ORIGINAL PAPER

Innovative learning spaces: class management and universal design for learning

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Abstract

Recent and important changes in pedagogy design include flexible learning methods that address student diversity (universal design for learning–UDL) and innovative learning spaces. The goals of this study were (1) to compare pedagogical practices in traditional and innovative learning environments in the context of the management dimension of classroom climate; (2) to measure the correlation between teacher-centered and student-centered learning and number of classroom discipline events; and (3) to measure the effect of select UDL principles and innovative learning spaces on the relationship between the rate of expression of teacher-centered learning and number of classroom discipline events. A total of 507 observations were carried out to document classroom pedagogical and discipline management, 265 (52%) in traditional classrooms and 242 (48%) in the innovative learning spaces of four elementary schools in the same geographical region. The rate of student-centered learning and pedagogical practices that express UDL principles was significantly higher in innovative spaces than in traditional classes. A moderate, positive and significant correlation was found between teacher-centered learning and number of classroom discipline events. In addition, the learning space, integration of tasks that encourage choice, and integration of tasks that address learners' differences were found as significant moderating variables of the relationship between teacher-centered learning and the number of classroom discipline events. The study provides an in-depth understanding of the relationships that exist between the applications of several pedagogical practices and discipline that are important for development of similar innovative learning space initiatives regionally and beyond.

Keywords Classroom climate · Classroom discipline · Classroom management · Educational change · Innovative learning spaces · Universal design for learning

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Introduction

Recent years have marked the development of constructivist pedagogical principles for designing innovative and flexible learning spaces that address student diversity (universal design for learning–UDL). The term 'innovative learning spaces' or 'future learning spaces' refers to spatial designs that encourage and support dynamic, engaging, and inspiring learning behaviors. A learning space can be an agent for change from the passivity and disconnectedness experienced sitting in chairs attached to the floor while facing a lecturer in a large lecture hall, to active exploration, collaboration, and discussion fostered by an open space (Oblinger, 2006). New learning spaces should influence learning based on specific pedagogical principles while giving deep consideration to theories of learning, subject matter, and teaching practices, especially use of technology (Ellis & Goodyear, 2016; Harrison, 2018; Hod, 2017).

The design of innovative learning spaces raises different questions about their teaching and learning processes and their value in comparison with traditional classrooms. The present comparison of innovative and traditional learning spaces in elementary education involved examining the relationship between two classroom management dimensions: teaching methods and discipline. Discipline in classroom management includes managing disruptive events like talking out of turn and engaging in off-task behaviors that negatively impact the learning environment and student engagement. Teachers use different strategies, such as applying adequate class procedures or routines and frequent use of proactive praise, to prevent misbehaviors from taking place and ensure that effective learning occurs (Clunies-Ross et al., 2008; Franklin & Harrington, 2019; McDonald, 2013; McInerney & McInerney, 2002).

With respect to teaching methods, it is common to distinguish between active and traditional learning. Active learning, or student-centered learning, emphasizes social interaction between learners and application of the constructivist approach, an active process of meaning and knowledge construction. The teacher guides a learning process whereby students construct and present knowledge in independent and diverse ways by means of illustration. This learning approach respects the diversity of learners in a class (Bishara, 2018; Nagowah & Nagowah, 2009; Rosenfeld & Rosenfeld, 2006). In contrast, in traditional or teacher-centered learning, the teacher is considered the repository of knowledge and hence in charge of learning. The teacher is the primary information giver and evaluator and the student, who is the passive information recipient. Learners are treated as a homogeneous group and the approach to the psychology of learning is usually behaviorist (Bishara, 2018; Ertmer & Newby, 1993; Nagowah & Nagowah, 2009).

Classroom management, of which the teaching methods and discipline dimensions are examined here, is an aspect of a larger construct: classroom climate. Together with management-organizational, the second primary aspect of classroom climate is social-psychological. Because classroom climate is derived from an ecological paradigm, aspects of the physical environment highly relevant to innovative learning spaces are part of the concept, such as classroom appearance, furnishings, size, physical resources, and even heating and ventilation (Evans, Harvey, Buckley, & Yan, 2009). Franklin and Harrington (2019) developed a new rubric for evaluating teacher and student roles and responsibilities, also relevant to this study, which delineates four domains of successful classroom practice: classroom teaching and learning; classroom behavior management; classroom environment –social aspects; classroom environment–physical space.

The goals of this study were (1) to compare teaching methods in traditional and innovative learning environments; (2) to investigate the relationships between teacher-centered and student-centered learning and number of classroom discipline events; and (3) to measure the effect of select UDL principles and innovative learning spaces on these relationships. The teaching and learning aspects examined here are pedagogical practices relevant to the principles of universal design for learning (UDL) often associated with innovative learning spaces.

Classroom climate: Management and discipline

A global summary of classroom life as experienced by its students and teachers is called 'classroom climate', or other terms such as 'classroom environment', 'classroom atmosphere' and 'learning environment' (Alansari & Rubie-Davies, 2020). These terms refer to "an overall assessment of the psychological, social, emotional, and organizational/managerial state of the classroom" (Babad, 2009, p. 54). The implicit rules of the group structure, the leadership styles of its dominant members, and the norms, cultural traditions, and expectations of the group members define the social climate of any organizational setting where people consistently work together (Hareli & Rafaeli, 2008; Kelly & Barsade, 2001).

Research indicates a positive relationship between students' sense of their classroom climate and several educational outcomes such as learning success, motivation, engagement, constructive learning processes, and reduced emotional problems, bullying, and conflict (Allen & Fraser, 2007; Bonne, 2016; DiLalla & Mullineaux, 2008; Evans et al., 2009; Fraser, 1989, 1994, 2002; Marsh & O'Mara, 2008; Sidelinger & Booth-Butterfield, 2010). Given these important links, several researchers have investigated ways in which classroom climate can be conceptualized and measured. Despite extensive research, it is important to emphasize that the cause-effect relationships between classroom climate and educational outcomes, or even the direction of cause, remain uncertain (Evans, Harvey, Buckley, & Yan, 2009).

To date, classroom climate assessment has usually been based on self-reporting questionnaires (Alansari & Rubie-Davies, 2020) of actual and preferred perceptions. The Learning Environment Inventory of Walberg and Anderson (1968) assesses student perceptions of their educational experience and the Classroom Environment Scale of Moos (1973) is another early example of these tools. The approach was based on self-reported actual and preferred perceptions of those in the setting. Classroom climate is a multi-faceted concept that includes a number of important dimensions of which Moos' measurement tool (1979) included three: (1) relationships, the degree to which individuals in the environment help and support each other; (2) personal development, the degree to which self-enhancement can occur; and (3) maintenance and change in the system, or the degree to which the environment is orderly, maintains control, and is able to change. Evans, Harvey, Buckley and Yan (2009) defined the dimensions of classroom climate somewhat differently: (1) academic, referring to pedagogical and curricular elements of the learning environment; (2) management, referring to discipline styles for maintaining order; and (3) emotional, the affective interactions within the classroom. The dimension of classroom management, particularly that of classroom discipline, is common to both groups of researchers.

Classroom management is a complex process including the management of space, time, activities, materials, learning work, social relationships, and student behaviors (Djigic & Stojiljkovic, 2012). Wang et al. (1993) claimed that classroom management has the most direct impact on student achievements. Martin and Baldwin (1993) suggested three dimensions for

classroom management: (1) the personality dimension, referring to teachers' beliefs about student abilities and motivation, and attitudes toward classroom climate; (2) the teaching dimension, referring to teaching methods, learning content, and managing space and time; and (3) the discipline dimension, referring to actions taken by the teacher to establish appropriate standards of behavior in the classroom based on principles of positive discipline.

Universal design for learning

Universal design for learning (UDL) is a set of pedagogical principles for designing flexible teaching and learning methods that address student diversity (with and without special needs) within the classroom context (Black et al., 2014; Capp, 2017; CAST, 2017; Evmenova, 2018). The concept originated earlier in architecture, where physical environments were designed to be accessible to all users regardless of their abilities and needs (Rao & Tanners, 2011). The philosophy of UDL is based on three principles: (1) multiple means of engagement; (2) multiple means of representation of knowledge; and (3) multiple means of expression of understanding (Capp, 2017; CAST, 2017; Evmenova, 2018). These principles are related to the cognitive learning process that is based: on affective networks responsible for motivation; recognition networks responsible for gathering and analyzing information; and strategic networks responsible for planning and executing actions (Dell et al., 2015; Robinson & Wizer, 2016). UDL implementation is supported by a set of nine guidelines and 30 checkpoints that are based on the three UDL principles. The result is a detailed practical description of the application of and research on the pedagogical philosophy (see Fig. 1). The first principle, for example, multiple means of engagement, includes three guidelines. One provides options for self-regulation by three checkpoints: promoting expectations and beliefs that optimize motivation; facilitating coping skills and strategies; and developing self-assessment and reflection (Black et al., 2014; Evmenova, 2018).

Technology is a key aspect of UDL because it provides the teacher with a means for representing knowledge in multiple ways, and students with an opportunity to demonstrate their understanding in multiple ways. Nevertheless, effective pedagogy is fundamental (King-Sears, 2009) and technological tools exist to contribute to achieving the UDL principles (Capp, 2017; Dell et al., 2015). UDL-based interventions that include online and blended learning, multimedia tools, social media, and interactive websites have been found effective in developing diverse learning abilities (e.g., Hall et al., 2015; Kennedy et al., 2014; King-Sears et al., 2015).

A concept similar to UDL is universal design for instruction (UDI), which contains principles for curriculum development and instruction that give all learners equal opportunities to learn. UDI includes several unique principles including: instruction that provides a choice in methods of use; tolerance for error; a community of learners in which interaction and communication among students and between students and teachers are promoted; and an instructional climate that is welcoming and inclusive and in which high expectations are promoted for all students (McGuire & Scott, 2006).

Method

Research setting

The study was carried out with the approval of a Chief Scientist at the Ministry of Education as part of a large study of the effectiveness of the new learning environment. The
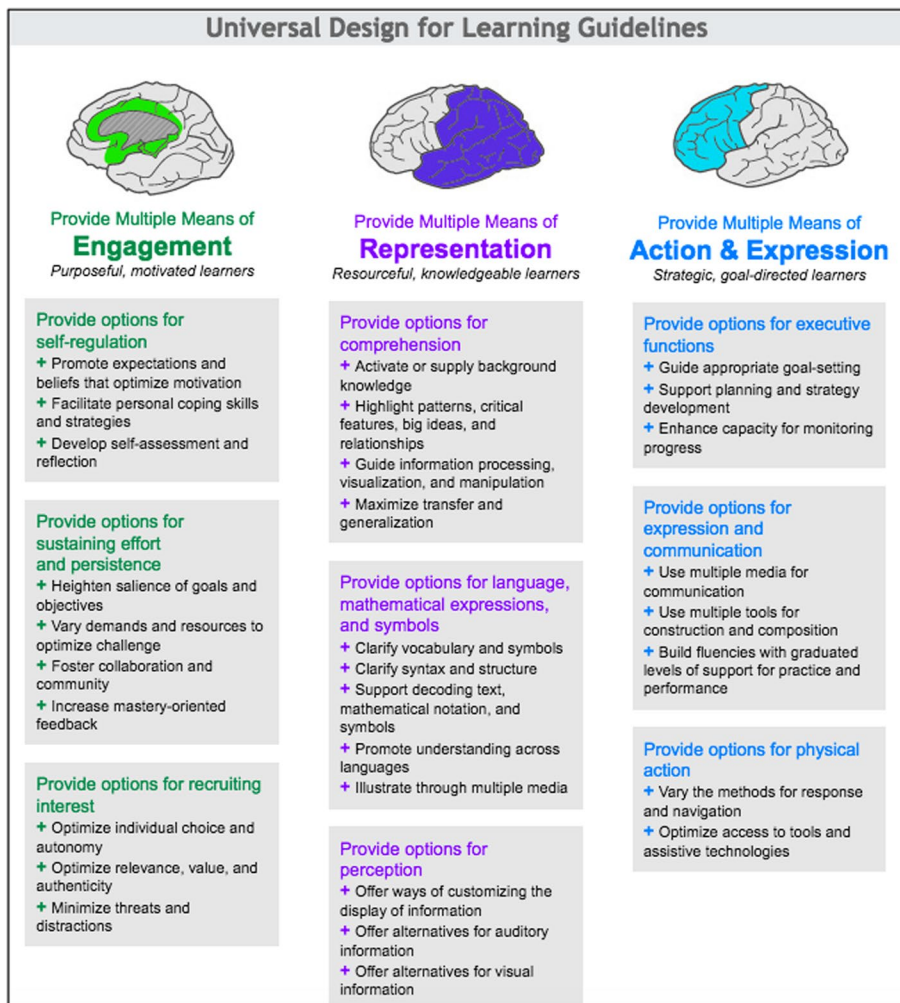
Fig. 1 Universal Design for Learning Guidelines (Meyer et al., 2014)

study involved four rural elementary schools in the process of implementing a pedagogical change from a more-traditional to a constructivist approach. The schools are located in the same geographical area, three with grades 1–8 and one with grades 1–6. In all schools, similar initiatives are gradually being developed and include redesigning of learning spaces. The innovative learning environments have evolved from a traditional classroom in which the tables are organized in a particular structure facing the teacher, to a flexible, common, and dynamic space. The learning space contains several subspaces that allow varied teaching and learning methods, which can be separated by partitions, when students work in small groups. The innovative changes are being implemented gradually, with both traditional and UDL teaching and learning taking place in the same age group, enabling comparison and evaluation of the new learning mode. The goal of this study was to examine the relationships between the teaching and discipline dimensions in classroom management while addressing two aspects, the design of innovative learning spaces and UDL.

Research questions

1. What pedagogical practices are key to the innovative learning spaces and to what extent are they similar to/different from those of the traditional classes?
2. What is the relationship between the rate of expression of teacher-centered learning and the number of expressions of classroom discipline events?
3. How do pedagogical practices of UDL principles and innovative learning spaces affect the relationship between the rate of expression of teacher-centered learning and the number of expressions of classroom discipline events?

In the context of the third research question, five aspects were selected: learning spaces (innovative or traditional), the principle of student choice, response to student diversity, and two aspects of the social context in learning–cooperative learning and co-teaching.

Hypotheses H1: More pedagogical practices of UDL principles would be observed in innovative learning spaces than in traditional classrooms.

H2: There would be a positive and significant relationship between teacher-centered learning and the number of classroom discipline events, and this relationship would be moderated by the innovative learning spaces and the implementation of pedagogical practices of UDL principles.

Figure 2 presents our research model.

Research tool

Characterization of the dimensions of teaching and discipline was accomplished through classroom observation. Because of the concern that one person's impressions of a classroom climate would not necessarily be shared by another observer (Evans et al., 2009), the observations focused on monitoring, as objectively as possible, the pedagogical practices implemented by teachers in the lesson and teacher references to discipline events. The study was based on the observation tool whose data were monitored and analyzed quantitatively.
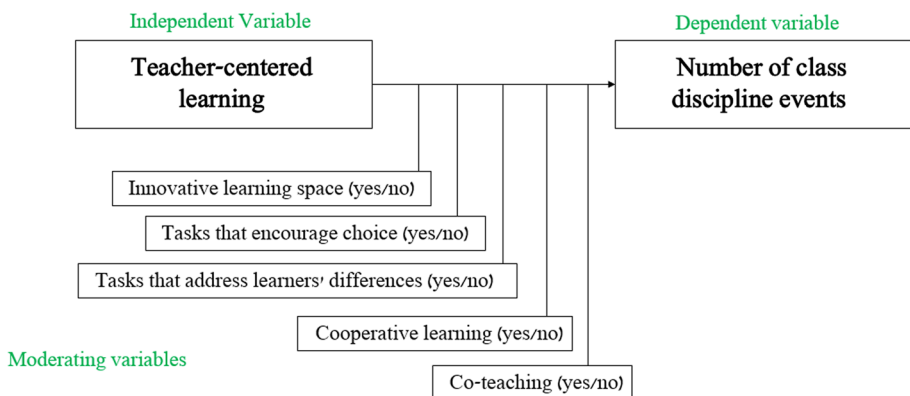

Fig. 2 The research model

The class observation tool contained three parts. The first part included a list of eight pedagogical practices: cooperative learning, individual learning, guided instruction, teachers' explicit expression of organization and management of written/oral learning processes, integrating visual representation, integrating tasks that encourage choice, integrating tasks that address learner differences, and encouragement of questioning and critical thinking. We selected these eight practices, based on their association with UDL principles, from a broader observation tool developed by Sasson et al. (2021) for characterizing learning environments pedagogically. The second part of the observation tool measured the rate of student-centered learning events (individual and group learning) as opposed to teacher-centered learning (frontal teaching). We used a percentage scale from 0 (no expression) to 100 (highest expression) to indicate the relative time of expression of each teaching/learning style during class. The third section of the observation tool monitored teacher references to discipline events. Each disruptive event, such as talking out of turn or engaging in off-task behavior that received explicit verbal reference from the teacher, was counted.

Two research assistants were trained to use the observation tool. In the first phase, they made joint observations. At the end of each observation, the observers discussed their results and calculated the degree of match in monitoring pedagogical behaviors. Six observations later, the observers obtained an 85% match rate and each observer was given the responsibility for conducting observations in two of the research schools. The study included 507 observations of 45 min each, with 265 (52%) of the observations taking place in traditional classrooms and 242 (48%) in the innovative learning spaces.

Results

Research question #1: Key pedagogical practices in the innovative learning spaces and the traditional classes.

The rate of student-centered learning in the innovative spaces was significantly higher than in the traditional classes with medium effect size. Table 1 presents the results. Chi-square tests were used to identify any significant differences between observed and expected frequencies of pedagogical practices. Five pedagogical practices out of eight examined were found to be significantly more common in innovative learning spaces: cooperative learning, guided instruction, integrating visual representation, integrating tasks that encourage choice, and integrating tasks that address learner differences. Teachers' explicit expression of organization and management of written/oral learning processes was significantly more frequent in traditional classes. No significant differences were found in the expression of individual learning between the learning spaces. The expression of teacher encouragement of questioning and critical thinking was very low in both learning spaces with no statistical difference. Table 2 presents the results.

Table 1 Rate of student-centered learning in the innovative spaces and traditional classes

Variable	Mean innovative space	Mean traditional space	Difference t
Rate of student-centered learning	64.64	48.49	$t = -{-}4.894$, df $= 505$, $p = 0.00$,
Cohen's effect size $= 0.435$			

The first hypothesis in the study was confirmed. In the innovative learning spaces, there was a higher expression of active learning that encourages choice and addresses learners' differences.

Research question #2: Relationships between the rate of expression of teacher-centered learning and the number of expressions of classroom discipline events.

The second hypothesis in the study was also confirmed. As hypothesized, a moderate, positive and significant correlation was found between teacher-centered learning and the number of classroom events ($r = 0.37^{**}$). A relatively-low, negative and significant correlation was found between teacher-centered learning and learning in innovative spaces, integrating of tasks that encourage learners' choice and address learners' differences and co-teaching. A moderate, negative and significant correlation was found between teacher-centered learning and cooperative learning ($r = -0.47^{**}$). Another interesting finding was a positive and significant correlation between innovative learning spaces and co-teaching. Table 3 presents the descriptive statistics and the correlations between all variables in the study as a preliminary stage for the statistical examination of the moderating variables.

Research question #3: The effect of pedagogical practices of UDL principles and innovative learning spaces on the relationship between the rate of expression of teacher-centered learning and the number of expressions of classroom discipline events.

Three variables out of five were found to significantly moderate the relationship between the rate of teacher-centered learning and the number of classroom discipline events: the learning space, integration of tasks that encourage choice, and integration of tasks that address learners' differences. Cooperative learning and co-teaching were not found to be moderating variables. The type of interaction of all three moderating variables was found to be similar. The slope of all graphs was positive, indicating an increase in the number of

Table 2 Frequency of key pedagogical practices in the learning spaces

Pedagogical practice	Frequency innovative space (%)	Frequency traditional space (%)	χ^2
Cooperative learning	60	40	$\chi^2_{(1)} = 19.319, p = 0.000,$
Cramer's V = 0.195			
Individual learning	63	62	n.s
Guided instruction	74	60	$\chi^2_{(1)} = 10.983, p = 0.001,$
Cramer's V = 0.147			
Teacher's explicit expression of organization and management of written/oral learning processes	62	76	$\chi^2_{(1)} = 10.151, p = 0.001,$
Cramer's V = 0.142			
Integrating visual representation	71	62	$\chi^2_{(1)} = 3.990, p = 0.046,$
Cramer's V = 0.089			
Integrating tasks that encourage choice	62	40	$\chi^2_{(1)} = 24.454, p = 0.000,$
Cramer's V = 0.220			
Integrating tasks that address learners' differences	72	45	$\chi^2_{(1)} = 37.789, p = 0.000,$
Cramer's V = 0.273			
Encouragement for questioning and critical thinking	6	4	n.s

Table 3 Descriptive statistics and correlations between study variables

Variable	Mean	SD	Correlation						
			1	2	3	4	5	6	7
Innovative learning space (yes/no)	.47	.49	1	.22**	.27**	.20**	.46**	-.21**	-.03
Tasks that encourage choice (yes/no)	1.50	.50	-	1	.18**	.31**	.18**	-.30**	-.08
Tasks that address learners' differences (yes/no)	1.57	.50	-	-	1	.16**	.18**	-.15**	.09*
Cooperative learning (yes/no)	1.49	.50	-	-	-	1	.20**	-.47**	-.10*
Co-teaching (yes/no)	.58	.50	-	-	-	-	1	-.32**	-.24**
Teacher-centered learning (continuous variable)	43.79	38.05	-	-	-	-	-	1	.37**
Number of classroom discipline events (continuous variable)	7.44	8.71	-	-	-	-	-	-	1

classroom discipline events with increased expression of teacher-centered learning. However, higher expression of teacher-centered learning in an innovative learning space, or in a learning environment in which learning tasks incorporated student choice or addressed learner differences, resulted in more discipline events compared with traditional learning or learning environments that did not encourage choice or respond to differences between learners. Table 4 and Fig. 3a–c present the results.

Discussion

The purpose of this study was to explore relationships between the teaching and discipline dimensions in classroom management and to test the moderating effect of the design of innovative learning spaces and the expression of selected UDL principles. A total of 507 observations (45 min each) were executed, 265 (52%) in traditional classrooms and 242 (48%) in innovative learning spaces in four elementary schools in the same geographical region. In all schools, similar initiatives are gradually being developed and include redesigning of learning spaces.

The rate of student-centered learning in the innovative spaces was significantly higher than in the traditional classes. In addition, a greater number of pedagogical practices that express UDL principles were observed in these learning environments, including co-teaching. Co-teaching, which involves two or more professionals teaching a diverse group of students in the same class in a combined manner (Cook & Friend, 1995), has been found to have a positive direct or indirect impact on classroom management, including the development of a classroom community (Brown et al., 2013) and the provision of increased personal attention to students (Austin, 2001). During co-teaching, students are exposed to different teaching and communication styles and to teachers with a wide range of skills and knowledge (Pratt, 2014). The significant correlation found in this study between innovative learning spaces and co-teaching strengthens the assumption that co-teaching contributes to the implementation of constructivist pedagogical practices. The findings here reinforce previous studies linking innovative learning spaces and classroom management through co-teaching (Austin, 2001; Brown et al., 2013; Pratt, 2014).

The learning space, integration of tasks that encourage choice, and integration of tasks that address learner differences were significant moderating variables in the relationship between teacher-centered learning and the number of classroom discipline events. In

Table 4 Analysis of interactions between the study variables

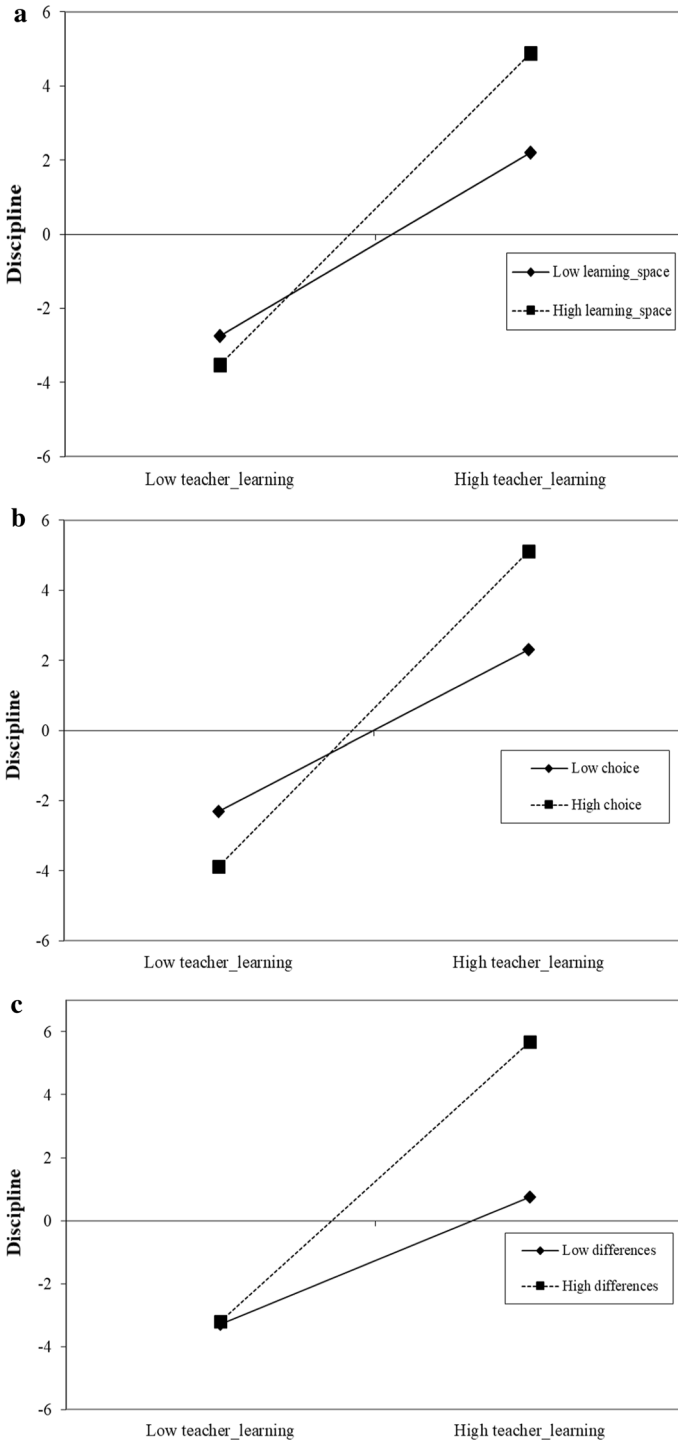| Variable	b	SE	β
Learning space (yes/no)	.96	.74	.06
Teacher-centered learning	.09	.01	.38**
Learning space * Teacher-centered learning	.05	.02	.10*
Tasks that encourage choice (yes/no)	.63	.75	.04
Teacher-centered learning	.09	.01	.39**
Tasks that encourage choice * Teacher-centered learning	.06	.02	.01*
Tasks that address learner differences (yes/no)	2.52	.72	.14**
Teacher-centered learning	.09	.009	.39**
Tasks that address learner differences * Teacher-centered learning	.06	.02	.14**

Fig. 3 **a** Learning space as a moderating variable **b** Tasks that encourage choice as a moderating variable **c** Tasks that address learners' differences as a moderating variable

the presence of these variables, the number of classroom discipline events rose with an increase in the expression of teacher-centered learning. In other words, an increase in student-centered learning results in a decrease in the number of discipline events. This finding can probably be explained by the level of engagement of learners in the lesson. This is in line with Imms and Byers (2017) who claimed that open-space learning, integrated with flexible furniture and visual and digital technologies, offers opportunities to enhance student learning experiences and engagement.

Implementing tasks that give students choices in the learning process also plays an important role. Kohn (1993) suggests that allowing students to make decisions about their own learning is a powerful tool for transforming passivity into student engagement. He claims that motivation increases and student misbehaviors decrease as students begin to see the learning activities as purposeful and essentially valuable. Moreover, designing learning activities to accommodate student differences in ability and attention span contributes to maintaining classroom stability and reducing misbehavior (Evertson & Harris, 1992; Lopes & Oliveria, 2017).

Conclusions

Analysis yielded a surprising result in the interactions between the moderating variables and the relationship between the rate of teacher-centered learning and the number of classroom discipline events. Higher expression of teacher-centered learning in an innovative learning space or in a learning environment in which learning tasks incorporate student choices, or which address learner differences, resulted in more discipline events compared with traditional learning or learning environments that include tasks that do not encourage choice or respond to differences between learners. The explanation for this finding could be related to the type of implementation of the pedagogical changes in the four schools included in the study. All students learned in both traditional and innovative environments throughout the week. This model of implementation is called the 'islands of innovation model' which, in contrast to the 'comprehensive innovation model', encompasses only part of the organization. This slower implementation approach usually leads to first-degree changes primarily involving changes in organizational characteristics and behaviors without significantly changing the organization's culture, norms, and basic assumptions (Argyris & Schon, 1978; Raz, 2006). Hence, this implementation model can create a 'pedagogical contradiction' during high expression of teacher-centered learning in the innovative spaces, leading to a degree of confusion among students and an increase in discipline events. Donnelly and Berry (2019) consider that, while traditional classrooms send a clear message to students regarding where to focus their attention and who is in charge, the innovative design of learning spaces raises many challenges for teachers and students.

Based on our research results, it is advisable to design learning spaces that naturally invite a variety of teaching and learning methods in continuous transition to reduce this pedagogical contradiction. Professional development of teachers is required for implementation of best pedagogical practices in innovative learning environments. Teachers need to be aware of the messages that these new environments send to their students and how they can impact on their classroom behavior to assist them in maximizing teaching and learning opportunities in these new spaces.

This study has several limitations. First, the focus was only on two dimensions of classroom management. There is a need for further research to expand the investigation and

include the personality dimension suggested by Martin and Baldwin (1993). In addition, the study used only quantitative tools and incorporating qualitative research tools could deepen understanding of the research issue.

Despite these limitations, there are theoretical and methodological contributions to this study. The study provides an in-depth understanding of relationships between the applications of several pedagogical practices and aspects of classroom management with an emphasis on the discipline component. The importance of this article is particularly evident in light of the worldwide trend in educational systems towards designing innovative learning spaces and implementing the principles of universal design for learning. Because the impact of these changes is only beginning to be explored, the study is important. Another important contribution is the further development of the observation tool to evaluate classroom management processes. The use of observation is currently undergoing expansion and experimentation, with the aim of providing both in-depth and broader information on classroom climate.

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