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Students' perceptions of classroom instructional environments in the context of 'Universal Design for Learning'

Michael M. Abell · Eunjoo Jung · Matthew Taylor

Abstract Using a sample of 867 students in Grades 5–12, the present study investigated whether students' perceptions toward the instructional environment in classrooms that employed Universal Design for Learning differed by school grade level and teacher gender. High-school students in the study showed higher perception scores than upper-elementary or middle-school students in the personalisation and participation aspect of the classroom environment. The results for teacher gender indicated that students in the study perceived a more personalised classroom environment with female teachers than with male teachers. Policy implications and methodological considerations are provided for future study.

Keywords Classroom environment · Universal design for learning

Introduction

Over the past two decades, researchers, policy makers and practitioners in the USA have been increasingly interested in the classroom instructional environment that influences students' learning processes (Biggs 1993, 1999; Craig 2007). Studies suggest that students' perceptions toward the classroom environment influence the way in which they actually learn. In studies on instructional environments, many researchers have explored the role of students' perceptions of the classroom environment in the context of grade level, teacher gender, and learning outcomes. For instance, studies have emphasised the importance of students' grade level in relation to classroom perceptions and learning. Numerous scholars support the view that students develop different perspectives of the classroom environment

M. M. Abell (✉) · E. Jung · M. Taylor
University of Louisville, College of Education and Human Development, Louisville, KY 40292, USA
e-mail: abell.mike@gmail.com

E. Jung
e-mail: ejung03@syr.edu

M. Taylor
e-mail: mptayl02@gwise.louisville.edu

as they progress through their school years (i.e. Byrne et al. 1986; Haertel et al. 1981). Teachers' gender is also an area of focus in relation to students' perceptions toward the classroom environment. Considering teacher gender as one aspect of the classroom instructional environment provides important perspectives. Students often develop different perceptions and learn differently depending on the gender of their teacher (i.e. Byrne et al. 1986; Klein 2004).

While there has been copious research that explores the relationship between students' perceptions in the context of grade level and teacher gender, there has never been a study of these variables in relation to Universal Design for Learning (UDL). This early study attempted to provide a springboard for further discussion of this important topic that is only now developing a research base.

UDL is a framework that guides the development of curricula and instructional practice based upon the needs of students (Hall et al. 2003; Meo 2008; Rose and Meyer 2002). According to Lieberman et al. (2008), "UDL creates access for all students to curriculum, eliminates barriers to learning and provides alternatives for methods of instruction, delivery of instruction materials and student responses" (p. 33). In building a collaborative approach to education, UDL is particularly relevant for students with special needs (McGuire et al. 2006). Unfortunately, all too often, students are unable to engage in the instructional process because of limitations placed on them by their disabilities, as well as by the curriculum itself. Given that UDL is particularly relevant for students with special needs (McGuire et al. 2006), the lack of research across other settings is regrettable and motivated this study.

To shed light on this important issue, we review research on: (1) UDL in the classroom context; (2) students' perceptions, grade level and teacher gender; and (3) classrooms employing UDL. By examining classroom instructional environments from the perspective of students, we can gain a better understanding of how they view their classroom activities, instruction and curriculum in the context of UDL.

UDL in the classroom context

Meo (2008) writes that, to meet the needs of diverse learners, the UDL framework serves as the basis for designing a curriculum in ways that offer students more control and personalisation through scaffolding difficult content or expressing what students have learned in different contextual forms. The principles of a UDL curriculum offer far-reaching supports to assist students and teachers in disciplines ranging from high-school social studies (Meo 2008), to college courses. In all these contexts, UDL principles embedded within curriculum materials can be used to support students' understanding of the content by bringing together these precepts. As such, UDL places an emphasis on instructional materials that are designed in a way that allows students, regardless of ability, to engage, interact and learn from them.

McGuire et al. (2006) propose a new paradigm that incorporates UDL principles into all measures used to assess accountability and educational progress. Such bold statements indeed suggest the significance of the principles and practices found in UDL. The President's Commission on Excellence in Special Education (2002) also encouraged educators and parents to examine the potential of UDL. The principles found in UDL offer new opportunities for improved inclusion of students with disabilities in the general curriculum, as well as new ways for all students including those who are gifted and talented to engage with the learning process.

But what tangible things does UDL directly offer the classroom instructional environment? Rose and Meyer (2002) postulate that UDL offers the classroom instructional environment new ways for students to engage in the instructional process through differentiated instructional practices and digitised instructional content. These materials offer built-in scaffolds and supports to assist all students regardless of their ability which ultimately supports personalised learning. According to Hall et al. (2003), UDL is defined as a theoretical framework that guides the development of curricula by publishers, as well as teachers, that meet the needs of all students. In that sense, UDL is more than just the development of a design framework, but rather it is a principle that encompasses a new philosophy. Such a philosophy offers new instructional resources and activities through flexible design and access to learning materials that have built in, as well as natural and appealing, learning supports.

Emphasis is placed on three core principles that guide UDL (Rose and Meyer 2002) materials and learning activities. First, *multiple means of representation* give learners various ways of acquiring information and knowledge. At the upper-elementary grades, this could take the form of 'big' books for better visual recognition coupled with an audio file (i.e. MP3) of the book that can be played individually during silent reading for those students needing support. At the middle-school level, it might take the form of short video clips pertinent to a story or content being studied while, at the high school-level, it could take the form of built-in scaffolds (i.e. audio files of text, intelligent assessment tools, text enlargement, on demand dictionaries, etc.) embedded within the students online textbook. Second, *multiple means of action and expression* provide learners with alternatives to demonstrate what they know. At the upper-elementary level, this could take the form of allowing students to act out their knowledge through role playing or dramatisation. At the middle-school level, it might take the form of students constructing digital collages (i.e. housed on Flickr) or short video clips that are narrated by the student and explain a concept or historical fact. At the high-school level, it could take the form of constructing a model or blog chronicling the assignment or end product. Third, *multiple means of engagement* tap into learners' interests, offer appropriate challenges and increase motivation. This allows the instructional content to be altered or adjusted by the students themselves to meet their own learning style, needs or challenges. At the upper-elementary through high-school, this principle centres on student choice by allowing them to participate authentically in the selection of their own assignments including those to be used for grading purposes. The principle is challenging and is aligned closely to project based-learning methods. This philosophy would promote the design of innovative instructional materials and ultimately channel learning in new ways to which students typically do not have easy access to now (Abell and Lewis 2005).

Students' perceptions, grade level and teacher gender

According to Eccles et al. (1984) and Simmons and Blyth (1987), once students reach early adolescence and middle school, they often perceive themselves as less academically competent while viewing school as less important or useful to future life. These perceptions all too often lead to lower academic achievement and higher rates of school failure. In the context of the instructional environment, student interest, choice and enjoyment decreased as grade level increased, which is consistent with other outcomes in early adolescents' attitudes when they enter and progress through middle school (Feldlaufer et al. 1989; Midgley et al. 1995). Interestingly, regarding student perceptions of the classroom instructional environment across grade levels, Gentry et al. (2002) noted that

female students consistently perceive their classroom activities to be more enjoyable than do male students. This line of research suggests that student views and perceptions influence student learning and need to be considered when designing effective educational practices and curriculum materials. Klein (2004) noted that a large portion of the variance in student achievement is due to teacher gender, though the overall influence of student gender is relatively small. There should be little doubt that teachers have a significant level of influence over their students just as the classroom environments influences their attitudes toward learning.

Borg and Falzon (1993) found that situational factors influence results as they pertain to teacher gender while they were investigating the achievement of students. In their study, results revealed that teacher gender significantly influenced students' overtly challenging behaviour. When Tatro (1995) studied the link between the teacher's gender and the grades that they were expected to award, it was found that the teacher's gender did significantly predict the expected grades of their students. Specifically, higher ratings were reported for female teachers who utilise investigative approaches. Teacher gender was also noted to have a relatively stronger association with students' perceptions than with student gender or class composition variables.

Student perceptions, grade level and teacher gender in classrooms employing UDL

UDL and Differentiated Instruction (DI) offer close parallels in relationship to their foundational components. Differentiated instruction is a teaching method that involves proactively planning varied approaches to what students need to learn and, at the right time, using the ways in which students are best able to express what they learn. This ultimately assists each student to learn at higher levels. Essentially, DI offers instructional approaches that are varied and can be adapted to diverse student needs (Tomlinson 2001, 2003). Similarly, there is an intersection between UDL and DI in that curriculum design increases flexibility in teaching and decreases the barriers that frequently limit student engagement with materials and learning in the classroom (Hall et al. 2003; Rose and Meyer 2002). Given the fact that this is the first study of its kind, examining the classroom environment in the context of UDL and DI and exploring relationships among student perceptions, grade levels and gender were deemed to be appropriate (Hall et al. 2003; Rose and Meyer 2002).

Differences in students' perceptions by grade level can offer teachers new insights into instruction and its impact at important transition points between grades, such as from middle to high school. For today's teachers, designing engaging lessons that better elicit student stories, opinions, beliefs and dreams is a catalyst for encouraging intrinsic motivation across student age groups. Research on students and teachers across grade and age levels point to a strong positive relationship between students' perceptions of teachers who honour and value students' voices and student motivation and achievement (Ginsberg 2005; McCombs 2003). When Byrne et al. (1986) measured the preferred classroom environment using a survey method among a sample of 1,675 students in Australia, they noted that Grade 11 students scored highest and Grade 9 lowest on preferred personalisation and participation, thus adding further support to the unmet need students have for personalised or differentiated instructional content, especially as they progress further in school and ultimately into senior-high school. Conversely, Way et al. (2007) found that middle-school students' perceptions of the level of teacher support and personalisation declined over their 3 years of middle school. Students' perceptions as they relate to teacher gender also provide insights that are important to instruction.

The challenge that teachers face when engaging students of different abilities, genders and ethnicities is substantial. The more prepared teachers are to meet a wide variety of student ability levels, either through DI or UDL, the more instructional impact they will have. Student characteristics such as ethnicity, socioeconomic, gender, culture, language and exceptionality with which teachers are faced could be better addressed through DI or UDL (Taylor and Whittaker 2003). For example, Meo (2008) examined the attributes of a UDL-aligned curriculum framework for regular and special-education high-school social-studies teachers. These curriculum materials offered differentiation that ultimately allowed more learners to benefit from and finally engage with their high-school social-studies content. A counter-argument is presented by Carrington et al. (2007) who found that the:

> …gender of teachers had little apparent effect on the academic motivation and engagement of either boys or girls. For the majority of the students, the gender of the teacher was largely immaterial. Students were found to value teachers, whether men or women, who were consistent and even-handed and supportive of them as learners. (p. 397)

Purpose of the study

The purpose of this study was to examine students' perception toward their instructional environment in classrooms exploring UDL. Given that no studies up to this point have examined the classroom instructional environment in the context of UDL, the Individualised Classroom Environment Questionnaire (ICEQ; Fraser 1990) was selected. The ICEQ was selected as the most appropriate published and validated tool for examining the instructional environment variables that align with UDL principles and associated variables. With the ICEQ, classroom instructional environment is examined using five variables: (1) personalisation; (2) student participation; (3) independence in decision making; (4) investigative problem solving; and (5) differentiation. These five classroom environmental variables align with the three core principles of UDL as mentioned earlier and therefore have the potential to provide insight into classrooms that strive to promote learning using new approaches such as UDL. The present study investigated whether students' instructional perceptions in a classroom aligned to UDL principles (i.e. using scaffolded interactive curricula, instructional personalisation, project-based learning, etc.) differ by school grade levels and teacher gender. The following research question guided the study:

Do student perceptions of the learning environment in classrooms employing a UDL framework differ according to:

- grade level (ranging from elementary to high-school grades)?
- teacher gender?

Method

Participants

The research questions were addressed using a sample of 867 students in Grades 5–12. A request for participation was sent to 176 school district Directors of Special Education explaining this opportunity to participate and providing instructions to share this opportunity with their school district principals. The request resulted in three schools being

selected to participate. These three school principals were then allowed to explain the opportunity and invite classroom teachers to participate on a voluntary basis. No participation requirements were placed on the minimum number of classrooms or subject areas. This ultimately resulted in a final count of 867 students across 3 schools encompassing 15 teachers.

Each participating student who took the survey provided his/her perceptions on the learning environment of his/her classroom. Of the student participants, approximately 10% were upper-elementary students (5th and 6th grades), approximately 81.4% were middle-school students (7, 8 and 9th grades) and 8.6% were high-school students (10, 11 and 12th grades). The participants provided their perceptions of their teachers and classroom instructional environments. Approximately 61% of the students described the classroom environment of a male teacher and approximately 39% described that of a female teacher. All of the teachers were experienced teachers with over 5 years of teaching experiences and two-thirds of the teachers had taught over 10 years.

Measures

Individualised Classroom Environment Questionnaire (ICEQ)

A revised version of the Individualised Classroom Environment Questionnaire (ICEQ) was administered to students to measure their perceptions on the classroom instructional environment in the context of UDL. Currently there are no instruments that specifically assess UDL factors. Given that, after an extensive review of available questionnaires was conducted, the ICEQ was chosen for its relatively close alignment to factors associated with UDL. The ICEQ was originally designed to measure secondary-school students' perceptions of the classroom environment and is divided into five classroom dimensions "which distinguish individualized classrooms from conventional ones" (Fraser 1990, p. 1). The five dimensions are (1) Personalisation: extent to which individual students are offered opportunities to interact with the teacher, (2) Participation: extent to which students are encouraged to participate, (3) Independence: extent to which students are allowed to make decisions and assume leadership, (4) Investigation: extent of development of inquiry-based skills, and (5) Differentiation: extent to which instruction is differentiated on the basis of ability, learning style, interests and rate of working. Because the ICEQ was not originally designed to measure UDL principles, some survey items were modified to reflect the component of UDL as described in detail below.

Development of the revised version of Individualised Classroom Environment Questionnaire (ICEQ–R)

The original survey consisted of 50 items that characterise students' perceptions of the classroom environment. The items were based on a five-point frequency scale ranging from 1 (Almost never) to 3 (Sometimes) to 5 (Very often). For the purpose of this study, some of the original items from the ICEQ were modified to capture more UDL-centric classroom principles and to extend the research base and further align instruments used to measure factors pertinent to UDL principles in applied classroom settings. To better align the ICEQ to the scope of this study, 15 items out of the original 50-item ICEQ were rephrased (Heining-Boynton 1990) as shown in Table 1.

It is important to understand the linkages that these questions have to UDL principles. Through these linkages, the study provided a more valid evaluation of how UDL influences

Table 1 Rephrasing of wording of items from Individualised Classroom Environment Questionnaire

Item no.	Original wording	Rephrased wording
1	Students discuss their work in class.	Students use technology to discuss their work in class.
2	Students find out the answers to questions from textbooks rather than from investigations.	Students find out the answers to questions from textbooks rather than from research.
3	Students choose their partners for group work.	Students chose the way they learn best to complete assignments (e.g. using technology, working independently, working with partners).
4	Students carry out investigations to test ideas.	Students carry out research to test ideas.
5	The teacher goes out of his/her way to help each student.	The teacher uses technology to individualise instruction.
6	Students find out the answers to questions and problems from the teacher rather than investigations.	Students find out the answers to questions and problems from the teacher rather than research.
7	The teacher lectures without students asking or answering questions.	The teacher lectures without the students asking or answering questions.
8	Students carry out investigations to answer questions coming from class discussions.	Students carry out research using a variety of sources (e.g. Internet, video, print materials).
9	The teacher remains at the front of the class rather than moving about and talking with students.	The teacher remains at the front of the classroom rather than moving about and talking with students.
10	Different students use different books, equipment and materials.	Different students use different books, or digital materials along with text reader software.
11	Students carry out investigations to answer questions which puzzle them.	Students carry out research using the Internet and other sources to answer questions which puzzle them.
12	The teacher tries to find out how each student wants to learn.	The teacher tries to find out what each student wants to learn.
13	Investigations are used to answer the teacher's questions.	Research is used to answer the teacher's questions.
14	The same teaching aid (i.e. blackboard or overhead projector) is used for all students in the class.	The same teaching aid (e.g. PowerPoint, Internet resources, computer, LCD projector) are used for all students in the class.
15	Students solve problems by obtaining information from the library.	Students solve problems by obtaining information from the Internet and other online resources.

students' perceptions of the classroom instructional environment. Some examples might include revised Items 5, 9, 12 and 13 that measure classroom Personalisation. Examples of Personalisation would include whether teachers' consider students' feelings, individualise assignments by utilising technology and work individually with students, all while considering how students learn best as specifically measured on the ICEQ. Personalisation is one of the key components of UDL in that all learning and instructional materials are able to be adjusted or scaffolded to meet the unique personal learning style of the student. This is represented by the term 'multiple means of representation' found in the principles of UDL. Another example might include revised Items 1, 2, 7 and 22 which measure Participation factors exhibited in the classroom. Examples of participation would include such qualities as teachers listening to students more than they lecture to them, students being

allowed to give their own opinions in class, and student ideas and suggestions being used during classroom discussions, which are measured by the ICEQ. These participation factors align with the UDL principle of offering students multiple means of engagement though participation in the instructional environment, regardless of ability, while utilising interactive instructional materials of high interest to the students. The altered questions thus attempt to begin the work needed to develop new or recalibrated classroom environment instruments to reflect the principles found in frameworks such as UDL.

To gauge student perceptions toward the classroom instructional environment, an exploratory factor analysis was conducted using the principal components method with varimax rotation and a Kaiser-Gutmann criterion for the 50 revised ICEQ items. At first, five factors for students' perceptions toward classroom environment with a Kaiser-Guttman criterion of an eigenvalue greater than 1.00 were extracted. The total variance explained by the five factors was 43% for students' perceptions toward classroom instructional environments. Because the general criterion of an eigenvalue greater than 1.00 could have resulted in a misjudgement of the most appropriate number of factors (Gorsuch 1983), a scree plot was carefully examined so that only factor loadings that exceeded 0.40 (Floyd and Widaman 1995) were retained. Therefore, 38 items out of the 50 items used were retained for the analyses. The rotated solutions yielded five interpretable factors for students' perceptions toward the classroom instructional environment in the UDL context. For Factor 1, of those 38 items, 14 items (Items 1, 21, 11, 26, 6, 37, 12, 17, 22, 41, 5, 36, 7 and 8) were grouped together through factor analysis. Cronbach's alpha coefficient was 0.88, suggesting that these items were a reliable measure of the concept. For Factor 2, eight items (Items 28, 43, 38, 18, 48, 33, 32 and 3) were grouped together. The alpha coefficient for Factor 2 was 0.81. Nine items (Items 29, 2, 16, 39, 49, 44, 14, 25 and 34) were grouped together for Factor 3. The alpha coefficient for Factor 3 was 0.82. Four items (Items 35, 20, 40 and 15) were grouped together for Factor 4. The alpha coefficient for Factor 4 was 0.59. Three items (Items 4, 19 and 31) were grouped together for Factor 5. The alpha coefficient for Factor 5 was 0.30.

However, these reliability coefficients for Factor 4 and Factor 5 were not acceptable to be included in the analyses (Vogt 2005). Therefore, after removing those 7 items for Factors 4 and 5, further factor analyses on the remaining 31 items were conducted. This time, employing the general criterion of an eigenvalue greater than 1.00 and examining the scree plot, three factors were extracted. After removing Items 36 and 41, which cross-loaded on all three factors, the 29 remaining items yielded three interpretable factors of students' perceptions toward classroom instructional environment in the UDL context. The total variance explained by these three factors was 44.4% for students' perceptions toward classroom instructional environments.

As shown in Table 2, Factor 1 was named Personalisation and consisted of 11 items (Items 1, 21, 26, 22, 6, 11, 12, 17, 37, 7 and 5). Cronbach's alpha coefficient was 0.86 suggesting that the new variable, Personalisation, was reliable. Factor 2 was named Investigation and comprised 10 items (Items 39, 49, 29, 44, 14, 2, 16, 25, 34 and 8). Its alpha coefficient was 0.83. Factor 3 was named Participation and consisted of 8 items (Items 28, 43, 38, 18, 48, 33, 3 and 23). The alpha coefficient for Factor 3 was 0.80.

This article reports findings for each of three factors separately below.

Procedures

The study was conducted in the spring of 2007 towards the end of the academic year. Thus, students had almost 1 year of experience in relation to the classroom instructional

Table 2 Sample items and factor loadings for three factors for students' perceptions of classroom environment

Sample items	Factor loadings		
	F 1	F 2	F 3
Factor 1: Personalisation			
Q1 The teacher considers students' feelings.	0.70		
Q21 The teacher is unfriendly to students.	0.74		
Factor 2: Investigation			
Q39 Students carry out investigations to answer questions which puzzle them.		0.76	
Q49 Students solve problems by obtaining information from the library.		0.73	
Factor 3: Participation			
Q28 Students are punished if they behave badly in class.			0.78
Q43 Students who break the rules get into trouble.			0.75

environments that they were describing. To collect data, the researchers provided teachers at each school with the URL to an online survey that measures students' perceptions of classroom instructional environments. The instructions for the electronic survey read: "You are rating what actually happens in this classroom. Please answer each question by selecting your response. How often does this *actually happen* in this classroom? If at any point you do not wish to complete the survey, you may click the 'stop survey' button." Those students who agreed to participate responded to the survey based on their experiences in the classroom instructional environment. Students were informed that their participation was voluntary, that all information would be held in confidence, and that there would be no penalty for not completing the survey. Students were directed not to provide their names to protect confidentiality. It was also stated that teachers would not see any survey responses.

A total of 1,186 students completed and submitted their survey. Among the survey responses, 867 student responses for 15 teachers (7 male teachers, 8 female teachers) representing the three schools remaining for final analysis. Student surveys were individually reviewed and only retained if all answers were completed on the student form. This resulted in 319 surveys being eliminated because of missing data.

Results

A series of one-way analyses of variance (ANOVA) was conducted to determine the statistical significance of any differences in students' perceptions of classroom instructional environments in the UDL context according to grade level or teacher gender.

The variable of students' grade level was first examined in relationship to students' perceptions of Personalisation, Investigation and Participation. For Personalisation, high-school students had significantly higher perception scores, $F(2, 864) = 17.66$, $p < 0.001$ ($M = 44.62$, $SD = 5.32$), than upper-elementary school students ($M = 38.30$, $SD = 8.96$) or middle-school students ($M = 39.21$, $SD = 7.73$).

For students' perceptions of Investigation, there was no significant difference among upper-elementary, middle-school or high-school students.

For students' perceptions towards Participation, high-school students had significantly higher scores, $F(2, 864) = 31.02$, $p < 0.001$ $M = 20.44$, $SD = 4.76$), than upper-elementary school students ($M = 17.91$, $SD = 5.02$) or middle-school students ($M = 17.52$, $SD = 5.40$).

Follow-up tests were conducted to evaluate pairwise differences among the grade-level groups. Because the test of homogeneity of variance was significant at the $p < 0.05$ level, the variances of three groups were assumed to be different. Therefore, we used the results of Dunnett's C test, a multiple comparison procedure that does not require the population variances to be equal. High-school students had significantly higher Personalisation scores than either upper-elementary or middle-school students. There were no significant differences between upper-elementary and middle-school students for Personalisation. There was a significant difference in the means among high-school, middle-school and upper-elementary students' perceptions of Participation. High-school students had significantly higher scores than either middle-school or upper-elementary students, and middle-school students had significantly higher scores than upper-elementary students.

The means and standard deviations for students' perception scores by students' grade level are reported in Table 3 and illustrated graphically in Figs. 1 and 2.

Next, the variable of teacher gender was examined in relation to students' perceptions of Personalisation, Investigation and Participation across all school levels. Students who

Table 3 Means and standard deviations for students' perception scores by students' grade level	Scale	Grade level	N	M	SD
	Personalisation	Upper elementary	88	38.30	8.96
		Middle school	706	39.21	7.73
		High school	73	44.62	5.32
	Investigation	Upper elementary	88	29.95	7.67
		Middle school	706	30.31	7.22
		High school	73	31.21	5.95
	Participation	Upper elementary	88	17.91	5.02
		Middle school	706	17.52	5.40
		High school	73	20.44	4.76
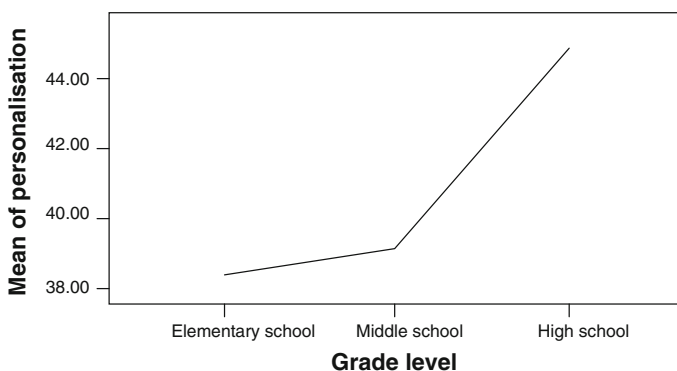
Fig. 1 Mean differences in Personalisation scores by grade level
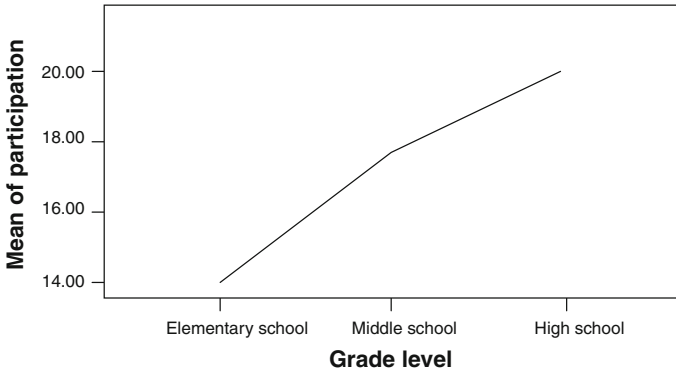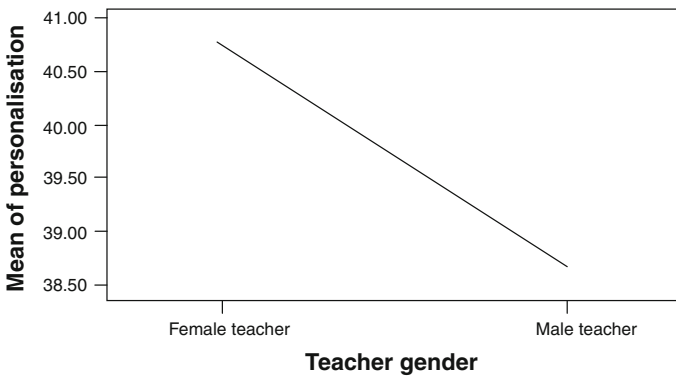
Fig. 2 Mean differences in Participation scores by grade level

Table 4 Means and standard deviations for students' perception scores by teacher gender

Scale	Teacher gender	N	M	SD
Personalisation	Female	336	40.83	6.92
	Male	531	38.73	8.28

N indicates the number of students who described the classroom instructional environment of either female or male teacher

Fig. 3 Mean differences in Personalisation scores by teacher gender

reported perceptions of the classroom instructional environments of female teachers overall had higher Personalisation scores ($M = 40.83$, $SD = 6.92$) than students reporting on male teachers ($M = 38.78$, $SD = 8.28$), with differences being statistically significant, $F(1, 865) = 14.24$, $p < 0.001$). However, the differences between teacher genders for Investigation and Participation were not statistically significant. The results are provided in Table 4 and Fig. 3.

Discussions/implications

The present study of whether students' perceptions of the instructional environment of classrooms aligned with UDL principles differed by school grade level and teacher gender had three important findings. First, high-school students had higher scores than upper-elementary or middle-school students for Personalisation, but there were no significant differences between upper-elementary and middle-school students' for Personalisation. Second, high-school students had significantly higher scores for Participation, while middle-school students had the lowest Participation scores. Third, students reported higher Personalisation scores for female teachers than for male teachers.

The finding that high-school students showed higher Personalisation scores than upper-elementary or middle-school students is important. As noted earlier, according to Eccles et al. (1984) and Simmons and Blyth (1987), once students reach early adolescence and middle school, they often perceive themselves as less competent academically, while viewing school as less important or useful for future life. By offering UDL-aligned instructional approaches and curriculum materials, senior-level students might begin to show more interest and engage more fully with curriculum materials that are relevant and comprehensible given their own learning style, ability and interests. This would also give students more opportunities for success with the rigorous academic requirements found at the senior high-school level. With more positive student perceptions of the classroom learning environment, high-school teachers also have improved opportunities to fully engage students, which is critical for achieving higher-order thinking skills. Our next finding was high-school students had significantly higher scores for class Participation. Because high-school students often view the classroom instructional environment as boring and non-engaging, this finding with high-school students is noteworthy. Enjoyment of something in school or the learning process itself is vital for school success. Elliot and Sheldon (1997) noted that enjoyment was a key variable that leads to goal attainment. Further research by Lee et al. (2003) and Remedios et al. (2000) confirmed that enjoyment and participation were intertwined with school engagement, which influenced overall school success. This gives further credence to the premise that UDL-aligned practices and materials show promise for students in upper grades for helping them to participate more fully, which ultimately enhances potential for school success. This is especially true for students nearing or in the senior-high school who might benefit from increased instructional participation as they prepare for post-secondary education. Middle-school students had the lowest class Participation scores, which warrants further study into why high-school students rate Participation more highly. UDL practices should theoretically offer benefits to students across all grade levels.

Finally, students reported higher Personalisation scores for female teachers. This supports the research by Klein (2004) who noted that a large portion of the variance in student achievement was attributable to teacher gender. This finding reinforces the claim made by Anderman and Midgley (1997) that teachers have a significant level of influence over their students. This suggests that generally female teachers do a better job personalising the instructional process. In regards to male teachers, these results could warrant further study to determine if more training and the use of specific UDL-aligned curriculum materials with engaging, interactive and scaffolded content could improve student perceptions of male teachers' personalisation of instruction. Future research should further examine (1) the roles that male and female teachers see for themselves within the instructional environment in terms of instructional personalisation, student participation and investigation, and instructional differentiation, and (2) what types of instructional personalisation

or nurturing might be occurring in classrooms of female and male teachers that could then be included in teacher training programs, especially preservice programs for male middle-school and high-school teachers.

As a method for improving authentic and engaging instruction for all students, UDL holds promise, but it warrants further study with more precise variables and measurement instruments. There is a need for validated instruments in addition to the ICEQ that can precisely measure components specifically aligned to UDL principles. New instruments such as these would benefit the research and practitioner community. Validated instruments would offer new tools for researchers to move the fledgling principles of UDL further into acceptance as another instructional framework. It would also provide practitioners in the field with new instruments for measuring and evaluating the classroom instructional environment. The classroom-based implementation of such instruments would offer researchers, teachers and administrators of K–12 schools new ways to measure and ultimately alter the environment based upon data-driven decision making (Fraser and Fisher 1986).

For educators to more fully understand the learning needs of students using a more personalised approach that UDL offers, more discussions need to occur. Specifically, for UDL to enter mainstream education practice, more instruments must be designed to measure its effectiveness across all of its dimensions. The personalisation of instruction through instructional grouping is one aspect warranting deeper examination through the use of validated instruments aligned to UDL principles. In one study, Bahr et al. (1991) investigated the effects of small grouping and teacher professional development on the use of computer-assisted instruction for improving reading. They found that homogeneously-grouped students showed significant reading improvement over heterogeneously grouped peers. This has implications for future research. In certain circumstances, students with similar abilities might work better together in groups than when left to their own accord or paired with others of varying ability levels.

This study offers a number of contributions to the field. It demonstrated that, in the context of an adapted classroom instructional environment questionnaire, aspects of UDL can begin to offer important information to help reshape instruction and how students perceive the instruction process itself. In particular, this study provided insight into the instructional environment that teachers must master to ultimately influence student learners in the context of classroom dimensions that include (1) Personalisation: extent to which individual students are offered opportunities to interact with the teacher, (2) Participation: extent to which students are encouraged to participate, (3) Independence: extent to which students are allowed to make decisions and assume leadership, (4) Investigation: extent of development of inquiry based skills, and (5) Differentiation: extent to which instruction is differentiated on the basis of ability, learning style, interests, and rate of working. This research, in turn, could offer preservice teacher educators with new insight into how to train beginning teachers to deliver instruction in the context of UDL. This then could impact the instructional environment in new ways by providing preservice training that captures issues identified in this study, as well as how new teachers can be made aware of and prepared for these issues before they enter the classroom. In particular, senior high-school students could be more engaged through UDL-aligned instructional practices, while younger age groups might not be to the same degree. As a secondary benefit, this study could also assist textbook and supplemental curriculum publishers in developing instructional materials that better engages the learner through differentiated as well as scaffolded digital content.

In conclusion, this research should also bring to light the value to high-quality research that assesses the all-important classroom instructional environment. High-quality instruction is the hallmark to higher-order learning. Teacher educators and beginning teachers themselves are in a constant search of ways to improve the learning environment. This can only be accomplished through further research and the development of validated instruments that can ultimately be used to measure the classroom instructional environment itself.

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