Planning Classroom Design and Layout to Increase Pedagogical Options for Secondary Teachers

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ABSTRACT

The places where high school teachers teach have a relationship with what and how their students learn. Certain aspects of the physical environment have been examined for decades, such as those that affect basic physiological needs including but not limited to climate control, air quality, appropriate lighting, and cleanliness. In addition to these needs, it is important to examine learning spaces in light of the changing pedagogies that teachers are being encouraged to employ with this current generation of students. Pedagogies are continually being added to and adapted; however, improvements in the physical environment are not always considered components of these curriculum adjustments. Without the proper facilities, teachers are limited in the pedagogical techniques they can utilize. As teachers are being required to differentiate teaching strategies, they need to be provided with the appropriate resources, including the most effective physical environments and classroom layouts and the training to use those spaces effectively. Continued studies are necessary to elucidate evidence for those aspects of the physical learning environment that are most effective for aiding in 21st century learning.

INTRODUCTION

Research continues on what teaching methods are most effective and what the condition of the physical learning spaces have on the occupants. Research focused on both effective pedagogies and operational learning spaces could increase the likelihood of student success. This paper will look at the needs of 21st century learners and the changing teaching techniques being promoted to address those needs. The focus will then turn to the benefits of considering the learning spaces in conjunction with the needs of the students and the pedagogies that could be most beneficial to them.

Educational spaces are increasingly deemed as important to academic success (Cleveland & Fisher, 2014). Evidence shows that educational building conditions affect student and teacher performance and behavior (Cash, 1993; Earthman & Lemasters, 2011; Lemasters, 1997; Uline, Wolsey, Tschannen-Moran, & Lin, 2010). Such evidence supports Maslow's (1943) theory of motivation, in that, until certain conditions and physiological needs are met the impulse to learn becomes of secondary importance. A study from Finland demonstrates that even students recognize these basic needs must be taken care of before they can focus on learning (Makela, Kankaaranta, & Helfenstein, 2014). Even though such studies that examine the fundamental needs of school occupants may continue to contribute to the literature, studies that investigate specific features of learning environments that support modern pedagogical techniques could fill a gap that currently exists. The value of including available educational facilities in curriculum considerations raises awareness of how classroom design encourages or inhibits teachers' choices and abilities to utilize a variety of pedagogies.

The changes in pedagogies are critical because secondary students, sometimes referred to as *millennials,* are no longer learning effectively from simply reading materials and receiving lectures (Elmore, 2010). Teacher-centric lessons are being phased out and classrooms designed for such teaching strategies no longer provide the best learning environments. Put another way, as teachers are encouraged to update pedagogies to be more student-centric, classrooms need to be adapted to allow for such changes.

Studies that examine teaching techniques other than the traditional teacher-centric methodologies have provided evidence that students can, at times, demonstrate significant improvements in their academic success when being taught by a variety of methods (Caballero et al., 2014). Studies that investigate the effective pedagogies as well as relevant physical environments for those pedagogies, can help teachers inform their choices of instructional methods. Evidence-based planning of pedagogies and physical environments may allow for a higher level of academic success.

Educators base curriculum development on many factors, one of which is the classroom space available (Parkay, Anctil, & Hass, 2010). Many teachers attempt to adapt their teaching methods without the ability to change their physical classroom environments and layouts. This inability to modify the physical learning space is a constraint to curriculum design and pedagogical choices (Cleveland & Fisher, 2013). Teachers in a study by Fuller et al., (2009)

affirmed that new school buildings with "novel condition(s)… invite pedagogical innovation" (p. 344). When strategies are employed to utilize, construct, or renovate schools for 21st century teaching and learning, teachers are empowered to expand their toolbox of teaching techniques as a result of more flexible spaces.

A valid concern raised by educational stakeholders when deliberating changes to school learning environments is that school facility improvement projects can have high costs. Much unnecessary spending could be prevented with the identification of best practices and low-cost yet highly effective options (Cleveland & Fisher, 2013). When looking at the usefulness of school innovations, debate abounds on how to evaluate the school buildings, specifically those facility aspects related to 21st century teaching and learning (Cleveland & Fisher, 2013). Cleveland and Fisher (2013) stated, "(A)pproaches to evaluations that attempt to assess the effectiveness of physical learning environments in supporting pedagogical activities are in their infancy and require further development" (p. 24). The creation of a systematic approach to identify and evaluate best practices in this area would help prevent unnecessary building renovations or construction costs for changes that may not hold much advantage to increased pedagogical advancements and student achievement.

The continued approach of maintaining traditional teacher-centric classroom settings allows the learning spaces to "dictate" what pedagogies the teacher can use (Pearlman, 2010). The request or even the requirement of teachers to use new pedagogies without changing the physical environment to actually enable them to effectively employ these same pedagogies could be frustrating at best, at worst could influence teachers to leave the profession. Fuller et al., (2009) suggested that research should "(T)ease apart which elements of a new or renovated school prove to be most motivating" (p. 346). Teachers with enhanced classroom spaces could feel more motivated and empowered in their roles.

STUDIES ON SCHOOL FACILITIES

Numerous Studies have provided overwhelming evidence that the physical environment affects teaching and learning (Cash, 1993; Earthman & Lemasters, 2011; Lemasters, 1997; Uline, Wolsey, Tschannen-Moran, & Lin, 2010). The following history represents only a sampling of studies available. In the early 1990s, Cash (1993) introduced a theoretical model of how the physical building comes to be in the current condition and how the building affects students' academic achievement and behavior. Cash (1993) stated, "A student may assume the faculty and staff of a poorly maintained building will accept or expect a lower standard of behavior and a lesser effort in academic achievement" (p. 1). Cash (1993) also developed the Commonwealth Assessment of Physical Environment (CAPE), which has been used in a number of studies where assessments of the conditions of school facilities were employed. Cash (1993), suggested that a minimum seven elements need to be considered when examining the effects of school buildings on students: lighting, acoustics, climate control, color, building age, density, and aesthetics.

Lemasters (1997), completed a systematic synthesis of studies pertaining to color, maintenance, age, classroom structure, climate control, density, noise, and lighting in educational facilities. Lemasters (1997) examined how different studies had discovered relationships between these building elements and student achievement and behavior. In 2006, Earthman created an instrument, My Classroom Appraisal Protocol © (MCAP), that measures teachers' perceived attitudes about their physical working conditions. A study utilizing the MCAP provided evidence that the physical work environment of teachers does appear to have an effect on their attitudes (Earthman & Lemasters, 2009). Leigh (2012) used the MCAP and the CAPE for a study that found elementary teachers' attitudes correlated with the condition of the school building. Earthman and Lemasters (2011) went on to establish a theoretical framework to consistently examine the condition of schools and effects of school conditions on both teachers and students.

Tanner (2008) found statistically significant relationships between student outcomes and the design of school buildings. He suggested that future research be conducted to look deeper into the particular aspects of school designs that affect student achievement. He also acknowledged these types of studies might be expensive and time-consuming; nevertheless, he expressed that such studies would be meaningful and helpful to each generation of students. Uline et al., (2011) suggested a relationship exists between schools with disorder and neglect and a climate where students feel social disorder and even fear. Uline et al., (2011) also found evidence to suggest physical school buildings can have an influence on teachers' choices to work or not to work in certain schools.

Tanner and West (2011) conducted a study on the effect of school size on academic outcomes. Overall, the results did not show a statistical difference in the academic success of the students based on school size alone; yet, Tanner and West suggested measuring with other indicators outside of academic success, such as absenteeism and

involvement in extra-curricular activities, to get a clearer picture of overall effects. Another suggestion was to investigate the effects of overcrowding in schools as opposed to school size (Tanner & West, 2011).

These studies show evidence that the physical school building has effects on students and teachers. However, further research is needed that will identify the most effective building elements or features for 21st century teaching techniques. Such studies will be valuable for stakeholders and decision makers when they consider school building design, planning, and funding. Effective school building improvements could motivate teachers and students and ultimately increase academic achievement.

NEEDS OF STUDENTS

A few key ways that this current generation of students learn is through interaction, collaboration, increased autonomy, and technology (Elmore, 2010). Evidence shows that they learn best if they experience something, rather than just listening to lecture (Elmore, 2010). Active ways of learning are not easily fostered in traditional classrooms with four or five rows of desks and a chalkboard in front where the teacher spends the majority of the time lecturing. In general, pupils are not as motivated to learn if they are asked to sit still at a desk and listen to direct instruction (Elmore, 2010). Lemley, Schumacher, and Vesey (2014) stated, "The attention spans of 21st century students are shorter than previous generations of students, they multitask more, and they are accustomed to having 24-hour access to information" (p. 105). Students are more motivated if they can use technology, discuss ideas and concepts openly in their classrooms and, at times, work with their peers (Elmore, 2010).

Contemporary students are very relational and team-oriented and benefit from group learning (Elmore, 2010; Rickes, 2009). They are also more likely to explore critical thinking skills if they are in an environment where they feel comfortable, and where they believe the teacher is open to innovative or creative ideas (Mathews & Lowe, 2011). Such environments promote relationships and autonomy, which help to increase academic success.

Twenty-first century teens use technology in almost every aspect of their lives and most of them know more about technology than many of their teachers and parents (Elmore, 2010). Pearlman (2010) stated, "At home they are likely to be equipped with computers, Internet access, iPods, and smartphones. At school, they typically sit at small desks, push a pencil or pen, and do worksheets" (p. 119). Another way to look at this phenomenon is that students no longer rely on teachers to give them information; rather, they obtain it for themselves via the Internet (Elmore, 2010). Teachers will be most effective if they adjust some of their classroom strategies when including technology in the classroom, such as becoming more of a facilitator, and placing more of the responsibility for learning on the students (Martinez & Schilling, 2010).

The proliferation of technology use in the day to day lives of students can cause traditional classroom activities to be less interesting. Rickes (2009) stated, "Technology and pedagogy are converging. Given their comfort level with technology and penchant for team-oriented behavior, millennials are substantively changing instructional space—as well as the very nature of instruction" (Rickes, 2009, p. 12). Capitalizing on their natural affinity for technology, students need to be taught how to use technology for business and industry, not just for entertainment (Kumar, 2013).

Students learn best through active learning and in environments that promote relationship building, teamwork, and give them a sense of autonomy. They also learn well through the use of technology since they are more comfortable using it than any generation has ever been. The pedagogies and learning spaces play a critical role in either meeting or not meeting the needs of millennials.

CHANGING PEDAGOGY TO MEET THE NEEDS OF 21st CENTURY LEARNERS

After exploring the needs of current pupils, the next step is to consider the different types of pedagogies necessary to meet those styles and needs. Nevid and Jaramillo (2011) stated, "(R)eaching and teaching millennial students challenges us to adapt our methods to the learning needs of students today. By interacting more with our students and lecturing less, we can create a more dynamic learning environment to help our students become more effective learners" (p. 56). High school educators cannot continue to teach as they always have and expect their students will continue to be engaged and successful. Kumar (2013) stated, "Textbook-driven, content driven, and focused teacher centered, paper and pencil education needs to be discarded" (p. 2).

One example of a pedagogy that is currently being promoted is that of Project-Based Learning (PBL). Bell (2010) stated, "PBL is a student-driven, teacher-facilitated approach to learning" (p. 39). Students solve "real world problems" using a variety of learning techniques (Bell, 2010, p. 39). PBL prepares students for activities they will encounter throughout their lives. Not all of the skills students glean can be assessed through standardized tests; nevertheless, studies have provided evidence that students being taught through PBL are scoring higher on such tests than those students being taught through a lecture-based curriculum (Bell, 2010). Students using PBL are also more

motivated (Bell, 2010). Students who are more motivated are more likely to remain engaged in lessons. A teacher-centric approach can result in passive learning; however, PBL engages students in active learning, affording them skills much needed in the 21st century (Bell, 2010). Technology is an important part of PBL, and therefore guiding students to use it appropriately—within parameters and safety guidelines—is an important task of teacher-facilitators (Bell, 2010).

The "Flipped Classroom" is another teaching strategy that may improve learning (Roehl, Reddy, & Shannon, 2013). Flipping a classroom means that class time is used for active learning and the students do the passive learning outside of class, such as reading or watching videos of their assignments (Roehl et al., 2013). Students' attention can be caught through the strategy of flipping the curriculum (Roehl et al., 2013). Active learning is accomplished through pedagogies that focus on keeping the students active and engaged and through requiring the students to take ownership of their own learning (Roehl et al., 2013).

Teaching and learning should look different in 21st century schools. Rather than traditional teacher-centric instruction there should be, "students writing journals online, doing research on the Internet, meeting in groups to plan and make their websites and their digital media presentations, and evaluating their peers for collaboration and presentation skills." (Pearlman, 2010, p. 123). When discussing modern educators, Pearlman (2010) suggested that once they accept the effectiveness of changing their teaching methods they will quickly desire changes in the physical learning spaces.

CHANGES IN THE PHYSICAL CLASSROOM

The next logical step is to ponder learning spaces that will be the most accommodating (Lemley et al., 2014). Rickes (2009) stated, "Instructors are interested in shifting seamlessly from a didactic approach to a hands-on demonstration, all in the course of the same class—and same space. This type of hybrid teaching space requires a considerable increase in square footage, sending space planning guidelines into a tailspin" (p. 13). Learning spaces need to be changed, yet, with best practices established, the "tailspin" may be avoided through a systematic list of improvements or changes. Many classroom layouts and designs have remained constant since the Middle Ages (Park & Choi, 2014). Unfortunately, this is the case even though evidence has demonstrated other layouts may be more effective in increasing classroom engagement and interactions (Park & Choi, 2014). The contemplation of the physical environment in conjunction with the curriculum design is not a new concept. Fuller et al., (2009) reminds us that John Dewey saw decisions about curriculum closely intermingled with the physical design of the available learning spaces.

Evidence shows that 21st century learners benefit from changes in pedagogy, and it is increasingly becoming clear that certain approaches to pedagogy, such as those needed for PBL, flipped classrooms and other types of active learning are difficult within the constraints of traditional classroom environments (Duncanson, 2014). When classrooms are not conducive to forms of active instruction, teachers resort to lecture-based teaching and avoid the more active techniques. It will not be effective to encourage or require high school teachers to utilize new pedagogies without also supplying them with appropriate learning environments to do so successfully. Learning spaces should be seen as features of curriculum and instruction and adjustments should be made in the design process of these spaces (Kumar, 2013).

Rickes (2009) stated, "Because Millennials prefer to learn and work in teams, small group rooms are needed that can be used as a breakout space during class or for study and project work after class has ended" (p. 12). A traditional classroom setting can at times be adapted for students to work in groups, though, more optimal arrangements can be created to accommodate student collaboration as a beneficial instructional technique. Active learning classrooms need to be flexible and allow for group work and many different activities at the same time (Roehl et al., 2013). Evidence shows that flexible classroom spaces help teachers utilize a number of pedagogies and modalities of learning (Duncanson, 2014; Fuller et al., 2009). Flexible learning spaces with increased opportunities for social interactions are an important element of a learning environment that encourages students to relate to others and also have a sense of autonomy (Lemley et al., 2014). Planning for learning spaces should be based on evidence from rigorous studies about the effects of facilities, for example, the strong evidence that flexible learning spaces have a positive effect on learning.

One avenue to increase classroom flexibility is to expand classroom space. Simply having enough spaces allows for teachers to diversify their teaching methods (Duncanson, 2014). Duncanson (2014) stated, "The lack of large spaces for student work forces the teacher to schedule all events in a one-size-fits-all modality" (p. 31). The effort of getting rid of clutter in classrooms can create more floor space and make the space more conducive to learning (Duncanson, 2014). Administration can encourage decluttering by offering training on effective use of classroom space and by providing teachers with places outside of classrooms for storage of necessary items (Duncanson, 2014; Fuller et al., 2009). Providing teachers with more space can improve the teaching and learning environment. Millennial students benefit from being able to move around and work in groups, both groups within classrooms and groups between

classrooms. Simply moving desks around may not be the best answer; and neither will the construction of new state-of-the-art buildings and/or classrooms if teachers are not trained how to utilize these spaces. Not only do the learning spaces need to be adapted, teachers also need training on how to best arrange their classrooms and utilize these arrangements effectively (Mercier, Higgins, & Joyce-Gibbons, 2014).

New designs that allow for more peer interaction and move away from a teacher-centric layout can be challenging to teachers (Mercier et al., 2014). These new layouts can encourage off-task behaviors. Pearlman (2010) discussed an updated classroom that "is populated by work tables and rolling chairs, not individual students' desks" (p. 124). Not all teachers are immediately comfortable with these changes and may need additional support or training to be effective in these environments (Mercier et al., 2014). Along with encouraging teachers to use varied active-learning pedagogies and providing new classroom designs, teachers will need to be equipped with updated classroom management techniques. Teachers that feel supported, prepared, and empowered may more effectively use the pedagogies necessary for the academic success of their students.

Another important aspect of learning spaces is the inclusion of technology. Parkay et al., (2010) stated, "Curriculum decisions are now influenced by technology in ways unimaginable fifty years ago, and the next fifty years promise changes equally dramatic" (p. 310). Parkay et al., (2010) went on to state that technology is changing how much and how fast students can obtain and utilize information and this change should govern the setup and the design of classrooms. The increase in the use of technology requires that teachers are able to move freely around the room to help the students harness the overwhelming amount of information available (Elmore, 2010; Lemley et al., 2014). Teachers helping students with technology may require one-on-one work, or small group work where the teacher guides step-by-step through the process. Appropriate monitoring can only occur in a classroom that is conducive to the teacher moving around and among the students. Simply put, active learning and use of technology within the classroom require changes in classroom layouts (Pearlman, 2010).

ADAPTING CLASSROOM DESIGN AND LAYOUT

Administrators may or may not have the ability to change the structural or built layout of the learning spaces within their buildings; however, most could allow and even encourage teachers within utilizing these spaces to experiment with classroom decorations, and layouts that have been found to be effective with a variety of pedagogies (Cheryan, Ziegler, Plaut, & Meltrzoff, 2014). Since millennials have a desire to trust those in authority such as teachers, creating an atmosphere in the classroom that encourages open communication can be an important aspect of encouraging such interactions. The physical environment can affect the atmosphere and has been referred to as the symbolic environment (Cheryan et al., 2014). Creating a warm, inviting, atmosphere within the classroom may take an investment of time and even some resources or funding; however, the changes could be accomplished on a teacher workday and on an established budget. Some of the changes in décor, such as painting the walls in a color other than white (Grube, 2014; Tanner, 2015), or decorating the walls with posters that are encouraging to both genders and all nationalities (Cheryan et al., 2014) have been found to have a positive effect on the learning environment and require only a small investment of time and money.

The layout, which also affects the atmosphere, can be more complicated to change depending on the space available, the furniture available, and the number of students that needed to utilize the space. Two classrooms of similar size may have to accommodate class sizes that differ by ten students or more. All efforts should be made to keep the number of students per classroom as low as possible for a variety of reasons including the idea that the ability for teachers and students to move around has been shown to increase comfort and student success (Tanner, 2015).

As stated earlier, simply increasing the open space available could be beneficial. This may take creativity and the removal of items from the rooms; however, the effort could pay off in a learning space more conducive to learning in the 21st century. Administrators could encourage teachers to remove all unnecessary furniture such as bookshelves that could be moved to storage, or multiple filing cabinets that could be combined. Not every teacher may readily possess the skills needed to open up floor space; however, could be aided by a peer, administrative leadership, or professional development.

The traditional classroom, as shown in figure 1, does not allow for easy movement and only allows for limited peer interaction. Educators that are trying to incorporate more active learning pedagogies will do well to avoid such a layout (Park & Choi, 2014). Traditional classroom layouts have areas, such as those near the front and center, that are more conducive to teacher student interaction and have been shown to produce higher academic achievement (Park & Choi, 2014).
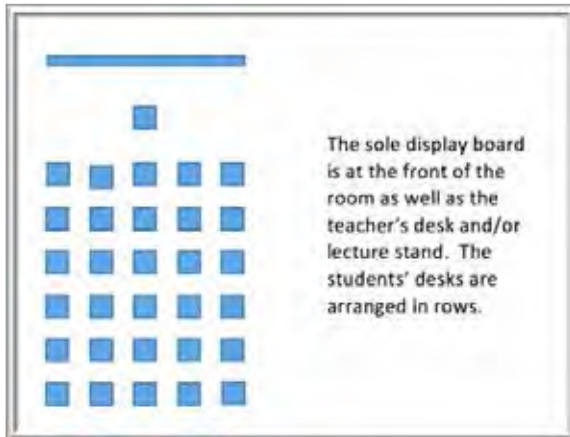
The sole display board is at the front of the room as well as the teacher's desk and/or lecture stand. The students' desks are arranged in rows.

Figure 1. Traditional classroom layout. A display board is placed in the front of the room, a teacher desk is placed near the front and the student desks are arranged in rows facing the front.

Active learning classrooms or ALCs, such as those displayed in figure 2 and 3, do not have predefined areas that are inequitably positioned (Park & Choi, 2104). ALCs increase teachers' interactions with all of their students, not just those sitting in the front few rows. Teachers can easily move around the room and visit different tables throughout lessons and individual or group work. College students learning in classroom layouts intentionally set up for active learning have shown increased academic achievement as well as increased interactions between students and more creative ideas (Park & Choi, 2014).

Classrooms set up for active learning are more conducive to group discussions and small group work. They also open up the pedagogical options for teachers to have different students working on different types of tasks at the same time. Different activities and learning can be taking place at each table. These types of layouts can encourage Project-Based-Learning (PBL), which is one teaching technique that is highly effective with millennials. If technology can feasibly be incorporated into the classroom layout/design it could be highly beneficial for the various display boards to be connected to computers for students to utilize them for group work such as that required with PBL. Such technology incorporations would also open up the movement that the teacher could allow for him or herself and for student engagement as well.
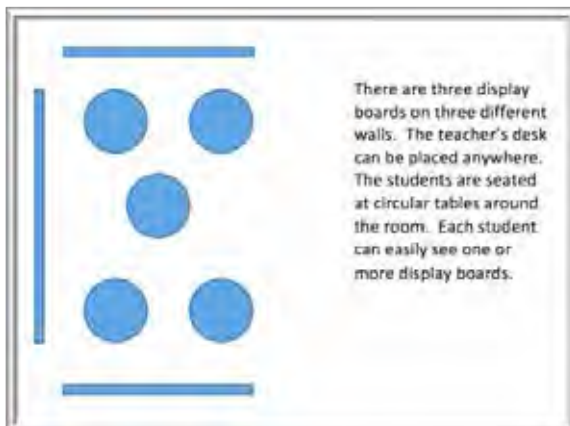

There are three display boards on three different walls. The teacher's desk can be placed anywhere. The students are seated at circular tables around the room. Each student can easily see one or more display boards.

Figure 2. Active learning classroom (ALC) using round tables and additional display boards.

There are three display boards on three different walls. The teacher's desk can be placed anywhere. The students are seated at square or rectangular tables around the room. Each student can easily see one or more display boards.
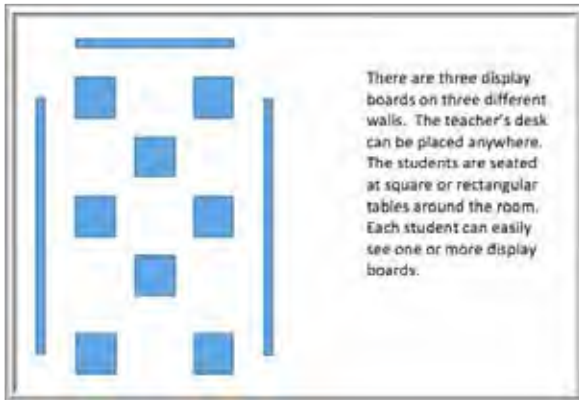
Figure 3. Active learning classroom (ALC) using square or rectangular tables and additional display boards.

The layouts represented in figure 2 and figure 3 would require replacing student desks with tables and obtaining and installing additional display boards in the classroom. Other arrangements can be made if the purchasing and replacement of desks cannot be accommodated or additional display boards cannot be acquired. These arrangements would consist of working with the current furniture and attempting to create an arrangement that would still encourage increased interactions between the teacher and the students and between the individual students. Semi-circular arrangement of desks, even if two rows were necessary, may create a layout more conducive to whole class discussion. If the desire is to create a layout for small group work the desks could be temporarily placed in a face-to-face layout to create make-shift tables of various sizes. Even though rearranging is not optimal it may be well worth the additional effort and time to create a physical arrangement where students can learn in a manner that is more comfortable to their learning styles.

Once décor or layout changes have been made to a classroom, it is critical that both the positive and negative effects be assessed (Cheryan et al., 2014) in order to provide information on whether or not the changes should remain, whether or not additional changes should be added, or whether or not the design and layout should be completely revamped. Teachers will need to find out what works for them and what works for their students. The main point is to try different layouts that may improve in the delivery of the materials through allowing for the use of a variety of pedagogies and to no longer allow the classroom layout and design to dictate what types of interactions and movement can be incorporated into the lessons.

CONCLUSION

Evidence shows that varied teaching methods can have a positive effect on learning. Data demonstrate that physical school building conditions affect learning. Research that examines the interaction between pedagogical choices and the physical learning spaces could provide information that would increase the effectiveness of planning, designing, and utilizing learning spaces. Such studies might also provide information about the limitations some classroom designs impose on teachers' ability to utilize certain pedagogies.

With changing standards and increasing expectations for educators to differentiate pedagogies, questions arise. Are teachers given adequate and appropriate resources, including the best physical environment? If teachers are expected to provide an environment where relationships can be built and students can work together in groups, construct projects, experience project-based learning, and have access to a technology-rich curriculum, are teachers given the right equipment and support? Are teachers provided with the physical environment to encourage all these aspects of 21st century learning without losing instructional time to moving furniture and "making do" with less than optimal resources? In order to support pedagogies that are friendly and beneficial to this generation of students, it is imperative to understand that physical learning environments must be adapted (Pearlman, 2010).

Facility design and renovation decisions need to be based on evidence, as these changes can come with high financial costs. As administrators attempt to answer these questions, evaluations of school buildings are needed to examine whether or not the available physical spaces allow for the pedagogies that are being encouraged (Cleveland & Fisher, 2013). Duncanson (2014) stated that current classroom layouts over-ride the decisions teachers make about

pedagogies. Teachers become frustrated and are less likely to embrace the creativity that would help them be effective with new pedagogies (Ryan & Deci, 2000).

High school teachers will benefit from being empowered to align their pedagogies with the needs of their students and to do so with the appropriate resources, including the best physical environment and the training necessary to work in the new environment. Continued studies into the best aspects of effective learning spaces will benefit both the teachers and the students. These facility changes will not happen quickly, and best practices may evolve as the students change. Ample evidence exists that educators cannot continue to teach as they always have, and the environment needs to adapt along with the new teaching methods. Students are learning differently. Teachers need to teach differently. Learning spaces need to be adapted accordingly.

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