Investigating the Relationship Between Professional Development and Student-Centered Learning Environments in Qatari Math and Science Elementary Classrooms

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In late 2002, Qatar Law Decree No.37 established key elements of educational reform in Qatar schools including national curriculum standards; an emphasis on critical thinking through student-centered teaching; establishment of independent (charter) schools; standards-based assessment; use of English as the language of instruction in math and science, and extensive professional development for teachers. In the classroom, the reform provides "an emphasis on encouraging a spirit of inquiry and hands-on learning" (www.education.gov.qa) that is often referred to as student-centered teaching because students are involved in activities and discussions that promote students' deep conceptual learning, knowledge construction, and autonomy. In math, the standards incorporate a reasoning and problem solving strand that is different from the previous focus on drill, while in science the incorporation of an inquiry strand differentiates the new curriculum from the previous one (Education Institute, 2002). This emphasis requires a change in the very traditional classroom learning environment focused on recitation and memorization described in the analysis of the Qatar educational system prior to implementation of the reform (Brewer, Goldman, Augustine, Zellman, Ryan, Stasz, & Constant, 2006). For example, Standard 4, from the National Professional Standards for Teachers and School Leaders (Education Institute, 2007), highlights the skills and dispositions that teachers need in order to be able to implement the new standards in independent schools and establishes the type of learning environments that "engage all students in purposeful and intellectually challenging learning experiences, encourage constructive interactions among teachers and

students, and enable students to manage their own learning and behaviour" (p.25). The reform incorporates many aspects of current reform movements in other nations (Calderhead, 2001), and represents an important accomplishment for a small country that did not institute public schooling until 1951.

While considerable study of the organizational structures and outcomes of Qatari educational reform in *Education for a New Era* initiatives has been planned and implemented (see Rand, 2007), little attention has been placed on the study of what is occurring in the site where learning actually takes place – the classroom. Little research in Qatari or other Arab classrooms has been conducted to examine the relationship between the learning environment and either attainment of the student-centered standards or professional development related to standards or even to determine whether the classroom teaching and learning elements associated with student-centered learning environments exist (see e.g., Knight et al., 2011). Since the reform focuses on creating learning environments that foster attainment of the student-centered curriculum standards, research on classroom learning environments in schools targeted for reform provides valuable information. In particular, the role of professional development in creating appropriate learning environments needs to be investigated.

Theoretical Framework

The focus on student-centered classrooms implies that certain models of learning (Bransford, Brown & Cocking, 1999, 2000; Schunk & Zimmerman, 2008); pedagogical approaches (Grossman, 2005); and preservice and inservice professional development (Darling-Hammond, 2000; Hawley & Valli, 1999; Knight et al., 2011; Loucks-Horsley et al, 1998; Putnam & Borko, 2000) form the framework of the goals and activities of the Qatari reform.

The constructivist-based model emphasizes the importance of engaging initial understanding of learners before conceptual change is possible; the importance of a deep foundational knowledge that allows meaningful conceptual frameworks to develop; the need to define, implement, and monitor one's learning goals and strategies; effective use of technology; development of dispositions that encourage critical thinking and reflection; and the need for professional development based on current principles of teacher learning (Brown et al., 2000; Knight et al., 2011; Putnam & Borko, 2000). The *Education for a New Era* Qatari reform emphasis on student inquiry, critical thinking and problem solving requires that students participate actively in classroom activities designed to foster these outcomes and that they engage in self-regulation of motivation and strategy use to emerge as independent, life-long learners (see e.g., Schunk & Zimmerman, 2008). The movement away from rote memorization places tremendous pressure on students, who must assume responsibility for motivational and cognitive processes that underlie learning, and on teachers, who must provide the kinds of instructional strategies and assessment practices within a learning environment that fosters development of student self-regulation and participation (see e.g., Blumenfeld, Kempler, & Krajcik, 2006; Bransford, Brown, & Cocking, 1999, 2000; Donovan, Bransford, & Pellegrino, 2000; Knight et al, 2011).

Learning Environment in Student-Centered Classrooms

Over the past three decades, the study of the psychosocial elements of learning environments has revealed strong, positive relationships with a number of cognitive and affective outcomes (Fraser & Walberg, 1991; Fraser, 1999; 2007), particularly in science and mathematics classrooms (Fraser, 1994; 1998; Koul & Fisher, 2005; Nix, Fraser, & Ledbetter, 2005). Some evidence exists at the middle school level for the connection between elements of active

engagement in the learning environment and positive student outcomes (Jadullah & Pounder, 2009). While initially studies were conducted primarily in western countries, recent research has found similar patterns of findings in non-western countries (Aldridge & Fraser, 2000; Fraser 2007). Although very few learning environment studies have been conducted with Arab elementary students, findings from recent studies indicate that investigations of this type are an important contribution to the understanding of conditions related to positive classroom climate (Zedan, 2010).

Student Behaviors in Learner-Centered Classrooms

Student engagement has been studied extensively in the past as a precursor and predictor of student achievement (Brophy, 2000; Brophy & Good, 1986). However, current views of student active engagement reframe the notion of time-on-task in ways that connect it more closely to the disciplines that form the context for engagement. The recent National Research Council report, *Taking Science to School* (Duschl, Schweingruber, & Shouse, 2007) refers to "productive participation" (p.194) that goes beyond mere participation to participation in ways that facilitate disciplinary learning. Engle and Conant (2002) discriminate between engagement, disciplinary engagement, and productive disciplinary engagement. Consistent with previous research, engagement involves students in speaking, listening, and working while exhibiting high levels of persistence in on-task behaviors. While this is positive, it does not ensure that students are engaging meaningfully with certain content. On the other hand, "disciplinary engagement" expands our previous notion of engagement to include content and activities specifically related to a discipline such as science or math. Going one step further, "productive disciplinary engagement" specifies intellectual progress as a result of this engagement and is demonstrated by

change over time in “student investigations, complexity of argumentation, and use of previous investigations to generate new questions, new concepts, and new investigations” (Duschl et al,2007, p. 195). The change should be evident in the nature of discussions that students have with each other and with the teacher. This kind of engagement depends on the discipline, task, and topic being studied and is influenced by student characteristics (e.g., motivation and attitudes) as well as teacher behaviors and classroom environment. Although this is an area of increasing interest in classroom research, few studies of the conditions for productive student participation, particularly aspects of the learning environment that encourage this kind of student-centered engagement, have been conducted to date (Duschl et al, 2007; Knight et al, 2011). Of particular interest are the kinds of classroom processes, including the level of challenge of the curriculum and how students interact with the content, each other, and the teacher, in order to develop deep conceptual understanding.

Teacher Role in Student-Centered Classrooms

Because learning in schools is traditionally dominated and controlled by adults, it is not often that students make decisions about their own learning. Even though educational philosophies aim to produce graduating students who are responsible citizens capable of participating thoughtfully in society, our educational practices have a tendency to foster dependence, passivity and a "tell me what to do and think" attitude (Goodlad, 1984). In the student-centered classroom, instruction focuses on the student. Decision-making, organization, and content are largely determined by the student’s needs and perceptions and even assessment may be influenced or determined by the student. In the learner-centered classroom, the role of the teacher changes to a facilitator rather than a director. This shift in teacher instruction is

effective in helping students make progress in their academic achievement, social skills, and acceptance of diversity. Stuart (1997) suggests that a student-centered teaching technique helps teachers and instructional designers set up an effective instructional environment for every member of the classroom, regardless of the diverse learning needs of students. Although the idea of learner-centered teaching is not new, it is a challenging task since it requires the development of instructional practice and a curriculum that has as its focus student intellectual autonomy, motivation, persistence, and use of inquiry learning and problem-solving strategies. In a student-centered learning environment, the instructor provides support to students, demonstrates flexibility with curriculum choices without compromising learning goals, and utilizes a variety of assessments (Motschnig-Pitrik & Holzinger, 2002). Also, the teacher facilitates active engagement of students through discussion. In contrast to the traditional classroom characterized by the initiation, response, evaluation (IRE) discourse format, student-centered classrooms feature discussion among students with teacher facilitation rather than domination (Sawyer, 2006). Professional development to enable teachers to assume this complex role is critical to the success of reform focusing on student-centered teaching and learning.

Research Design

Two phases of research were implemented across the three years of the project. The first phase was primarily descriptive and involved initial development and adaptation of instruments for data collection; training of researchers and research assistants in the methodologies used in the study; determination of the schools, classrooms, and teachers for participation in the study; and implementation of the descriptive-correlational research component in selected sites. The research in the baseline phase 1) depicted the classroom instructional strategies implemented in

response to Qatari educational reform goals; 2) described the extent to which students in Qatari Independent elementary schools engaged in productive classroom participation and self-regulated learning; 3) determined teachers' and students' perceptions of reform elements; and 3) generated profiles of classrooms in higher- and lower-performing Qatari schools (Ikhlef & Knight, 2011; Knight et al, 2011; Knight, Parker, & Ikhlef, 2011). Systematic observation and surveys were used to describe teachers' and students' behaviors and perceptions.

A quasi-experimental design was employed for the second phase of the research which is the focus of this study. Findings from the first phase were used to inform implementation of the second phase. Professional development modules targeting improvement of student-centered instruction in classrooms were developed based on the initial baseline data. Three key variables in particular which were not evident in baseline findings focusing on the extent to which student-centered instruction was implemented were emphasized in the professional development modules: *Student-Centered Instruction*; *Real World Applications*, and *Differentiating Content and Strategies*. Schools from Phase I were asked to participate in the intensive two-week professional development seminar with half of those volunteering assigned to the professional development group and half assigned to the comparison group. Observations and surveys that were used in the baseline phase were implemented with participants at the beginning of the Fall 2009 semester prior to the Professional Development Seminar and then again at the end of the semester.

Research Questions

While some educators have questioned whether western theories can be successfully applied in non-western classrooms (Zedan, 2010), recent cross-cultural research in learning

environments and studies in Arab schools suggest otherwise (Aldridge & Fraser, 2000; Zedan, 2010). Therefore, additional investigation of learning environments, particularly in Arab school contexts implementing western theories, is warranted. The purpose of this study was to investigate differences in the learning environments of Qatari math and science classrooms at two levels: 1) in higher and lower performing Qatari schools implementing the recent *Education for a New Era* reform elements which focused on transforming traditional classroom environments into more student-centered, inquiry environments and 2) in classes of teachers who experienced the Professional Development Seminar and those who did not. More specifically, the research questions were:

1) What is the relationship between students' perceptions of the learning environment and observed features of the learning environment (student-centered teaching and learning) in math and science classes in Qatari Independent Elementary schools?

2) Are there differences in the math and science classroom learning environments in higher and lower performing Qatari elementary independent schools?

3) Are there differences in the learning environments in math and science classrooms of teachers who participated in the Professional Development Seminars and those who did not?

Methods

Participants

Participants for the first phase of research included teachers and students from a sample of randomly selected math and science classes in randomly selected independent elementary schools (See Knight et al., 2011). The study was confined to math and science classes since they were the focus of new curriculum standards that specified instruction be conducted in English in

math and science classrooms. Phase I data were collected in the Fall of 2008 in 17 schools randomly selected from 46 schools that comprised the first two cohorts established as independent schools by the Supreme Education Council. Each school in the baseline sample had implemented the Qatar standards for at least 3 years. Three to five third and fourth grade math and science classrooms were randomly selected from these schools for participation. The sample included 67 teachers and approximately 1150 students.

Participants for this study, which constitutes the second phase of the research project, included a subsample of teachers from the sample described in the previous paragraph. Only teachers from schools that had participated in the baseline study; had experienced the reform for three or more years; and had student achievement data available were invited to participate. A modified random assignment was then employed. All math and science teachers from Phase I who agreed to participation constituted the pool of teachers from which the Professional Development and Comparison teachers were selected. The sample consisted of 47 teachers and approximately 1000 students. For the comparison of teachers from high and low schools, 24 teachers and their students were in the higher-performing schools and 23 teachers and their students were in the lower-performing schools. For comparisons of teachers who received professional development and those who did not, 27 teachers and their students were included in the Professional Development group and 20 teachers were included in the Comparison group.

Professional Development Seminar

The Professional Development Seminar offered two weeks of intensive participation focused on activities in the three target areas: *Student-Centered Instruction*; *Real World Applications*, and *Differentiating Content and Strategies*. Teachers in this group were provided

with instruction on current best practice in each of the three areas and they actively participated in the same activities they would have their students do in their classrooms. They had the opportunity to observe and design lessons and discuss components of the lessons that supported or did not support student-centered instruction. During the Professional Development Seminar, school curriculum coordinators and the professional development seminar coordinator observed classroom lessons taught by the participants and encouraged reflective dialogue about lesson development, strategy use, and student learning.

Teachers included mathematics and science teachers in grades 3 and 4. An example of a mathematics lesson included the math skill of calculating the perimeter of a square or rectangle. As part of this lesson, students were to select a location on the school grounds and find the perimeter of that location. The variables were emphasized by connecting the concept of perimeter of a school location to everyday experiences of the students. Students were able to select the location, plan for materials needed, and explain the process used to determine perimeter. This created a more student-centered focus in the lesson not commonly found in previous recitation-oriented Qatari classrooms. Also, the tasks were slightly differentiated due to locations requiring slightly different processes for calculating perimeter. Examples of science lessons included identification of properties of metals and their uses and identification of habitats with a focus on the ocean and desert. The variables were emphasized by connecting to real world experiences of students with the uses of various metals in their surroundings and also the common habitats of ocean and desert in the region.

For both of the lessons, professional development providers had the teachers simulate the lesson as it would be practiced with students in their own classes. Teachers worked in small groups and experienced the flexibility in the lesson. In the metals lessons, they were able to

identify uses rather than select from a list and in the habitats lesson, they selected animals common to the ocean and desert. Professional development providers emphasized with the teachers how the structure of the lesson could become more student-centered by giving students choice.

Procedures

The extent to which interactions and activities in the classroom were student-centered was determined through observations using the Teacher Attributes Observation Protocol (TAOP; Fouts, Brown, & Thieman, 2002). Teachers were asked to conduct a 'typical' class on the observation day. While the observations do not provide an exhaustive profile of classroom interactions, they provide a snapshot of what is occurring on a given day in Qatari elementary math and science classrooms. For teachers in the Professional Development group, the observations provide evidence of whether teachers were able to translate the content of the Professional Development Seminars into classroom behaviors, but not necessarily whether they consistently did so.

The TAOP is a measure designed to capture constructivist approaches to teaching and has seven components consisting of 27 indicators. The seven components include student conceptual understanding, activities that encourage meaning through reflection, application of knowledge to real world contexts, student active participation and exploration, differentiation of content and strategies that build on the diverse experiences and characteristics that learners bring to the classroom, challenging curriculum to develop depth of understanding, and summative assessment that focuses on higher-order thinking. TAOP scales range from Not Observed (0) to Observed Very Often (4). Interrater reliability for the TAOP was .79 and internal consistency

reliability of the likert-type instrument was .93. Table 1 provides definitions of each of the scales and a sample item from the protocol.

Table 1: TAOP Scale Definitions and Sample Item

I. Scale Definitions

Conceptual Understanding
Student work shows evidence of conceptual understanding, not just recall.
Reflection
Students are engaged in activities to develop understanding and create personal meaning through reflection.
Real World Connection
Apply knowledge in real world contexts
Active Participation
Students are engaged in active participation, exploration and research.
Differentiation/Diverse Experiences
Students use diverse experiences to build effective learning.
Challenging Curriculum
Students are presented with a challenging curriculum designed to develop depth of understanding.
Assessment
Summative assessment allows students to exhibit higher order thinking and construct knowledge.

II. Sample Item (Conceptual Understanding Scale)

Response Scale

Not Observed	Very Little	Somewhat	Often	Very Often
0	1	2	3	4

I. Student work shows evidence of conceptual understanding, not just recall.

Students use appropriate methods and tools of the subject area to acquire and represent information.
text analysis, creative or expository writing, discussion, oral presentation, reading, interviews, desktop publishing, manipulatives, models,maps, timelines, calculators, primary sources, drawing, graphs, symbols

0	1	2	3	4

Students also responded to surveys to determine their perceptions of the learning environment. Students were administered the Individualized Classroom Environment Questionnaire (ICEQ; Fraser & Fisher, 1991;Spinner & Fraser,2002) which consists of 25 items in five scales: *Personalization, Participation, Independence, Involvement,* and *Differentiation*. Students indicated their agreement with statements about their classroom on a five point scale ranging from Strongly Disagree to Strongly Agree. Internal consistency reliability was .79. Table 2 provides a sample item for each scale.

Table 2: ICEQ Scales and Sample Items

Personalization	
The teacher cares about student feelings.	
Participation	
Students give their opinions during discussions.	
Independence	
The teacher decides how much movement and talk there should be in the classroom. (Reverse score)	
Involvement	
Students do investigations to test ideas	
Differentiation	
Different students use different books, tools, and materials.	

Results from the Qatar Comprehensive Educational Tests (QCET) which are administered in grades 4-6 each year were obtained for each school in math/science from reports of the Qatar Evaluation Institute (2009). Findings indicate the extent to which schools met the Qatar curriculum standards in 2009. For this analysis, sample schools in the top tier of the list were used to define higher-performing schools in comparison with schools in the bottom tier which were considered lower-performing. It should be noted that achievement results cannot be matched to our sample for individual class or student analysis. While the fourth grades in our sample were included in the test results, the third grade classrooms were not included since they

were not eligible for testing until the following year. Nevertheless, the achievement results provide an indication of overall school performance within the time frame of our study. The results yielded 9 schools in the top tier for Meets Standards and 8 schools in the bottom tier. However, some data are missing from schools in both groups.

Data were aggregated to the classroom level. Descriptive statistics were calculated for all variables overall, by school performance group, and by professional development group. Regression analyses were used to determine the relationship between student perceptions of classroom environment and observed classroom processes. Analyses of Variance (ANOVAs), Multivariate Analyses of Variance (MANOVAs), and t-tests, depending on the best fit with the characteristics of the data, were used to determine differences in observations of teacher and student classroom behaviors (observed classroom learning environment) and students' perceptions of their learning environments (perceived learning environment) by professional development group membership and school performance level.

Results

Descriptive and correlational statistics for observed teacher and student behaviors and students' perceptions of the learning environment and are presented in the following sections. Differences by type of school and professional development group are also discussed.

Relationship Between Observed and Perceived Learning Environment

To address the first research question concerning the relationship between students' perceptions of the learning environment and observed features of the learning environment,

descriptive statistics were calculated. Regression analysis was used to determine the relationship between perceptions and classroom processes.

Observed Learning Environment. The TAOP investigated the nature of the content of classroom instruction, activities, and materials including the depth of conceptual understanding elicited and the degree to which the curriculum was challenging for students. Constructs were measured using a scale of 0 (not observed) to 4 (observed very often).

The overall mean of the posttest indicated that the behaviors were observed between "Very Little" and "Somewhat", an improvement over the pretest with observations of behaviors "Not observed" or observed "Very little". Individual scales for the post ranged from "Very Little" to "Somewhat". *Challenging Curriculum* and *Conceptual Understanding,* followed by *Differentiation* of content and strategies and *Reflection* were observed more frequently than the other variables. *Real World Applications* was seen least often. There was a great deal of variation as indicated by the standard deviations.

Correlations between TAOP subscale scores were all positive. Correlations ranged in magnitude from $r = .085$ to .782 at the pretest and from $r = .482$ to .880 at the posttest. A comparison of the means showed that the average scores on each of the TAOP subscales increased from the pretest to the posttest as seen in Table 3. A MANOVA was run comparing teachers' mean TAOP subscales scores from the pre and posttests. The overall MANOVA was statistically significant: $F(7, 21) = 7.119$, $p<.001$, partial eta squared = .704. The Greenhouse-Geisser test statistic was used to compare the pre and posttest scores on each of the seven subscales. There was a statistically significant effect of time for all subscales: $F(1, 27)$ ranged from 15.210 to 37.142, all $p \leq .001$, partial eta squared ranged from .360 to .579.

It should be noted that the mean score overall was about three times higher than the baseline mean obtained during the first phase of the study (See Knight et al., 2011 for baseline study) and the individual scales were much higher as well. The results depict an emerging set of instructional strategies consistent with the direction of the educational reform in Qatar, but not yet realized.

Table 3. Teaching Attributes Observation Protocol: Pretest, Posttest, and Overall Means and Standard Deviations

TAOP Scales	**Pretest (n=47)**		**Posttest (n=38)**	
	Mean	**SD**	**Mean**	**SD**
TAOP Overall	.75	.41	1.58	.84
Conceptual Understanding	1.15	.64	1.96	.84
Reflection	.77	.55	1.62	.88
Real World Applications	.18	.31	.94	.77
Active Student Participation	.39	.38	1.24	.98
Differentiation	.79	.51	1.68	.99
Challenging Curriculum	1.13	.74	2.04	.96
Assessment	.79	.64	1.58	1.14

Scales range from 0 (Not Observed) to 4 (Observed Very Often)

Student Perceptions of Learning Environment. Students' perceptions of the student-centered classroom environment needed to facilitate development of self-regulation were somewhat mixed. For both the pre and post, students reported high degrees of *Personalization* and *Participation*, and to a lesser extent, *Investigation*. However, students' perceptions of their *Independence* and teachers' *Differentiation* of work and activities for different students were

considerably lower. The low level of perceived *Differentiation* is consistent with the results of the observation for this variable. However, there was not a significant difference overall between the two administrations administrations (repeated measures MANOVA F (5, 28) = 1.309, p = .289, partial eta squared = .189_); the unit of measurement was at the teacher level. There was a statistically significant effect for time for the Differentiation subscale. Using Greenhouse-Geisser, F (1, 32) = 6.684, p = .014, partial eta squared = .173. No other subscales showed statistical or practical significance.

Table 4.Individual Classroom Environment Questionnaire: Pre, Post, and Overall Means and Standard Deviations

ICEQ Scales	**Pretest (n=44)**		**Posttest (n=41)**	
	Mean	**SD**	**Mean**	**SD**
ICEQ Overall	3.21	.14	3.19	.17
Personalization	4.05	.29	4.07	.34
Participation	3.68	.28	3.71	.32
Independence	2.17	.38	2.16	.32
Investigation	3.39	.28	3.43	.26
Differentiation	2.78	.24	2.58	.34

Scales range from 1 (Strongly Disagree) to 5 (Strongly Agree)

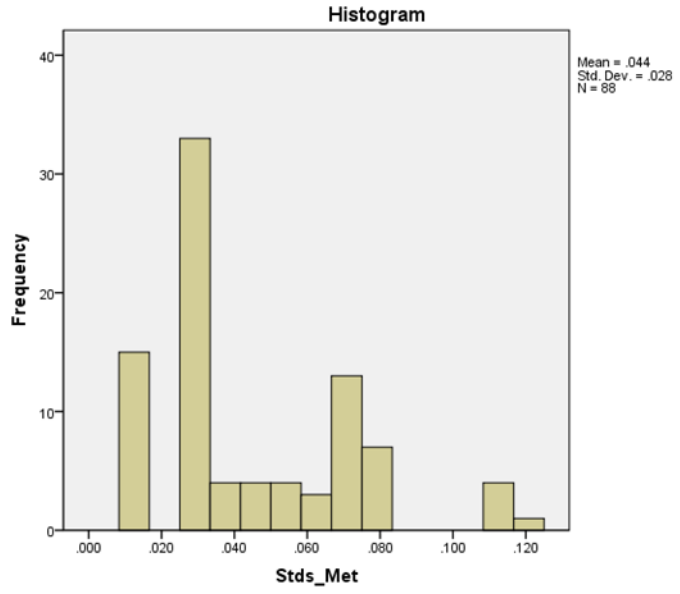
Relationship Between Observed and Perceived Environment. Regression analysis to examine the relationship between the post observed classroom processes (TAOP) and post students' perceptions of their learning environment (ICEQ) yielded a significant relationship (F(1,31) = 5.49; p=.026) and the R square was small to medium (Adjusted R2=.12). When considering individual scales of the learning environment in relation to observed classroom

processes, the variable *Personalization* was significantly related to teachers' classroom behaviors (F(1,31)=7.02; p=.013) with an adjusted R square of .16, a medium effect size. As the extent to which students perceived that teachers cared for them and personalized learning increased, observed student-centered teaching and learning behaviors also increased.

Differences by Higher- and Lower- Performing Schools

The second research question examines differences in observed and perceived classroom environment in higher- and lower-performing schools. However, it should be noted that overall achievement related to the curriculum standards is very low (See Qatar Evaluation Institute Report, 2009) even for higher-performing schools. The proportion of standards met by schools ranged from 1.65% to 11.91% for this sample and the proportion of science and math standards met ranged from 0% to 26.67% (an outlier in this sample).Without the outlier, the top percent of standards met in science and math was 8.49%. Figure 1 presents a histogram which depicts the lack of variance in the achievement measure.

Figure 1:



Observed learning environment. Table 5 provides the results of the descriptive analyses of higher-performing schools (HPS) and lower-performing schools (LPS) for the TAOP. No significant differences were found between higher- and lower-performing schools in terms of overall/composite TAOP for the pretest (t=.624, p=.54, *d* = .193 ;) or the posttest (t=-.342, p=.734,Cohen's *d* = .118). Findings indicated no differences by level of performance perhaps because performance in general was quite low as described in the previous section and observed behaviors related to the standards were also quite low. However, the direction of the mean differences in the TAOP (student-centered instruction) overall and for most of the scales was in favor of the HPS, despite initial mean differences in favor of LPS.

Table 5. Teaching Attributes Observation Protocol by Higher- and Lower Performing Schools

	Lower-Performing				**Higher-Performing**			
TAOP Scales	**Pre (n=23)**		**Post (n=15)**		**Pre (n=24)**		**Post (n=23)**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
TAOP Overall	.79	.42	1.52	.81	.71	.41	1.62	.87
Conceptual Understanding	1.20	.55	1.89	.89	1.09	.72	2.00	.82
Reflection	.79	.56	1.56	.71	.74	.55	1.66	.98
Real World Applications	.26	.36	.80	.74	.12	.24	1.03	.78
Active Student Participation	.50	.42	1.18	.98	.27	.30	1.28	1.00
Differentiation	.86	.53	1.64	.92	.74	.49	1.70	1.07
Challenging Curriculum	1.17	.83	2.03	1.03	1.09	.65	2.04	.94
Assessment	.70	.56	1.53	1.19	.89	.71	1.61	1.14

Scales range from 0 (Not Observed) to 4 (Observed Very Often)

Students' perceptions of learning environment. Table 6 presents the means and standard deviations of the ICEQ survey administered to students to determine differences in perceptions of learning environment in Higher- and Lower-Performing Schools. MANOVA results indicated no differences by school performance ($F(1,31)=.80$; $p=.56$). As previously indicated, the low performance and low variance in performance may have impacted the findings.

Table 6. ICEQ Scales by Higher- and Lower-Performing Schools

ICEQ Scales	**Lower-Performing**				**Higher-Performing**			
	Pre (n=23)		**Post (n=15)**		**Pre (n=24)**		**Post (n=23)**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
ICEQ Overall	3.20	.12	3.18	.15	3.23	.16	3.20	.18
Personalization	4.06	.20	4.04	.35	4.04	.37	4.09	.35
Participation	3.66	.31	3.68	.34	3.71	.24	3.72	.32
Independence	2.10	.31	2.17	.28	2.24	.44	2.15	.35
Investigation	3.36	.24	3.38	.24	3.43	.32	3.46	.28
Differentiation	2.79	.26	2.61	.30	2.76	.22	2.56	.37

Scales range from 1 (Strongly Disagree) to 5 (Strongly Agree)

Differences by Professional Development Group Membership

The third research question examined differences in observed and perceived classroom environment between classes of teachers who participated in the professional development seminars and those who did not. As previously noted, the seminars focused on three variables identified as low in the baseline data (Knight et al, 2011): Student-centered teaching, Real world application, and Differentiation of content and strategies. Student-centered teaching behaviors were captured by the overall scores of the TAOP and ICEQ, while Real world applications and Differentiation could be gauged by individual scales on the instruments.

Observed learning environment. Student-centered teaching and learning behaviors using the TAOP were examined by professional development group membership. The overall mean of the TAOP was higher for the teachers who participated in the professional development seminars but there were no significant statistical differences between the two groups (F (1, 36)=.914; p=.35; eta2=.025), possibly due to the low power for the analysis (.15) and the fact that both groups increased the means for all variables from pre to post. Means of all the subscales were in favor of the professional development group with the exception of *Assessment,* which was higher for the Comparison teachers for both the pre and posttests, although both groups increased.

Table 7. Teaching Attributes Observation Protocol by Professional Development Group Membership

	PD Group				**Comparison Group**			
TAOP Scales	**Pre (n=27)**		**Post (n=21)**		**Pre (n=20)**		**Post (n=17)**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
TAOP Overall	.82	.44	1.70	.76	.66	.37	1.43	.92
Conceptual Understanding	1.30	.68	2.11	.85	.93	.51	1.78	.83

Reflection	.81	.61	1.74	.69	.71	.46	1.47	1.07
Real World Applications	.23	.36	1.03	.80	.12	.21	.82	.72
Active Student Participation	.49	.36	1.44	.85	.25	.36	1.00	1.10
Differentiation	.79	.52	1.84	.82	.80	.50	1.47	1.18
Challenging Curriculum	1.21	.78	2.24	.82	1.03	.70	1.79	1.09
Assessment	.74	.66	1.48	1.20	.87	.62	1.71	1.09

Student perceptions of learning environment. Table 8 presents the means and standard deviations of the ICEQ survey administered to students to determine differences in perceptions of learning environment between teachers who experienced the professional development and those who did not. As previously indicated, there were no differences by pre and post (Manova $F(1,31)=.679$; $p=.61$). There were significant differences however by group membership ((Manova $F(1,31)=5.95$; $p<.0001$) for all variables and by the interaction of time and group membership (Manova $F(1,31)=.6.38$; $p<.0001$) for *Personalization*, *Participation*, and *Independence.* Given, the significant interaction, only these three variables will be considered for comparison. In each case, the Professional Development group significantly increased from pre to post while the Comparison group decreased. These should be interpreted cautiously, however, since the partial eta squared values were low (.002-.005).

Table 8. ICEQ Scales by Professional Development Group Membership

	PD Group				Comparison Group			
ICEQ Scales	**Pre (n=25)**		**Post (n=24)**		**Pre (n=19)**		**Post (n=17)**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
ICEQ Overall	3.20	.14	3.22	.14	3.23	.14	3.14	.19
Personalization	4.05	.35	4.12	.30	4.06	.19	4.00	.40
Participation	3.70	.29	3.79	.30	3.66	.27	3.58	.33
Independence	2.08	.32	2.13	.29	2.28	.43	2.20	.36
Investigation	3.45	.33	3.46	.26	3.32	.17	3.39	.28
Differentiation	2.72	.24	2.61	.34	2.85	.22	2.54	.34

Scales range from 1 (Strongly Disagree) to 5 (Strongly Agree)

Discussion

The findings from this study have implications for the implementation of reform and professional development in Qatar and in general. Overall, results from observed learning environment, perceived learning environment, and student assessment of standards in this study suggest that the reforms related to student-centered instruction in Qatar are not yet in place and unlikely at this point to foster student self-regulation as discussed in the theoretical framework. Students experienced low independence and little real world application in their learning environments as well as low success on assessments of standards mastery. These outcomes run counter to the autonomy, relatedness, and competence needed to nurture the inner resources necessary for motivation and self-regulation (Reeve, Ryan, Deci, & Jang, 2008). Studies

indicate that students' positive perceptions of autonomy - not present to a great extent in this study - lead to increased learning (Zimmerman & Schunk, 2008). Furthermore, engagement with challenging curriculum, which can foster spontaneous use of self-regulation strategies (Lens & Vansteenkiste, 2008), was observed infrequently. It is not surprising that the standardized tests which assessed progress on student-centered learning goals indicated low levels of mastery and little progress. Unfortunately, the lack of variance in standards achievement makes it difficult to determine any performance patterns related to students perceptions and teacher behaviors.

Findings, however, may be related to limitations of the study. Although the schools were randomly drawn from eligible schools, mitigating possibility of bias, not all math and science classrooms in each school were observed due to considerable absenteeism of teachers. In addition, some schools were unable to be observed due to scheduling problems. Scheduling observations was a major challenge during the study due to widespread uncertainties and last-minute changes that appear to be common in Qatari elementary schools, but are very disruptive to teaching and learning. In addition, the length of the observation may not have captured the teaching and learning in the class to the extent needed, even if there were no problems with the schedule. However, the fact that multiple data sources - observations, self-reports, and test performance - support similar findings suggests that the shortcomings presented above probably were not responsible for the negative findings. In addition, a subsequent needs assessment study that found a similar lack of implementation of reform elements in both Qatari elementary and secondary classrooms (State of Texas Educational Research Center, 2011) reinforces the findings.

Another possibility, and one that has been common in the U.S., is that the climate of testing, and/or the nature of the test, implemented to evaluate the curricular reform may not be

consistent with the actual standards. Teaching to the test, particularly if the test is more oriented to basic skills, often works against more student-centered approaches. Traditional direct instruction has been successful in raising standardized test scores (Good & Brophy, 2000) and teachers may revert to this model at the expense of more student-centered instruction.

Another explanation is that the instructional behaviors related to student-centered inquiry teaching and standards are emerging and have not yet been implemented to the extent that we can see a relationship between achievement and instruction. Both observations and student outcomes indicate low levels of standards implementation. Teachers and students may not yet have acquired and practiced the actual skills needed to implement student-centered instruction and impact student achievement. Actual change in performance may lag behind changes in teacher and student dispositions due to the pressures that this approach places on students and teachers (See e.g., Boekarts, 1999; Schunk & Zimmerman, 2008). Anecdotal information provides support for this possibility. During one observation, field notes indicated that a particular teacher would turn to the observer frequently and give the 'label' for the instruction she was providing (e.g., "this is tying the content to student lives"). However, in most cases the observer noted that the example was either incorrect or of low quality. The lag between recognizing and implementing standards-based instructional activities may require considerable professional development and extensive coaching.

The lag between acquisition of dispositions for student-centeredness and performance may also be due to a cultural and/or linguistic mismatch between the curricula adopted and Qatari students and teachers. Other researchers and educators have noted difficulties in importing Western-influenced reform elements into Gulf Arab countries in particular (Ahmad, 2011; Shah & Baporikar, 2011). In a study targeting school administrators' perceptions of the

licensure process and the professional standards for teachers in Qatar, researchers found that over 70% of respondents thought that the imported process had been adopted top-down rather than adapted for Qatari culture and half of the respondents thought that it was not applicable to the local context (Ellili-Cherif, Romanowski, & Nasser, 2012). The authors of the study noted that in the traditional Qatari system successful learners were those that could reproduce knowledge verbatim on tests and assessments and that classroom critical thinking activities required by the reform frustrated educators who desired one 'correct' answer for problems (Ellili-Cherif, Romanowski, & Nasser, 2012). This may be the case for both teachers and students. The imported curriculum may lack the sociocultural relevancy or relatedness needed for the development of motivation and self-regulation on the part of students.

Since much of the student-centered emphasis specified by Qatari reform requires active discussion among students and the teacher, lack of English proficiency of teachers and students may hinder efforts. A needs assessment of professional development conducted by the State of Texas Educational Research Center and Qatar University College of Education researchers found a problem with the use of English in classroom instruction at all levels of Qatari schools (State of Texas Educational Research Center, 2011). Results of observations as well as interviews and surveys of teachers and administrators revealed the need for more professional development in ESL as well as more culturally sensitive materials aligned to the Qatari standards.

Professional development in general to support teachers has not been lacking. As a result of the reform initiative, Qatar invested considerable effort in professional development (Haydar, 2005; McNiff, 2010; Nasser & Romanowski, 2011) for teachers in independent schools. While teachers have experienced many professional development workshops, they indicate that the

workshops need to be more practical and hands-on with subsequent follow-up in order to enable them to implement the reform elements (State of Texas Educational Research Center, 2011).

Some cause for optimism exists in the significant improvement of observed behaviors from pre to post in the current study. Improvement of both the groups in implementation of student-centered instruction is likely due in part to the professional development provided to support the reform, although this is difficult to determine given variations in implementation of professional development both within and across schools. Therefore, the various impacts of the professional development implemented in the current study and that implemented by Qatari initiatives on classroom environment and behaviors are not clear. The professional development model in this study was more hands-on, but may have lacked the duration and follow-up suggested by teachers. The interaction effects that demonstrated that the perceptions of students of teachers who had the additional professional development provided in this study increased significantly for three key student-centered environment variables (personalization, participation, and independence), while perceptions decreased significantly for students of comparison teachers, perhaps reflects the more targeted and intensive nature of the seminars. More time might have been needed to produce a significant change in behaviors.

The study also provided some evidence for increased focus on an important learning environment variable in the move to more student-centered classrooms. *Personalization*, students' perceptions of the extent to which teachers care about their opinions and feelings and relate learning to students, increased for the PD group and decreased for comparison teachers. Since *Personalization* was related to teachers' observed student-centered instructional behaviors overall, additional study of this variable may be informative.

Summary

While the results of this study may be disappointing to educators and reformers focused on implementation of the ambitious reform agenda, findings provide some basis for optimism and direction for improvement. All teachers showed statistically significant improvement in student-centered instruction over time, even though it remained low, which supports the notion of emerging skills discussed in the previous section. Furthermore, although differences between instructional behaviors of teachers who participated in a relatively brief professional development seminar and those who did not were not significantly different, student perceptions of three key student-centered environment elements emerged as different. Professional development may initially make a difference in the perceived climate of the classroom. In classes without targeted professional development, students perceived that Qatari teachers provided less attention to key student-centered environment elements.

The present study is important because it focuses on manipulable classroom environment variables and examines relationships between perceived and observed environment. Next steps for research might include examination of the measures used to gauge progress to insure a match between standards and assessment of the standards; identification and case studies of classrooms that are making progress with the goal of providing models that can assist teachers and administrators in implementation of the standards; and targeted professional development that goes beyond general awareness of appropriate student-centered instructional strategies and includes intensive practice and coaching with feedback (See e.g., Hawley & Valli, 1999).

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