



**Examining the perceptions and practices of undergraduate
dental students and facilitators about Problem-based
Learning (PBL) instructional approach in the United Arab
Emirates**

دراسة لقياس تصورات و ممارسات طلبة طب الاسنان في مرحلة ما قبل التخرج
بطريقة حل المشكلات (PBL) واساتذتهم حول التعليم في دولة الامارات العربية

by

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of the requirements for the degree of
MASTER OF EDUCATION**

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Abstract

Problem-based learning is useful learner-centered instructional approach in which learners collaborate within small groups to solve an authentic ill-structured problem that has no right or wrong answers. However, designing and facilitating problem-based learning can be challenging for instructors as well as instructional designers, especially for learning dental education. Recently many medical and dental schools globally have included PBL in their curricula. Therefore, recently no one has questioned whether the outcomes expected of the learner in a PBL setting are applicable to students from different cultural upbringings.

The aim of this study was to examine the perceptions and practices of students and facilitators about PBL as teaching method and what are the issues that have arisen based on their experience and knowledge. The study conducted in fall semester 2017 in dental school in a major governmental university in the United Arab Emirates. A survey instrument designed with twenty-one statements rated on a Likert scale (i.e., from “strongly agree” to “strongly disagree”) delivered to 340 dental students (n=400) and 82.5% of the students (n=330) completed the questionnaire. In addition, semi-structured interviews were conducted with four PBL dental educators to provide knowledge and insights about the challenges they experienced, as well as identifying the key elements of problem-based learning in higher education.

Main results included the PBL teaching method was favored by the students as well as their educators. One sample T test for the gender responses were $T = -0.620$ and $P\text{-value} = 0.535$ showed no significant difference while One-way ANOVA were $T = 4.518$ and $P\text{-value} = 0.001$ found significant different between study level in problem-based Learning, ordered, as expected, as follows: Year 5 > Year 4 > Year 3 = Year 2 = Year 1. To conclude the facilitators of PBL and their students appear to be very positive about their experience on PBL in their curriculum. The positive and negative observations appear to be similar in both male and female questionnaire results the difference arose in the year of study the other main finding that there a clear support for the traditional lecture format. Also, a major result of the study indicated that teachers have good pedagogical knowledge about PBL, and have developed their practices but not at the same level of their knowledge.

Keywords: Problem-based learning, Dental Education, Undergraduate Dental Students, Facilitators

نبذة مختصرة

يمثل التعليم القائم على حل المشكلات نهج تعليمي يعتمد فيه المتعلمون بشكل خاص على انفسهم بالتعاون ضمن مجموعات صغيرة لحل مشكلة حقيقية سيئة التنظيم ليس لها إجابة صحيحة أو خاطئة. ومع ذلك ، يمكن أن يكون التحدي الأكبر بالنسبة للمعلمين هو تصميم المشكلة بحد ذاتها خصوصا في تعليم طب الاسنان.مؤخرقامت معظم المؤسسات التعليمية بادراج (PBL) كاحدى طرق التعلم مما لم يدع مجال للشك للكليات الطبية عالميا في تطبيق(PBL) ضمن مناهجها بما في ذلك كليات طب الاسنان الغرض الرئيسي من هذه الدراسة التي أجريت في فصل الخريف 2017 في احدى جامعات دولة الامارات العربية هو شرح تصورات طلاب كلية طب الاسنان و المعلمين المخولين بالتعليم بطريقة حل المشكلات وفقا لتجاربهم وخبراتهم المعرفية.

تضم هذه الدراسة مجموعتين من المشتركين وهم 340 طلبة كلية طب الاسنان واربعة من المشرفين الاكاديميين من كلية واحدة. وقد استخدمت أدوات متعددة لجمع بيانات كافية من خلال تطبيق منهجيات مختلطة. فهناك استبيان لجمع تصورات الطلاب والطالبات (النوع الكمي) يحتوي على واحد وعشرين تصريحاً مصنفًا على مقياس ليكرت (أي من "موافق بشدة" إلى "لا أوافق بشدة") عن (PBL) وتعليق مفتوح. بالإضافة إلى ذلك أجريت مقابلات شبه منظمة (النوع الكيفي) مع اربعة من اختصاصي طب الأسنان اكاديميين وقد استخدمت لتوفير المعرفة والرؤى حول التحديات التي يواجهونها ، وكذلك العناصر الأساسية للتعلم القائم على حل المشكلات.

وأخيرا، تم تحليل النتائج على ضوء الاحصاء واطهرت ان كلتا المجموعتين تشجع التعليم بطريقة حل المشكلات كما اشارت الى عدم وجود فوارق كبيرة بين الجنسين في تصوراتهم حول التعليم بهذه الطريقة على العكس من النتائج التي قارنت التصورات بناء على المستوى الدراسي والتي اشارت الى وجود فوارق ظاهرة بين المراحل التعليمية حيث ان تصورات الطلاب في السنتين الخامسة والرابعة كان اعلى عن طلاب السنوات الاولى والثانية والثالثة. أشارت النتائج الرئيسية للدراسة إلى أن المعلمين لديهم معرفة تربوية جيدة حول PBL ، وطوروا ممارساتهم ولكن ليس على نفس المستوى من معرفتهم و ما يزالوا يحتاجون الكثير من التطبيق.

الكلمات الرئيسية: التعليم القائم على أساس حل المشكلة (PBL)، طلبة كلية طب الاسنان،معلمي (PBL) بكلية طب الاسنان

Dedication
To God; for inspiring and leading me

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I would like to express my deepest gratitude to my advisor, Professor, Sufian Forawi who supported this work. His supreme art of teaching has helped me to increase my tolerance, energy and knowledge. His passion in teaching is unique and that is empowered me throughout these years. He is widely recognized as the first, and currently leading, science educator in the MED program that I have the honor to be in. I am proud and grateful to have such a mentor.

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Lastly but not least, I thank my family and my best friends who motivated me through this journey and kept my enthusiasm to the maximum. All of my accomplishments are shared with my mentors, family and those who embraced my efforts to add a piece to Science Education. My belief is that the fundamental purpose of education is to generate people who are proficient in creating new ideas, improvements and innovations.

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His Highness Sheikh Dr. Sultan bin Mohamed Al Qasimi, Supreme Council Member and Ruler of Sharjah and President of the University of Sharjah (UoS), During His Highness speech, He emphasis and explained that the best way to confront the obscurantist and extreme waves is to establish the right education from childhood through sound educational methods and continuity with the child until he reaches university level.

1. Chapter 1: Introduction

Problem-based Learning (PBL) is a teaching approach conceived and implemented around four decades ago, having come out of McMaster University's medical school in Canada in the 1960s (Norman and Schmidt, 1992). The main advantages of PBL stem from how it is structured around real-life problems. Students attempt to reach one of multiple possible solutions with little or no direction from a teacher. Learners have to engage in higher order thinking (metacognition) and independently organize, analyse, and synthesize information (Bonwell & Ellison, 1991; Ramnanan & Pound, 2017). Because PBL lends itself to a multiplicity of strategies, it is suitable for students of various levels, from various disciplines and cultural contexts who may possess varying learning styles (Ibarra, 2001; Kain, 2003).

1.1 Problem Based Learning (PBL)

During the past three decades, the outline for accepting the psychosomatic basis of learning has moved steadily from a teacher-centred approach to a student-centred approach. That viewpoint has retained accumulative duty on learners for their own learning. (Boud & Feletti, 1997). The learners become conscious of these shifts and reason about conceptual relations or describe learning as a process of conceptual refinement, and they construct their own conceptualizations and solutions to problems. Since, students should not depend on teachers to learn instead, they must be self-regulating learners throughout their lives. (Sungur and Tekkaya, 2006)

Teaching investigation discloses that perceptions and cognition that empower the students to be independent learners are highly associated to theoretical learning. That viewing platform has led to greater emphasis on how classroom context than before and other background influences and shape student learning and motivation. Therefore, educators focus their attention on students' strategic hard work to manage achievement through specific beliefs and processes. (Barrows, 1998). (Sungur and Tekkaya, 2006)

PBL has been regarded as the "the most significant innovation in education for the professions for many years some argue that it is the most important development since the move of professional training into educational institutions" and as such as been well documented (Boud

and Feletti, 1997, Neufeld et al., 1989, Spaulding, 1991). It has certain ‘essential’ components. These include a “wicked” problem (one that may not have a correct answer or an easy solution), small group collaboration, tutors that serve as facilitators rather than experts, and, crucially, self-directed learning (Barrows, 1998). As students analyze the phenomena introduced within each problem they are forced to confront their own strengths and weaknesses, and by implication their own learning goals and the research necessary to learn the material, develop and then analyze solutions.

After a small group of early adopters, PBL has now begun to spread widely across the globe in the 40 years since its conception. In that time, several versions of PBL have appeared in various fields and levels of education (Ambreen et al., 2011).

In 1994, the World Health Organization made several recommendations about dental education. Amongst these suggestions, they stipulated that dental education should be problem-based, socially and culturally relevant, and community oriented. Thus, changing patterns of oral health, application of molecular and genetic research to dentistry and an increasing rationalization of health management worked together with the recommendations to bring about significant change in dental education curricula (Hendrickson and Cohen, 1988). In response to the changes, dental schools began to design curricula, which were more responsive to student learning and more sensitive to evaluation mechanisms. They adopted a contemporary, student-centered approach built up around flexible methods of teaching and learning. This facilitated an improvement in dental clinical skills through an increase in self-assessment and criterion-referencing. Teamwork and competency-based systems emerged later as additional defining characteristics. (Chambers, 1994)(Marchese, 1994)

Currently, one can observe PBL instructional strategy at work in most medical and dental schools, predominantly within small group work. In most instances, groups of students are presented with a clinical case around which other instructional experiences are based (Ambreen et al., 2011). Styled in this way, PBL engages students and enhances their abilities to solve problems. The positive impact of PBL and the advantages of including it within dental curricula are both strongly evidenced within dental educational literature. Students are placed in an environment where they must assess and examine the evidence available (Charlie and Orr, 2010). Because each student must individually construct a mental framework of the problem and

possible solutions, the practice is student-centered and student driven, increasing the motivation and desire of the student to learn. Students are much more likely to become active learners as a result and show accelerated development of critical thinking, problem-solving, and self-directed learning skills. (McFall, 2013)

To guarantee that PBL has a great chance of achievement, it is vital to have PBL cases that are well inscribed, has a lifelike and interesting clinical trigger, has an suitable level of difficulty and challenge, and has a sensible load for component modules. Moreover, it is indispensable that the PBL case must have suitable learning objectives, which should be associated with learning from the rest of the curriculum. First, without a well-crafted PBL case, both tutors and students feel that time is wasted without knowing what is expected in terms of the learning objectives that need to be achieved. It is a common worry among those in the faculty not committed to PBL whether students can learn sufficient content from or through PBL. In turn, students worry about the breadth and depth of content, which they need to master. (Chan, 2009) These are valid and recurring issues and need to be addressed because they lead to anxiety for the students and question the validity of the educational value of PBL. To ensure that students learn sufficient content of appropriate scope and difficulty, the way the PBL case is structured is very important because this will either help or hinder the role of the tutors in PBL. It is important that the PBL case has a realistic and interesting clinical trigger, has an appropriate level of difficulty/challenge, and has a reasonable workload for component tutorials. It is essential that the PBL case must have appropriate learning objectives, which should be aligned with learning from the rest of the curriculum.

Moreover, whereas it is implicit that PBL should be problem-based, Barrows (1998) stressed that the problems must be authentic problems that students will deal with in clinical exercise. Furthermore, students must be given no more than the brief material they would primarily have in specialized practice such as the patient's complaint. This permits students to produce many potential reasons of the problem, as well as to find appropriate evidence via patient history and oral examination. The demonstration of a realistic clinical problem guides to problem solving, which entails applying the problem-solving skills needed in professional practice. The tutor assists in this endeavor by promoting the use of effective problem-solving strategies (Barrows, 1998).also the most critical issues regarding PBL is the need to place its significance and context

within the rest of the curriculum. It is essential to consider how much time will be dedicated to PBL within the curriculum and how adequate the resources are to support PBL. (Chan, 2009)

To ensure that PBL has a high chance of success, it is important to have PBL cases that are well written. First, without a well-crafted PBL case, both tutors and students feel that time is wasted without knowing what is expected in terms of the learning objectives that need to be achieved. It is a common worry among those in the faculty not committed to PBL whether students can learn sufficient content from or through PBL. In turn, students worry about the breadth and depth of content, which they need to master. (Chan, 2009) These are valid and recurring issues and need be addressed because they lead to anxiety for the students and question the validity of the educational value of PBL. To ensure that students learn sufficient content of appropriate scope and difficulty, the way the PBL case is structured is very important because this will either help or hinder the role of the tutors in PBL. It is important that the PBL case has a realistic and interesting clinical trigger, has an appropriate level of difficulty/challenge, and has a reasonable workload for component tutorials. It is essential that the PBL case must have appropriate learning objectives, which should be aligned with learning from the rest of the curriculum.

1.2. Enabling of problem-based learning

The facilitators of problem-based learning are required to change roles from mostly subject matter experts to coaching or mentoring facilitators (Spronken-Smith & Harland, 2009). Facilitation is a contrast to the conventional role of the teacher as an expert of dispensing knowledge, directing the sequencing and learning process, and leading discussions that, for the most part, are from teacher to learner and back (Barrows & Wee, 2010). The facilitator's role is to encourage learners to use dynamic techniques such as experiments and real-world problem-solving scenarios to create more knowledge, then reflect on that knowledge and guide learners to understand and build on pre-existing conceptions (Khalid & Azeem, 2012). thus it can be stressed that PBL facilitation should imply that students get more opportunities to talk than the teacher. The increase in student voice also leads to more ownership because the ownership comes when “students have an opportunity to explain what they understanding, and in the ability to say so the student voice is connected to student understanding and ownership of learning. Table 1 shows

the differences of the facilitators and students role in a problem-based learning environment (Freiberg & Lamb, 2009; Northern Illinois University, 2012).

Table 1: Facilitator's Role and Student's Role in Problem-Based Learning

PBL Facilitator's Role	Student's Role
Learner-cantered	Students are active and take possession of their own learning
Facilitator/Instructing	Students are empowered and encouraged to seek information
The facilitator inspires group Learning	Students are guided to interact with other peers as well as the facilitator, thus leading to feedback and immediate improvement and transfer of knowledge
Topic matter is introduced	Students knowledge is constructed through prior knowledge and experiences
Facilitator is the topic matter	Students knowledge is negotiated, challenged, and tested by other learners
Facilitator directs or guides students in activities	Students decide what needs to be learned
Facilitator assessment of learner's knowledge	Students assess their own learning through reflection by way of self-, peer-, and facilitator evaluation

1.3. Dental Education in U A E

Although the education system of the United Arab Emirates (UAE) is still in its early stages, concerted efforts are being made to accelerate its development (Kirk, 2010), reflecting one of the priorities of the founding fathers to educate and train the UAE's citizens.

The development of medical education within the Gulf Cooperation Council (GCC) countries (Saudi Arabia, Bahrain, Qatar, United Arab Emirates, Oman, and Kuwait) is relatively new and reflects the significant social, cultural and economic transformations to affect the region since the late 1960s. The region's medical colleges have the goal of supplying physicians who can populate the growing healthcare services of each country (Hamdy et al., 2010).

Demographic concerns have an impact on the mission statements and vision of these medical colleges. At present, colleges share similar curricula structures and have moved towards an integrated organ system in the first two to three years. This is followed by a clerkship phase of another two to three years, supplemented by clinical rotations around several disciplines. This strategy creates room to reduce the number of hours dedicated to didactic teaching to provide space and resources for PBL, which PBL-oriented colleges have done so to varying extents.

At the University of Sharjah, the Program Evaluation Committee facilitates continual improvement of the curriculum and ongoing quality assurance. Data from all educational activities are continuously collected from students and faculty and are evaluated to phase out deficiencies, address curriculum gaps, and provide points of action for assessment committees. An electronic curriculum blueprint is regularly consulted and ensures that curriculum outcomes and contents are aligned.

1.4. Significance of the study

The findings of this study come at an opportune time for university administrators – particularly as they seek to meet the UAE's need for an increasing supply of appropriately qualified medical graduates. PBL reduces the burden of memorization and integrates students into the workforce at an earlier date, effectively pooling educational and clinical resources. Any examination of both students and educators' experiences and perceptions of PBL curricula will provide data into the issues and inefficiencies within the PBL process and the environmental milieu, constructive or not, that influences PBL practices.

By taking a qualitative phenomenological approach, the researcher can understand the positions of proponents of PBL. Through these interviews, not only can we gather data to improve the PBL instructional strategy, but we also provide proponents with an opportunity to

reflect on their opinions and ideas and guard against Haghparast's concerns (Haghparast et al., 2011) that a teacher's pedagogical choices may be pejoratively impacted by what a teacher thinks he knows.

Course administrators may apply these findings to improve the efficacy of teaching and learning environments. Currently, PBL has mixed outcomes in dental curricula, which may stem from residual structural inefficiencies, particularly the dominance of the discipline tradition (Townsend & Winning, 2011). Because "disciplines shape the nature of pedagogy and such pedagogies reflect the practices and culture of the discipline" (Savin-Baden & Major, 2007, p. 834). These findings constitute a rare opportunity for the advantages and disadvantages of PBL in dental education to be presented explicitly and objectively to policymakers and administrators to choose the most effective way of implementing PBL into their existing curricula.

In summary, this study complements the existing literature of healthcare education with its exposé of the lived experiences of the practitioners of a new learning method. The method has its challenges and limitations, but also conveys several advantages, which could prove instrumental for the success of medical education in meeting the UAE's growing need for medical practitioners. This research will provide dental administrators and college policymakers with insights about PBL to assist in their decisions regarding PBL's relevance in helping the, to meet these goals.

1.5. Statements of the Problem

Some accuse the educational arm of the medical profession with failing to meet the demands of modern clinical practice. Currently, the profession is struggling to provide an answer. Traditional teaching methods cannot keep pace with the rapid developments of new medical knowledge, new technology, and the growing expectations placed on the profession by society (Sox, 2007). Students are overburdened with volumes of information which, from a practical point of view, they cannot be expected to master (Ludwigsen, 1999) (Norman, Schmidt, 1992). Those seeking reform look to PBL as one possible solution.

This creates the potential drawback, as suggested by Townsend and Winning (2011), that dental education is now directing more resources to fine-tuning the conditions and environment

of PBL than it is to proving the merits of the system in the first place. There remain diverse student outcomes within the dental literature on PBL and questions remain as to whether factors other than PBL itself are at play in its apparent successes. Dolmans and Jacobs (et al, 2005 and 2003) note that the quality of the patient case influences the quality of student learning in the PBL environment.

1.6. Study purposes and questions

The main purpose of this study was to examine the perceptions and practices of undergraduate dental students and facilitators about PBL teaching approach. Therefore, in order to assess their perspectives and practices this study answered the following main questions:

- 1) What perceptions do undergraduate dental students have about PBL instructional approach and its practice in UAE?
- 2) What perceptions do PBL facilitators have about PBL instructional approach and its practice in UAE?
- 3) How do the students' demographic variables influence the students' perceptions about PBL instruction?

1.7. Research Design

To gather the quantitative and qualitative data needed to answer the research questions a mixed-methods study was designed to reveal the attitudes and perceptions within the dental faculty towards PBL.

The first component of this method was a survey instrument consisting of twenty-three statements about PBL. These statements were developed to examine and quantify the level of support and enthusiasm towards PBL, levels of agreement about PBL's advantages, and whether an educator should use PBL as a replacement for conventional methods of teaching. The second component of this method was an additional survey comprising of seven open-ended interview questions, which allowed participants to present their thoughts on the advantages and disadvantages of PBL. These survey instruments will be validated by a faculty member in possession of significant experience in survey design who will provide feedback on the overall

format and structure of the survey, as well as each statement's wording. Additionally, the survey was piloted on five respondents and their responses were evaluated and the survey was modified and finalised as required.

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1.8. Scope of Work

PBL's primary advantage is the positive cognitive impact it has on its students. Its appeal to educators and teachers is that the boost to wider academic achievements brought about by this improvement in cognitive skills. The purpose of this study is to explore and explain teacher's perceptions about the problem types and project features, which best promote these cognitive skills and to investigate how these perceptions feed into teachers' practices within the dental school. This study will also explore students' perceptions of problem-based activities; specifically, to assess the extent to which students attribute assessment success to the presence of PBL as a mode of study.

Given the important of students, practitioners, and curricula-design the mixed-methods study will investigate and gather data in two domains: First, the cognitive domain examines how

teaching strategy can support cognitive learning, examines the students perceptions that support content assimilation, and how best to structure student interaction within collaborative learning.

Second, the PBL content domain, which evaluates and discusses nature of the problem-based learning, in additions examines the teacher's perceptions about it. Discuss the issues that they face during practicing and how to deal with it within their program of study. The main contributor to this study was the College of Dentistry,

1.9. Structure of Dissertation

This dissertation is divided into five chapters. This chapter has provided the context of the study and its potential significance to dental education in the UAE, it has explained the research question and the scope of the study, and has provided the definition of the key concepts, rationale, and purpose.

The next chapter will review the literature on PBL, how it is practiced, and the impact it has had on cognitive skill as well as discussing the facilitators and students views exclusively in dental field. Chapter Three will outline the methodology of this study, including the practical work done to collect two types of data. Additionally, instruments, sampling, reliability, and validity will also be described for any wishing to repeat or corroborate the study's findings. Chapter Four will present the data analysis and results. Chapter Five will present discussion, conclusion moreover the suggestion and recommendations of the study's finding will be included.

Chapter 2: Literature Review

2.1. Overview

There are several trends currently emerging to meet the need for curricula form in dental education. To date, these include competency-based education (Chambers & Glassman, 1997; Licari & Chambers, 2008), comprehensive patient care setting (Holmes et al., 2003; Evangelidis, 1999), virtual reality simulation (Buchanan, 2001; LeBlanc et al., 2004), service learning (Yoder, 2006; Haden et al., 2003; Formicola, 2008), and, finally, problem based learning (Fincham & Shuler, 2001).

Increasingly, PBL is being implemented in dental schools in a complementary style alongside competency-based education, although the degree to which PBL has been implemented in dental schools varies (Fincham et al., 1997). However, they “conclude that dental students working in an authentic PBL program, in which there are no scheduled lecture presentations, exhibited a high level of achievement in a standardized external assessment (National Dental Boards, Part I) that was equal, if not superior to the majority of U.S. dental school students working in a traditional lecture-based didactic curriculum.” (p. 419) additionally, empirical data gathered by Savery (2009) has shown that PBL may have a wider place within the hard sciences by virtue of its ability to enhance the self-direction and familiarity students possess towards and with real-world tasks.

In this chapter, I review the existing literature on implementing PBL. To begin, I review the context of the UOS and education reform. I then review the theories supporting PBL and the conceptual frameworks that have shaped this study. I go on to describe the goals and theoretical foundations of PBL. Finally, I will summarize the aims of research studies that have opened up the “black box” of PBL and investigate the conversations and learning interactions that occur within the PBL group among dental students and their facilitators. Additionally, I will review the dental student perception and their facilitators about PBL.

2.2. Conceptual Framework

Any investigation into pedagogy is complex and can involve teachers, learners, the environment in which the learning takes place and the mechanisms by which each interacts with every other element. This chapter, therefore, seeks to establish an explicit conceptual framework to provide clarity as to the object and methods of the study and identify the “key factors, constructs, or variables” which Miles and Huberman (1994) identified as crucial to a solid theoretical framework.

Both the theoretical and the conceptual frameworks origins of PBL can be traced back to the foundational writings of John Dewey (1916). Dewey argued that “Methods which are permanently successful in formal education go back to the type of situation which causes reflection out of the school into ordinary life” (p. 154) and that “...all principles by themselves are abstract; they become concrete only in the consequences that result from their application” (Dewey, 1938, p. 20).

Dewey philosophizes that learning is socially mediated and that by implication educators had a responsibility to impartially facilitate the process of knowledge acquisition (Dewey, 1938). From a theoretical standpoint, PBL is underpinned by the constructivist theory of learning. The most common instrument for evaluating students’ experience of PBL is a Problem Based Learning Environment Instrument (PBLEI) by Senocak (2009).

One of the primary aims of PBL is to improve students’ critical thinking, problem solving and cognitive development abilities to memorize and recall information – thus making the process of educating cohorts of medical students more efficient. Activation of prior knowledge, elaboration and context matching are three methods generally acknowledged by information processing theory to improve memory and the recall of information. The extent of one’s prior knowledge on a subject is a particularly strong determinant of what one can learn about a subject. The brain must form synaptic connections between existing memories and new material. By activating prior knowledge, we facilitate learning by simulating connections between old and new information. (Onyon, 2012)

In the context of a medical school, administrators can quite easily facilitate the consolidation and remembrance of new clinical information by ensuring the underlying physiological and pathological elements are discussed when students are presented with clinical cases. Students are then forced to create connections between the case in question and knowledge gained during their foundational or school years. There is still debate over the efficacy of this method. Small groups have been shown to better process new information after a discussion of the problem in a small group (Norman and Schmidt, 2000) but Colliver (2000) questions whether the benefits attributed to group discussion could simply be a reflection of the additional time spent within an educational activity.

PBL acts as a catalyst for higher levels of student motivation. Motivation can be separated into two types – controlled and autonomous (Albanese, 2000). Controlled motivation is instigated via rewards or punishments whereas autonomous motivation manifests itself as a byproduct of the interests and desires of the individual learner and what they find to be significant and interesting. Within our education systems, controlled motivation mechanisms are ubiquitous and manifest themselves in attendance registers and assessments. Controlled motivation mechanisms often cause students to act with a sense of pressure and anxiety, and leads to superficial, rote learning. Autonomous motivation, on the other hand, has been shown to improve understanding and academic performance (Ludvigsson, 2003).

Constructivism serves as the theoretical framework within which PBL operates. More specifically, through a form of social constructivism Students bring their individual assignments to a group and discuss, collaborate, and reach consensus (Gregson, Romito, & Garetto, 2010). The best suitable teaching and learning approaches should enable students' attainment of twenty-first century skills and experiences through self directing learning groups (NASRV 2008). In agreement Airasan and Walsh (1997, cited in Orlich et al. 2013, p. 82) sense that "[C]onstructivism is a theoretical model about how learners come to know". Moreover, it is an educational idea that recognized with discovery learning where students obtain new knowledge that builds on their previous knowledge or information when they perform their own experiences (Balim 2009). Furthermore, Forawi (2014, p. 41) contends "[C]onstructivism is the dominant paradigm of learning in science, and a large amount of science education research has been carried out from a constructivist perspective".

Ronis (2008) argues that there is adjacent similarity between inquiry model and the theory of constructivism; understanding is in our interactions with the authentic situation around us. This is the core concept of constructivism. Thus, PBL is an example of constructivist approach where learners must examine the close occurrences by evaluating the collected data to make a logical conclusion (Blanchard et al. 2010) rather than the teacher passing the material inactively to learners (McKinley 2012). Therefore, constructivist thinking inspires self-directed learning approaches that allow students to have the active role during following the learning process through planning processes and evaluating evidences (Kang, Jordan & Porath 2009) which improve their problem-solving and critical thinking skills (Hmelo-Silver 2004). Each student's goal or question acts as a stimulus around which understanding can be constructed. Knowledge is actively built by the learner as each student seeks and scrutinizes input from others. Furthermore, students are forced to reflect on and defend their views as they interact with others who possess contrasting or opposing views thus constructing new modes of learning (McCarlie & Orr, 2010).

Despite its documented advantages as a learning theory, PBL is still limited in ways, which expose it to challenges from other areas of medical and dental education. PBL requires proper execution in order to convey its benefits. Currently, not all faculties understand it, it is not easy to apply to every classroom, and its student-centered methodology conveys teaching staff less control than they do normally would have if teaching via direct instruction. This study seeks to gather and understand the perspectives of medical and dental practitioners and students to develop PBL into as optimum a version as possible. If this method improves as a mode for instruction, it has the potential to phase out other methods over time.

2.2.1 PBL Scenarios

There is a degree of consensus that the characteristics of the problem itself are the key to successful outcomes in a PBL environment (Duch, 2001; Hung, 2006, 2009; Savery, 2006; Sockalingam and Schmidt, 2011; Weiss, 2003). Nevertheless, there remains indistinct and insufficient advice on what constitutes a high-quality problem-based scenario. Some conceptual frameworks exist for designing PBL scenarios; Hung, for example, proposed 3C3R (2006, 2009). Despite the contextual and functional advice, he offers, the field still requires a systematic

investigation into the levels of success or failure of various options. Botti and Noguez (2004) were the first to innovate with a thorough blueprint for PBL scenario elements. They provided a catalog of elements and quality descriptors to guide the design of effective PBL scenarios. Within this catalog was included structure, authenticity, curricular relevance, learner relevance, ways and means, thinking requirements, and potential solutions. More recently, Sockalingham, et al. (2012) proposed a 5-point Likert quality-rating scale for problem scenarios. The scale was aimed at satisfying certain specific conditions set within the PBL literature. Sockalingham was determined that each problem should “facilitate [...] accomplishment of intended learning objectives”, be “authentic and representative of real-life situations”, each should “pique the interest of the student”, should “promote collaborative learning”, and “foster and facilitate critical thinking” (Sockalingham, 2012, p. 43). Both authors carried out an H analysis to assess the reliability of the Likert scale and its replicability. The results indicated moderate to good reliability with a range of scores from .66 to .78.

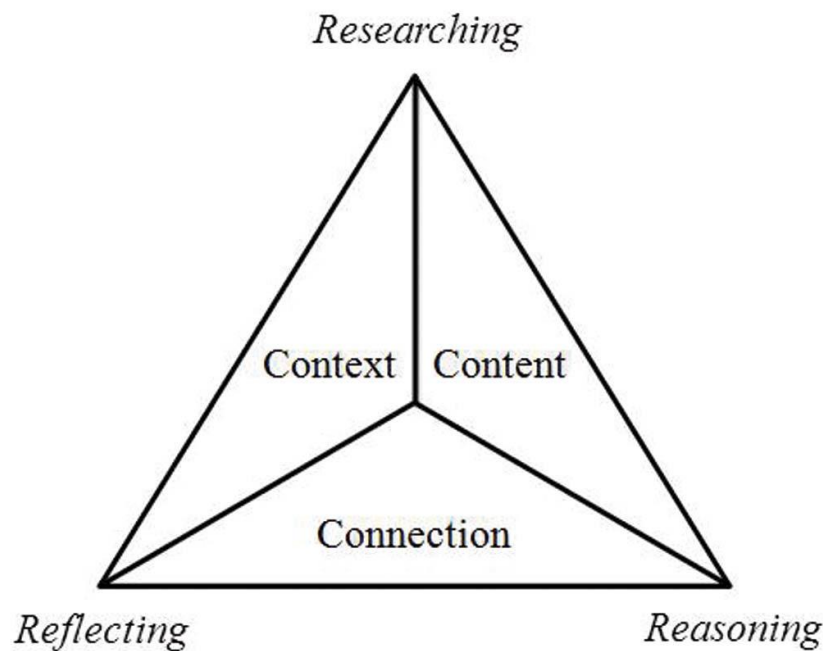


Figure 1: Framework of a 3C3R-PBL problem design.

There are substantial pedagogical and organizational benefits to adopting a structured approach to PBL problem design. Rather than being left to a student's or tutor's interpretation, PBL scenarios can be tailored to fit learners' characteristics, to meet learning goals, to better target curricula demands and to accommodate clinical constraints. Hung's 3C3R model aims to prioritize those issues critical to the effectiveness of problem-based learning. When designing the content and scope of a scenario 3C3R looks to activate students' prior knowledge, their problem-solving capacity, and their ability to self-direct their learning. Additionally, any scenario should reflect the cognitive ability and prior PBL experience of the student. Learning goals should be tailored to the level of the student. Content, Context, and Connection form the integral part of PBL problem design within Hung's (2006) 3C3R conceptual framework. Designed around these core elements are the 3Rs are obligations to Research, Reason and Reflect.

A 3C3R design focuses on mastering the necessary learning contents, developing the expected learning goals in appropriate depth, utilizing proper and effective research methods, using rational and efficient reasoning processes, while integrating conceptual knowledge processes and effective strategies to solve the problem (Hung, 2006). This kind of accuracy can help the students to attain their learning goals as intended and anticipated. Therefore, the 3C3R model could enable PBL to be a more consistent form of instruction.

2.3 Literature Review

Dentistry is a profession in its own right (McCarlie & Orr, 2010) and, regardless of the similarities they share, should not be seen as a subsidiary of medicine. Dental education has its own challenges and prerequisites; consequently, it is important to consider the importance of PBL within dentistry specifically.

Dentists face complicated clinical situations daily which require them to think critically and solve complex problems. Increasingly, the pedagogical choices of dental faculties seem to reflect this. Leaders are seeking out modes of instruction which elicit and improve critical thinking. PBL is becoming increasingly popular within dental education for this reason (Johnsen, Finkelstein, Marshall, & Chalkley, 2009).

Often, students in the earliest stages of their careers will be using critical thinking skills and drawing on knowledge from other areas to mitigate a lack of dentistry-specific knowledge. Accordingly, educators within dentistry should look to modes of learning which test this ability to learn from other fields and to assess, evaluate, and find solutions for clinical problems (Nadershahi, Bender, Beck, & Alexander, 2013). PBL is an appropriate tool for improving these skills in dental education, offering an environment in which students can learn more effectively (McCarlie & Orr, 2010).

2.3.1 PBL in Dental Education

PBL in dental education requires students to plan and carry out research tasks and to work collaboratively in small groups (Hmelo-Silver, 2004). In parallel with these tasks dental faculties will facilitate PBL sessions in which students take responsibility for their own learning.

In these sessions, students will be provided with a challenging clinical case to analyze and solve within small groups. They are expected to collect information, data and ideas and then brainstorm and organize what they have collected. Normally, they are permitted to consult scientific textbooks and reliable search engines to gather any data required to reach a solution. Given the vast amounts of data available, students are obligated to reject flawed, irrelevant, or substandard ideas. They naturally develop frameworks for criticizing, approving, or rejecting information and automatically begin to organize good ideas and structure knowledge into frameworks. During the process, they are also forced to consult with their peers to share information, ideas, and to criticize each other's contributions (Fincham & Shuler, 2001).

In a coup for PBL worldwide, Fincham and Shuler (2001) discovered that the implementation of PBL correlated with an improvement in dental students' performances in the National Board Dental Examination (NBDE), upon which dental licensure is granted. Fincham and Shuler (2001) reasoned that PBL could be a noteworthy replacement for traditional curricula because, not only did it improve dental students' scores, but it achieved a holistic improvement in students' academic wellbeing. Students in Fincham and Shuler's study not only improved, but they reported enjoying and feeling engaged in their learning.

Fincham and Shuler argued that because PBL engages and encourages students to become active learners it conveys a large advantage over conventional instruction, which only promotes

the memorization of facts. Moreover, Thistlethwaite et al. (2012) provided a supporting observation that students not only enjoyed PBL cases more but also expressed an awareness that such a mode of learning was beneficial. Similarly, Guven, Bal, Issever, and Can Trosala (2014) found that students enrolled in a PBL pharma-cobio-chemistry course in dental education found it both enjoyable and useful. Where assessments are concerned, PBL also has also been shown to improve dental graduates' perceived preparation for dental practice (Bengmark, Nilner, & Rohlin, 2012; Yiu et al. 2011).

Nevertheless, objective outcomes of teaching and learning are, ultimately, far more important than students' perceptions of their preparations for dental practice. It is important to substantiate whether implementation of PBL correlates with improved acquisition of knowledge. In a recently published literature review, a select number of well designed, randomized, and controlled trials in dental education evaluated the effectiveness of PBL (Bassir, Sadr-Eshkevari, Amirikhorheh, & Karimbux, 2014). Bassir et al. concluded that PBL doesn't have a negative effect on knowledge acquisition, and in fact improves students' abilities in applying their knowledge to clinical situations. It was establish in additional methodical appraisal of the literature that no noticeable difference between PBL and traditional teaching at the level of randomized controlled trials or comparative studies (Polyzois, Claffey, & Mattheos, 2010). Polyzois et al. argued, however, that the comparative studies including single PBL intervention in a conventional curriculum had consistently favourable results for PBL.

Conversely, a study originating from the University Of Iowa College Of Dentistry purported the opposite. The college implemented a PBL curriculum and Marshall et al. (2011) had the opportunity to compare students' performances in assessments before and after the changes were made. In this case, a learning report was replaced with a structured, peer-reviewed critique. Student performances over the two consecutive years were analyzed and the comparison of one year with the other showed a significant improvement in attainment after the implementation of PBL. Student scores were statistically significantly higher. Marshall et al. argued that the clear improvement in student performance after implementation of PBL reflects the importance of regularly reviewing one's curriculum and addressing any inconsistencies or shortfalls. Students' scores are some of the most common data cited when measuring student achievement. Consequently, this study supports the notion that PBL is a promising strategy to improve student

performance at an organizational or even national level. Given this potential, it is valuable to assess students' perspectives towards PBL as a teaching method to explore strategies for its widespread implementation.

Similarly, Alrahlah (2017) supports the structural and meta-cognitive benefits of PBL. PBL encourages students to become invested in and take responsibility for their own teaching and learning. Students are intrinsically motivated to build relationships and work productively within teams, to cope with new and changing circumstances, and to reflect on their learning skills. This form of metacognition improves students' all-round critical thinking skills – preparing them aptly for future careers.

All this at a time when Haghparast, Ghorbani and Rohlin (2016) are emphasizing the need to develop curricula whose very design is aimed at improving the efficiency of students' learning and the mechanisms at work behind their education.

2.3.2 Dental Students and PBL

As students enter higher education there is a discrepancy between teachers' expectations and the average levels of study skills, ambition, and professional awareness. Often, students have not received the instruction on how to be effective learners until they receive explicit instructions and opportunities to practice and apply these new skills ((Rachal, Daigle & Rachal 2007). Historically, students' primary exertions have been directed towards excelling in written examinations. Their content knowledge, therefore, is secondary – and leads to 'surface' learning (Parton & Bailey 2008). This reality manifests itself in a prevalence of good written answers but lower average abilities in oral expression and critical thinking. Consequently, teacher-student relationships are often negatively affected by a need to overcome poor learning strategies.

Dental students must also live up to the expectations set by external bodies. Requirements of the ADEA, for example, oblige students to retain sufficient competency to evaluate emerging trends in healthcare, maintain their critical thinking and problem-solving skills and continuously evaluate contemporary research and integrate relevant findings with clinical expertise to ensure up-to-date, evidence-based practice (Competencies for the New General Dentist, 2008).

There are effective distresses from students about the change into an active learning curriculum, such as problem-based learning. Many students frequently sense disordered as to where they should concentrate in their studies on or what they need to learn to be effectively ready for classes (Hmelo-Silver, 2004). While Fincham and Shuler (2001) encouraged PBL, they selected some necessities to ensure its effective implementation. Students should follow the PBL model to make the most of their learning. For example, timekeeping and attending are vital. Furthermore, students should be permissible to think aloud with their peers and should go over each stage of the PBL process.

To be successful in a PBL setting, individuals must master the problem-solving process in addition to the specific requirements of the course or unit which they are working towards. Often, first-time PBL students will struggle to identify and prioritize relevant skills and subject knowledge without an instructor introducing and framing possible approaches to the problem (Vardi & Ciccarelli, 2008). Poorly structured or complex problems, too, may impede success where students are overly reliant on didactic teaching. Students may struggle to find the “correct” path towards successful completion of the scheme of work (Henry et al., 2012).

2.3.3 Dental Faculty and PBL

Given the emphasis that PBL places on the importance of self-directed learning, a spectrum of competing opinions exists on the scale and scope of the role of PBL tutors (Blumberg, Michael, & Zeitz, 1990). Barrows (1998), for example, argues that the PBL tutor should raise student awareness in higher cognitive thinking and question development. Others worry that a focusing predominantly on cases is limiting and leaves gaps in students’ knowledge (Blumberg & Michael, 1992) and that tutors have an important role to play in blending active learning styles with traditional modes of instruction. In this way, students can develop the independent learning skills facilitated by PBL without moments of confusion or periods of loss mitigating the improvements made (Blumberg & Michael, 1992).

As formerly stated, through PBL students are first offered with a multifaceted clinical case which required to be resolved, at which point each group is anticipated to assess the progression frequently. After recognizing the problem and gathering the facts, perceptions should be suggested, prearranged, and education needs should then be derived. Subsequently, students

examine and study these ideas, during which learning means (e.g., books, computers) should be referred. Students then re-evaluate their learning needs, filtering their ideas as more data and facts are gained. Students catch good ideas, discard imperfect ones, and derive conclusions. Most dental educators recognize PBL as a valuable, imperative teaching technique, as found in a recent study in which the attitudes and perceptions of U.S. dental faculty and students at ten dental schools were surveyed (Abdelkarim et al., 2014). Dental education associates were found to be accepting of PBL, but they supposed its application is mainly reliant on the topic. They similarly believed in using PBL as an aide-de-camp, rather than a replacement of, structured didactic learning. Dental educators did not recommend substituting conservative learning methods with PBL. Abdelkarim et al. establish that dental students had similar viewpoints to their faculty, as they believed that PBL was not adequate by itself and consequently must not replace organized didactic learning. As of global perception, PBL was endorsed even in enormous Chinese classes deprived of the necessity for extreme educational resources (Qin, Kong, Lu, Lu, & Wang, 2010). Qin et al. intended to regulate the feasibility of implementing PBL in a large stomatology modules and whether prior PBL experience was required for that implementation. In two large classes with students who were both knowledgeable and inexperienced with PBL found it pleasurable and useful, and Qin et al. concluded that previous PBL experience was not essential. In one more Chinese study in dental education, Zhang et al. (2012) established that a hybrid course on oral and maxillofacial surgery (a dental specialty concerned with the surgery of the jaws and related facial structures) enhanced operative skills, case examination skills, and self-confidence for fourth-year dental students'. In the same study, students' marks improved upon finishing point of both PBL and traditional lectures. The PBL group improved scores in both their case analysis and other skills. In agreement to that a meta-analysis was carried out which assessed PBL's effectiveness in the context of Chinese dental education. The results of the study suggested that PBL should be used in conjunction with other teaching methods, as an optional, rather than the primary, mode of instruction. (Huang et al; 2013). It was noticed that improvements in attainment by those eventually graduating from the course was often offset by a decrease in the rate at which students passed. Chinese dental schools therefore devised a tailored PBL model specific to their needs and conditions. To conclude, research studies conducted via surveys rely too much on the perceptions of respondents and may be subject to inherent bias. A number of studies, in fact, which prospected medical and dental

faculty attitudes towards PBL, may have been focused on students' interests in learning via PBL, and not on the objective assessment of PBL's ability to add value. Zhang et al. claimed that upcoming testing must be conducted after those students' graduation to evaluate the long-term effects of the PBL method.

2.3.4. Comparison between PBL with traditional lectures

Problem-based learning is often compared to a traditional learning control group. An instructor primarily knows traditional learning as a presentation of materials. Learning is teacher-centred, with the instructor delivering materials in a lecture-based format to passive learners. Textbooks are often the primary source for content and written examinations are used as the typical mode of assessment. Traditional learning has also been called didactic, conventional, and teacher-guided teaching.

Students on a PBL course tend to place more focus on using resources such as the library and online sources. By contrast, those who are taught in a traditional approach place more emphasis on the resources supplied by the faculty itself. Moreover, students who learn through problem-solving strategy are more likely to use this spontaneously to solve new problems in the future compared with those taught in a traditional way. (Colliver, 2000)

Learning encompasses three domains and problem-based learning mentions them in its process and learning goal expectations. The cognitive domain is centered on understanding knowledge, thinking, problem-solving, and mental skills in a learning environment, the affective domain focuses on feelings, emotions, attitudes, values, and awareness about learning. It also encompasses the passion and feelings that accompany a learning experience. and the conative domain focuses on the activation of behaviour or actions in learning. It underscores the willingness and desire to learn, concerned with volition, directed efforts and follow-through ((Leary, 2015) Self-directed learning is the main aspect of problem-based learning that concentrates on learning discovery and understanding individualized learning processes. It is concerned with enhancing the ability of a learner to take control of their learning, to foster transformational learning, and to promote social interaction for gaining access and perspectives on information.

Several studies have examined the learning outcomes associated with the traditional lecture-based approach. The results demonstrate that this method can effectively provide students with required knowledge; other methods, however, may be more effective. Moreover, in comparison with other methods, traditional lectures are not ideal for teaching skills or changing students' attitudes (Jeffries and Jeffries, 2014). These results point to the benefit of reducing the number of lecture hours in health and medical curricula, replacing and them with more effective teaching methods, such as PBL (Jeffries and Jeffries, 2014). in agreement to this Alrahlah (2016) stated that evidence shows that students in PBL-based courses exhibit superior professional skills and effective learning compared with those instructed using traditional approaches.

Zahid et al (2016) suggest that the PBL-based curriculum students performed significantly better than the didactic lecture-based curriculum students in both theoretical knowledge base (MCQs) and in clinical examination (OSCE). The proportion of the new curriculum students with top grades was significantly higher while their number with lower grades was significantly less than the lecture-based curriculum student's results.

A significant number of reviews and meta-analyses have been carried out which have failed to demonstrate unequivocally that PBL confers any benefit over traditional curricula (Van der Vleuten CP.1996). Some studies (Koh et al 2008) have demonstrated that PBL can promote clinical skills and professional competency, but PBL's utility in improving broad acquisition of subject knowledge is uncertain. (Nandi et al 2000)(Berkson et al 1993)(Schmidt et al 2011) These discrepancies can be explained in two ways. Firstly, the lack of consensus around how PBL should be implemented has led to a multiplicity in PBL styles. The myriad iterations of PBL make any meaningful comparisons of the processes involved difficult Maudsley (2016). Secondly, it is extraordinarily difficult to measure the outcomes and efficacy of PBL. Different outcome measures have been used by different proponents, and the very fact that PBL is an innovation and is meant to cultivate and assess a broader range of skills, makes it difficult to draw firm conclusions and make comparisons with more traditional curricula. (Neville, 2009)

One difficulty in evaluating PBL is that the process used to solve the problem and the solution reached is equally important. In addition, social interactions in a PBL group are complex; they unfold in sequence over time. Evaluation of the acquisition of such skills is quite difficult. For instance, knowledge evaluations have been used to assess students in PBL courses,

but this approach does not effectively capture the acquisition of collaboration skills during PBL. Assessment by facilitators might be better, but it could affect group harmony. Moreover, the issue can be even more complicated when students have worked as facilitators or co-facilitators (Albanese and Dast, 2014).

The uncertainty about the effectiveness of PBL and the heterogeneity in the published literature (Balendran and John, 2017) provided the drive for this study. Moreover, very limited work has been done in this regard in our country. The current study was planned to examine the perception of the dental students and their educators about the PBL teaching method in order to design the curricula with the much-benefited mode of learning.

Chapter 3: Methodology

The previous chapter has shown that there are limited studies in PBL that have investigated fundamentals of problems- based instruction and its practice in the UAE, and no studies refer to its impact on under graduate dental students.

This study aims to examine the problem based learning from students and facilitators perspective in higher education. This chapter will discuss the context, the research sample, instruments and ethical issues. Later, the methodology will be discussed through using mixed methods (quantitative and qualitative). Mixed methods approach is used to answer the queries of the study and to achieve its goals. This design is defined as “an approach to inquiry that combines or associates both qualitative and quantitative forms” (Creswell 2009, p.4).

3.1. Approach of the study

The study endeavours to examine the perceptions of PBL teaching instruction in students’ learning process from student’s perspective as well as from the facilitator’s perspective. Moreover, to appreciate if the demographic of the students has an impact of their perceptions. The study followed the mixed method approach. This research will follow a single mixed method research design which is defined by Creswell (2012) as defines the mixed method research design as a “procedure for collecting, analysing and "mixing" both quantitative and

qualitative methods in a single study or series of studies to understand a research problem” (p 535). As this research has been a single study, Punch (2009) agrees that mixed methods research is “empirical research that involves the collection and analysis of both qualitative and quantitative data where they are mixed or combined in some way” (p ;288). Lai & Viering (2012) stated that different instruments applied to overcome the difficulty in measuring types of scientific skills such as cognitive and collaborative skills as they are interrelated. In agreement to that Creswell (2012) highlighted that mixed method can help in providing a clear understanding of the study problem, whereas using one type sometimes is not enough to address the problem of the research or answer it.

In addition, a mixed method approach has been used to explore the efficiency of supportive learning involving the collection of data. The quantitative approach has been employed to collect numerical data from a large sample size to explain and get better understanding from the results (Gay 1996). Moreover to allow the researcher to measure the frequency of opinions, followed by the analyses of the data to figure out the responses from the questions and test these results later, and to build a relationship between results and literature review (Creswell 2012). Whereas, the qualitative approach has been used to provide the chance to gather comprehensive information about phenomenon's or individuals and it includes the coding data. (Creswell 2012).

Interviews conducted face-to-face and in depth to allow the researcher to control the questions and give the chance to collect useful information and data from the participants. Then qualitative data coded to identify the overarching themes and subthemes presented by dental faculty. Afterwards, qualitative themes emerged and recurring themes identified.

3.2. Context

This study was carried out at the College of Dental Medicine on the University of Sharjah's Sharjah campus. The college is one of the region's leading centres of dental medicine and has been chosen for the study because it is the workplace of the researcher. This makes access to participants and approval for research barrier-free and accelerated the time taken to conduct research and collect data. Moreover, PBL has been implemented at Sharjah's College of Dental Medicine since 2005; it has been in practice from BDS1 up to BDS5 about 8-9 sessions in each semester.

3.3. Participants and Sample

The first cohort of participants is a multi-ethnic group of students representing every level of the student body between years one and five. Three hundred and fifty students were selected at random from the same programme and constitute the sample size for the questionnaire technique whilst the sample size for the interview technique is five students, one from each level of the study, who voluntarily participated. The total size of the sample for this study is 340 where participants were volunteering in this study. The table below shows the number of Students Participated in study explaining their study level.

Table 2: Students Sample per Data Collection

Study level	Participants of Questionnaire	Participants for Interview
BDS year 1	77	1
BDS year 2	73	1
BDS year 3	69	1
BDS year 4	46	1
BDS year 5	41	1

The scholar used simple random sampling. In this type of sample, each participant of the population has the same chance of being nominated (Cohen et al 2007) and the researcher obligated to get the view about PBL statements from diverse aspect separately. The researcher used handouts for the questionnaire and stay in different classes of the program to insure that the perceptions is given from all study level also to guarantee that all participants would answer the questionnaire without missing any questions. The researcher explained to the participants the reasons of the study and the outcome of it. Moreover, full explanation has been given by the researcher to the participants about the right to withdraw from the study, the participation is voluntary, and they can refuse to participate if they want to. The participants read and given the consent form that explain the study and their rights before participating in this study (Appendix2)

Second Participants group are the PBL facilitators, three PBL facilitators are selected to participate in this research with different years of experience and different education qualification.

Table 3: Facilitator's Participant qualifications and years of experience

PBL Facilitator	Study Level	Years of experience
1	Professor	25
2	Professor	20
3	Associate Professor	10

3.4. Instruments

Instrumentation is well-defined as “the whole process of preparing to collect data, it involves not only the selection or design of the instruments but also the procedures and the conditions under which the instruments will be administrated” (Fraenkel & Wallen 2012, p. 118).

In the first page of the survey instrument, the purpose of the research project presented examining the perceptions of dental students and faculty towards problem-based learning. In addition, all participants completed a demographic survey that designed to elicit a couple of information such as year of study and gender. To encourage study participants' participation and consent, they were informed with the following information: the procedure involves filling out a hard copy survey, which takes approximately five minutes. There were no predictable risks or benefits to participation, and responses were anonymous. No identifiers, such as name or e-mail, were requested. Study participants were informed that they cannot be identified, and the results of this study are to be used purely for scholarly purposes. Study participants were then provided an email to use should they have any questions about the research study. A copy of the survey pages is included in Appendix 4.

3.4.1. Students Questionnaire

A questionnaire is one of the “Written-response instructions” (Fraenkel & Wallen 2012, p. 122) that is defined as “a self-report data-collection instrument that each research participant fills out as part of a research study” (Johnson & Christensen 2012, p. 162). The main aim of the

questionnaire must be based on the type of the research problem to provide the researcher with the needed information, the fact that the questionnaire is anonymous and has uniform procedure can be highly beneficially to the researcher as well as easy to score. (McMillan & Schumacher 2010)

Primarily, there was one quantitative section to examine the dental student's perceptions of the essential elements, practice and effectiveness of PBL based on Likert scale to indicate a rank order of agreement or disagreement (Bell, 2005). The likert scale is designed with potential responses to provide maximum flexibility to reflect the best student's perceptions. (McMillan & Schumacher 2010) It was delivered to students at the beginning of first term in the academic year 2017, also there was one open-ended comment at the end of the questionnaire for further clarification aims to explore students' perceptions about PBL teaching instruction that they feel to add in support to their responses.

All the quantitative data is saved in Microsoft EXCEL file to be statistically analysed using the Statistical Package for Social Science (SPSS) software. Reliability of this questionnaire was checked by piloting it and the results are in table 3.

3.4.2 Interview Process

The semi-structured interviews occurred at the interviewees' convenience and in locations of their choosing. The researcher attempted to interview the participant in a location where the participant felt comfortable and where it was reasonably quiet. One interview occurred at the campus library, and two in the interviewee's office

To ease the participant into the interview, the researcher began with easy-to-answer demographic type of questions. For example, the participant's years of teaching experience, the interview continued towards the interviewee's thoughts and experiences with PBL. Participants' passionate beliefs about PBL surfaced with animated descriptions of the advantages of PBL and comparisons to their learning experiences as a student in the traditional curriculum.

The researcher used an interview guide to facilitate the interviews. Participants were informed regarding the nature of the study. Interviewees read and signed the consent form. (Appendix A)

Participants were able to withdraw consent at any time during or after the interview by telling or emailing the researcher. The researcher recorded the interviews with digital tape recorder.

3.4.3. Pilot Study

Pilot study is very significant since wording of the survey is of paramount important. Therefore, the prior testing process of the questionnaire wording was conducted for a several reasons such as eliminations of the ambiguities in phrasing, increasing the practicability and insuring validity and reliability for more efficient study questionnaire (Cohen et al. 2000). Consequentially quite a few adjustments were made to this pilot questionnaire. Some words have been reviewed and altered to avoid repeating or unclear statements, moreover to prevent possible confusions. (McMillan & Schumacher 2010) The reliability level of student questionnaire was measured by SPSS software, and resulted in Cronbach's-Alpha = 0.896 which signifies a high level of internal constancy for this questionnaire with 23 quantitative questions. The table below illustrates the reliability scale of the questionnaire.

Furthermore, a professional instructor contribute was to ensure validity reviewed all the forms of the study instruments.

Table 4: Reliability Scale of the Questionnaire

Reliability Statistics	
Cronbach's Alpha	No of Items
.896	23

3.5. Ethical Issues

Ethics is considered as an essential matter that the researcher has to take to consideration throughout the study. The researcher must keep all the data private, and the entire participant information and identity confidential and undisclosed as demanded by the college ethical process. These procedures make the participants. Furthermore, the researcher notifies the

participants that this data will be used for instructive purposes and the anonymity of the contributors will be protected and numbered (Creswell, 2012). All the survey data, discussion and the interview transcript will be kept in a safe cabinet for a period of time.

The researcher took permission before collecting the data for this study. Firstly, a permission letter was sent to the Office of Vice Chancellor for Research & Graduate Studies, UOS, from the British University in Dubai (BUiD) to allow the researcher to conduct the research (Appendix 1). Then, the researcher received the approval to conduct the research from the director of the Research Ethics Committee, UOS to collect data for this study (Appendix 2).

During collecting the data from the participants, the researcher explained the reasons for this study and the information needed from it. In the questionnaire technique, the researcher was able to clarify the survey statement to the participants and go through some of the statement with them. After that, the researcher claimed in the confidentiality of the whole process.

In the interview, all the participants have been informed that their answers and response will remain confidential and they are free they are free to do so if they decided to withdraw at any stage with no cost. They have been also informed that their name will not be mentioned. Before each interview, the researcher briefly explained to the participants the purpose of this study and asked them to sign the consent form. The consent form included that the participation in this study is voluntary and participant's responses will be recorded. During the interview, if the participant does not feel comfortable to answer any questions, she/he has the right to decline the question or end the interview. Moreover, the researcher will not identify the participants' names, they can sign without mentioning their names, they will remain anonymous, and the researcher will use coding system in the study.

Chapter 4: Results and Data Analysis

The aim of the current study is to examine dental students and faculty perceptions regarding Problem-Based Learning (PBL). This chapter illustrates the results that gathered from quantitative and qualitative data to explore and investigate perceptions of PBL instruction and its practice in higher education. Three hundred and thirteen dental students completed the quantitative survey. A few responses for each statement were missing because study respondents were allowed to skip some questions if they choose to. The reliability analysis of this survey resulted in a Cronbach's Alpha score of 0.896, and the Cronbach's alpha is a numeric score ranges from zero to one, and used to measure or esti A value above 0.70 is favourable, and a value above 0.80 indicates high reliability. Results are presented in the following five sections: demographic information, overall responses of students, perceptions based on both gender and academic year (study level), followed by the facilitator's responses the open-ended interview questions to questions.

4.1 Demographic Information

4.1.1. Gender

Based on the results of the One sample t test was found there is no significant difference between gender in Problem-based Learning ($p=0.535$) for the overall survey statements. This means that both male and female dental undergraduate students have similar views about PBL based on the study questionnaire. See table 5 below that shows the results from the demographic gender section of the dental student's questionnaire. Table 4 shows the number of student that participated in study and the percentage in each study level, and table 5 shows the results for the Test of significance:

Table 5: Distribution of sample size by gender and study level

Gender	Study Level	Number of Students	Percentage
Male	Year 1	16	20%
	Year 2	16	21%
	Year 3	20	29%
	Year 4	19	41%

	Year 5	14	29%
Female	Year 1	61	80%
	Year 2	57	79%
	Year 3	49	71%
	Year 4	27	59%
	Year5	34	71

Table 6: Test of significance based on gender

statement	Mean	Standard deviation	Test
Gender	M = 2.29 F = 2.33	M = 0.06 F = 0.04	<u>One sample t test</u> T = - 0.620 P-value = 0.535

The below bar charts illustrate female and male responses to the questionnaire statements and shows that there are no much differences in the dental students responses about PBL teaching instruction between males and females. See statics analysis table for male and female result appendix 6

Fig 2: Female overall average positive responses (strongly agree and agree)

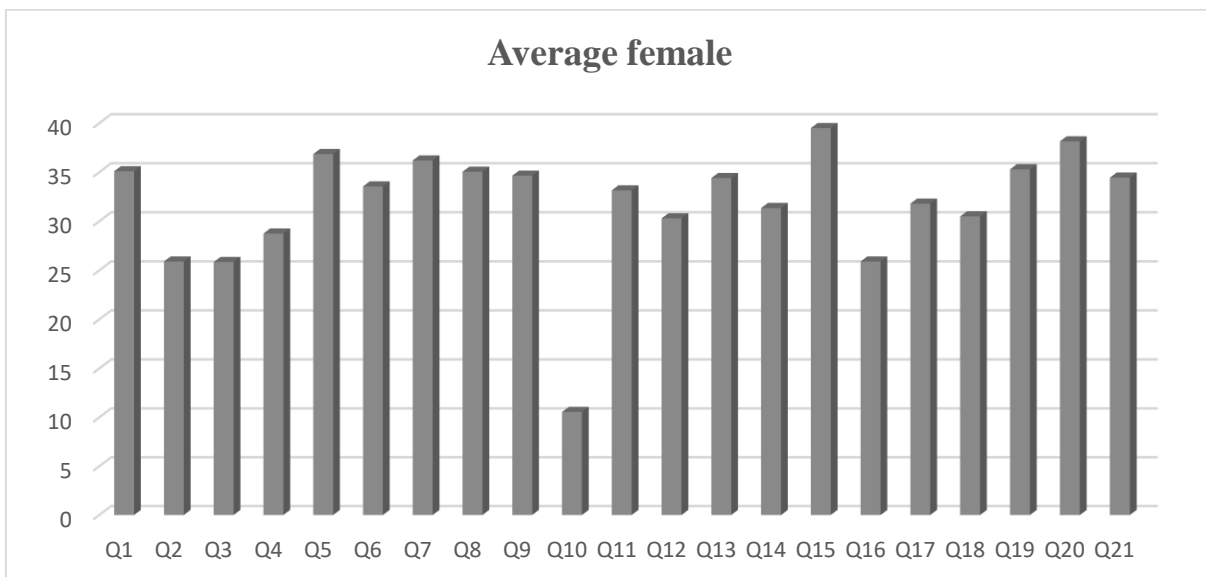
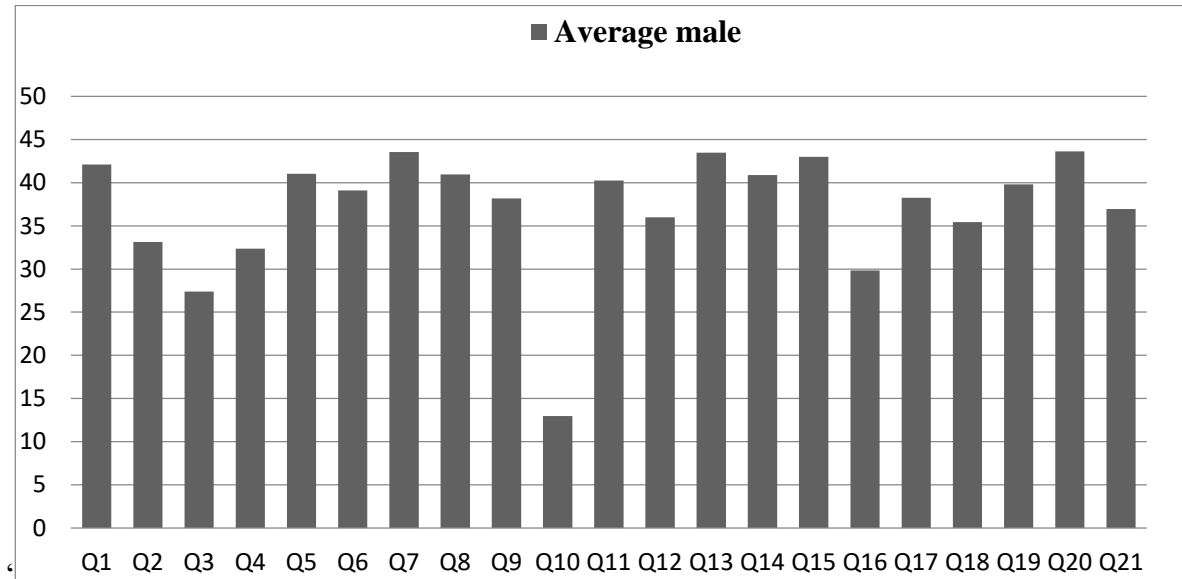


Fig 3: Male overall average responses (strongly agree and agree)



4.1.2. Study Level

Based on the results of the One-way ANOVA test a significant difference was found for study level in problem-based Learning ($p=0.001$). This means that participating students differ significantly of their PBL perceptions from years 5, 4, 3, 2, and 1, consecutively as indicated in table 6 below. In addition, order them as follow: Year 5 > Year 4 > Year 3 = Year 2 = Year 1.

Table 7: Test of significance for study level

statement	Mean	Standard deviation	Test
Study Level	Year 1 = 2.34	Year 1 = 0.60	<u>One-way ANOVA</u> T = 4.518 P-value = 0.001
	Year 2 = 2.32	Year 2 = 0.55	
	Year 3 = 2.23	Year 3 = 0.56	
	Year 4 = 2.14	Year 4 = 0.69	
	Year 5 = 2.32	Year 5 = 0.59	

4.2 Students Perceptions of PBL Statements

The aim of this questionnaire is to reveal the perceptions of all participants from the college of dental medicine. Table 8 illustrate the questionnaire statements and the overall responses, The average ratings are calculated based on the weight of 1 to 5 assigned to the Likert scale (strongly agree to strongly disagree). The level of agreement dental student's respondents to twenty statements tends to be in favour of "agree" selection, as evidenced by the largest number of this selection for most of these statements. On the other hand, dental students tend to "disagree" with these statements displayed on Q10 evidenced by the largest number of the disagree to this statement. Table 8 shows responses of dental students in this study, by number and percentages of total respondents to each statement.

Table 8: Frequency of student's answer's in the questionnaire

Problem-based Learning Questionnaire									
SA		A		N		D		SD	
#	%	#	%	#	%	#	%	#	%
The PBL teaching strategy is interesting									
71	22.7	144	46.0	58	18.5	28	8.9	12	3.8
The proper training of PBL was given before its implementation									
46	14.7	125	39.9	84	26.8	50	16.0	8	2.6
The knowledge gained by PBL is more thorough than it would be by conventional teaching (lectures)									
71	22.7	99	31.6	83	26.5	45	14.4	15	4.8
Understanding the objectives through PBL are better than if it has been lectured in the conventional way									
68	21.7	117	37.4	71	22.7	43	13.7	14	4.5
This PBL strategy takes more time than conventional lectures									
84	26.8	148	47.3	46	14.7	31	9.9	4	1.3
In PBL knowledge is organized around problem rather than disciplines									
64	20.4	143	45.7	77	24.6	22	7.0	7	2.2
In PBL learner assume responsibility for their own learning									
63	20.1	159	50.8	72	23.0	18	5.8	1	0.3
In PBL learners become active processors of information									
66	21.1	154	49.2	65	20.8	21	6.7	7	2.2
PBL encourage learners activate prior knowledge and learn to elaborate and organize their knowledge									
86	27.5	134	42.8	68	21.7	19	6.1	6	1.9
The curriculum should be completely PBL- based									
21	6.7	51	16.3	75	24.0	91	29.1	75	24.0

PBL enhances the ability to find the information using the internet/library									
59	18.8	149	47.6	70	22.4	29	9.3	6	1.9
PBL helps in identifying the areas of weakness for improvement									
62	19.8	126	40.3	84	26.8	33	10.5	8	2.6
PBL maximize the use of knowledge and abilities									
57	18.2	159	50.8	59	18.8	31	9.9	7	2.2
PBL enables the learner to establish a concrete action plan to achieve their learning goals									
38	12.1	163	52.1	82	26.2	26	8.3	4	1.3
PBL enhances the communications skills through discussions and presentation									
94	30.0	147	47.0	47	15.0	21	6.7	4	1.3
PBL increases ability to manage the time effectively									
61	19.5	108	34.5	86	27.5	46	14.7	12	3.8
PBL helps to convert from passive to active life long learner									
61	19.5	141	45.0	78	24.9	25	8.0	8	2.6
The role of facilitator in the PBL process is helpful									
61	19.5	131	41.9	73	23.3	38	12.1	10	3.2
PBL improves the decision-making skills									
78	24.9	143	45.7	65	20.8	21	6.7	6	1.9
PBL improves the problem-solving skills									
85	27.2	152	48.6	51	16.3	20	6.4	5	1.6
PBL develops the confidence in self-directed learning									
91	29.1	126	40.3	68	21.7	20	6.4	8	2.6

Table 9: Table of significance for overall dental student's perceptions about PBL

Statement	Mean	Standard deviation	Test	Comments
Overall We assume that students agreed on problem-based learning	2.32	0.59	<u>One sample t test</u> T = - 20.349 P-value = 0.000	We found that there significant agreed between students in problem-based Learning

Fig 4& 5 below illustrates the positive and negative perceptions of undergraduate dental students toward PBL respectively by percentage to each questionnaire statement. Fig 4: shows that the majority of dental students agreed about the positive statements of PBL with percentages range from 55% to 75%. Fig 5: illustrate the dental student's negative responses about the PBL statements it is clearly shows that the 10th statement of the questionnaire had the highest disagreement with over 50% of the students.

Fig 4: Over all undergraduate dental students' average positive responses of PBL

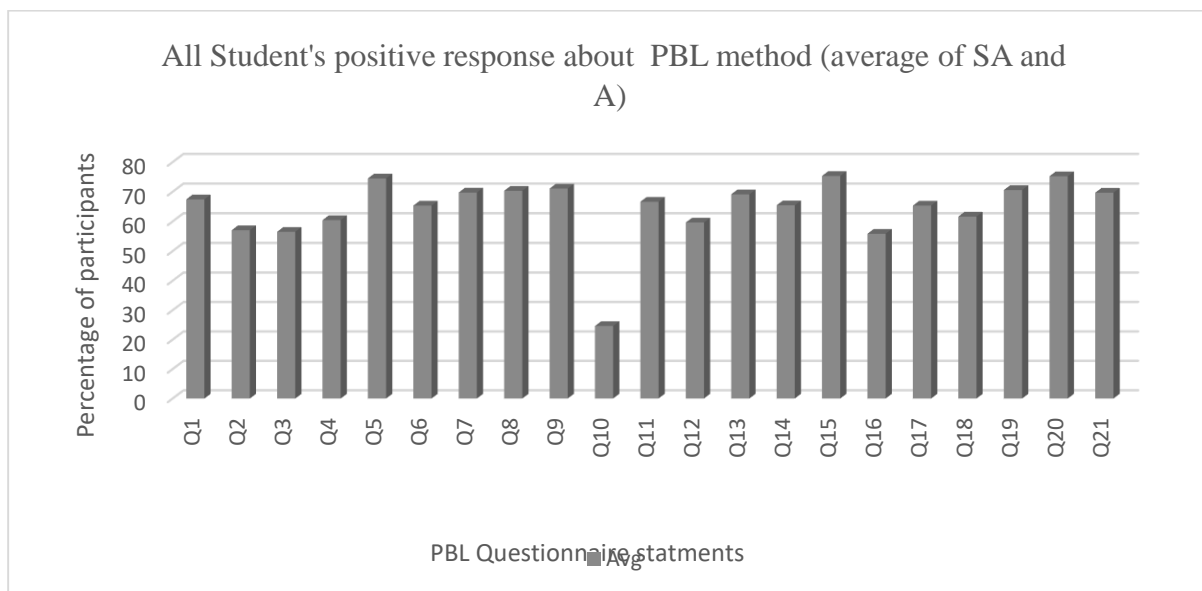
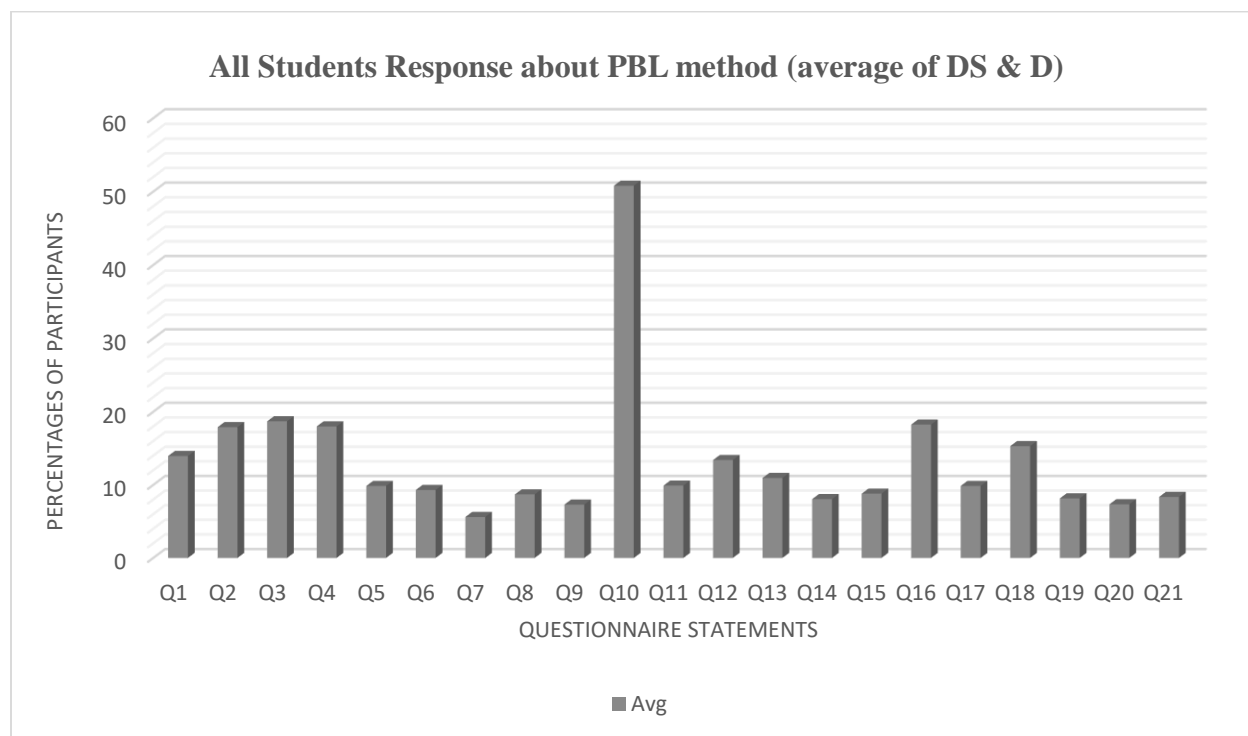


Fig 5: Over all undergraduate dental students' average negative responses of PBL



4.3 Qualitative Results

The Facilitators questionnaire included nine open questions to collect some qualitative data to examine their perspective and practice about PBL, further more to explain and discuss face-to-face the issue that they face during practice.

Faculty members provided different responses about their views on effective use of PBL in their classes. Below are sample responses:

4.3.1 The interviews questions

- **PBL is an effective instructional strategy. Briefly discuss**

Faculty members provided different responses about their views on effective use of PBL in their classes, but generally they all in favour of PBL instruction approach and they conclude that PBL is an effective method of teaching and the advantages of this type of instruction are PBL give the students a chance to solve interdisciplinary problems. And it's an activity that improves teamwork; students learn to work as researchers with new various technologies and materials.

Students have a chance to present their work. On the other hand some educators are not able and willing to prepare interdisciplinary tasks and it is more difficult to evaluate the work of the individual member of the team.

Below are sample responses:

Example:

“PBL, its students directed philosophy ‘it is highly effective because it improves many skills such as critical thinking, it has its learning out comes therefore it encourage the students to search library/internet and exposed to wide range of materials while solving the problems so they can meet the learning outcomes. It gives the students the chance to choose the way to go about solving the problems, and where to get the information to solve it”

“PBL it’s an effective instructional method it enhances student knowledge and communication it also improves the solving problem skill and that is very beneficial for the learners in supporting their scientific”

The only drawback when some student relies on others to solve the problem therefore the facilitator must play a very important role here by directing the student to divide the work between them clearly”

- The integration of basics and clinical science and PBL teaching approach

As expected, all the facilitators noted their undoubted beliefs about the great integration between basic science and clinical science by PBL as a teaching approach and its activities consistently in their classes. They also highlighted the pattern of integration and they think that’s the main value of PBL because it enhances students ability to retain knowledge through integration.

Example:

“There is very good integration of basic and clinical sciences.in my opinion PBL it interdisciplinary teaching method where there are a number of topics can be taught in one PBL session”

“Throughout the years there is an increase in the clinical science while the basic sciences decrease so the integration of the basic science and clinical follow same pattern and

increase throughout the years and it shows in the student ability to defend and generate their clinical cases much better in the seniors level (year 4 and 5)

“The integration can show clearly during the discussion when the students start to recall the basic science knowledge to solve the case or the problem and that’s make the PBL is strongly effective in motivating the students toward learning science topics and stimulate their interest towards integration scientific knowledge”

- **Workload of PBL challenging and easily manageable**

There was a different response in this component so while most of facilitators agreed on work load are quit manageable one thinks is not and gave some explanation to that moreover they highlighted different challenges that they face during practice of PBL.

Example:

“Workload is not heavy is as other similar university is quite manageable once the conversion to PBL is up and running the workload become controllable”. On the other hand one of the interviewees’ respond was “workload is not easy manageable, because it takes a lot of time to prepare for PBL session and the ratio for facilitators to learners is high”

“The biggest challenge is the conversion from didactic teaching method to PBL.

“Interviewer directed the question”: How about the PBL scenarios are challenging?

“ohh very much, while preparing the program and we want to decide on a case to be discuss is very challenging to design case that encamps all the knowledge we want to deliver to the students and they need to know to meet the learning out comes. The need for experience clinician and technologist who are trained in PBL”

“The need of many facilitators for one session especially if you have 100 students in the year it means we need at least 10 facilitators and should be trained and that is not the case quite often”

- **The adequateness time spend for PBL process and the time spend for making it**

Example:

“I must say that for any curriculum not only PBL the time spent in designing the way of teaching is longer than the teaching time, because it a continuous process of designing, improving and evaluating to decide the topic all the way and the integration between topic takes long time. Also monitoring the student’s progress and performance is the part of making the teaching materials. Therefore, the time is not adequate”

“Is not adequate at all, it takes a lot of time to prepare the scenarios it usually from the materials that going to be taught in the same week. if it from basic science it will be for e.g. from physiology anatomy interdisciplinary authentic case, but when the case prepared it can be used for quite a time and improves on it after is used because the area of defect can shows after that”

- **The clinicians easily approachable for reviewing the PBL scenarios**

Example:

“Because around the world the PBL is, new although it has been there for 25 years it is still new comparing it with other teaching method. so some of the clinician still finding difficult to convert or accept the change to PBL so is not easy to make them put some time to review the cases but there are other who are in very much support for PBL and they are enthusiastic putting effort to review scenarios”

“all the scenarios I used are already sit and I only go by the one are given to me but I highly recommend that we should have our scenarios sit by us as lecturer and according to what areas we think our student are lack or need to improve on’

- **The issues or difficulties that facilitators face during PBL sessions**

Example:

“If the scenario is good and encamps all the materials need to be integrate also if its stimulating scenario if all this placed in order then the challenge goes to the students, the students are need to be prepare to be lifelong learners and become self-directed learners. The PBL method helps them to have the skill at library to select the relevant materials, which are valuable, have evidence base, and discard the materials that have no strong

foundation. After they select the fact, they have to summarise and present these facts in the classroom they must be students from certain clipper”

“Classrooms are not enough also the lay out of the classrooms is not set as discussion classrooms which is not helping during the sessions it is set for the traditional lecture room”

“Other issues that can be reported during PBL session when some individual adopt quietness and dominant behaviour and that’s lead to a negative problems in team cooperation activities”

- **The faculty tasks for developing, evaluating and assessing the PBL curriculum**

Example:

“Their task is to develop the cases in multidisciplinary way so to develop one case they have to have technologist radiologist prosthodontics and so on. The evaluation must come from both students and teachers. The teachers must have criteria to follow for assessing the student performance and should be able to assess how they present the cases to meet the objective. Therefore, the assessment is very objective and the student will progress when they are informing about their work by guiding them to the right track”

- **Additional comments regarding use of Problem-based Learning approach**

Example:

“Is a very stimulating and motivating very innovating and make the student up right. but we have to prepare the students initially with the basic science and knowledge to be able to tackle the problems therefore we must start use the PBL when most the materials needed is been taught I’m very much in support of PBL teaching strategy and I would recommended that 30% of the curriculum should be didactic lecture 70%”

To conclude the study results from both quantitative and qualitative analysis shows that the PBL instructional approach is in a very much favour by the dental student as well as their facilitators with different extent, on the other hand complete or semi complete change to PBL is not in

favour by the undergraduate students although their facilitators hold different views. In addition the students in higher level of study are more families and supportive of PBL than the ones in the junior level which shows that the initial periods of introducing PBL can face some difficulty in accepting the change to PBL but when the students get the concept of PBL and start to practice in regular basis the tend to have perspective.

Chapter 5: Discussions, Conclusions, Recommendations and Limitations

Introduction

Instructional methods improvement is a regular demand for the educators, thus initiation of PBL developed in order to assist students' self-directed learning, intrinsic enthusiasm, dynamic learning, and problem-solving skills. Initially, PBL was developed in medical education and after its benefit been approved and documented, it became applicable in other disciplines (Shrivastava, Shrivastava, & Ramasamy, 2013). Due to its documented benefits of PBL application in medical education, it found extensive acceptance in dental education. Thus, it was beneficial to evaluate and compare the attitudes and perspectives of dental students and faculty towards PBL using a valid survey instrument.

This study aims to identify dental students and facilitators perceptions about PBL fundamentals and their practices to develop students' scientific skills and enhance student's achievement. Multiple instruments were used to overcome the difficulty of measuring skills (Lai & Viering 2012). The study focused on three main dimensions to achieve its goal, which are Pbl dimension, cognitive dimension and content dimension. Three hundred and thirteen dental students completed the quantitative survey, and a number of these respondents added valuable qualitative data. Interpretation and analysis of results are discussed in sections. First, data collected in the quantitative survey instrument are interpreted. This interpretation includes findings of the statistical analysis as well as interpretation of quantitative and qualitative data collected in this portion of the survey. Subsequently, interpretation of qualitative data, including PBL advantages and disadvantages and PBL practice, are discussed. Study conclusions, limitations are presented in this chapter and the recommendations are presented afterwards for future studies.

5.1. Cognitive Dimension

This dimension is represented in students' perceptions of PBL features and their experiences to practice science process skills in PBL sessions. Problem-based learning has shown positive gains in cognitive outcomes. (Walker & Leary, 2009)

Dental students' perceptions from all study levels about PBL instructional method based on their knowledge and experience were perceived through the results of their questionnaire to answer the twenty-one statements. Students' responses indicated that majority of students at higher education (dental schools) consistently practice many features of PBL. Figure. Displays the positive average ratings of statements by all the students and demonstrates that overall both genders tend to have similar agreement with all the survey statements according to the statistics of the study. The statics analysis shows no significant different on the student's perception between male and female. Despite the high percentage of students who agreed positively with most of the survey statements there was very negative response for the 10th statement that "PBL should be used as a replacement of conventional teaching" received the highest disagreement response with about 55% by all undergraduate student as displays in bar chart. Figure..... this finding may be due to the issues that dental student and faculty face during PBL session, such as suitable scenarios or the overcrowding of their curricula. In addition, they have very limited time cover a large number of curricula and PBL is time consuming teaching method in agreement to this Hendricson and Cohen (2001) argued that dental curricula are overcrowded and PBL was inserted as an "add-on." Further, dental faculty are perhaps not fully aware of the benefits of PBL or are sceptical about replacing existing methods in dental education with PBL or even increasing its use largely. Moreover, the high agreement for the 5th statement on the survey that stated "The PBL strategy takes more time than conventional lectures", can also explain the rejection of the student for the replacement of the curricula with PBL method. These findings are consistent with their teachers' responses in the interview as they confirmed that the time needed for PBL preparation and dispensing is quit high comparing with traditional teaching methods.

Over 70% of the dental students agreed with the statement stated "PBL enhances the communications skills through discussions and presentation" problem-based learning assist student in improving social and interactive communication through collaboration and interaction

which are important skills for dealing with the public on a daily basis regarding various issues and concerns (Cleveland & Saville, 2007)

Over 70% of the dental students agreed that “PBL improves the problem-solving skills” in agreement with Barrows and Wee (2010) the problem-based learning approach uses complex real-world problems as a context for learners to develop problem-solving and critical thinking skills. Problem solving develops an understanding of the issue or problem, conduct research for possible solutions to resolve the problem, and assess the outcome. Having good problem-solving skills along with critical thinking skills helps future dentist to overcome the daily practice in their field.

From the qualitative data collected from the five students interviewed from each study level, it can be drawn that PBL instructional method is favoured and that PBL makes positive contributions in terms of the skills mentioned in those items, on the other hand they highlighted that there is not enough time to have the amount of session that can make the students familiar with the PBL process. Also, it has been pointed that although, they are usually engaged in experimental activities in PBL sessions, few of them pose and investigate their own questions. The students also pointed that they tend to remember the information from each other during PBL sessions easily and retain the knowledge for long time, in agreement to Barneveld & Strobel, (2009) who stated that PBL appears to result in better retention over time of what is learned. In light of these findings, it may be concluded that PBL is especially useful in teaching basic sciences in dental education. It helps the students acquire skills such as problem-solving, communication, critical thinking, decision-making, approaching the patient as a whole, integrating basic and clinical knowledge, self-directed learning, and increasing the motivation for learning, all of which are crucial components of medical education.

When the mean scores obtained from the responses based on their study level were compared a significant difference was observed between the mean scores given by the students to the survey statements the students gave higher scores to these statements in the higher level of the study which is the 5th year (BDS5) followed BY 4th year students (BDS4) then 3rd year (BDS3 BDS2 BDS1) this finding could be due the fact that mentioned by one of the interviewees as stated the percentage of basic science decrease through the years while the clinical science

increase and that is properly what made the student in the higher level of study have higher positive percentage than the student in the first, second and third year be explained by

Finally, it can be concluded that the preparation of a suitable scenarios for the selected topic, characteristics of the faculty members who previously had followed PBL curricula and are still involved in PBL sessions, the acceptance of PBL by the students and tutors, the gradual improvement of the students' access to information and the infrastructure (the library, the number of computers, internet connections etc.) all these elements were positively impacted the opinions of the participants.

5.2. PBL Content Dimension

This domain is represented in the facilitator's perceptions of BPL fundamentals and their practices to develop students' scientific skills and knowledge through authentic cases in the dental school.

All of the participants at the time of the interviews were currently using or had used problem-based learning in their learning environment and have had some experience revising their organizations' curricula or working on a team that designed training using problem-based learning. Four of the participants worked in a higher education environment facilitating one or more dental education courses Table ...summarizes their academic level and number of years in education field.

Facilitator's perceptions and practices of PBL fundamentals were perceived through the results of their interviews answers. Their responses reflected that they are impressively aware of the features of PBL and its practice to different types of scientific skills in dental education. The three interviewers tend to agree with the effectiveness of PBL as an instructional method; however, the degree of using PBL as an instructional method instead of didactic lectures was varied.

All the interviewers' agreed on the effectiveness of PBL as teaching method stating that PBL promotes active learning, problem solving, peer-learning, critical thinking, interactive learning, improved communication, and student engagement. In addition, it creates interdisciplinary connections and links basic and clinical sciences, a substantial advantage for students because

students generally acquire knowledge by scaffolding and relating new ideas and circumstances to their existing knowledge (Schunk, 2012). On the other hand, they clearly stated that solid foundational knowledge should be achieved first in order for the PBL to be effective as well as well-trained tutors or facilitator. These are the key for successful PBL strategy in agreement to (Leary et al., 2013) who stated that PBL scholars generally agree that tutors should be trained in the process of PBL. Moreover, to act as an appropriate facilitator, tutors should and often return to process-facilitation skills from training workshops (Dolmans et al., 2002; Hendry, 2009). PBL tutors must understand how their role as some changes during the course of a particular problem. In addition, tutors should have a great deal of familiarity with the problem and common approaches to solving it, either as a result of closely collaborating with the case designer or by co-authoring the instructional materials (Chan, 2008).

There is a strong theme displayed by interviewed faculty that PBL should not be used as the sole method of instruction, emphasizing that PBL should be used as an adjunct, not a replacement of conventional teaching. although the degree of agreement was varied, while one dental faculty suggest that the percentage of PBL in the curricula should be about 70% and the 30% should be conventional lecture other one argued that PBL “cannot teach everything” and it should be about and another mentioned that PBL should be “backed up by a core set of lectures.” Therefore, the concerns about PBL and the appropriate implementation of PBL are universal and are likely inherent to this instructional method. It is clear that faculty members in dental education view the degree to which PBL should be used differently. Some would like to use it extensively and others prefer to integrate it in small increments. Furthermore, the ways in which faculty like to implement PBL in their instruction vary significantly. Also, It has been noted that the faculty incorporate clinical cases as a form of PBL it is possibly confusing PBL with case-based learning. However, most faculties provided viable ranging of PBL instruction, which stresses PBL’s large potential dental education but suggested that it should be used only as another mechanism for learning, and added that it should take only 30% of teaching time.

Well-trained facilitators are one of the issues that they face in performing the PBL due to the need for much number for facilitators comparing to the number needed for conventional way of teaching in support to this there is an extensive literature regarding development of faculty in their role of teaching for higher education as a whole. Van Petegem (2010) suggests some best

practices that may well inform faculty development specific to PBL. For example, increases in faculty learning, faculty behaviour, student learning and institutional change is coinciding with training extended over time as compared with single contact formats. Thus, it is important to provide learning supports to help students extract and organize information when solving problem based learning activities. The tutors in their responses to the open-ended question regarding opinions and suggestions about PBL, they mentioned several problems: the time-consuming nature of PBL, the difficulty of allocating time for PBL while being busy with routine work, the burden of acting as tutors in a topic in which they are not competent, and not believing in the benefit of PBL. (Gürpınar E, et al 2016) In this open-ended question, the tutors requested identification of topics that are suited to self-directed learning and appropriate for comprehensive discussion and for better construction of PBL scenarios.

Two of the interview highlighted the the evolution of the PBL is difficult and they suggested that after the student finish the discussion and come up with conclusion the give them MCQ'S about the same problem to assist the facilitators in grading the students, in support to this finding Albanese and Dast (2014) discussed that the difficulty is in evaluating the process used to evaluate the problem because it is important to evaluate the process together the solution reached.

5.3. Conclusions

To conclude the students' perception and understanding of the learning methodology by the process of PBL is favoured by dental facilitators and students. The junior faculty members are prepared to promote transfer of concepts across the curriculum by use of appropriate methodology of PBL. There is support from the academic administration (principal and the faculty responsible for the implementation of this PBL-based curriculum). However senior faculty members did not show a strong inclination towards PBL and are still in favour of didactic lectures. It has however been emphasized that for proper implementation of PBL curriculum careful and enthusiastic training of the faculty and students is the key factor for success.

Both student and facilitators agreed that PBL should be used as an adjunct to conventional teaching, acknowledge its advantages, and are aware of its limitations. They provided a wide range of subjects in which it can be use in presented several examples of its implementation. It

can be concluded that PBL is a challenging teaching method that requires time, training, and resources. It is highly dependent on delivery, and if used improperly, it can compromise the students' knowledge base.

Despite the promising evidence linking problem-based learning and effective teaching in higher education to certain aspects of skills for innovation, more work is needed in this area. In reality, there is no dichotomy between problem-based learning and "traditional" teaching and learning approaches - policymakers and practitioners would benefit from a better understanding about which specific practices are effective for fostering different skill sets. There is also scope to examine the impact of problem-based learning on a broader range of indicators of skills for innovation, and for the impact of contextual factors to be tested. There is therefore strong potential for further research to provide additional important insights into the development of skills for innovation.

5.4 Limitation and Recommendations

The current research study delivered a hard copy survey instrument and evaluated the perceptions of undergraduate dental students and some PBL faculty members. The interpretation of the results in the present study is limited because the participants were from only one university the perceptions of practicing dentists may significantly differ from those of the two studied groups. Therefore, it is important to note that the opinions presented in this study do not reflect all opinions in the dental community. These two groups, however, represent an important part of the dental field. In additions, we employed the single group design survey, which does not require a comparison group.

It is important to evaluate students and faculty attitudes and perceptions of education, licensure, practice, educational instructions and academia in all disciplines and other allied health care professions. In fact, the evaluation of students and faculty attitudes and perceptions of any discipline would be valuable. The goal of dental education is to prepare students to become knowledgeable and skilled dentists. (Howard, et al. 2009) to achieve this goal a competent clinician is expected to have a comprehensive understanding of a clinical problem with the underlying principles of biology and medicine and to render care in the light of best available scientific evidence.

Establishing a committee of PBL and insure that its task to promote PBL has been met by regular review for its teaching materials and consistent evaluation for its outcomes. In addition, promotion of PBL teaching approach in the clinical dental practicum will lead to increase of the teaching period as the PBL need extra timing than the traditional lectures therefore a proper preparation and evaluation for the time needed is crucial for the successes.

A second recommendation is research or study to identify ways for educators training courses to develop professionals and to promote the benefits and value of the problem-based. Further study to assess the student achievement through PBL approach is essential to encourage the syllabus department to increase the PBL sessions.

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APPENDICES

Appendix 1



Date: January 21st, 2017

University of Sharjah, College of Dentistry
Sharjah UAE P.O Box 27272

Dear Prof Hien Chi Ngo
Dean of College of Dental Medicine

The British University in Dubai offers a Master's of Education (Med) degree to interested students, teachers, and professionals in the United Arab Emirates to maximize their career opportunities and increase their knowledge. The Med program has been designed in collaboration with the School of Education of the University of Birmingham, one of Britain's leading schools of education. The Med program is approved and accredited by the Ministry of Higher Education and Scientific Research, UAE and has graduated many students since its start in 2004 in several different areas in education. The purpose of this letter is to kindly ask you to allow Ms. Amal Mohamed Zain a student in this program, to be able to collect data for a research study by administering a questionnaire (PBL Curricula) for Dental College students and PBL facilitators. As part of the University's research ethical guidelines, the data collected will be anonymous and will be treated with utmost confidentiality.

Finally, we look forward to your kind cooperation. The questionnaire administration may take place during the first term of education year 2017 -2018. If you require any additional information, please don't be hesitant to contact Ms. Amal Zain at 0561808585 or Prof. Sufian Forawi at sufian.forawi@buid.ac.ae or 050 1270746.

Sincerely Yours

A handwritten signature in black ink, appearing to read 'Sufian Forawi', is written over a horizontal line.

Professor Sufian A. Forawi,
Science Education Coordinator

Appendix 2

Office of Vice Chancellor for
Research & Graduate Studies
Research Ethics Committee



مكتب نائب مدير الجامعة لشؤون
البحث العلمي والدراسات العليا
لجنة أخلاقيات البحث العلمي

- **Date:** 16 / 10 / 2017
- **Reference number:** REC-17-07-13-01-S
- **Title of the research:**
The study to examine the perceptions of students and facilitators about their knowledge and practice of PBL curricula
- **Name of the principle investigator:** Ms. Amal Mohamed Zain

Dear Ms. Amal,

The Research Ethics Committee has reviewed the above application, and has voted in favor of approving it from an ethical perspective.

Kindly note that this approval is based on the conditions that,

1. the research is executed according to the research protocol described in the application form, and/or its subsequent modifications, if those modifications were requested by the Research Ethics Committee
2. the information sheet and/or informed consent are those approved by the Research Ethics Committee
3. the research tools are those approved by the Research Ethics Committee

Please note that it is your responsibility, as the principle investigator, to immediately inform the Committee of any changes in the research protocol and/or the research methodologies, should the need for those changes arise prior to or during the conduct of this research study.

On behalf of the Research Ethics Committee, I wish you and your team success in your research project.

Sincerely,

Dr. Suhail Al-Amad
Chair, Research Ethics Committee
University of Sharjah

Appendix 3

Consent Form

Study Title: The study to examine the perceptions of students and facilitators about their knowledge and practice of PBL curricula"

Performance Site: University of Sharjah, College of Dentistry UAE

Researcher: The following investigator is available for questions about this study,
Amal Mohamed-Zain phone: 0561808585 email: 2015101132@student.buid.ac.ae

Purpose of the Study: this study to examine the perceptions of students and facilitators about PBL, based on their knowledge and experience, educators encourage teachers to implement PBL strategy in their curricula to support students' achievements through promoting their cognitive skills. The purpose of this study is to explore and explain teachers' perceptions about problem/project features that promote these skills as well as their actual practices in the dental school. In addition, students' experience in the light of their perceptions of problem based activities will be investigated as a lens to extract the impact of PBL implementation on their achievements in exams.

Subject Inclusion: All dental school students

Study Procedures: students will be asked to participate in questionnaire that will focus on their readiness and perception of problem based as a learning instruction.

Benefits: Subjects will not receive any monetary benefits from this study.

Risks: This study does not present any risks for participants.

Right to Refuse: Subjects may choose not to participate or to withdraw from the study at any time without penalty or loss of any benefits to which they might otherwise be entitled.

Privacy: Results of the study may be published, but no names or identifying information will be included in the publication. Subject identity will remain confidential unless disclosure is required by law.

Appendix 4

Problem-based Learning Questionnaire

Instruction

This questionnaire measures the perceptions of students and facilitators about their knowledge and practice of Problem-based Learning (PBL) curricula. Questionnaire is voluntary and confidential which take few minutes to respond to by making a tick (✓) on the appropriate choice.

Demographics Years: 1st Year____2nd Year____3rdYear: ____4th Year____5th Year____

Gender: Male____ Female____

PBL Questions: Please tick appropriate box (SA= Strongly Agree, A=Agree, N=Neutral/don't know, D=Disagree, SD= Strongly Disagree)

#	Questions	SA	A	N/D	D	SD
1	The PBL teaching strategy is interesting					
2	The proper training of PBL was given before its implementation					
3	The knowledge gained by PBL is more thorough than it would be by conventional teaching (lectures)					
4	Understanding the objectives through PBL are better than if it has been lectured in the conventional way					
5	This PBL strategy takes more time than conventional lectures					
6	In PBL knowledge is organized around problem rather than disciplines					
7	In PBL learner assume responsibility for their own learning					
8	In PBL learners become active processors of information					
9	PBL encourage learners activate prior knowledge and learn to elaborate and organize their knowledge					
10	The curriculum should be completely PBL- based					
11	PBL enhances the ability to find the information using the internet/library					

12	PBL helps in identifying the areas of weakness for improvement					
13	PBL maximise the use of knowledge and abilities					
14	PBL enables the learner to establish a concrete action plan to achieve their learning goals					
15	PBL enhances the communications skills through discussions and presentation					
16	PBL increases ability to manage the time effectively					
17	PBL helps to convert from passive to active life long learner					
18	The role of facilitator in the PBL process is helpful					
19	PBL improves the decision-making skills					
20	PBL improves the problem-solving skills					
21	PBL develops the confidence in self-directed learning					

Thanks much for participating in this survey, for any inquires please contact
amzain@sharjah.ac.ae

Appendix 5

Problem-based Learning

Interview questions

For facilitators of PBL

Interview

Please answer the following questions and put a tick on the appropriate response.

Professor Associate Professor Assistant Professor Lecturer

How long have you been teaching in higher education? -----

What classes do you teach? -----:-----:-----

Background questions

When was the first time PBL introduced to UOS as a teaching strategy? Why?

For which study level do you incorporate teaching with use PBL instruction?

How many sessions of PBL do you teach in year and how many cases?

PBL Curricula questions

- 1) PBL is an effective instructional strategy. Briefly discuss
- 2) Is there a good integration of basics and clinical science?
- 3) Is the workload of PBL easily manageable?
- 4) How workload is challenging?
- 5) What do you think of the time spent for PBL process and the time spent for making it? Is adequate
- 6) Are the clinicians easily approachable for reviewing the PBL scenarios?
- 7) What are the issues that you faced during PBL sessions and how were they resolved?
- 8) What are the faculty tasks for developing, evaluating and assessing the PBL curriculum?
- 9) Do you have any additional comments regarding use of Problem-based Learning approach?

Thanks for participating in this survey, any inquiries please contact

amzain@sharjah.ac.ae

Appendix 6

Descriptive analysis:

Table 1: Distribution of sample size by gender and study level:

Gender	Study Level	Number of Students
Male	Year 1	16
	Year 2	16
	Year 3	20
	Year 4	19
	Year 5	14
Female	Year 1	61
	Year 2	57
	Year 3	49
	Year 4	27
	Year 5	34

Table 2: Frequency of students answer's in the questionnaire:

Question	Problem-based Learning Questionnaire									
	SA		A		N		D		SD	
	#	%	#	%	#	%	#	%	#	%
Q1	71	22.7	144	46.0	58	18.5	28	8.9	12	3.8
Q2	46	14.7	125	39.9	84	26.8	50	16.0	8	2.6
Q3	71	22.7	99	31.6	83	26.5	45	14.4	15	4.8
Q4	68	21.7	117	37.4	71	22.7	43	13.7	14	4.5
Q5	84	26.8	148	47.3	46	14.7	31	9.9	4	1.3
Q6	64	20.4	143	45.7	77	24.6	22	7.0	7	2.2
Q7	63	20.1	159	50.8	72	23.0	18	5.8	1	0.3
Q8	66	21.1	154	49.2	65	20.8	21	6.7	7	2.2
Q9	86	27.5	134	42.8	68	21.7	19	6.1	6	1.9
Q10	21	6.7	51	16.3	75	24.0	91	29.1	75	24.0
Q11	59	18.8	149	47.6	70	22.4	29	9.3	6	1.9
Q12	62	19.8	126	40.3	84	26.8	33	10.5	8	2.6
Q13	57	18.2	159	50.8	59	18.8	31	9.9	7	2.2
Q14	38	12.1	163	52.1	82	26.2	26	8.3	4	1.3
Q15	94	30.0	147	47.0	47	15.0	21	6.7	4	1.3
Q16	61	19.5	108	34.5	86	27.5	46	14.7	12	3.8
Q17	61	19.5	141	45.0	78	24.9	25	8.0	8	2.6
Q18	61	19.5	131	41.9	73	23.3	38	12.1	10	3.2
Q19	78	24.9	143	45.7	65	20.8	21	6.7	6	1.9
Q20	85	27.2	152	48.6	51	16.3	20	6.4	5	1.6
Q21	91	29.1	126	40.3	68	21.7	20	6.4	8	2.6

Table 3: Frequency of students answer's in the questionnaire by gender:

Question	Gender	Problem-based Learning Questionnaire									
		SA		A		N		D		SD	
		#	%	#	%	#	%	#	%	#	%
Q1	M	23	27.1	32	37.6	16	18.8	10	11.8	4	4.7
	F	48	21.1	112	49.1	42	18.4	18	7.9	8	3.5
Q2	M	20	23.5	33	38.8	18	21.2	9	10.6	5	5.9
	F	26	11.4	92	40.4	66	28.9	41	18.0	3	1.3
Q3	M	19	22.4	33	38.8	18	21.2	13	15.3	2	2.4
	F	52	22.8	66	28.9	65	28.5	32	14.0	13	5.7
Q4	M	19	22.4	35	41.2	16	18.8	15	17.6		
	F	49	21.5	82	36.0	55	24.1	28	12.3	14	6.1
Q5	M	19	22.4	45	52.9	15	17.6	4	4.7	2	2.4
	F	65	28.5	103	45.2	31	13.6	27	11.8	2	0.9
Q6	M	13	15.3	41	48.2	23	27.1	6	7.1	2	2.4
	F	51	22.4	102	44.7	54	23.7	16	7.0	5	2.2
Q7	M	14	16.5	43	50.6	24	28.2	4	4.7		
	F	49	21.5	116	50.9	48	21.1	14	6.1	1	0.4
Q8	M	13	15.3	47	55.3	18	21.2	6	7.1	1	1.2
	F	53	23.2	107	46.9	47	20.6	15	6.6	6	2.6
Q9	M	23	27.1	39	45.9	18	21.2	5	5.9		
	F	63	27.6	95	41.7	50	21.9	14	6.1	6	2.6
Q10	M	8	9.4	16	18.8	22	25.9	25	29.4	14	16.5
	F	13	5.7	35	15.4	53	23.2	66	28.9	61	26.8
Q11	M	16	18.8	41	48.2	22	25.9	4	4.7	2	2.4
	F	43	18.9	108	47.4	48	21.1	25	11.0	4	1.8
Q12	M	19	22.4	31	36.5	23	27.1	11	12.9	1	1.2
	F	43	18.9	95	41.7	61	26.8	22	9.6	7	3.1
Q13	M	20	23.5	39	45.9	19	22.4	7	8.2		
	F	37	16.2	120	52.6	40	17.5	24	10.5	7	3.1
Q14	M	10	11.8	48	56.5	23	27.1	3	3.5	1	1.2
	F	28	12.3	115	50.4	59	25.9	23	10.1	3	1.3
Q15	M	20	23.5	41	48.2	15	17.6	7	8.2	2	2.4
	F	74	32.5	106	46.5	32	14.0	14	6.1	2	0.9
Q16	M	20	23.5	31	36.5	19	22.4	12	14.1	3	3.5
	F	41	18.0	77	33.8	67	29.4	34	14.9	9	3.9
Q17	M	18	21.2	39	45.9	21	24.7	5	5.9	2	2.4
	F	43	18.9	102	44.7	57	25	20	8.8	6	2.6
Q18	M	14	16.5	39	45.9	19	22.4	12	14.1	1	1.2
	F	47	20.6	92	40.4	54	23.7	26	11.4	9	3.9
Q19	M	18	21.2	42	49.4	19	22.4	5	5.9	1	1.2
	F	60	26.3	101	44.3	46	20.2	16	7.0	5	2.2

Q20	M	23	27.1	40	47.1	17	20.0	3	3.5	2	2.4
	F	62	27.2	112	49.1	34	14.9	17	7.5	3	1.3
Q21	M	24	28.2	36	42.4	19	22.4	3	3.5	3	3.5
	F	67	29.4	90	39.5	49	21.5	17	7.5	5	2.2

Table 4:Test of significance:

statement	Mean	Standard deviation	Test	Comments
Gender	M = 2.29 F = 2.33	M = 0.06 F = 0.04	<u>Independent sample t test</u> T = - 0.620 P-value = 0.535	We found there is no significant difference between gender in Problem-based Learning
Study Level	Year 1 = 2.34 Year 2 = 2.32 Year 3 = 2.23 Year 4 = 2.14 Year 5 = 2.32	Year 1 = 0.60 Year 2 = 0.55 Year 3 = 0.56 Year 4 = 0.69 Year 5 = 0.59	<u>One-way ANOVA</u> T = 4.518 P-value = 0.001	We found significant different between study level in problem-based Learning. And order them as follow: Year 5 > Year 4 > Year 3 = Year 2 = Year 1
Overall We assume that students agreed on problem-based learning	2.32	0.59	<u>One sample t test</u> T = - 20.349 P-value = 0.000	We found that there significant agreed between students in problem-based Learning.

Appendix 7

Test of reliability:

Reliability Statistics	
Cronbach's Alpha	N of Items
.894	23

Cronbach's Alpha = 0.894 > 0.7 (Very high reliable between questionnaire variables)