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Perceptions of pre-service teachers on the design of a learning environment based on the seven principles of good practice

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Abstract This study explored the perceptions of 88 pre-service teachers on the design of a learning environment using the Seven Principles of Good Practice and its effect on participants' abilities to create their Cloud Learning Environment (CLE). In designing the learning environment, a conceptual model under the name 7 Principles and Integrated Learning Design (7P–ILD) was created. The 7P–ILD model was developed based on Chickering and Gamson's Seven Principles of Good Practice, cloud tools, and selected strategies. A survey design was used and two instruments were administered to all participants. The findings indicated the 7P–ILD positively influenced participants' ability to confidently build their CLE. Participants were most satisfied with 7P–ILD related to the principle student-faculty contact, and least satisfied with the principle time-on-task. Pre-service teachers' perceptions did not differ by type of project (individual or collaborative); however, there was a significant difference between kindergarten and elementary pre-service teachers regarding time- on- task principle and high expectations principle. These results suggest the 7P–ILD can be a practical model to adopt for teacher preparation and with more research and modifications; it could become an emerging model for building more robust and effective learning environments where teacher autonomy and technology is enhanced.

Keywords Cloud learning environments · Good practice · Web 2.0 technologies · Teacher education

1 Introduction

Teaching and learning at the higher education levels is facing many challenges especially the ability to keep students engaged and motivated as well as to ensure what

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is learnt is applied (Johnson et al. 2016). Among the many reasons for this, one that stands out is the fact that students are more digitally oriented as compared to the instructors (Prensky 2010). To counter this imbalance, instructors need to increase their digital abilities as well as improve the pedagogical design of their courses. Chickering and Gamson's Seven Principles of Good Practice (1987) have extensively been used by instructors and have resulted in positive results and effects on learners (Cakir and Delialioglu 2009; Panther Bishoff 2010 and Zhang and Walls 2006). The current study was conducted using Chickering and Gamson's Seven Principles of Good Practice to design a learning environment and to explore its effect on the perceptions of pre-service teachers and eventually how this effect translated into their abilities to create their web-based Cloud Learning Environment (CLE). The design of the learning environment was developed as a model based on the following seven principles, namely: encourage student-faculty contact, encourage cooperation among students, encourage active learning, give prompt feedback, emphasize time on task, communicate high expectations, and respect diverse talents and ways of learning vis-à-vis technology tools and selected strategies and tasks. The model was launched under the name 7 Principles and Integrated Learning Design (7P–ILD) (see Fig. 1). It was important that the participants in this study build their projects in a cloud learning environment as this is the future of learning, whereby use of cloud services will not only allow future teachers to cut down the cost of technology, but also enable teachers to easily share and improve their work since the web-based cloud environment allows for such possibilities. Thomas (2012) and Mikroyannidis (2012) say that the CLE enables students and teachers to design, produce, collaborate, and publish more productively. Studies conducted by Rahimi et al. (2015) showed that as educational institutions are actively adopting new technologies to improve student learning and to meet the needs of today's students, educators' interests have shifted towards cloud computing technology. The CLE provides easy and affordable access to numerous resources for teaching and learning and examples of CLE include the use of *Google's Suite of Tools*, such as *Google Sites* and *Google Apps*.

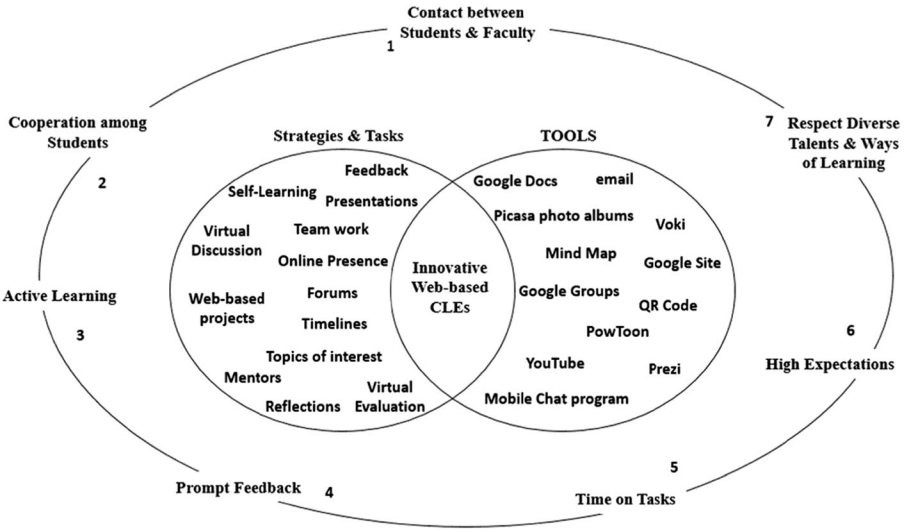

Fig. 1 7P–ILD based of the seven principles of good practice

2 Problem statement

The purpose of this study was to explore the perceptions of pre-service teachers on the 7P–ILD and its effect on the abilities of pre-service teachers to effectively create their cloud learning environments. The study was conducted to close some obvious gaps related to effective design of learning that were traced through a recent research study conducted by the National Centre for Education Development (NCED) in Kuwait in collaboration with the National Institute of Education (NIE) Singapore (2013). The major gap identified was that although the Kuwait Ministry of Education (MOE) is ready to provide ICT use in teaching and learning, however the current ICT use is not as pervasive as desired and is below expectations. Another gap identified was that the majority of MOE officers gave low ratings for the quality of Kuwait's teacher preparation programs and the quality of teachers graduating from these programs. The research study emphasized the following steps to be taken: "…MOE mounts instructional design professional development courses for teachers to improve on their pedagogical skills through the use of ICT" (National Centre for Education Development 2013, p. 82). As such, it can be said that the MOE (Kuwait) reiterated the importance of sound design principles into the teaching and learning process. There are various ways to enhance the professional development of teachers, which amongst others include a direct intervention of a planned program. The method employed in this study was two-fold, one; planning the whole instructional approach using the seven principles of good design and two, having participants create their web-based projects in a cloud-learning environment modelling the design of the environment. In such a manner, the participants learnt implicitly about good design and created web-based designs that replicated such best practices. The expert student approach was used whereby the different tools that were needed to create the projects were self- taught and peer mentored as there were ample resources in the world-wide web to assist participants in their learning journeys. Inadvertently, this builds participant independence, peer-support, participant confidence and satisfaction in the use and application of technologies in an instructionally rich environment.

3 Research questions

The following research questions guided the study:

1. What were pre-service teachers' perceptions of the 7P–ILD which was developed based on the Seven Principles of Good Practice?
2. Were there significant differences in the pre-service teachers' perceptions about the 7P–ILD for type of project (individual or collaborative) and type of educational program in which they were enrolled (kindergarten, elementary, and intermediate/secondary)?

4 Literature review

The design and development of a learning environment in higher education requires initiating change in the teaching and learning process. The design of an effective learning environment has the potential to play an important role in the development and emergence

of new pedagogies, where shifting control from teacher-centered to student-centered designs is increasingly important. This shift towards the new pedagogies obligates teacher education institutions to equip future teachers with the necessary skills and tools to meet the demands of the changing workforce and knowledge economy. Education is not just learning, it is becoming the 'good, capable, world-improving person' (Prensky 2014, p. 1).

4.1 The seven principles of good practice

Chickering and Gamson (1987) developed the *Seven Principles of Good Practice* to address a paradigm change in students' role from passive receptors to active learners. The seven principles of good practice are: (1) encourage student–faculty contact, (2) encourage cooperation among students, (3) encourage active learning, (4) give prompt feedback, (5) emphasize time on task, (6) communicate high expectations, and (7) respect diverse talents and ways of learning. These principles were originally developed for implementation in traditional classroom settings. However, recent research found that these principles are useful in designing and evaluating the effectiveness of technology-enhanced classroom environments (McCabe and Meuter 2011). The intensive role of information and communication technology in higher education resulted in the following response from Chickering and Ehrmann (1996): 'If the power of the new technologies is to be fully realized, they should be employed in ways consistent with the seven principles' (p. 1). The seven principles are explained in further detail in the next few paragraphs.

The first principle is to encourage student–faculty contact. The contact between students and faculty reflects the instructor's concern for students' communication processes, which is a vital factor for maintaining student involvement in learning (Chickering and Gamson 1987). The implementation of this principle for effective teaching could be accomplished through setting clear guidelines for the type of communication with students. This can include specifying timelines for students to complete required tasks that facilitate fruitful interaction (Graham et al. 2001).

The second principle is cooperation among students. This principle represents the collaborative and social nature of learning among students. This also reflects the subsequent sharing of ideas as well as the student reflections that promote deeper understanding (Chickering and Gamson 1987). The fulfillment of this principle can be accomplished by stimulating effective cooperation among students through well-designed focused tasks, such as the creation of collaborative videos, concept maps, presentations, and project proposals (Graham et al. 2001). Bourke (2010) examined cooperation among students in a social constructivist learning environment that was based on the seven principles of good practice (Chickering and Gamson 1987). Specifically, Bourke sought to determine which method of cooperation (team construction, weekly group chat, chat room assignments, and scheduled time meetings) resulted in the greatest overall satisfaction. The results revealed that many students felt frustrated when they were grouped with other students who did not plan ahead of time. Therefore, the findings of the study suggest that using forums for individual contributions is preferred over group-oriented assignments. In the current study discussion forums were implemented to maintain the social constructivist design. In support of the two above-noted principles, Liu et al. (2012) stated that class communication can be set at different levels during the implementation of a CLE. Specifically, the communication can be set to the whole class, groups within the class, or between the instructor and an individual student.

The third principle, active learning, is about engaging students in the learning process in a meaningful way. To fulfill this principle, students can do a variety of tasks. For instance, they can produce projects; conduct a discussion with peers and instructors; and read critically, analyze, and reflect on their experiences. The fourth principle is providing prompt feedback. This principle represents the frequent and immediate feedback that guides students in their learning that in turn provides opportunities for improvement. Students can be given two types of feedback: information feedback and acknowledgment feedback. Information feedback provides an evaluation of tasks or questions; acknowledgement feedback provides a response to an event, such as receiving certain assignments (Graham et al. 2001).

The fifth principle, time on task, facilitates effective learning for students and effective teaching for instructors (Checkering and Gamson, 1987). Regularly distributed deadlines encourage students to organize their time according to the required tasks and provides a context for regular interaction with the instructor and the project teams (Graham et al. 2001). The sixth principle, high expectations, is related to the instructor's role in communicating high expectations for students' performance; these high expectations become self-fulfilling through the effort they give (Chickering and Gamson 1987). Instructors should design challenging assignments, provide examples for students to follow, explain the expectations of the included activities, and praise publicly the outstanding work provided by students to comply with this principle (Graham et al. 2001). The seventh and final principle is to respect diverse talents and ways of learning. This occurs when a variety of learning resources are provided to students and they are allowed to choose topics for their own projects. This facilitates the incorporation of diverse views, as well as the encouragement of the creation of innovative artifacts using a variety of pedagogical strategies and tools.

The *Seven Principles of Good Practice* (Chickering and Gamson 1987) is one of the best-known frameworks of research-based instructional practices for designing constructivist learning environments. Based on its popularity, this framework has been used to design and evaluate the learning environment in traditional face-to-face courses as well as online courses. Higher education research has revealed that this framework assists faculty members examine and improve their teaching (Graham et al. 2001). Therefore, many studies have been conducted on higher education students utilizing this framework at the university and college level; these studies have been conducted to investigate the effectiveness of online teaching environments and how to improve teaching and student learning. Babb et al. (2012) conducted a study applying the *Seven Principles of Good Practice* (Chickering and Gamson 1987) to evaluate the design and delivery of a hybrid course. They administered surveys to 75 university students. The researchers found students' satisfaction and performance were positively affected by the benchmarks; this was especially true for active learning, student–student interaction, professor feedback, and communication of high expectations for students. Similarly, Vaughan et al. (2012) investigated the effects of a blended approach utilizing the *Seven Principles of Effective Teaching* in a study focused on fostering 300 university students' engagement and success. The participants indicated that the approach was the key to academic success. Furthermore, Bangert (2006)

evaluated the effectiveness of online teaching strategies via Chickering and Gamson's (1999) *Seven Principles of Effective Teaching*. Their investigation yielded four interpretable factors: student–faculty interaction, active learning, time on task, and cooperation among students. In addition, Byers (2002) utilized Chickering and Gamson's (1987) framework to design a web-based learning environment for a university course. The use of the framework enabled the researcher/instructor to improve the course during the implementation process, and provided a firm base for further improvements.

In studies conducted at the college level, Cakir and Delialioglu (2009) utilized Chickering and Gamson's (1987) framework to investigate the factors that affect student engagement in a blended learning course of 51 pre-service computer teachers. The results revealed that active learning was the only factor that had an impact on students' engagement outcomes. These findings assert the potential of the blended learning environment to provide equal learning opportunities for all students. Similarly, Kocaman-Karoglu et al. (2008) conducted a case study to investigate pre-service teachers' perceptions of their learning in a blended course that was guided with the *Seven Principles of Good Practice*. The results indicated that the students formed positive feelings towards the blended environment.

The above studies demonstrate that the *Seven Principles of Good Practice* have been implemented in different leaning environments, including online and blended settings. Furthermore, these studies reveal that the seven principles were utilized differently in different learning environments. In some of the studies, these principles were utilized to design the learning environments; however, other studies used the principles as benchmarks for evaluation or design.

5 Methodology

5.1 Participants

A survey methodology was used with a convenience sample of 88 pre-service female teachers. Participants were enrolled in a required computer course in the College of Education at Kuwait University. The study took place during the 2014/2015 academic year. Of the 88 participants, 44 participated during the spring semester and 44 participated during the summer semester. The majority of the participants were in their third or fourth year of study.

All the participants completed the surveys after completing a signed consent form. The background information was self-reported by the participants, and was based on four categories: type of the program, type of final project, technological knowledge, and experience in using synchronous collaboration. The participants were from the three available programs at the college, specifically, 25 (28%) were from the kindergarten program, 28 (32%) were from the elementary program, and 35 (40%) were from the intermediate/secondary program. Whilst a majority (77%) of the participants worked on collaborative projects, 85% of the participants had not experienced the concept of cloud computing or synchronous collaboration. In addition, all pre-service teachers owned their own smartphones and could use them to manage their CLE.

5.2 Instruments

Two survey instruments were developed for feedback: one for use before the start of the course and one after completion of course. The first instrument was administered during the first week of the class. This instrument consisted of 20 items that sought pre-service teachers' existing technology skills. The 20 items were rated on a five-point Likert scale, with 1 = very low skill and 5 = very high skill. These items were classified into eight categories: mobile phone skills; using Microsoft Office Suite; using Wikis; using email; developing videos; dealing with social media; participating in forums; and using LMS. Examples of the skills in the eight categories are as follows: using blogs, sharing information resources via mobile phones (i.e., video links, pictures), and producing movies. The Cronbach alpha score of the instrument was 0.862.

The second instrument (perception survey) was administered during the last week of the class. This instrument was a 35-item survey created to investigate pre-service teachers' perceptions of the effectiveness of the design of the learning environment. The initial development of the instrument was guided by the literature, primarily the *Seven Principles of Good Practice* (Chickering and Gamson 1987); in addition, the type of authentic activities introduced in the learning process also guided the development of the instrument. The 35 items were divided into seven sections with each section reflecting the items in the seven principles. These sections are as follows: (1) student–faculty contact (items 1–5); (2) cooperation among students (items 6–10); (3) active learning (items 11–15); (4) prompt feedback (items 16–20); (5) time on task (items 21–25); (6) high expectations (items 26–30); and (7) respect for diverse talents and ways of learning (items 31–35). The items were rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Experts with knowledgeable in different relevant areas, including teaching with cloud technologies and research methodology, were consulted. They were asked to validate both instruments for their relevance, suitability, and layout when considering the teaching and learning methods implemented in the learning environment. The internal consistency of the second instrument had a Cronbach alpha score of 0.794. Both instruments were given to pre-service teachers in the class; they answered all the questions anonymously. The survey data were collected via paper-based questionnaires. Statistical Package for the Social Sciences (SPSS), version 20 was used to analyze the data.

5.3 Description of the learning environment

The author served as the instructor and designer of the 7P–ILD. As previously mentioned, the *Seven Principles of Good Practice* (Chickering and Gamson 1987) guided the development of the conceptual model for the pedagogical design of the learning environment. There were several teaching and learning strategies and tools that were used to maximize the design and development of the learning activities. These strategies and tools were generated to ensure the current gaps identified in the problem statement were addressed. As such the whole 7P–ILD was created as per the components in Fig. 1.

The conceptual model consisted of three components that were used to design how the course would be taught and evaluated. Specifically, the components were: cloud tools, some selected strategies, and the *Seven Principles of Good Practice*. As shown in Fig. 1, these components represented the practices that were initiated during the course. The strategies were as follows:

1. Student–faculty contact. To comply with this principle, the instructor/researcher communicated with the pre-service teachers through emails created by Google accounts and via discussion forums created by Google groups. In addition, the instructor and students shared their ideas on students' assignments and projects created by Google Docs, Google sites, and other tools. Furthermore, face-to-face meetings were arranged with students when there was a need. Finally, responding to student queries within a reasonable time was also considered.
2. Cooperation among students. To support this principle, participants/pre-service teachers were informed at the beginning of the course that they should work on their projects in teams. Furthermore, grade bonuses were assigned to those who provided virtual assistance to others, presented certain tools in the class as student experts or acted as mentors on the discussion forums.
3. Active learning. To fulfill this principle, participants were asked to produce projects using cloud technologies. Furthermore, students had the opportunity to share and discuss their projects synchronously with other students before presenting them in the class. This step allowed students to learn from the feedback provided by the instructor and other students (Graham et al. 2001). Grades were also assigned for synchronously sharing documents, mind maps, and demo sites where they can practice the required skills. In addition, a large portion of the grade was assigned for the final project which was created using Google Sites.
4. Prompt feedback. To comply with this principle, participants had the opportunity to receive two types of feedback: information feedback and acknowledgment feedback. These two types of feedback were provided by evaluating students' assignments and posts when they shared them virtually with the instructor or when they met face-to-face.
5. Time spent on tasks. This principle was fulfilled when the instructor clarified the deadlines for sharing all course assignments from the beginning of the semester. The required skills along with the selected videos were gradually introduced according to an arranged weekly schedule.
6. High expectations. To comply with this principle, different strategies were utilized to meet the instructor's and participants' high expectations. First, some former pre-service teachers' outstanding projects were presented to assist the students in setting their own course goals. Second, the learned activities were communicated and expectations were carried out. In addition, students were given the opportunity to perform many tasks to foster their own high expectations, including collaborative online documents, mind maps, online forums, demo sites, and the final website. Finally, participants raised their expectations when they worked on topics of their interest and when they observed the instructor's interest in their topics.
7. Respect diverse talents and ways of learning. To support this principle, participants were given the opportunity to choose the topic for their final project. The participants were given guidelines that emphasized that the topics they selected should

be reflective of their areas of specialty and contemporary education. Furthermore, the activities and assignments given to the participants were selected to reflect the different characteristics and learning styles among pre-service teachers. From the outset, pre-service teachers knew that the minimum number of cloud tools they should include in their final online projects. The majority exceeded the required numbers of tools by adding other tools such as QR Code, VOKI, Picasa photo albums, Prezi, and other web technologies.

5.4 Implementation of the course

The course (Computers-in-Education focusing on cloud Technologies) was implemented over 15 weeks in a face-to-face environment. The course was held in a computer lab with Arabic as the medium of instruction. The participants/pre-service teachers were required to create a final web-based project in the CLE. Before the start of the course, participants were given the pre-course survey to establish their technology tool use ability. At the conclusion of the course, the participants were given a post instructional survey instrument to gauge their perceptions of the learning experience.

Pre-service teachers' web-based projects was created using CLEs tools. The focus on specific tools for the 7P–ILD was to provide pre-service teachers with hands-on experience. This experience provided the participants with a set of tools and allowed them to use these tools in a personal way. Thus, what finally evolved in the CLE was a product related to the students' content area (science, language, or mathematics).

6 Results

Descriptive statistics, *t*-tests, and ANOVAs were used to analyze data. The results of the study were compiled to answer the two research questions. Data on the participants' technological background are presented in Table 1.

As shown in Table 1, the results indicated that the participants were most proficient at using mobile phone technology and least comfortable with using the Learning Management System. They were moderately proficient with using some Web 1.0 tools

Table 1 Technological skills of participants [$n = 88$]

Skills	Mean	SD
Using a mobile phone	4.38	0.812
Using Microsoft Office tools	3.70	1.351
Using Wikis	3.59	1.536
Using email	3.10	1.564
Creating online videos	2.30	1.421
Using social media	2.11	1.255
Using online forums	2.09	1.455
Using LMS	1.45	1.330
Overall	2.78	0.820

Table 2 Participants' perceptions of the 7P–ILD

Principles	Mean	SD	Rank
1. Encourage student–faculty contact	4.51	0.409	1
2. Encourage cooperation among students	4.43	0.465	3
3. Encourage active learning	4.20	0.528	4
4. Give prompt feedback	4.18	0.426	5
5. Emphasize time on task	3.50	0.575	7
6. Communicate high expectations	4.14	0.480	6
7. Respect for diverse talents & ways of learning	4.45	0.477	2
Overall	4.20	0.301	

N=88

(email and MS Office), and least proficient with Web 2.0 tools (online forums, social media, online videos, and wikis). The overall mean of using the tool indicates that pre-service teachers had intermediate pre-technological skills. This prior knowledge was important in the design of the learning permutations of the cloud technologies.

6.1 Research question 1

6.1.1 What were pre-service teachers' perceptions of the 7P–ILD which was developed based on the seven principles of good practice?

Table 2 shows the overall perceptions of the participants' responses to the 7P–ILD.

The results indicated that pre-service teachers were most satisfied with the 7P–ILD related to *student–faculty contact* and were least satisfied with *time on task* (see Table 2). When asked to rank the model's principles in terms of usefulness, the following were the results: (1) student–faculty contact; (2) respect for diverse talents and ways of learning; (3) cooperation among students; (4) active learning; (5) prompt feedback; (6) high expectations; and (7) time on task. To examine the relation between the participants' overall technological skills and their overall perceptions of the 7P–ILD, a correlation analysis was conducted and yielded no significant results, $r\ (86) = 0.143$, $p = 0.184$, $p > .05$.

An in-depth analysis of the highest and lowest ranked principles was carried out and is presented in Tables 3 and 4 respectively.

Table 3 Participants' perceptions of student–faculty contact

Items	Mean	SD	Rank
The continuous communication with the instructor increased my motivation to learn the required skills (item 1).	4.74	.577	6
The learning environment using Google Sites was comfortable for approaching the instructor (item 2).	4.65	.644	14
I needed to communicate more with the instructor to be able to build my site in a satisfactory way (item 3).	3.63	1.021	28
My passion increased for using Google Tools because of the instructor's encouragement (item 4).	4.83	.485	1
The instructor's interest in my leaning contributed to overcoming the difficulties I faced when I built my site (item 5).	4.70	.590	9

Table 4 Participants' perceptions of time on task

Items	Mean	SD	Rank
The required skills match their allocated time (item 21).	4.35	.910	22
I was exposed to a lot of psychological pressure out of fear that I would not be able to finish the project at the right time (item 22).	3.74	1.160	27
The allocated time for learning the needed skills might have been invested in a more effective way (item 23).	3.48	1.250	29
I expected to finish the project according to the deadline (item 24).	3.81	1.092	26
The sequential way of presenting the required skills helped me to manage my time effectively (item 25).	4.53	.694	18

With regards participants' perceptions of student-faculty contact related to continuity of communication, use of Google Sites as a communication tool, intensified contact with instructor, instructor encouragement and instructor's focused interest shows that instructor encouragement was most useful and important with the highest mean of 4.83 and ranked No 1 amongst all the survey items posed to the participants. The results revealed that the participants' motivation increased because the instructor offered encouragement and continuous communication.

As shown in Table 4, the results indicated that the majority of participants felt some psychological pressure that resulted from feeling that they might not be able to meet the deadline for the final project. In addition, participants indicated that the allocated time for learning may have been invested effectively despite their satisfaction with the time for learning the required skills.

The analysis of the items' highest and lowest mean scores of pre-service teachers' perceptions of the effectiveness of the 7P–ILD is shown in Table 5.

As shown in Table 5, the results indicated that students were motivated to invest tremendous effort in their CLE projects as it related to their worldwide presence; this was apparent via the two highest-ranked items. Participants' increased passion to use online tools was equally important, and was influenced by the continuous contact with the instructor. The lowest-ranked negative item revealed that participants were satisfied with working on the required online tools of their CLE projects. To further explore their satisfaction, a correlation coefficient was computed between the overall mean of active learning and the overall mean of respect for talents and ways of learning; a highly positive, significant correlation emerged, $r(86) = .46$, $p < .001$, ($p = .000$).

Table 5 The items' highest and lowest mean scores of participants' perceptions of the 7P–ILD

Items	Mean	SD	Rank
Encourage active learning			
I made a lot of effort in building my final project because it reflects my personality to a worldwide audience (item 13).	4.83	.460	1
Encourage student–faculty contact			
My passion increased for using Google Tools because of the instructor's encouragement (item 4).	4.83	.485	1
Respect for diverse talents and ways of learning			
I felt upset because I was required to include the skills I learned in the final project (item 35).	1.91	1.035	35

Table 6 The differences in participants' perceptions of the 7P–ILD based on type of project

Principles	Type	N	M	SD	*t*	df	Sig. (2-tailed)
Overall mean of the principles	Individual	20	4.21	0.313	0.195	86	0.846
	Collaborative	68	4.19	0.300			

6.2 Research question 2

6.2.1 Were there significant differences in the pre-service teachers' perceptions about the 7P–ILD for type of project (individual or collaborative) and type of educational program in which they were enrolled (kindergarten, elementary, and intermediate/secondary)?

A *t*-test analysis was conducted to address this question and results are presented in Table 6.

The results of the *t*-test examining the differences in pre-service teachers' overall perceptions of the 7P–ILD by the type of the project (individual or collaborative) indicate that there was no significant difference between the groups at the 0.05 level.

A one-way ANOVA was conducted to determine whether there were differences between type of educational program (kindergarten, elementary, and intermediate/secondary) on participants' perceptions towards the 7P–ILD guided by the *Seven Principles of Good Practice*. The results are presented in Tables 7 and 8.

The results of the ANOVA indicated that there was a significance difference at $p < 0.05$ level. Specifically, the ANOVA indicated significant differences between the groups for time on task, $F(2, 85) = 3.785$, $p = 0.027$. The results indicated that there was a medium effect size ($\eta^2 = 0.082$), with program type accounting for 8.2% of variance for time on task.

Follow-up tests were conducted to evaluate the pairwise differences between the means. The test of homogeneity of variances indicated that the variances did not differ significantly; therefore, post hoc comparisons were conducted via Scheffe's method. A significant difference emerged between kindergarten pre-service and elementary pre-service teachers' perceptions. Pre-service teachers enrolled in the elementary program had higher perceptions towards 7P–ILD than the pre-service teachers enrolled in the kindergarten program (see Table 8). The results also showed no significant differences between the pre-service teachers enrolled in the kindergarten program and the

Table 7 Differences in participants' perceptions of the 7P–ILD between types of program

Principles (DV)	Variance source	Sum of squares	df	Mean square	F	Sig.
Time on task	Between groups	2.355	2	1.178	3.785	.027*
	Within groups	26.443	85	.311		
	Total	28.798	87			
High expectations	Between groups	1.619	2	.810	3.735	.028*
	Within groups	18.424	85	.217		
	Total	20.044	87			

* $p < .05$

Table 8 Descriptive statistics of participants' perceptions of the 7P–ILD by type of program

Principles (DV)	Type of program (IV)	N	Mean	SD
Time on task	Kindergarten	25	3.24	0.614
	Elementary	28	3.64	0.475
	Intermediate/Secondary	35	3.57	0.577
	Total	88	3.50	0.575
High expectations	Kindergarten	25	3.93	0.529
	Elementary	28	4.26	0.459
	Intermediate/Secondary	35	4.18	0.421
	Total	88	4.14	0.480

intermediate/secondary program. In addition, no significant differences were found between the pre-service teachers enrolled in the elementary program and the intermediate/secondary program. Pre-service teachers enrolled in the elementary program had the highest perceptions towards the 7P–ILD. Thus, pre-service teachers enrolled in the elementary program perceived time as a more critical factor to finishing the required tasks within the allocated time compared with the kindergarten and intermediate/secondary pre-service teachers.

When differences in high expectations were examined, the ANOVA test indicated there were significant differences between the groups, $F(2,85) = 3.735$, $p = 0.028$. The results indicated that there was a medium effect size ($\eta^2 = 0.081$), with program type accounting for 8.1% of variance of the high expectations variable.

Follow-up tests were conducted to evaluate the pairwise differences between the means. The test of homogeneity of variances indicated that the variance did not differ significantly; therefore, post hoc comparison tests were conducted using Scheffe's method. A significant difference emerged between the kindergarten and elementary pre-service teachers' perceptions. Specifically, the pre-service teachers enrolled in the elementary program had higher perceptions towards the 7P–ILD than the pre-service teachers who were enrolled in the kindergarten program (see Table 8). The results also indicated that there were no significant differences between the pre-service teachers enrolled in the kindergarten program and those enrolled in the intermediate/secondary program. In addition, no significant differences were found between the pre-service teachers enrolled in the elementary program and the intermediate/secondary program. Pre-service teachers enrolled in the elementary program had the highest perceptions towards 7P–ILD. This indicates that pre-service teachers enrolled in the elementary program have high expectations towards the design of the learning environment when compared with the pre-service teachers enrolled in the kindergarten or intermediate/secondary programs.

Given the pattern of results noted above, the overall correlation between time on task and high expectations was conducted and revealed a highly positive, significant correlation, $r(86) = 0.677$, $p < 0.0001$. Thus, it appears that when pre-service teachers have high expectations towards the 7P–ILD, they also perceive time on task as crucial.

An additional ANOVA was conducted to examine the differences between the three educational programs (kindergarten, elementary, and intermediate/secondary) in technological skill level reported in the pre survey. The results revealed that no differences existed, $F(2,85) = 0.39$, $p = 0.962$.

Table 9 Major findings of the pre-service teachers' perceptions of 7P–ILD

Major findings	7P–ILD
The design positively influenced participants' ability to confidently build their CLEs, either individually or in a team.	Design
Participants were most satisfied with the design related to the principle *student–faculty contact*, and were least satisfied with the principle *time on task*.	Principles
The worldwide presence of participants' work in the CLE and instructor encouragement were the top rated factors.	Top perceived factors (items)
There was a moderate-to-strong positive and significant correlation between the students' perceptions towards the 7P–ILD on their engagement in the learning process (active learning) and having the choice to incorporate their diverse views in the innovative CLE (respect for talents and ways of learning).	Correlation among the principles
There was no significant difference in the participants' perceptions between the two project types (individual/collaborative).	Differences between project type (*t*-test)
There was a significant difference between the kindergarten and elementary pre-service teachers on their ratings of the time on task principle and the high expectations principle. The pre-service teachers enrolled in the elementary program had the highest perceptions towards the 7P–ILD on both principles.	Differences between program type (ANOVA)
There was a strong, positive correlation between the time on task principle and the high expectations principle.	Correlation between principles

6.3 Summary of major findings

The major findings of the study are presented in Table 9.

7 Discussion

The purpose of this study was to explore the perceptions of pre-service teachers on the 7P–ILD and its effect on the abilities of pre-service teachers to effectively create their cloud learning environments. This model was developed based on the *Seven Principles of Good Practice* (Chickering and Gamson 1987), cloud tools, and selected strategies. The results revealed that pre-service teachers positively perceived the 7P–ILD.

The highest perceived principle was student–faculty contact and the highest perceived item was active learning, Therefore, the following conclusions were drawn:

a. Encouragement was provided by the instructor, and that increased the passion and interest of the pre-service teachers to produce innovative CLEs.
b. Communication was an important aspect of the learning environment, especially when the instructor provided continuous and comfortable communication.
c. The easy flow of communication between the instructor and the pre-service teachers, as well as among pre-service teachers via the cloud tools, enhanced the pedagogical design and development of the CLE by participants. The use of Google Sites was particularly effective.
d. Active learning is a process of engaging pre-service teachers in meaningful learning and worldwide presence; it encourages the creation of innovative artifacts that reflects the participants' diverse views and talents.

These key findings corroborate with findings of Wang (2014) where students rated student–instructor interaction positively when they were constructing their web-based

projects for an online course. Moreover, Erturk (2016) conducted a study with 36 undergraduate students to understand factors that affect students' use of Google Drive as a cloud computing application to promote various types of collaboration and sharing. The results indicated that the cloud technology helped students to form closer connections with each other outside of the classroom. This reinforces the notion that online collaboration is an essential component of active learning and teaching strategies. In another study, Denton (2012) reported that pre-service teachers responded favorably to the use of Google Docs for sharing and publishing their constructed content on the web, and collaborating on a variety of learning activities. Similarly, Cakir et al. (2010) examined how Google collaboration technologies influenced 60 pre-service teachers' engagement in group work during a technology course. The results indicated that the collaborative tools improved students' communication and persuasion skills.

The lowest perceived principle was time on task and the lowest perceived item was for respect for diverse talents and ways of learning. The following conclusions were drawn:

a. Most pre-service teachers did not expect to finish their final project by the deadline; this resulted in a lot of psychological pressure.
b. A more effective way of investing the time for learning the necessary skills is needed.
c. The 7P–ILD had a high impact on pre-service teachers' respect for the diverse talents and ways of learning of the participants, especially as they related to the skills required for the final project in the CLE.

The above findings point to the fact that technology-related assignments present a number of significant challenges to pre-service teachers. Indeed, the pre-service teachers in the current study faced challenges in the 7P–ILD. These findings corroborate with findings reported by Cakir et al. (2010) where pre-service teachers spent greater than average time working on their web projects. In another study, Donna and Miller (2013) investigated the barriers in using cloud-based technology among pre-service teachers, and how barriers may influence the future integration of cloud-based technology. One barrier reported in this study was time, and respondents indicated that cloud-computing technologies are challenging to learn and to use.

There was no significant difference in pre-service teachers' perceptions of the 7P–ILD when compared by project type (individual/collaborative) and the type of educational programs (kindergarten, elementary, and intermediate/secondary). This pattern of findings indicates that pre-service teachers do not have a preference as to whether work is done individually or in teams. This finding also indicates that granting participants more autonomy helps them reach their goals via their engagement in active learning and having the choice to incorporate their diverse views into their own web-based CLEs. Moreover, this may also indicate that, despite working on their own, they may have had support from a bigger community of participants through the forum discussions. This finding is consistent with findings from a study of 108 second-year university students working individually and in teams during an online course (Suanpang 2004). The results indicated that students appreciated both working on projects individually and with a group.

The fact that no significant differences emerged between the pre-service teachers in kindergarten, elementary, or intermediate/secondary programs indicates that the 7P–ILD had learning resources that were understandable to and useful for all participants. This also indicates that familiarity with social media tools via the use of smartphones

may assist their navigation of Google Groups; this is further substantiated by the fact that there were no differences between the three educational programs in their pre-technological skills. Ravenna et al.'s (2012) review supports this interpretation by indicating that student interaction was an essential component of online learning; and that increasing interaction directly leads to higher levels of student satisfaction and performance. In addition, the literature indicates that the combinations of interactions (student–student interaction, student–instructor interaction, and student–content interaction) in a blended learning environment are important to students' learning experiences and course satisfaction (Kuo et al. 2009).

Importantly, there was a significant statistical difference between the kindergarten and elementary pre-service teachers on two aspects of the 7P–ILD: time on task and high expectations. These two types of teachers mostly work with very young children; therefore, kindergarten and elementary pre-service teachers are required to create more concrete learning resources in their courses compared with intermediate/secondary pre-service teachers. This may result in time being a critical factor to finish their assigned tasks given their expected high performance. It is also noted that the intermediate/secondary pre-service teachers demonstrated higher persistence in carrying out their tasks; this is likely because they have more exposure to advanced courses in their areas of specialties. High outcome expectations in introductory technology courses appeared to have a considerable positive influence on pre-service teachers' performance and motivation (Niederhauser et al. 2012).

7.1 Implications for practice

While the current investigation was limited in scope, it provided insights on how to prepare pre-service teachers to create effective web-based CLEs. The study showed that the 7P–ILD based on a well conceptualized model assist students to be active, engaged, and deeply involved in a constructivist learning environment. The application of critical and creative thinking skills was high, as well as the transfer of knowledge and skills to new situations. Therefore, from the results of this study and the extensive interaction with pre-service teachers during the implementation process of the learning environment, the following implications can be drawn for practice:

1. Consider adopting the 7P–ILD as a model that integrate cloud tools and constructivist-based strategies for pre-service teachers; this will promote positive perceptions of and motivation to creating effective learning designs.
2. Foster authentic activities through free, accessible, and affordable technology tools to foster the development pre-service teachers learning practices.
3. Integrate web-based projects with a self-learning approach to accelerate the use of cloud tools.
4. Prepare pre-service teachers in time management tasks that will enable them to balance demands in the real world.
5. Maintain continuous communication in the learning environment to stimulate users' higher-level cognitive abilities and to provide them with opportunities to control their learning.
6. Support pre-service teachers as they build confidence and competence in completing their CLEs, and reinforce their high expectations as they practice via interactions with peers and instructors.

7.2 Limitations of the study

The following are limitations of the present study:

1. The study included a convenience sample of female pre-service teachers enrolled in a specific computer course in the College of Education at Kuwait University. Thus, the study was limited to female pre-service teachers since co-education is not permitted at the college. Randomization options would add extra value to the current data, including data on other sections of the computer course that are taught by different instructors using the same learning design of the environment.
2. The data in the current study were limited to self-reported perceptions of pre-service teachers. Data collection from a variety of instruments is needed, especially qualitative measures (e.g., open-ended questions using interview protocols). This will allow researchers to understand the deeper meanings of interaction in the 7P–ILD.
3. The study focused on pre-service teachers enrolled in four sections of a computer course. Thus, the study is limited to a few sections thereby making the generalizability limited. The findings are not applicable to the entire body of pre-service teachers enrolled in other sections of the course.
4. The 7P–ILD is limited to the proposed constructivist-based learning design model, the implemented strategies, and cloud tools. Other constructivist-based models can be adopted to design similar learning environments for further comparison.

7.3 Recommendations for further research

1. Future work using the suggested model should focus on factors related to *time on task* and *high expectations*. This can be achieved by guiding pre-service teachers to document their weekly online accomplishments via blogs that will reduce psychological pressure and maintain their high expectations. In addition, it is recommended that future learning environment designs focus on increasing the high expectations of kindergarten and elementary teachers.
2. Qualitative studies should be conducted to investigate the finer designs related to the activities provided.

8 Conclusion

The purpose of this study was to explore the perceptions of pre-service teachers on the 7P–ILD and its effect on the abilities of participants to effectively create their cloud learning environments. This study used Chickering and Gamson's Seven Principles of Good Practice, cloud tools, selected strategies in the design of a learning environment model with the purpose of having participants create their final web-based learning projects in the CLE. Overall, the findings indicate that pre-service teachers positively perceived the learning environment model despite their differences in computing background, work setting, and educational programs. This study adds to the body of research related to effective design of learning environments, and highlights the effectiveness of utilizing Chickering and Gamson's (1987) *Seven Principles of Good Practice* in the development of a learning environment model. While the study

indicated that the proposed model had positive effects, follow-up studies should focus on the transfer of learning and how this type of design influences pre-services' technological abilities longitudinally.

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