled the system to adapt, change and learn: (1) leadership teams require a collective disposition and commitment to learning; (2) relationships with students matter; (3) regularly ask students for their opinions and input regarding high school redesign using consistent survey instruments; (4) changes require

collaboration; and (5) it is important to redesign learning tasks and assessment.

Discussion

Removing the Carnegie Unit was both an enabling constraint and an impetus for change. When the Carnegie Unit was removed, participants started to initiate changes in the seven high schools. Schools within this study used the removal of the 25-hour per credit requirement as an opportunity to begin questioning everyday structures and practices to initiate change. Participants indicated the removal of a time structure supported their high school redesign plans. When the time was no longer standardized, course work could be offered as interdisciplinary learning units, and this required a change in scheduling structures and assessment practices. This observation is consistent with the notion of disequilibrium needed to prompt changes in a learning system (Davis et al., 2012; Schwartz, Bransford, & Sears, 2005). Removing the Carnegie Unit provided an enabling constraint and the right amount of instability or disequilibrium needed for high schools to begin questioning taken-for-granted structures and practices to redesign for the learners. As participants discussed their involvement in high school redesign, it was clear the removal of the Carnegie Unit was a catalyst for changes in organizational learning according to five constitutive factors.

First, collective efficacy is necessary for high school redesign. Change and adaptation require leadership teams who work collectively and have a collective focus on improving student learning. Collectively determining priorities and shared expectations of impacting student learning is associated with effective leadership (Davis et al., 2012; Hallinger, 2011; Kools & Stoll, 2016; Pont, Nushce, & Moorman, 2008; Robinson, Lloyd, & Rowe, 2008). This collective disposition, or in complexity terms, ethos, was noted by principals and teachers in all seven high schools (Davis, Sumara, & D'Amour, 2012) as an important factor for carrying out changes involved in redesigning high schools. Shifting from individual to collective responsibility and collective goal setting is necessary for school improvement (Hargreaves & Shirley, 2012; Yuan & Zhang, 2016). Researchers argue that teachers with a greater sense of collective efficacy are willing to take more risks in change efforts that can advance student learning (Kools & Stoll, 2016; Tschannen-Moran & Gareis, 2015; Wahlstrom et al., 2010).

Second, building strong relationships, particularly with students, matters for high school redesign. In a longitudinal study, Bryk and Schneider (2003) found that schools with low levels of trust have one-in-seven chances of academic improvement. Fostering effective relationships involves developing a culture of trust and mutual respect (Alberta Education, 2018) and it is necessary to consider relationships with students. High school educators in this study identified relationships with students as an important factor in moving forward with high school redesign. A positive school culture with a focus on relationship development with students can support students in developing as learners, learning from successes as well as set-backs (Dweck, 2008; Masten, 2011). Building in-time for teacher advisory is not a pervasive feature in high schools (McClure, Yonezawa, & Jones, 2010). As noted by Benson and Polliner (2013), "when a school takes time and space for advisory, it sends the message that knowing and supporting kids are at the center of its mission" (p. 55). Educators in the high schools involved in our study described allocating time for establishing learning communities with teacher advisory as a critical aspect of student support.

Third, students need to provide input towards the redesign. Using student data to inform decision making is not a new concept. The high schools in this study reported using student data to inform decisions but emphasized the value of using leading indicators instead of trailing indicators. Researchers conceptualize leading indicators (e.g., student questionnaires) as systematically collected data that can be used immediately for proactive approaches, that spur investigations, and inform the adjustment of resources (Supovitz, Foley, & Mishook, 2012). In other words, data were collected from students in the high schools in our study throughout the year and informed immediate changes in the schools. Unlike trailing indicators (e.g., standardized test results) that provide data the following year, the participants involved in high school redesign emphasized the importance of gathering input from students and using this input to inform redesign decisions including approaches for learning (Kools & Stoll, 2016). We recognize the search for validated instruments that provide leading indicators may be challenging. In this study, the high schools were using an online questionnaire developed by J. Douglas Willms and Patrick Flanagan (<http://thelearningbar.com/>) to anonymously survey students and measure a wide variety of indicators

about student engagement, wellness, and school culture with options for adding site-specific questions. Regularly gathering input from students on leading indicators throughout the year was a common strategy described by teachers and school leaders that continually informed decisions and guided high school redesign.

Fourth, collaboration is necessary for change. Researchers contend that teachers who collaborate well in teams positively impact teacher performance and student learning (Ronfeldt, Farmer, McQueen, & Grissom, 2015). Furthermore, Louis (2015) suggests schools can have an organizational learning culture that emphasizes both collaboration and adaptation. For example, the high schools in this study noted the importance of ongoing and frequent collaboration that was made possible through modifying and rearranging traditional course schedules (Yuan & Zhang, 2016). Traditional course schedules did not consider teacher collaboration and, if a common time was available for teachers to collaborate, it was usually accidental and not an intentional part of the scheduling process. The high schools in this study intentionally adapted schedules to engage in collective learning and improve effectiveness of collaboration and interdependence (Berlin & White, 2012; Johnson, 2012). Fullan and Hargreaves (2016) highlight that a culture of collaborative professionalism is a factor distinctive of high performing educational systems:

The factors that separate Canada, Singapore, and Finland from many systems, for example, are not their teacher evaluation systems or lists of professional standards. The fundamental difference between these systems and many other countries is a culture of collaborative professionalism that permeates the system, serving both individual and collective learning. (p. 7)

Fifth, high school redesign efforts involve changes to teaching and assessment practices in the school. Pedagogical knowledge, defined as a “body of knowledge of teachers for creating effective teaching and learning environments for their students,” is connected to improved student learning (Guerriero, 2017, p. 13). Likewise, embedded assessment practices can help move learning forward and inform teaching practice (Davies, 2007; Stiggins, 2006; Wiliam, 2011). In high school redesign, our participants discussed how they engaged with their colleagues in inquiry related to advancing pedagogical approaches that lead to optimal student learning (Rincón-Gallardo & Fullan, 2016). Teachers and school leaders described professional learning involving continuous cycles of collaborative inquiry, whereby teachers were working together and across disciplines to design instruction, discussing assessment strategies for mastering learning, and analyzing evidence of student learning (Earl, 2008; Kools & Stoll, 2016; Timperley, 2011). These cycles were consistent with elements of high-quality learning designs in the literature:

- a. understanding of how students learn (Robinson, 2011; Marzano, 2009);
- b. the concepts in the disciplines they teach (Guerriero, 2017; Marzano, Pickering, & Pollock, 2001);
- c. robust, authentic task design (Herrington & Oliver, 2000; Newmann, Smith, Allensworth, & Bryk, 2001; Thomas & Brown, 2011);
- d. the extent to which the designs include tasks that are meaningful to the students (Perkins, 2009, 2014); and
- e. the extent to which the tasks that were designed connected students to the world outside of school. (Newmann, et al., 2001; Perkins, 2009, 2014).

In the high schools involved in this study, it was clear the teachers and school leaders focused on making improvements to teaching and assessment practices as part of their redesign efforts. Overall, the research outcomes include a deeper understanding of creating adaptive learning systems in high schools with evidence of impact on the learning community.

We recognize that there were limitations in our study, such as the sample size of educators who participated in the survey and interviews from leadership teams in seven high schools. Some of the schools were in rural areas with small student populations and provided names of only three individuals who comprised the teams leading the redesign initiative and larger urban schools provided names of up to ten members of the team (principals, assistant principals, and teachers). Some leadership team participants completed the survey while others agreed to participate in an interview or focus group. Principals also provided us with student engagement results; however, a future study could involve gathering in-depth data directly from students through interviews or focus groups. We also recognize it would be interest-

ing to follow the progress of the redesign efforts in these schools for a longer duration and specifically at times of leadership teams transition when lead teachers and school leaders move to different positions and schools. Authorities on educational change agree that change is difficult, that any gains take many years to observe and that reform requires overall system coherence with changes in policy and practice (Childress, Elmore, Grossman, & King, 2004; Farrington, 2014; Fullan, 2000; Newmann, Smith, Allensworth, & Bryk, 2001). Despite the limitations of the study, the findings can inform other high schools undergoing redesign.

Although the study took place during one school year, the findings were consistent with complex adaptive systems. There was a collective strength and collaboration in these schools as a learning system that exceeded the capacity or strength of the individuals in the school (Davis & Sumara, 2006). Interactions within the system (teacher-student relationships) and feedback processes are important. Seeking and acting-on input provided by students throughout the school year is important for moving forward with high school redesign. It was evident there was emergence within the system, through continual and “on the spot tinkering” (Newell, 2008, p. 12) in response to feedback and gathering data through leading indicators. The constitutive factors identified in this study for enabling high school redesign emphasized the importance of collaboration and adaptation. This study provides insight into the ways in which leadership teams formed complex adaptive systems to enable change and may serve to inform practitioners and school leaders, schools and systems, and those who study policy changes in schools.

Conclusion

We have described five common processes as *constitutive* factors that enabled high school redesign and facilitated the mechanisms that allow the system to adapt, change and learn. Drawing upon a complex system perspective, we gathered data from teachers and leadership teams and recognized their role within complex evolving forms which cannot be understood independently from their context and interrelationships.

Our mixed methods design allowed us to examine seven high schools involved in redesign efforts aimed at improving student learning, engagement, and well-being. Removing a strict adherence to time required by the Carnegie Unit was a catalyst for redesigning high schools as well as addressing low-levels of student engagement in secondary schools. Through surveys and interviews with principals and teachers in urban and rural areas in seven schools across six different school jurisdictions in Alberta, our research team used a complex adaptive systems-thinking lens to examine the schools. In this article, we reported on findings specifically related to the five constitutive factors and their impact on high school redesign by improving learning experiences, achievement, engagement, attendance, retention, and parental involvement and satisfaction: (1) leadership teams require a collective disposition and commitment to learning; (2) relationships with students matter; (3) regularly ask students for their opinions and input regarding high school redesign using consistent survey instruments with leading indicators; (4) changes require collaboration; and (5) it is important to redesign learning tasks and assessment.

The Alberta Ministry’s decision to remove the Carnegie Unit as the system of measure for high schools in Alberta was an enabling constraint with the potential to create foundational changes to Alberta’s education system and to change school structures to support better learning for all students. The findings from this study serve to inform practitioners and school leaders, schools and systems globally to continue to challenge the fundamental structures of schooling and the academic and non-academic features in their efforts to support high school redesign efforts.

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