

5-2003

# Problem-Based Learning: Implications for the Allied Dental Sciences Program at Jordan University of Science and Technology

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PROBLEM-BASED LEARNING: IMPLICATIONS FOR THE ALLIED  
DENTAL SCIENCES PROGRAM AT JORDAN UNIVERSITY OF SCIENCE  
AND TECHNOLOGY

By

Zain A. Malkawi, B.S.  
June 2000, Jordan University of Science and Technology

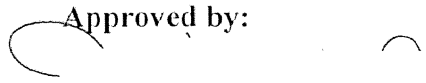

A Review of the Literature Submitted to the Faculty of  
Old Dominion University in Partial Fulfillment of the  
Requirements for the Degree of

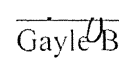
MASTER OF SCIENCE

DENTAL HYGIENE

OLD DOMINION UNIVERSITY  
May 2003

Approved by:

  
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## ABSTRACT

### PROBLEM-BASED LEARNING: IMPLICATIONS FOR THE ALLIED DENTAL SCIENCES PROGRAM AT JORDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

**Zain A. Malkawi**  
**Old Dominion University**  
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The purpose of this paper is to review the problem-based learning literature and recommend changes to the Allied Dental Sciences curriculum at Jordan University of Science and Technology so that problem-based learning can be incorporated into the curriculum. Characteristics of problem-based learning include students' active participation in learning, and interpersonal skills development through discussion, social interaction, collaborative teams or tutorial groups. Problem-based education encourages students to develop communication and critical thinking competencies, enhance self-directedness and ownership of their own learning, and improve, students' knowledge, and independence. For example, two courses in the current Allied Dental Sciences curriculum, Dental Radiology and Dental Materials were revised to reflect a problem-based philosophy. Weaknesses in the current Allied Dental Sciences curriculum include a teacher-centered approach instead of a student-center approach to learning, and minimal strategies to encourage critical thinking, self-directedness and communication skills. Therefore, the following changes are recommended to make the Allied Dental Sciences curriculum problem-based and to facilitate lifelong learning:

1. Apply a student-centered approach rather teacher-centered approach to learning, e.g., students become the center of the learning process by increasing assignments that

require working in small collaborative or tutorial groups to explore real-world problems.

2. Employ small group learning strategies in didactic course work to challenge students to discuss and solve case-based problems instead of the traditional course work with emphasize on learning subject matter via lectures.
3. Develop students' competence in searching the professional literature by using library resources and electronic databases.
4. Utilize electronic communication systems such as asynchronous, on-line discussion with other universities to maintain a current curriculum.
5. Develop on-line lecture information with self-assessment quizzes for use by students.
6. Implement evaluation strategies such as rubrics for oral presentations, group problem solving, debates, and papers to measure problem-based learning outcomes.
7. Introduce an on-line clinical problem-solving series that is illustrated with high quality photographs, graphics, and videos a variety of dental diseases. After a set time, students can compare their problem solving and clinical decisions to that of a faculty expert.
8. Encourage students to use the steps of the problem-based learning model to develop their self-directedness and confidence in their own-self learning. The steps include:
  - Encounter the instructional problem.
  - Problem solving by use of professional and reasoning skills.
  - Identify the needs of learning.
  - Use the gained knowledge to solve problem.
  - Summarize what has been learned.

9. Develop instructional website for each full-time faculty member and have at least one course connected to professional website.
10. Redesign each didactic course into a problem-based curriculum, using the newly revised ADS 326 Dental Radiology II and ADS 212 Applied Dental Materials as a guide.
11. Use quantitative and qualitative measures to assess the problem-based learning curriculum outcomes. The formal evaluation can include on-line questionnaires, focus groups, in depth interviews of students, analysis of recorded communications among students or analysis of students' products, discussion, comments and feedback from students.

## ACKNOWLEDGMENTS

The author wishes to express sincere appreciation to the following individuals for their valuable contributions to this paper.

My parents, Abdel-lateef and Mona Malkawi, for their patience, encouragement and love throughout my education and during this manuscript.

Michele L. Darby, BSDH, MS, Graduate Program Director, Gene W. Hirschfeld School of Dental Hygiene, Old Dominion University, for direction, professional expertise, continual assistance and encouragement throughout this paper.

Gayle B. McCombs, RDH, MS, Director, Dental Hygiene Research Center, Gene W. Hirschfeld School of Dental Hygiene, Old Dominion University, for her time in providing encouragement, constructive feedback, and assistance in completion of this manuscript.

## TABLE OF CONTENTS

	PAGE
<b>ACKNOWLEDGEMENTS</b> -----	5
<b>LIST OF TABLES</b> -----	8
<b>LIST OF FIGURES</b> -----	9
<b>INTRODUCTION</b> -----	10
STATEMENT OF THE PROBLEM -----	10
SIGNIFICANCE OF THE PROBLEM -----	11
DEFINITION OF TERMS -----	13
<b>REVIEW OF THE LITERATURE</b> -----	15
THE PROBLEM- BASED LEARNING MODEL -----	15
METHODS TO ENHANCE THE PROBLEM-BASED LEARNING PROCESS -----	18
OUTCOMES OF PROBLEM-BASED LEARNING IN PROFESSIONAL EDUCATION -----	28
SUMMARY -----	34
<b>RECOMMENDED CHANGES TO THE ALLIED DENTAL SCIENCES CURRICULUM AT JORDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY</b> -----	36
<b>SUMMARY AND CONCLUSIONS</b> -----	43
<b>REFERENCES</b> -----	47
<b>APPENDICES</b> -----	50
a. Allied Dental Sciences Program (ADSP) Curriculum at Jordan University of Science and Technology -----	51
b. ADS 326 Dental Radiology II -----	72

## TABLE OF CONTENTS (Cont.)

	PAGE
c. ADS 212 Applied Dental Materials -----	87
d. Rubric for Evaluation of Journal Article Critique -----	106
e. Allied Dental Sciences Program Curriculum Management Plan-----	108



## LIST OF TABLES

TABLE	PAGE
1. Problem-Based Learning Strategies-----	19
2. Website Information on Problem-Based Learning-----	25
3. Pedagogical Methods to Enhance the Learning Process-----	28
4. Methods for Evaluation of Problem-Based Curriculum Effectiveness -----	32

## LIST OF FIGURES

FIGURES	PAGE
1. The Problem-Based Learning Cycle -----	16
2. Steps to Apply the Role-Play Strategy in Problem-Based Learning-----	23
3. Student Learning Outcomes From Problem-Based Learning Curriculum-----	30

## INTRODUCTION

The Allied Dental Sciences Program (ADSP), which leads to a bachelors degree in dental assisting and dental hygiene, started in 1996 at Jordan University of Science and Technology as a part of the College of Dentistry. In 2000, the program became part of the Applied Medical Sciences College. The first two years of the ADSP curriculum focus on the acquisitions of theoretical knowledge in the basic, medical, and dental sciences; the last two years focus mainly on the development of clinical competence (See Appendix A). The current curriculum relies heavily on the teacher-centered approach to learning, with minimal time in developing students' critical thinking and self-directness. Classroom time is spent delivering didactic information and answering students' questions related to the lecture. Moreover, the ADSP curriculum places little emphasis on accessing information via the library and electronic database resources, or critical thinking activities such as oral presentations, papers or debates as learning strategies. The ADSP curriculum needs to be developed to meet the demand for dental hygienists capable of life long learning, critical thinking and evidence-based decision making, and to graduate self-confident and independent healthcare professionals. This paper identifies the weaknesses in the ADSP curriculum and recommends changes according to *best practices* in problem-based learning as documented in the current literature.

### **Statement of the Problem**

The purpose of this paper is to encourage development of the current ADSP curriculum at Jordan University of Science and Technology as a problem-based curriculum (PBL). Specific goals are to:

1. Review the dental and medical literature in the area of problem-based learning.

2. Recommend specific teaching strategies that will enable problem-based learning to occur in the ADSP curriculum at Jordan University of Science and Technology.
3. Recommended assessment strategies necessary for evaluating problem-based learning outcomes.

### **Significance of the Problem**

Jordanian citizens have numerous oral health needs. Rababa'h, Jama'ni and Al-Omari (1998) assessed the severity and prevalence of periodontal disease and dental caries in 507 subjects, ages 15 to 44 years at a Jordanian army airbase. Results showed that the prevalence of periodontal diseases in army recruits is greater than in a younger age group, and that the dental care needs could not be met by any single public health agency. The researchers recommended that a preventive, rather than restorative approach, be adopted that promoted good oral hygiene practices and identified high risk individuals and groups to receive more effective oral health care.

World Health Organization data reveals that dental caries, oral mucosal lesions, oral tumors, and tooth mortality are the most common oral diseases among different samples of Jordanian citizens (WHO Oral Health Country/ Area Profile Programme, 2003). These data demonstrate the lack of oral health among Jordanian citizens and the need to prevent these diseases in the population. Jordanian government is attempting to increase the oral health conscious of the people via its dental institutions and dental manpower. Presently, Jordan has two dental schools and one school for dental hygiene. The data underscore the importance of establishing preventive public health programs such as pit and fissure sealant application in schools and community water fluoridation. Given the oral care needs of the Jordanian population, dental hygienists must be prepared to collaborate with

dentists to prevent and control oral diseases in the population. Dental hygienists must have proficiency in evidence-based practice, the ability to access current evidence-based information, interpersonal communications to effect behavioral change in the Jordanian population, critical thinking and decision making skills. With these skills, dental hygienists can reactive interdependency with dentists and target vulnerable population most in need of preventive oral care. Therefore, having a strong curriculum for the ADSP at Jordan University of Science and Technology is necessary to expand access to care for the Jordanian population, and meet the oral care needs of the populations and educational needs of dental hygienists.

The ADSP curriculum was built on the principle of the teacher as the main source of information and the student as the receiver of the teacher's knowledge. Worldwide changes have occurred in curriculum development and dental hygiene theory and practice. The ADSP curriculum needs to be revised to reflect current curriculum theory in problem-based learning. If this curriculum is developed according to problem-based principles, the faculty will be able to:

1. Prepare students for problem solving in the real world. This is best achieved by encouraging students to be self-directed and independent in searching for solutions to problems while in school, and developing their skills in accessing evidence-based information to solve problems both independently and collaboratively.
2. Prepare students who can compete with those from similar program from other countries. By developing interpersonal communication skills, students will be

able to motivate clients and exchange experiences with dental hygienists worldwide as well as those in Jordan.

3. Establish a program that serves as a model for other programs at the university. Successful learning outcomes achieved from problem-based learning will encourage other university programs to follow the same philosophy. The primary outcome will be competent healthcare professionals capable of serving the needs of Jordan's population.

### Definition of Terms

**Curriculum:** Planned guidelines of learning content and instructional strategies developed by a faculty and used to deliver an academic program so that students can achieve competence in a specific discipline (Curriculum Approach and Definitions, 2003).

**Problem-Based Curriculum:** An academic plan that enables students to be centered in the learning process by avoiding the traditional pedagogical methods that emphasize the role of the teacher, e.g., lecture methods. The aim of a problem-based curriculum is to develop students' critical thinking, self-confidence, interpersonal communication and decision-making skills (MCW Libraries, 2003).

**Problem-Based Learning:** An educational process that differs from the teacher-dominated approach to learning used in traditional educational settings. Problem-based learning places students in small groups to investigate and analyze real problems. Student in problem-based learning use a problem-solving process, which includes identifying the facts in the problem, generating ideas about the problem, and identifying the subject

content that students must learn to develop their problem solving skills (MCW Libraries, 2003).

**Problem-Based Learning Strategies:** Problem based approaches include peer teaching, cooperative learning groups, case studies, simulations, games, written assignments, out-of-class and in-class exercises, triggers and role-play (Teaching at Carolina, 2003).

**Problem-Based Learning Assessment Strategies:** Evaluation methods that match the desired competencies and the problem-based learning methods employed by the faculty, e.g., rubrics for essays, group problem solving, debates and papers to demonstrate the extent to which problem-based learning outcomes are achieved. (Leap: Problem-Based Learning, 2003).

**Lesson Planning:** Outlines prepared by teachers to ensure that the significant information is learned, appropriate topic sequence is used, and instruction is delivered according to a pre-determinant schedule so that students can achieve competence. Lesson plans include general and specific goals and competencies to be achieved; materials, media and equipment needed; introduction, procedures, and conclusions of the lessons and methods of evaluation to determine level of student achievement.

## REVIEW OF THE LITERATURE

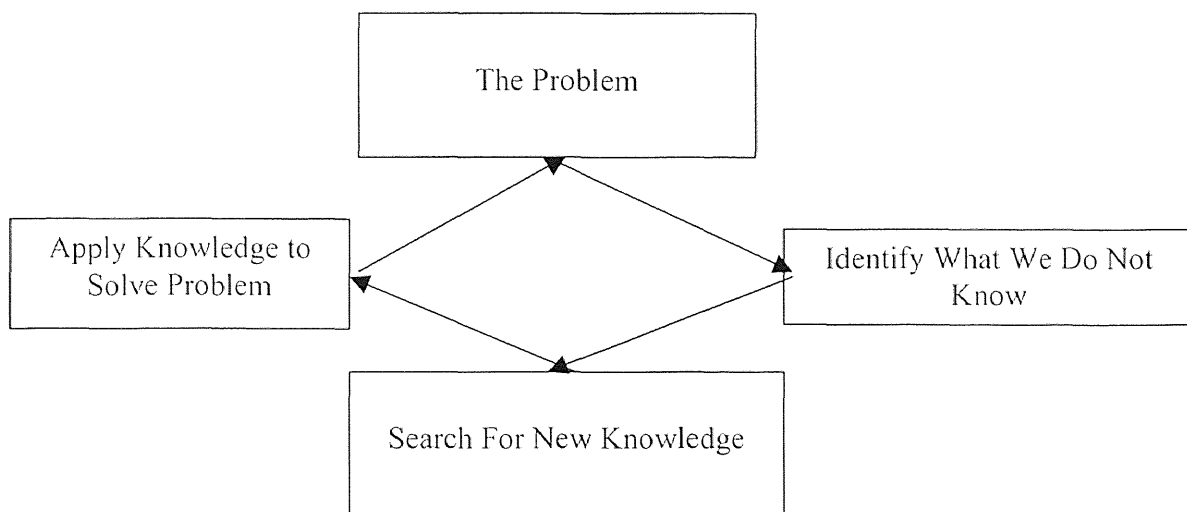
Studies have been conducted to evaluate the effectiveness of the problem-based learning model in health sciences curricula (Al-Omari, Jama'ni & Rababa'h, 1998; Anderson, Lennon, McDonald & Stooky, 2001; Bligh, 1995; Brandon & Majumdar, 1997; Bruhn, 1997; Brunner, Christaki, Juul-Dam, Katezenellenbogen & Silverstein, 2001; Brutvan, 1998; Chichester, Mann & Wilder, 2002; Curriculum Approaches and Definitions, 2003; Dawka & Ghosh, 1999; Elliot & Kepell, 2001; Grabarck, Helm & Moore, 2001; Ikram, 1999; Learning Theories and Instructional Strategies Matrix, 2003; Learning Through Technology (LT<sup>2</sup>), 2003; Leap: problem-Based Learning, 2003; MCW Libraries, 2003; Psychology, 2003; Reiff, 2001; Shanley, 1999; Teaching at Carolina, 2003; The University of Adelaide, 2003; The Center For Teaching and Learning, 2003). This review has been organized according to the problem-based learning model, methods to enhance the learning process, and outcomes of problem-based learning in professional education.

### **The Problem-Based Learning Model**

Problem-based learning can be characterized by small groups of students who are encouraged to develop their own learning styles while challenged with specific instructional problems. The process of PBL is initiated with a real world problem. The group determines what is known about the problem, collect information independently, and share knowledge within small collaborative groups. Together, they apply what is known about the problem, then collaborate on the learning experiences to solve the issue. The process is known as the problem-based learning cycle (Leap: Problem-Based Learning, 2003), (See Figure 1). The groups in problem-based learning experience should



be small, less than ten students, which creates peer pressure to increase the likelihood of reciprocal work from each group member.



**Figure 1: The Problem-Based Learning Cycle:**

**(Leap: Problem-Based Learning, 2003)**

Students assume responsibility for their learning and teachers contribute by giving guidance and facilitating the activity rather than providing answers to their learners questions (MCW Libraries, 2003). Problem-based learning differs from other traditional learning models in two ways. The problem is presented first before students have learned basic knowledge in PBL. Students build their own knowledge through a variety of learning strategies such as discussions, debates, simulated problems, case studies, independent research, concept mapping, and assessment. Also, the problem can be introduced in sections to stimulate students to obtain additional knowledge sequentially (The Center for Teaching and Learning, 2003). This learning strategy gives students the opportunity to solve the problem by using their own experiences and other information resources. In the problem-based learning model, students are not the single factor in

determining the learning outcomes, rather teachers, by supporting students with guidelines and suggestions. Teachers play an active, vital role in asking cognitive questions, observing students' participation, and formulating self-assessment tools.

The situations in PBL usually have a set of different events or extraordinary phenomena, which need clarification and explanation. Ideas for PBL activities are derived from the professional literature, television, and news programs, actual clinical situations, or newspaper articles.

Bruhn (1997) pointed out that the main purpose of the PBL strategy is to develop and maintain skills in problem solving and to create a new kind of healthcare professional who could think critically and has skills in clinical decision making. Bruhn (1997) also asserted that PBL prompts students to learn, to find information to solve problems, to know how to work in different systems and to develop their professional skills. These skills should equip students to use their knowledge in a variety of situations with diverse clients, and to become self-directed learners once in practice. Also, graduates of problem-based curricula are highly motivated for continued learning (Bruhn, 1997).

McGrath (2002) documented the main characteristics that distinguish PBL from the traditional student-centered style of education. The PBL model uses the teacher as facilitator of learning, and in small groups, students work through cases or problems. On the other hand, McGrath (2002) stated that PBL has some disadvantages. For example, in the Problem-Based Learning Model, the teacher is no longer the provider of information; therefore, the teacher must learn to engage students to be self-directed and independent in obtaining and applying knowledge. In a self-directed environment, students derive information from themselves, outside resources or from members of their group.

Brandon and Majumdar (1997) showed that to get significant results from the Problem-Based Learning Model, specific steps should be followed:

- Encounter the problem.
- Use professional and reasoning skills.
- Identify the needs of learning
- Use the new knowledge to solve problem.
- Summarize what has been learned.

Researchers indicated that both student and teacher need to cooperate in applying these steps in the transition from a traditional, structured academic environment to a new unstructured learning environment. Brandon and Majumdar (1997) believe that the educators in the healthcare professions should work together to enhance the development of critical thinking skills among students and engage students in analytical problem-solving and active learning situations. Brandon and Majumdar (1997) also suggest that the PBL process must challenge students to determine cause, facts, and inferences to formulate an intervention plan for their instructional problem.

### **Methods to Enhance the Problem-Based Learning Process**

Various methods have been suggested to enhance the PBL process. These methods include peer teaching, cooperative learning groups, case studies, simulations, games, written assignments and out-of-class exercises, triggers, and role-play. Opportunities for evidence-based decision-making and its application in dental hygiene didactic courses, practice and research prepare students to be self-directed and independent practitioners. Table 1 shows the main strategies used in problem-based learning.

**Table 1: Problem-Based Learning Strategies (Teaching at Carolina, 2003)**

Learning Strategies	Purpose
Peer teaching	<ul style="list-style-type: none"> <li>- Increase motivation</li> <li>- Encourage participation and shared views in small groups.</li> <li>- Develop deeper understanding of the material.</li> </ul>
Cooperative learning groups	<ul style="list-style-type: none"> <li>- Increase the efficiency and effectiveness of student learning.</li> <li>- Exchange of learning experiences and knowledge.</li> <li>- Improve skills in managing discussions.</li> <li>- Practice regulation skills, problem solving.</li> </ul>
Case studies	<ul style="list-style-type: none"> <li>- Enhance analytical and critical thinking.</li> <li>- Maintain the ability to master common knowledge.</li> <li>- Improve skill in managing discussions.</li> </ul>
Simulations	<ul style="list-style-type: none"> <li>- Provide opportunities for decision-making.</li> <li>- Practice negotiation skills, problem solving and techniques for reaching compromises.</li> </ul>
Games	<ul style="list-style-type: none"> <li>- Provide experience of life in a rigid class oriented society with many rules.</li> <li>- Improve social and interpersonal skills.</li> </ul>
Written assignments and out-of-class exercises	<ul style="list-style-type: none"> <li>- Maintain writing skills.</li> <li>- Enhance skills in accessing library resources.</li> </ul>
In-class exercises	<ul style="list-style-type: none"> <li>- Apply concepts that have been taught.</li> <li>- Provide opportunities to correct ones' own errors and misconceptions about information and homework problems.</li> </ul>
Triggers	<ul style="list-style-type: none"> <li>- Introduce hypothetical problem.</li> <li>- Stimulate thoughts and actions.</li> </ul>
Role-play	<ul style="list-style-type: none"> <li>- Improve interpersonal communication skills.</li> <li>- Develop communicative strategies to overcome clinical problems that one may face in the real world life.</li> </ul>

A study by Grabark, Helm and Moore (2001) was conducted at Northern Arizona University Department of Dental Hygiene where interactive web-based courses have been developed to enable dental hygienists to complete a baccalaureate degree on-line. The aim of the research was to evaluate the dental hygiene students' skills and outcomes

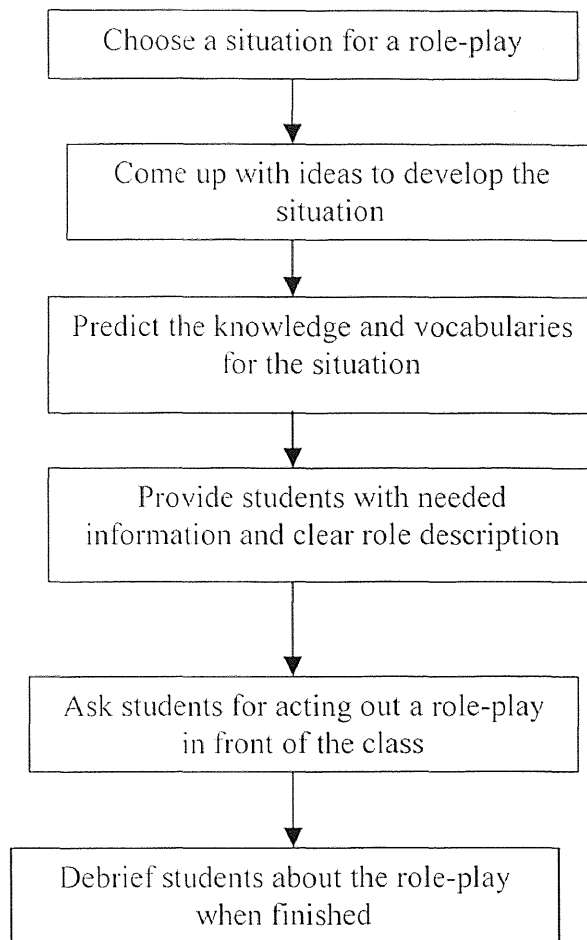
from the web-based courses. Students evaluated the web-based courses (periodontics, radiology, career management, pain management, research design, public health and pharmacology) at the end of the semester. Some students were given the chance to play a more active role in learning technology by creating a homepage; where as other students in the same group continued taking the web-based courses without creating a homepage. Findings indicated that students preferred and liked flexibility and convenience of web-based courses, but many students had difficulty with the restructuring of the roles and transferring from teacher-centered to student-centered approach to learning. The students were evaluated again after the completion of the second semester. The first and second evaluations were compared for each student and analyzed using the t-test. The results showed that students who designed a homepage had significantly improved attitudes about web-based courses at the second evaluation. In contrast, students who did not create a homepage showed only minimal changes in their attitudes from the first to the second evaluation. The researchers concluded that computer skills acquired in creating a homepage improved students' attitudes about learning in web-courses. Findings suggest that to be able to learn dental hygiene content, having computer skills will help students prepare for future roles in their communities.

Chichester, Mann and Wilder (2002) conducted a study to determine the utilization of activities that enhance evidence-based decision-making in both baccalaureate and non-baccalaureate U.S dental hygiene programs. Survey results from about 235 U.S dental hygiene program directors showed that non-baccalaureate respondents used the library facilities, journals, indices and electronic databases less than the baccalaureate respondents. Moreover, of the respondents from the non-baccalaureate

program director reported less application of evidence-based findings to the clinical setting in their programs than the baccalaureate program directors. Both baccalaureate and non-baccalaureate degree programs incorporate some aspects of evidence-based education, but baccalaureate students are more proficient in applying the evidence-based information in clinical situation. Perhaps baccalaureate students used libraries resources more, indicating that the goals and demands of the baccalaureate curriculum differ from those of the non-baccalaureate curriculum. Researchers recommend that dental hygiene faculty incorporate library assignments, research findings utilization and evidence-based decision making into the curriculum. The researchers asserted that competencies in searching for evidence-based information help dental hygienist in providing optimal care for patients and for lifelong learning. Competence in accessing evidence-based information is considered part of problem-based learning because it requires critical thinking and self-directedness in determining the sources of knowledge, making decisions and problem solving. The results underscore the importance of PBL in the dental hygiene curricula, and for encouraging lifelong learning in graduates.

One of the learning strategies that can be used in the problem-based curriculum is a case study. Case studies are active learning methods that redirect the learning process from the teacher to the student. Case studies provide students with real life examples that can be applied to the theoretical concepts. Case studies increase students' motivation and interest in the subject, as well as provide the learners with the suitable challenge for decision-making. Through the case study, students must use different learning tools and information resources to pursue their own learning goals (Learning Through Technology LT<sup>2</sup>, 2003).

Role playing is another learning strategy to enhance the problem-based learning process. Role-play is a teaching strategy that allows students to practice different communication skills by acting out real life situations in a classroom. The teacher starts by choosing a situation for a role-play. The students' learning needs and skill requirements lead the teacher to ideas on how this situation may develop. Moreover, the teacher should review the skills and prepare small groups of students to play the roles. Once finished, the teacher then debriefs the played situation, first as a small group discussion and then as a large group discussion, to identify what students would change to have better skills. (Kodotchigova, 2003) (Figure 2).



**Figure 2: Steps to Apply the Role-Play Strategy in Problem-Based Learning  
(Kodotchigova, 2003)**

To achieve international cooperation in the oral health field, Shanley (1994) suggested using the international multimedia center curriculum in health sciences through electronic communication. An international multimedia center curriculum is defined as an electronically designed instructional system, which can enhance international collaboration among faculties from different health sciences. Shanley (1994) recommended that healthcare programs be based on an infrastructure of compatible electronic communication systems and include instructional videos tapes, CD-ROMs, DVDs, and computers-assisted learning programs. Shanley (1994) suggested that this



system would need a catalogue of electronically-based interactive training programs that could be accessed in health sciences curricula worldwide. Catalogue development requires international collaboration from different experts to stimulate desire for curriculum standards in health education and client care, internationally. In concept, faculty who participate in the multimedia center curriculum share their instructional experiences and expand their knowledge to students with high quality instructional methods that meet universal educational and practice standards. However, universal competencies should be identified before setting up this electronic communication system. These competencies must establish some fundamental abilities that should be acquired by dental professions, such as understanding the basic sciences, health history and patient assessment, recognizing common oral and systemic diseases, and establishing oral health goals and objectives for community health programs. Shanley concluded that more than 40 clusters of programs for problem-based health science curricula had been planned in Dublin, Ireland for use by a consortium of schools to maintain quality health science curricula. Each problem-based learning program focuses on a different clinical challenge, e.g., HIV seropositive patients. Learning is enhanced through related materials such as oral manifestations of HIV infection, infection control protocol, medical/dental collaboration, public health principles, and topics that deal with preclinical and clinical situations such as sexually transmitted diseases, the immune system, and economics. Educators in the consortium have a choice to use some or all of the programs, either to maintain or supplement their curricula. Shanley believes that through the use of electronic communication learning, experiences and knowledge could be efficiently shared among schools across different countries.

Elliott and Keppell (2001) investigated how computer technology could be used to enhance the effectiveness of problem-based learning in a medical curriculum. Audio-visual triggers, designed for use on a computer, can introduce small groups of students to a hypothetical medical problem considered “problem of the week”. Once presented with the problem, students have to list their observations, define the patients’ problems, identify possible causes, and plan care to solve the patient’s problem. Group discussion and diverse perspectives are necessary for each problem. Students then decide, individually or as a group, what other information is needed to help solve the problem. At the week’s end, the students’ final clinical decisions are compiled and compared to that of an expert. Elliott and Keppell (2001) pointed out that introducing the clinical problem on-line provides all students with high quality photographs, movies and video. The website, <http://www.medfac.unimelb.edu.au/dev/kelliott/fig2.gifb>, shows how computer technology can be used in the problem-based curriculum. More websites focusing on problem-based learning are listed in Table 2.

**Table 2: Website Information on Problem-Based Learning**

Source	URL	Description
University of Delaware	<a href="http://www.udel.edu/pbl">http://www.udel.edu/pbl</a>	Information related to problem-based learning activities.
Center for Problem-Based Learning	<a href="http://www.imsa.edu/team/cpbl">http://www.imsa.edu/team/cpbl</a>	Information related to the professional development and publications in problem-based learning.
Maricopa Community College	<a href="http://www.mcli.dist.maricopa.edu/pbl/">http://www.mcli.dist.maricopa.edu/pbl/</a>	Overview of problem-based learning, sharing of lessons, ideas and original publications.

Southern Illinois University School of Medicine	<a href="http://www.pbli.org">http://www.pbli.org</a>	Information related to a problem-based learning initiative.
Queen's University Kingston, Ontario, Canada	<a href="http://www.meds.queensu.ca/medicine/pbl/pblhome.htm">http://www.meds.queensu.ca/medicine/pbl/pblhome.htm</a>	Rationale for problem-based learning and students responsibilities in problem-based learning.
RSM Press: Quality Publishing from the Royal Society of Medicine	<a href="http://www.rsmpress.co.uk/bkdaavid.htm">http://www.rsmpress.co.uk/bkdaavid.htm</a>	Information related to problem-based learning in medicine
Center for Teaching Excellence	<a href="http://www.umdj.edu/meg/active_case.htm">http://www.umdj.edu/meg/active_case.htm</a>	Information on active learning and case-based learning
University of Washington Dental Hygiene Baccalaureate Degree Completion Program	<a href="http://www.washington.edu/dhyg/core.htm">http://www.washington.edu/dhyg/core.htm</a>	Information related to core courses and program expectations in developing intellectual skills and applying skills.

Elliot and Keppell (2001) interviewed the director of the faculty education unit of the medical school to gain more understanding of the interaction of students with audio-visual triggers. Interview findings suggested that the more authentic the trigger, the more effective it is as a tool to introduce real life situations to students. At the beginning of the problem-based learning session, students quickly look at the trigger, take notes of the features, and then discuss the scenario. This process was repeated several times through out the week. Elliott and Keppell (2001) showed that each time students revisited the trigger; they used new information to elaborate and improve their interpretation of the medical scenario. Elliott and Keppell (2001) also highlighted the need to incorporate complex information into the trigger, immerse students in a problem and create a mind set that helps students to approach the problem. Researchers concluded that using photographs, graphics, and videos to improve the on-line virtual

problem afforded a great degree of student interactivity (Elliott & Keppell 2001). The learning outcomes, which students gained from using triggers as a learning strategy, include self-directedness in exploring on-line resources and discussion, interpersonal skills, concern for a virtual clinical situation and integration of knowledge across different years of the curriculum.

McGrath (2002) suggested several teaching methods to transfer knowledge to students in a problem-based learning curriculum including posting lecture information on a website for anywhere and any time accessed by students. Transferring knowledge to a web-based format decreases student's face-to-face time with the teacher, which is replaced with problem-solving discussions about patient cases. In addition, self-assessment quizzes, which relate to knowledge-based information can be added to the website. Self-assessment quizzes can be assigned either before or after the instructional session to guide study habits and assess student learning. Such strategies stimulate active learning and enable students to learn via other technological devices.

Anderson, Lennon, McDonald and Stooky (2001) aimed to explore the effect of a curriculum change involving problem-based learning on library usage by dental students. The study examined library circulation rates for three years immediately prior to, and for three years immediately after, implementation of a problem-based curriculum. The results indicated an increase in total library circulation directly related to students involved in problem-based learning. The researchers concluded that the new (problem-based learning) curriculum motivated students to use more library resources than did the traditional curriculum. Using library resources is an important competency for lifelong

learning and evidence-based decision-making expected of practitioners. Table 3 summarizes the pedagogical methods used to enhance the learning process.

**Table 3: Pedagogical Methods to Enhance the Learning Process**

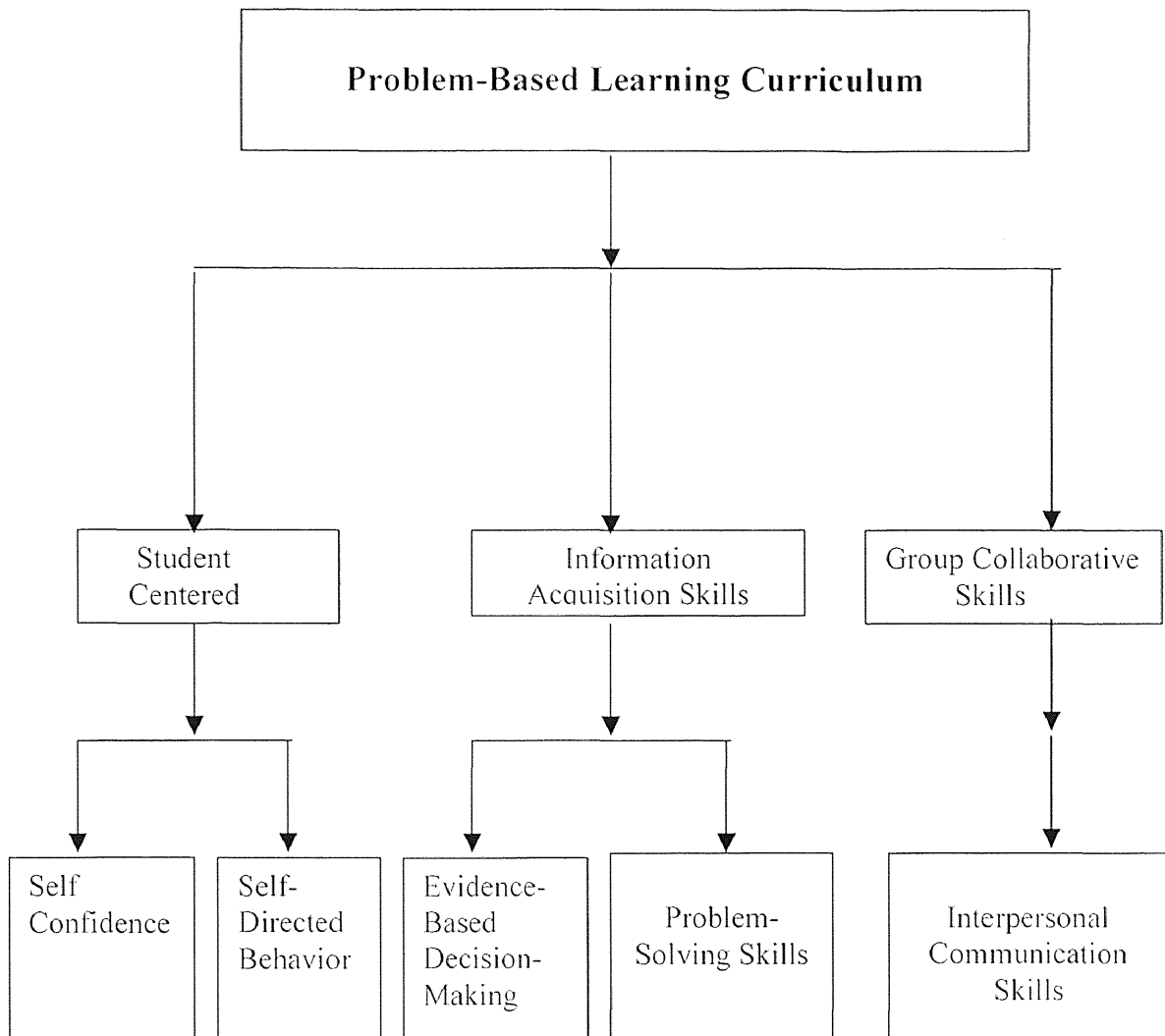
<b>Method</b>	<b>Outcomes</b>
Evidence-based information	<ul style="list-style-type: none"> <li>- Proficiency in life long learning.</li> <li>- Develop independence and competence in using library and electronic resources.</li> </ul>
Evidence-based decision making (Independently and in small groups)	<ul style="list-style-type: none"> <li>- Enhance critical thinking and group problem solving</li> <li>- Solving instructional problems</li> <li>- Share expertise</li> </ul>
International multimedia center curriculum in health sciences via electronic communications	<ul style="list-style-type: none"> <li>- Stimulate desire for educational standards in health training and care internationally.</li> <li>- Efficiently and effectively share learning experiences and knowledge globally</li> </ul>
Computer technology: introducing the clinical problem on-line and using triggers: introduce students to hypothetical clinical problem situation.	<ul style="list-style-type: none"> <li>- Introduction of virtual patients and to the circumstances surrounding the supposed situations.</li> <li>- Provide high quality graphics, movies and videos to enhance learning.</li> </ul>
Posting lecture information on-line.	<ul style="list-style-type: none"> <li>- Accessible anywhere and anytime.</li> <li>- Decrease student' s face-to-face time with teacher.</li> <li>- Increase learning time devoted to problem-solving and student-centered discussions.</li> </ul>
Self-assessment quizzes	<ul style="list-style-type: none"> <li>- Monitor students' learning and guide study habits.</li> </ul>

### **Outcomes of Problem-Based Learning in Professional Health Education**

Before educators willingly incorporate problem-based learning methods into a curriculum, they must be convinced of tangible advantages in student learning outcomes.

Juul-Dam, Brunner, Katzenellenbogen, Silverstein and Christakis (2001) studied the differences between pediatric residents exposed to a problem-based curriculum

compared with those exposed to lecture-based learning. Researchers assigned 80 pediatric residents to one of two groups. For three months, group one received a twice-weekly period of problem-based learning, while the other group continued receiving lecture-based learning. Residents exposed to problem-based learning demonstrated significantly higher levels of self-directed learning than those exposed to lecture-based learning. Residents were administered questionnaires to evaluate self-directed learning behaviors and the amount of time spent in independent study. Researchers found statistically significant increases in measures of self-directed learning in the group exposed to the problem-based model of learning compared to the lecture-based learning group. The researchers concluded that residents exposed to problem-based learning engaged in significantly higher levels of self-directed learning than those exposed to the lecture-based learning model. Some desirable learning outcomes are demonstrated in the literature and summarized in Figure 3.



**Figure 3: Student Learning Outcomes From Problem-Based Learning Curriculum**

A study by Dawka and Ghosh (1999) demonstrated the value of merging didactic lectures with problem-based learning in a physiology class for medical students. The researchers assigned about 100 students to receive a didactic lecture on the body systems, supplemented by tutorial classes conducted with smaller groups of students. In the tutorial, a problem to be solved was presented to students to apply what had been learned. After the unit of instruction was completed, a questionnaire was used to examine students' opinions on the usefulness of the problem-based learning approach and tutorial

format. Eighty percent of the students reported that a combination of didactic lecture and problem-based learning in the tutorial classes was *very useful* in understanding the body system that they were currently studying. More than 60% of the students felt that small group discussions reinforced ideas, and helped their performance on the final exam. Only 7% of the students felt that the combination of didactic lecture and problem-based learning was not useful. The researchers concluded that a mix of didactic lectures and problem-based learning sessions ensures that students gain knowledge, motivation toward self-learning, and experience in clinical decision-making. The study's findings also underscore the importance of using a variety of instructional strategies to meet diverse learning styles of students.

To determine curriculum effectiveness, teacher and course evaluation is essential (Leap: Problem-Based Learning, 2003). A variety of assessment methods can be used to determine problem-based curriculum effectiveness, e.g., outcomes evaluation and process evaluation (Leap: Problem-Based Learning, 2003). Outcomes evaluation focuses on the qualities of the problem-based learning courses and subjects; process evaluation focuses on what happens during the educational process and explores the course in its operation (Leap: Problem-Based Learning, 2003). Several steps should be followed in problem-based curriculum evaluation: selecting what is evaluated, selecting the most appropriate strategy for the evaluation, analyzing the results, providing feedbacks, and taking action to modify the curriculum (Leap: Problem-Based Learning, 2003). Table 4 represents examples of the diverse techniques that can be used for the evaluation of problem-based curriculum effectiveness.



**Table 4: Methods for Evaluation of Problem-Based Curriculum Effectiveness**

**(Leap: Problem-Based Learning, 2003)**

<b>Method</b>	<b>Target of the Evaluation</b>
Questionnaires	Students, graduates, employer opinion of alumni competence
Interviews	Students, graduates, employer opinion of alumni competence
Student's diaries/work records/logs	Learning activities & reactions
Discussion (focus group, panel)	Teaching and /or curriculum effectiveness
Comments: both solicited and unsolicited	Teaching and /or curriculum strengths and weaknesses
Observation of student/teacher behavior	Learning processes, teacher behaviors, student-teacher interaction, student attitudes and student competencies
Unobtrusive' observation (e.g. noting the extent of use of library books from circulation records)	Students' learning activities, student competencies
Feedback sections on web pages	Almost all areas of teaching, the curriculum, learning resources on web, quality of facilities
Products of student work	Student learning and student competencies

Reiff (2001) conducted a study to examine the effects of a problem-based learning curriculum on self-directed learning behaviors between two groups of pediatric residents. The researcher used three distinct, three-months periods of observations. These three periods included a pre-exposure period, an exposure period (PBL session verses no problem-based learning session), and a follow-up period. The pre-exposure period included student participation in a lecture series; the exposure period involved students in twice-weekly problem-based learning sessions. The follow-up period reverted back to the

daily lecture series. After three months, self-directed learning behaviors were reassessed. Results showed significant increases in the self-directed learning behaviors in residents exposed to PBL sessions. However, the group exposed to problem-based learning required significant increases in the amount of time for searching and discussion. These findings suggested that PBL could maintain and increase self-directed learning and lengthen learning time. The researchers cautioned that more time is required to implement PBL than traditional learning strategies.

Ikram (1999) conducted a study to evaluate student behavior in an equitably accepted student-teacher relationship at Punjab Medical College, where teaching was course oriented. Fifteen students from the second year were assigned an instructional problem and evaluated via a questionnaire on overall behavior in an extracurricular activity and on the quality of their student-teacher relationship. Ikram (1999) showed that students maintained a highly exploring nature and know more about reasoning. PBL in healthcare can improve teacher-student relationships as well as improve the level of students' knowledge and independence. The researcher concluded that PBL, whether curricular or extracurricular, maintains and improves student-teacher relationships, and maintains the students' interest to learn.

A study by Harvard Medical School (1995) showed better communication skills and interactions skills with patients in students from a problem-based learning model as compared with students assigned to the traditional program of learning. After two years, students in the problem-based learning model showed more flexible thinking and self-confidence than those in the traditional learning program. The researchers concluded that students assigned to a problem-based learning model scored equally well on knowledge

acquisition, and had better communications skills with patients than those in the traditional program.

In summary, PBL is a student-centered approach rather than teacher-centered approach to learning. PBL focuses on small groups of students challenged with real life problems instead of traditional course work. Problem-based pedagogical methods may include accessing evidence-based information, evidence-based decision making, learning units from the international multimedia center curriculum in health services accessed via electronic communication, computer technology, e.g., introducing the clinical problem on-line and using audio-visual triggers, role-playing clinical situation, posting lecture information and self assessment quizzes on a website. Case studies can be used in the problem-based curriculum to confer the role of the learning process from the teacher to the student. Case studies enhance students' critical thinking by providing students with a real life examples and encouraging them to produce suitable solutions to solve this problem. Role-play is another learning strategy that can be used in the problem-based curriculum. Role playing strategies enable learners to practice different clinical and communication skills by acting out real life situation in a classroom. Role-play can also help students define what they would change to have better skills, group discussions should be carried out after playing the role; so this explanation can take place. Researchers show that PBL improves students' communication skills, self-confidence and critical thinking. PBL in healthcare can maintain positive teacher-student relationships and improve students' knowledge and independence (Ikram, 1999). Using the electronic communication system can transfer knowledge to the students by using website resources and web-based self-assessment quizzes for anywhere and any time use

(McGrath, 2002). PBL requires students to use library and electronic databases resources (Anderson, Lennon, McDonald & Stooky 2001). Interjecting didactic lecture with PBL ensures that students not only receive information, but also are motivated toward self-learning (Dawka & Ghosh, 1999). Future healthcare practitioners need to know how to work in different systems, develop competency and use their professional knowledge in various clinical situations and with diverse patients (Bruhn, 1997). These competencies can be developed in a problem-based curriculum.

**RECOMMENDED CHANGES TO  
THE ALLIED DENTAL SCIENCES CURRICULUM AT  
JORDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY**

In order to prepare ADSP students to participate in technology, possess interpersonal communication skills, make evidence-based clinical decisions, conduct research, and pursue life long learning, the following recommendation should be implemented:

- a. Design a student-centered approach rather than teacher-centered approach to learning. This can be accomplished by incorporating instructional problems, case studies, role playing and audio-visual triggers into didactic instruction that generates students' discussion and decisions making rather than passive note taking.

Rationale: A student-centered approach will gives learners the opportunity to be independent and self-directed; change the learning process from student as a receiver of information to student as participant in the learning process; give students the opportunity to pursue their own learning objectives; build students' confidence as independent problem solvers and decision-makers; operationalize an educational philosophy where the teacher is no longer the main source of information, to one where the teacher is the provider of assistance, encouragement, suggestions, and guidelines; improve teacher-student relationships and interpersonal skills among those in the learning community, including patients; and help future healthcare providers work with diverse people to solve complex problems.

- b. Courses should build on the small group learning strategy where students are challenged with a real problem that needs to be solved, rather than passively absorbing traditional lecture information.

Rationale: Using small collaborative groups of students as a learning strategy gives students the opportunity to share their own ideas, learn from each other, and engage in active rather than passive learning. For example, in active learning, students participate by making a conscious effort to discuss issues, take notes, access additional information, and make clinical decisions, role-play (Psychology, 2003). On the other hand, in passive learning, students may simply read assignments, listen in class and take notes (Psychology, 2003). Also, using small groups in the learning process gives each group responsibility for independent thinking, latitude in problem solving, and competence in life long learning skills.

- c. Expand students' knowledge of and frequency in using library and Internet resources, so that they gain competence in accessing information, rather than obtaining information solely from the teacher.

Rationale: Using library and Internet resources develops students' competencies in accessing information from journals, index, electronic databases and Internet websites; identifying appropriate evidence-based resources to solve problems; and developing skills for life long learning.

- d. Use the electronic communication system to maintain and enrich the current curriculum.

Rationale: It is necessary to benefit from different educational fields by exchanging educational experiences, ideas and new developments. Educational and information technology will provide faculty members and students with the most significant enhancement for learning. However, there are criteria for estimating the quality of electronic communication.

e. Develop websites for all-full time faculty.

Rationale: All full time faculty must have a professional website if they are to provide students with web-based instructional opportunities, and to exchange instructional and learning experiences with other universities and countries.

f. Each faculty member should develop at least one on-line course that is connected to their professional website.

Rationale: Course websites give students and faculty an opportunity to access course information from anywhere and at any time, develop asynchronous tutorials and self-assessment tests and increase problem-solving, student-centered discussions about patients' cases. Course websites enable faculty to provide students with learning experiences that enhance students' knowledge of computer technology.

g. Post lecture information to a website with self-assessment quizzes.

Rationale: Posting lecture information and self-assessment quizzes to a website helps students to acquire information and test their knowledge from anywhere and at any time as long they have Internet access. This technique can help students' transition from the face-to-face system of learning to greater use of other technological devices that enhance learning. Self-assessment quizzes help students' determine their learning needs and monitor their study habits.

h. Introduce a clinical problem series on-line illustrated with high quality photographs, graphics, and videos with patients who present with a variety of dental diseases and special needs. After a set time, students can compare their problem solving and clinical discussion making to that of a faculty expert.

Rationale: A weekly or monthly on-line clinical problem series will introduce students to virtual patients and to the circumstances surrounding the hypothetical situation to enhance critical thinking, evidence-based decision-making, and problem solving skills.

- i. Encourage students to use the steps of the problem-based learning model to develop self-directedness and confidence in their own self-learning. These steps include:

- Encounter the instructional problem.
- Problem solving through professional and reasoning skills.
- Identify learning needs.
- Use the gained knowledge to solve problem.
- Summarize what has been learned.

Rationale: Practicing these steps when solving problems in collaborative groups or analyzing a case will develop students' skills in controlling and managing discussions, gain students' attention, create a mind set that helps students approach the problem, and improve the quality of students' education and clinical decision-making skills.

Ultimately, a problem-based curriculum will create a new kind of healthcare professional and prompt students to learn and work in different systems.

- j. Use quantitative and qualitative evaluation measures to assess the problem-based learning curriculum outcomes. The formal evaluation can be on-line questionnaire, focus groups, in-depth interviews, analysis of recorded communications or analysis of student' products. (The University of Adelaide, 2003).



Rationale: It is important to have faculty gather assessment data, which will assess the learning process, weakness in the curriculum, and the degree to which the curriculum achieves its goals.

k. Redesign ADS 326 Dental Radiology into a problem-based course. The following summarized points were addressed in the revised course (Appendix B):

- Course credits, e.g., 3 credits
- Course hours (days and times)
- Course level: ADS third year in the second semester.
- Course description
- Methods of delivery
- Required texts and materials
- Methods of students assessment
- Radiographic techniques
- Evaluation policies
- General and specific objectives
- Statement of student responsibilities and accountability

Rationale: The revised course now reflects a problem-based learning philosophy.

Problem-based developed class activities now include case studies on dental radiographic interpretation of periodontal diseases, dental caries and film duplication, and role-play exercises on bisecting angle technique and localization techniques. In the case studies small group discussion will be encouraged to enhance student-centered learning and to produce suitable solutions for the real life (instructional) problem. According to role-play theory, six steps should be followed to have successful role-play strategy: choosing an

appropriate situation for a role-play which meets students' needs, coming up with thoughts and ideas on how the role players' situation can be developed, predicting knowledge and vocabularies for this situation, providing students with needed information and clear role description so that students play the role with confidence in front of the class. and debriefing once the role-play is finished (Kodotchiggova, 2003).

- I. Redesign ADS 212 Applied Dental Materials into a problem-based course. The following summarized points were addressed in the revised course (Appendix C):
  - Course credits, e.g., 3 credits
  - Course hours (days and time)
  - Course level: ADS second year in the first semester
  - Course description
  - Methods of delivery
  - Required texts and materials
  - Course requirements
  - Methods for students assessment
  - Laboratory safety
  - Students' responsibilities and duties
  - General and specific objectives
  - Statement of students' responsibilities and accountability

Rationale: The revised course now reflects a problem-based learning philosophy.

Problem-based learning activities include small-group discussion during some class sessions and discussion of the assigned articles chosen for critique. Also case studies will allow students to apply knowledge to new situations. The two articles for critique will

develop students' skills in using the library and electronic databases resources, evidence-based decision-making, and writing skills (Appendix D).

- m. Evaluate the effectiveness of problem-based curriculum by applying some methods such as questionnaires, interviews, students' work records, discussion, comments, observation of student/teacher behaviors, unobtrusive observation by noting the extent of using library books from circulation records, feedback from students.

Rationale: Evaluation the effectiveness of problem-based curriculum will assist faculty in establishing strong curriculum guidelines, encourage students to be accountable for information, encourage students to critically evaluate the curriculum, and promote evaluation by providing constructive feedback. The use of a curriculum management plan (Appendix E) will insure continual curricula improvement to meet students' and society needs and to keep up with the technological advances.

- n. Apply suitable assessment strategies for necessary problem-based learning such as rubrics for oral presentations, debates, group problem solving, and papers to measure problem based-learning outcomes.

Rationale: To assess students' knowledge and to specify that the learning objective has been achieved successfully, outcomes evaluation must focus on the qualities of the problem-based learning courses and activities.

## SUMMARY AND CONCLUSIONS

As of 2003 the Allied Dental Sciences Program (ADSP) curriculum at Jordan University of Science and Technology uses mainly a teacher-centered approach to learning with minimal strategies to develop student's critical thinking and self-directedness. The curriculum places little emphasis on using library resources and electronic databases. Therefore, the existing ADSP curriculum needs to be developed to meet both the needs of students and the community. The purpose of this paper is to encourage development of the current ADSP curriculum at Jordan University of Science and Technology as a problem-based curriculum through specific goals. These goals included:

- Reviewing the dental and medical literature in the area of problem-based learning
- Recommending specific teaching strategies that will enable problem-based learning to occur in the ADSP curriculum
- Recommending assessment strategies necessary for evaluating problem-based learning outcomes.

After reviewing the medical and dental literature in the area of PBL, several important issues have been retrieved. PBL is a student-centered approach rather than teacher-centered approach to learning. Also, it focuses on small groups of students challenged with real life problems instead of traditional course work. The pedagogical methods of PBL may include accessing evidence-based information, evidence-based decision making, learning units from the international multimedia center curriculum in health services accessed via electronic communication, introducing clinical problems

online and using audio-visual triggers, role-playing clinical situation, and posting lecture information and self-assessment quizzes on a website. Researchers show that problem-based learning in health care can maintain positive teacher-student relationships and improve students' communication skills, self-confidence, and critical thinking (Ikram, 1999).

Using case studies as a learning strategy in the problem-based curriculum will help transfer the learning process from the teacher to the student. Since case studies are linked with increased student motivation and interest in subject, this learning strategy will enhance students' ability to find suitable solutions to real life (instructional) problems. Role-play is a learning strategy, which allows students to practice different communication skills by acting out real life situation.

Electronic communication can transfer knowledge to the student efficiently by using website resources and web-based self-assessment quizzes for anywhere and any time use can help the student monitor their own learning (McGrath, 2002). Also, problem-based learning requires students to use library and electronic databases resources. The future healthcare practitioners need to know how to work in different systems, develop competency and use their professional knowledge in various clinical situation and with diverse patients (Bruhn, 1997). All these competencies can be developed in a problem-based curriculum. To prepare ADS students to use technology, improve interpersonal skills, make evidence-based clinical decisions, conduct research, and pursue life long learning, the following recommendations should be implemented:

- Design student-centered rather than teacher-centered approaches to learning.

- Build courses around small-groups learning strategy where students are challenged with real problems that needs to be solved rather than passively absorbing traditional lecture information
- Expand students' knowledge and frequency of using library and Internet resources.
- Use the electronic communication system to maintain and enrich the current curriculum.
- Develop at least one web course for each full-time faculty member.
- Post lecture information and self-assessment quizzes to a website.
- Introduce a clinical problem series on-line illustrated with high quality graphics, movies and videos on complete teaching cases to fulfill special needs.
- Encourage students to use the steps of the Problem-Based Learning Model to develop self-directness and confidence in their own learning.
- Redesign ADS 326 Dental Radiology II and ADS 212 Applied Dental Materials into a problem-based learning, evaluate the effectiveness of the problem-based learning and apply suitable assessment strategies for necessary problem-based learning.

As a result of revising ADS 326 Dental Radiology II, the course now reflects a problem-based learning philosophy. Some problem-based learning components including case studies and role-play strategies. According to problem-based learning theory, students need to work in small groups to develop confidence in making decisions and skills in working with others. Working in groups facilitates the sharing of different ideas

and in class learning experiences among group members. The teacher needs to follow specific steps to get successful results from problem-based role-playing strategies. These steps include choosing an appropriate situation for role-play, creating ideas on how this situation may develop, preparing needed knowledge and vocabularies to use for the situation, providing students with clear descriptions for the role-play, student acting the situation in front of the class and then, spending some time to debrief the role-play after it is finished.

Finally, if the ADSP curriculum is developed according to problem-based theory and principles, the faculty will be able to prepare students for real world problem solving by encouraging students to be self-directed and independent in accessing evidence-based information both independently and collaboratively. The faculty will be able to prepare students who can compete with those from similar program within the global community. By improving the interpersonal communication skills, students will be able to motivate clients and exchange experiences with dental hygienists world wide as well as those in Jordan. Furthermore, the faculty will be able to establish a program that serves as a model for other programs at the university. Learning outcomes achieved from problem-based learning will encourage other university programs to follow the same philosophy. The ultimate problem-based learning outcome is the preparation of competent healthcare professionals capable of serving the needs of Jordan's population.

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## APPENDICES

**Appendix A**

**Allied Dental Sciences Program (ADSP) Curriculum at Jordan**

**University of Science and Technology**

**College of Applied Medical Sciences  
Department of Allied Dental Sciences  
Allied Dental Sciences**

College of Applied Medical Sciences at Jordan University of Science and Technology grants a bachelors degree in Allied Dental Sciences after successfully completing (129) credit hours. These credit hours are represented in the following courses:

<b>Requirement</b>	<b>Obligatory</b>	<b>Elective</b>	<b>Total (Hours)</b>
University	16	9	25
College	44	-	44
Department	60	-	60
Total	120	9	129

University requirements include obligatory and elective courses. The obligatory requirements include the following courses:

<b>Course no.</b>	<b>Course title</b>	<b>Credits</b>	<b>Practical hours</b>	<b>Theoretical hours</b>	<b>Prerequisite</b>
MS 100	Military Science	3	-	3	
CS 100	Introduction to Computer	3	-	3	
A 103	Applied Arabic Language	1	3	-	A 101
E 111	English Language I	3	-	3	
A 101	Arabic Language	3	-	3	

E 112	English Language II	3	3	-	E 111
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Students whose native language is not Arabic must take the following courses:

Course no.	Course name	Credits
A 101 a	Arabic language for the non Arabic speakers	3
A 103 a	Application studies in Arabic language for the non Arabic speakers	1

The elective courses include the following courses:

Course no.	Course name	Credits
HS 112	Haddeth Shareef	3
HS 113	Al-Akedah	3
HS 114	Al-Fikeh	3
HS 115	Islam and Contemporary Issues	3
HS 116	Islamic Economic System	3
HS 121	Introduction to Sociology	3
HS 122	Introduction to Anthropology	3
HS 123	Introduction to Education	3
HS 124	Jordan's Educational System	3
HS 125	Introduction to Philosophy	3
HS 126	Introduction to Psychology	3
HS 131	Islamic Culture	3

HS 161	Contemporary Problems	3
HS 231	The History of Science for Islam	3
Ph 103	Environment Protection (not for medical & nursing students)	3
Ph 104	Society Health & Nutrition (not for medical & nursing students)	3
Phar 104	Drugs & Medicinal Plants in Jordan (not for medical & pharmacy students)	3
HS 141	Introduction to Economic	3
HS 151	Introduction to Administration	3
Ph 200	Principles of First Aid	3
PP 200	Home Gardens (not for farming students)	3
PP 201	Bees Keeping (not for farming students)	3
VM 211	Animal health (not for veterinary medical farming students)	3
ME 121	Fundamentals of Automobile Engineering	3

The college obligatory courses (44 credits) include the following courses:

Course no.	Course name	Credits	Prerequisites
Math 102a	Calculus	3	
Bio 103	Biology	3	
Phy 103	Physics	3	

Che 103	General Chemistry	3	
Che 107	Chemistry Lab	1	Chm 103or Co-requisite
Bio 107	Biology Lab	1	Bio 103 or Co-requisite
Che 217	Organic Chemistry	3	Chm 103
CS 116	Programming Language	3	CS 100
M 212	Pathology	3	M 218 & M 234
M 218	Gross Anatomy & Histology	3	Bio 107
M 222	Biochemistry	3	Chm 217
M 227	Biochemistry Lab	1	M 222 or Co-requisite
M 234	Human Physiology	4	M 218 or Co-requisite
M 242	Microbiology	3	Bio107
M 243	Microbiology Lab	1	M 242 or Co-requisite
M 302	Medical Ethics	1	
Ph 311	Biostatistics	2	
PT 485	Managements in Allied Medical Sciences	3	
Total		44	



The department requirement courses (60 credits) include the following courses:

Course no.	Course name	Credits	Prerequisite
ADS 101	Introduction to Dental Science & Dental Terminology	1	
ADS 211	Dental Morphology & Occlusion	2	ADS 101
ADS 212	Dental Materials	3	ADS 101
ADS 321	Restorative Dentistry	2	ADS 212
ADS 322	Removable Prosthodontics	2	ADS 212
ADS 323	Anesthesia & Oral Surgery	2	M 218, M 219
ADS 324	Peadodontics & Orthodontics	2	
ADS 331	Periodotics I	2	M 218
ADS 332	Oral Pathology & Oral Medicine	2	M 212, M 242
ADS 341	Cariology	1	
ADS 325	Radiology I	2	
ADS 311	Clinical Allied Dental Sciences I	3	ADS 321, ADS 331
ADS 326	Radiology II	3	ADS 325
ADS 333	Periodotics II	3	ADS 331
ADS 403	Medical Emergencies	1	
ADS 412	Clinical Allied Dental Sciences II	3	ADS 312
ADS 434	Clinical Oral Hygiene I	6	ADS 333

ADS 443	Oral Epidemiology for Allied Dental Sciences Students		
ADS 444	Dental Hygiene & Oral Epidemiology	2	
ADS 445	Preventive Dentistry	2	PT 311
ADS 413	Clinical Allied Dental Sciences III	3	ADS 412
ADS 435	Clinical Oral Hygiene II	5	ADS 434
GH 351	Nutrition	3	Bi0 103, Chm 103 or Co-requisite
M 219	Head & Neck Anatomy	3	M 218
ADS 366	Pharmacology for Allied Dental Sciences Students	1	M 234
ADS 491	Methodology & Research Project	1	
Total		60	

## Suggested Plan for Allied Dental Sciences Program

### First year/First semester

Course no.	Course name	Credits	Practical hours	Theoretical hours	Pre-requisites
ADS 101	Introduction to Dental Science & Dental Terminology	1	-	1	
A 101	Arabic Language	3	-	3	
A 103	Applied Arabic Language	1	1	-	
Bio 103	Biology	3	-	3	
Bio 107	Biology Lab	1	1	-	Bio103 or Co-requisite
Chm 103	General Chemistry	3	-	3	
Chm 107	Chemistry Lab	1	1	-	Chm 103 or Co-requisite
E 111	English Language I	3	-	3	
Total		16	3	13	

**First year/Second semester**

Course no.	Course name	Credits	Practical hours	Theoretical hours	Pre-requisites
Phy 103	Physics	3	-	3	
Ms 100	Military Science	3	-	3	
Cs 100	Introduction in Computer	3	1	2	
Chm 217	Organic Chemistry	3	-	3	Chm 103
E 112	English Language II	3	-	3	
Math 102a	Calculus	3	-	3	
Total		18	1	17	

Second year/First semester

Course no.	Course name	Credits	Practical hours	Theoretical hours	Pre-requisites
M 234	Human Physiology	4	1	3	M 218 or Co-requisite
GH 351	Nutrition	3	-	3	Bio 103, Chm103 or Co-requisite
ADS 211	Dental Morphology & Occlusion	2	1	1	ADS 101
ADS 212	Dental Materials	3	1	2	ADS 101
M 218	Gross Anatomy & Histology	3	1	2	Bio 103, Bio 107
M 242	Microbiology	3	-	3	Bio 103, Bio 107
M 243	Microbiology Lab	1	1	-	M 242 or Co-requisite
Total		19	5	14	

**Second year/Second semester**

<b>Course no.</b>	<b>Course name</b>	<b>Credits</b>	<b>Practical hours</b>	<b>Theoretical hours</b>	<b>Pre-requisites</b>
M 219	Head & Neck Anatomy	3	1	2	M 218
Ph 311	Biostatistics	2	-	2	
CS 116	Programming Languages	3	1	2	CS 100
M 212	Pathology	3	-	3	M 218, M 234
M 222	Biochemistry	3	-	3	Chm 217
M 227	Biochemistry Lab	1	1	-	M 222 or Co-requisite
	Elective Course	3	-	3	
Total		18	3	15	

**Third year/First semester**

<b>Course no.</b>	<b>Course name</b>	<b>Credits</b>	<b>Practical hours</b>	<b>Theoretical hours</b>	<b>Pre-requisites</b>
ADS 321	Restorative Dentistry	2	1	1	ADS 212
ADS 322	Removable Prosthodontics	2	1	1	ADS 212
ADS 323	Anesthesia & Oral Surgery	2	1	1	M 218, M 219
ADS 324	Peadodontics & Orthodontics	2	1	1	
ADS 325	RadiologyI	2	1	1	
ADS 331	Periodotics I	2	1	1	M 218
ADS 332	Oral Pathology	2	1	1	M 212, M 242
ADS 341	Cariology	1	-	1	
	Elective Course	3		3	
Total		18	7	11	

**Third year/ Second semester**

Course no.	Course name	Credits	Practical hours	Theoretical hours	Pre-requisites
M 302	Medical Ethics	1	-	1	
ADS 366	Pharmacology for Allied Dental Sciences Students	1	-	1	M 234
ADS 311	Clinical Allied Dental Sciences I	3	3	-	ADS 321, ADS 331
ADS 326	Radiology II	3	2	1	ADS 325
ADS 333	Periodontics II	3	2	1	ADS 331
	Elective Course				
Total		14	7	7	



**Fourth year/First semester**

<b>Course no.</b>	<b>Course name</b>	<b>Credits</b>	<b>Practical hours</b>	<b>Theoretical hours</b>	<b>Pre-requisites</b>
ADS 403	Medical Emergencies	1	-	1	
ADS 412	Clinical Allied Dental Sciences II	3	3	-	ADS 311
ADS 434	Clinical Oral Hygiene I	6	5	1	ADS 333
ADS 444	Dental Hygiene & Oral Epidemiology	2	1	1	
ADS 445	Preventive Dentistry	2	1	1	PT 311
	Elective Course	3		3	
Total		14	10	4	

**Fourth year/Second semester**

Course no.	Course name	Credits	Practical hours	Theoretical hours	Pre-requisites
PT 458	Managements in Allied Medical Sciences	3	-	3	
ADS 413	Clinical Allied Dental Sciences III	3	3	-	ADS 412
ADS 435	Clinical Oral Hygiene II	5	5	-	ADS 434
ADS 491	Methodology & Research Project	1			
Total		12	8	3	

## Revised Allied Dental Sciences Courses Descriptions

- *101. Introduction to Dental Sciences and Dental Terminology.* Lecture 1 hour; 1 credit. An introduction to the professional dental field. The course outlines history of dentistry and its different specialists, and familiarize students with various technical terms used in dentistry and healthcare. (offered first year/ first semester).
- *211. Dental Morphology and Occlusion.* Lecture 1 hour; laboratory 3 hours, 2 credits. Prerequisite: ADS 101. An introduction to tooth morphology with emphasis on developing students' knowledge in tooth structures and shapes, and various classification of dental occlusion. (offered second year/ second semester)
- *212. Applied Dental Materials.* Lecture 2 hours; laboratory 2 hours; 3 credits. Prerequisite ADS 101. An introduction to dental materials with emphasis on those restorative materials and techniques commonly used in dental practice and which may be required for use by the dental hygienist. An overview of current trends in dental materials is presented. (offered second year/ first semester).
- *311. Clinical Allied Dental Sciences I.* Clinic 5 hours, 3 credits. Prerequisite: ADS 321 and ADS 331. Clinical experience at Jordan University of Science and Technology supervised dental clinics. Clinical application of introductory skills, essential to rendering oral health services to patients with emphasis on basic dental hygiene instrumentation. (offered third year/ second semester).
- *321. Conservative Dentistry.* Lecture 1 hour; clinic 3 hours; 2 credits. Prerequisite: ADS 212. An introduction to operative dentistry, crown and bridge work, and root canal therapy with emphasis on the fundamentals of dental

sciences and the role of the dental assistant in dental conservative clinical techniques. (offered third year/first semester).

- *322. Removable Prosthodontics.* Lecture 1 hour; clinic 3 hours; 2 credits.  
Prerequisite ADS 212. An introduction to dental materials used in removable prosthodontics. Emphasis is on fundamental and practical competency in the various clinical dental assisting techniques in producing removable prostheses. (offered third year/ first semester).
- *323. Anesthesia and Oral surgery.* Lecture 1 hour; clinic 3 hours; 2 credits.  
Prerequisites: M 218 and M 219. Introduction to the fundamental principles of anesthetic agents, dental materials and instruments used in oral and maxillofacial surgery. Emphasis is on the development of dental assisting competencies in the various clinical oral procedures. (offered third year/ first semester).
- *324. Orthodontics and Pedodontics.* Lecture 1 hour; clinic 3 hours; 2 credits. An introduction to dental materials and instruments used in orthodontics and pedodontics with emphasis on the development of dental assisting competencies in orthodontics and pedodontics. (offered third year/first semester).
- *325. Dental Radiology I.* Lecture 1 hour; laboratory 3 hours; 2 credits. Study of the nature and production of x-rays and basic principles and procedures in dental radiology. Emphasis is on radiation physics, radiation biology, radiation protection, basic intraoral radiographic techniques and film processing and mounting procedures. (offered third year/ first semester).
- *326. Dental Radiology II.* Lecture 1 hour; laboratory 3 hours; 3 credits.  
Prerequisites: ADS 325. Continued development of the principles and techniques

obtained in dental radiology I with emphasis on supplemental intraoral techniques, extraoral techniques and localization techniques, radiographic interpretation, and management topics including a quality assurance and film and equipment design, selection, maintenance and care. (offered third year/ second semester).

- 331. *Periodontology I*. Lecture 1 hour; clinic 3 hours; 2 credits. Knowledge of the role of dental plaque biofilm and other risk factors in the etiology of periodontal diseases, microbiology of periodontal diseases, pathogenesis of periodontal diseases, classification and sequel of periodontal diseases. Emphasis is on development of assisting competencies in the various periodontal treatment procedures. (offered third year/first semester).
- 332. *Oral Pathology*. Lecture 1 hour; clinic 3 hours; 2 credits. Prerequisite M 212 and M 242. Principles of the disease process and general pathology including pathogenesis, injury, inflammation, neoplasia and circulatory disturbances are followed by the study of pathology of the teeth, supporting and associated oral structures. Emphasis is on the clinical and radiological appearance of local and systemic disease processes affecting the oral and facial structures. (offered third year/ first semester).
- 333. *Periodontology II*. Lecture 1 hour; clinic 3 hours; 3 credits. Prerequisite: ADS 331. Continued development of the basic knowledge of the role of dental plaque biofilm and other risk factors in the etiology of periodontal diseases, pathogenesis of periodontal diseases, classification of periodontal diseases,

assessment of periodontal parameter, and nonsurgical periodontal therapy in the clinical sessions. (offered third year/ second semester).

- *341. Cariology for Allied Dental Sciences.* Lecture 1 hour; 1 credit. Study of dental caries, individual and community based methods of prevention, epidemiological measures used to measure the prevalence and incidence of dental caries. (offered third year/first semester).
- *366. Pharmacology for Allied Dental Sciences.* Lecture 1; 1 credit. Prerequisite M 234. A study of the pharmacologic and therapeutic agents used in oral healthcare, their preparation, effects, and application. (offered third year/ second semester).
- *403. Medical Emergencies.* Lecture 1 hour; 1 credit. A study of systemic conditions with emphasis on the prevention and management of medical emergencies in the oral care setting. (offered fourth year/ first semester).
- *412. Clinical Allied Dental Sciences II.* Clinic 3 hours; 3 credits. Clinical experience at Jordan University of Science and Technology supervised dental clinics. Prerequisite: ADS 311. Continued development of the clinical dental assisting competencies in periodontics, prosthodontics, conservative dentistry, orthodontics, pedodontics and oral surgery. (offered fourth year/first semester).
- *413. Clinical Allied Dental Sciences III.* Clinic 3 hours; 3 credits. Clinical experience at Jordan University of Science and Technology supervised dental clinics. Prerequisite: ADS 412. Continued development of the clinical dental assisting competencies in periodontics, prosthodontics, conservative dentistry, orthodontics, pedodontics and oral surgery with emphasis on the treatment of patients with special needs. (offered fourth year/second semester).

- *434. Clinical Oral Hygiene I.* Lecture 1 hour; clinic 5 hours; 6 credits. Clinical experience at Jordan University of Science and Technology supervised dental clinics. Prerequisite: ADS 333. Development of clinical proficiency and decision making in providing comprehensive preventive oral health services. Emphasis is on clinical application and development of dental hygiene competencies. (offered fourth year/ first semester).
- *435. Clinical Oral Hygiene II.* Clinic 5 hours; 5 credits. Clinical experience at Jordan University of Science and Technology supervised dental clinics. Prerequisite ADS 435. Continued development of clinical proficiency and decision-making in providing comprehensive, evidence-based preventive oral health services. Emphasis is on clinical competencies and development of skills necessary for the treatment patients with special needs and periodontitis using the dental hygiene process. (offered fourth year/second semester).
- *444. Dental Hygiene and Oral Epidemiology.* Lecture 1 hour; practice 1 hour; 2 credits. Introduction to the principles of dental public health, oral epidemiology, prevention and control of oral disease on a community basis, and community dental health services. Emphasis is on program assessment, planning, implementation, and evaluation for the development of community dental programs. (offered fourth year/ first semester).
- *445. Preventive Dentistry.* Lecture 1 hour; clinic 3 hours; 2 credits. Prerequisite: PT 311. An introduction to the theoretical foundations of preventive and therapeutic oral health services used in the dental hygiene process. Emphasis is on

development of clinical competencies on the basic preventive methods used in dental hygiene. (offered fourth year/ first semester).

- *491. Research Methods.* Lecture 1 hour; 1 credit. Designed to develop skills in scientific methods and critical analysis of research findings. Emphasis is on types of research, problem selecting and hypothesis writing, research planning and design, data collection and measuring techniques, analysis and interpretation data, research proposal writing and computer application. A written research paper is required. (offered fourth year/ second semester).



Page 1 of 1

## **Appendix B**

### **ADS 326 Dental Radiology II**

**Jordan University of Science and Technology**  
**College of Applied Medical Sciences**  
**Department of Allied Dental Sciences**

**ADS-326:** Dental Radiology II

**Course Credit:** 3 credits

**Instructor:**

**Course hours:** Lecture 9:00 am-9: 50 am Sunday & Tuesday

Laboratory 9:00 am-9: 50 am Thursday

**Curricular Level:** Allied Dental Science, Third Year, Second Semester

**Course Description:** Continued development of the principles and techniques obtained in ADS 325 Dental Radiology I with emphasis on supplemental intraoral techniques, extraoral techniques, localization techniques, radiographic interpretation, and client management topics.

**Required Texts and Materials:**

1. Dental radiography. Principles and Techniques, JI Hring & L Janes W. B. Saunders Co. 2<sup>nd</sup> edition, 2000.
2. Radiographic Interpretation for the Dental Hygienist, JI Haring & L j Lind, W.B. Sunders Co., 1993.
3. Excercises in Oral Radiographic Techniques. A Laboratory Manual, EM Thomson-Lakey, Prentic- Hall, 2000.

**Methods of Delivery:**

- Didactic instruction/discussion, demonstration, case studies, peer teaching, laboratory application and reading assignments.
- Laboratory sessions include a demonstration of the assignment by instructor.
- Each student is required to wear the radiation-monitoring device.
- Each student is responsible for all material covered in lecture, laboratory sessions, and reading assignments.

- Laboratory assignments are due at the beginning of the class session on the date specified in the course outlines. The laboratory assignment grades will be reduced by one point for each day late.
- The following radiographic series are required to be taken in a simulated clinical environment on the practice manikin:
- Two full-mouth series (18 films per series):
  - Bisecting angle technique series
  - Paralleling technique series
- One panoramic series
- Student is expected to place, expose, process, mount and critique each series.
- Students are required to secure all radiology equipment at the end of laboratory session.
- Evaluation of student performance will be as follows:
  - Laboratory assignments and radiographic series: 30%
  - Test 1: 20%
  - Test 2: 20%
  - Final Exam: 30%

**Explanation of Evaluation:**

1. Tests will cover lecture material, laboratory activities and reading assignments.
  - Final examination will be comprehensive.
  - Tests will be given in the lecture room during the regularly schedule class period.
2. Student who does not take test during the schedule dates is to:
  - Schedule a meeting with instructor
  - Have ready documentation of excused absence:
    - If absence is unexcused, student will receive a grade (zero) for the test not taken.
    - For excused absence, make-up test must be taken as soon as possible (maximum one week after the missed examination).

- Test format will be decided by instructor and may include but not be limited to:
  - Oral examination
  - Essay
  - Short Answer
  - Listing
  - Demonstration/performance
  - Combination of the above

**Testing:**

- ADS 326 exams are not released. After completing each exam, review of the questions will take place in class.
- If student wishes to review the exam, it is up to the student to schedule an appointment with the instructor.

**General Objectives/Goals:**

Following successful completion of this course, the student will:

1. Determine and apply the appropriate supplemental radiographic technique
2. Utilize appropriate intraoral radiographic techniques for special clients such as children, partially or completely edentulous, exaggerated gag reflex, low palatal vault or the presence of palatal or mandibular tori.
3. Interpret both intra and extra oral dental radiographs for identification of dental materials, periodontal diseases, and pulpal and periapical lesions.
4. Demonstrate proficiency in panoramic radiography, including client positioning, exposing, processing, mount and identifying and critiquing for acceptability.

**Specific Weekly Objectives:**

Following attendance at lecture and lab, completion of reading assignments and participation in-class activities, the students will:

**Week 1: Dental Photography (Didactic Period of Instruction):**

1. Specify uses for dental photography.

2. Identify characteristics of a good clinical photograph.
3. Critique intraoral photographs for acceptability.
4. Analyze the components of an intra-oral camera.

**Week 1: Dental Photography (Laboratory):**

1. Analyze appropriate image ratio when taking intraoral photograph.
2. Operate an intra-oral camera.
3. Utilize an intra-oral camera in patient oral healthcare.
4. Expose a basic photographic series by using appropriate equipment and dental photographic record keeping methods.

**Week 2: Bisecting Angle Technique and Special Procedures (Didactic Period of Instruction):**

1. Identify the advantages and disadvantages of the bisecting angle technique.
2. List disadvantages of “Finger Holder” method of packet placement.

**Week 2: Bisecting Angle Technique and Special Procedures (Laboratory):**

1. Appropriately set up the radiology operatory following accepted infection control protocol.
2. Demonstrate knowledge of infection control protocol during placement and exposure of intra-oral radiographs.
3. Demonstrate knowledge of infection control protocol for the dark room.
4. Demonstrate appropriate attitude, verbal and non-verbal facilitative skills that will enhance patient trust during the radiographic procedure.
5. Knowledgeably answer typical client questions regarding the radiographic procedure.

6. Alter basic radiographic procedures for special clients such as exaggerated gag reflex, shallow palatal vault, the presence of palatal or mandibular tori, complete or partially edentulous and patient with physical or developmental disabilities.

**Week 3: Radiographic Interpretation: Dental Materials (Amalgam, Composite, Crown and Bridge, Root Canal Therapy, Orthodontics Appliances), Traumatic Injuries and Periapical Lesions (Didactic Period of Instruction):**

1. Define the terms interpretation and diagnosis.
2. Use the appropriate terms for radiographic description.
3. Recognize deviation from normal radiographic anatomy.

**Week 3: Radiographic Interpretation: Dental Materials (Amalgam, Composite, Crown and Bridge, Root Canal Therapy, Orthodontics Appliances), Traumatic Injuries and Periapical Lesions (Laboratory):**

1. View radiographs under conditions appropriate for radiographic interpretation.
2. Identify the radiographic appearance of specific dental materials.
3. Identify incorrect vertical angulation errors of the bisecting angle technique.

**Week 4: Radiographic Interpretation of Periodontal Disease (Didactic Period of Instruction):**

1. Discuss uses and limitation of radiographs in periodontal assessment.
2. Identify the predisposing factors of periodontal disease as seen radiographically.
3. Describe early, moderate and advanced radiographic signs of periodontal disease.
4. Identify the appropriate use of radiographic projection to best image periodontal changes.

**Week 4: Radiographic Interpretation of Periodontal Disease (Laboratory):**

1. Use the appropriate technique to best image periodontal changes.

2. Identify the difference between horizontal and vertical bone loss as seen radiographically.

**Week 5: Exam 1 (Case Studies on Periodontal Diseases and Dental Materials: Amalgam, Composite, Crown and Bridge, Root Canal Therapy, Orthodontics Appliances Radiographs)**

**Week 5: Complete Exe. 4 and 14 (Laboratory):**

1. Locate the planes of the film and the long axis of the tooth as they relate to locating and imaging the imaginary bisecting angle technique.
2. Adjust the stable film holder for use with the bisecting angle technique.

**Week 6: Radiographic Interpretation of Dental Caries (Didactic Period of Instruction):**

1. Discuss radiographic signs of dental caries.
2. Use the appropriate radiographic projection to best image dental caries.
3. Be aware of factors that may look like dental caries.

**Week 6: Radiographic Interpretation of Dental Caries (Laboratory):**

1. Specify the difference between dental caries and other conditions that may be mistaken for dental caries (cervical burnout, abrasion, attrition, erosion, and composite restoration).
2. Use the appropriate technique to best image dental caries.

**Week 7: Extroral Radiography (Didactic Period of Instruction):**

1. Identify need for extraoral radiographs.
2. Specify each type of extraoral radiographs with its diagnostic need.
3. Define the main characteristics of extraoral radiography.
4. Identify types of radiographic cassette.

5. Describe the uses for and technique of mandibular lateral oblique radiograph.

**Week 7: Extroral Radiography (Laboratory):**

1. Apply methods of extraoral films identification.
2. Describe the technique used for mandibular lateral oblique radiograph.
3. Describe the technique for cephalometric radiographs.
4. Demonstrate methods in the care of screens and film cassettes.

**Week 8: Film Processing and Film Duplication (Didactic Period of Instruction):**

1. Identify the equipments needed for duplication of radiographs.
2. Describe rationale for duplication radiographs.
3. Discuss the process of radiographic duplication.

**Week 8: Film Processing and Film Duplication (Laboratory):**

1. Demonstrate film duplication procedure.
2. Specify film duplication errors and apply methods used for correction.

**Week 9: Exam 2**

1. Case Studies on Dental Caries
2. Case Studies on Film Duplication

**Week 9: Complete Extraoral Radiographs and Film Duplication.**

1. Discuss rationale for duplicating radiographs.
2. Explain the process of radiographic duplication.

**Week 10: Occlusal Radiography and Disto-Oblique Periapicals (Didactic Period of Instruction):**

1. Identify patient need for occlusal radiographs.
2. Identify the indications for occlusal radiographs.



3. Discuss the three types of occlusal radiographs.
4. Define the situation that needs the use of the disto-oblique periapical technique.
5. Demonstrate the methods of localization.

#### **Week 10: Occlusal Radiography and Disto-Oblique Periapicals**

##### **(Laboratory):**

1. Specify the film size needed for occlusal radiographs.
2. Verbally and demonstrate the technique used when taking topographical and cross-sectional occlusal radiograph of the maxilla and mandible.
3. Analyze disto-oblique periapical radiographs when appropriate.
4. Expose. Process, mount and critique for acceptability, occlusal radiographs of the maxilla and the mandible.

#### **Week 11: Panoramic Radiography (Didactic Period of Instruction):**

1. Discuss the theory of image production for the panoramic radiograph.
2. Discuss panoramic radiographs when needed.
3. Utilize the advantages and disadvantages of panoramic radiographs.

#### **Week 11: Panoramic Radiography (Laboratory):**

1. Use the correct load of a panoramic cassette and extra oral film.
2. Discuss and demonstrate the correct techniques for operation panoramic unit.
3. Specify operator errors and apply methods for correction.
4. Discuss panoramic patient positioning errors and use methods for correction.

#### **Week 12: Panoramic Anatomy and Panoramic Artifacts (Didactic Period of Instruction):**

1. Define normal radiographic anatomy as seen on a panoramic radiograph.
2. Define panoramic imagery artifacts, ghost images and negative shadows.

## **Week 12: Panoramic Anatomy and Panoramic Artifacts (Laboratory):**

1. Discuss alternate oral and maxillofacial imaging modalities and explain how they relate to oral radiology.
2. Discuss the advantages and the disadvantages of digital radiography.

### **Statement of Student Responsibilities and Accountabilities:**

**Attendance:** Attendance and class participation are required as responsibilities associated with becoming a professional healthcare provider. The student should contact the course instructor in case of an absence. Only an excused absence can be made up.

### **Meeting Established Deadlines:**

- All course related assignments are to be submitted to the course instructor on the establishing due date.
- Work submitted after the established deadlines will be penalized by losing 20% of the final grade of the assignment.
- Students are encouraged to keep a duplicate copy of all written assignments submitted.

**Planner for ADS 326 Dental radiology II (Didactic Period of Instruction)**

Week	Didactic Period of Instruction	Reading Assignment
Week 1	<ul style="list-style-type: none"> <li>• Orientation</li> <li>• Dental photography</li> </ul>	<ul style="list-style-type: none"> <li>• Handouts: Dental photography</li> </ul>
Week 2	<ul style="list-style-type: none"> <li>• Bisecting angle techniques</li> <li>• Special procedures</li> <li>• PBL class activity: Role-play on bisecting angle technique</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 25: Radiography of patients with special needs</li> </ul>
Week 3	<ul style="list-style-type: none"> <li>• Radiographic interpretation</li> <li>• Dental materials, tooth development, traumatic and periapical lesions</li> <li>• PBL class activity: Slides identification on dental materials, tooth development, traumatic and periapical lesions</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 29: Introduction to radiographic interpretation</li> <li>• Chapter 32: Interpretation of traumatic and periapical lesions</li> <li>• Explore website: <a href="http://www.dent.ucla">http://www.dent.ucla</a></li> </ul>
Week 4	<ul style="list-style-type: none"> <li>• Radiographic interpretation of periodontal diseases</li> <li>• PBL class activity: Slide identification on radiographic interpretation of periodontal disease</li> <li>• PBL class activity: Case studies on radiographic interpretation of periodontal disease</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 31: Interpretation of periodontal disease</li> </ul>
Week 5	<ul style="list-style-type: none"> <li>• First Examination</li> </ul>	

Week 6	<ul style="list-style-type: none"> <li>• Radiographic interpretation of dental caries</li> <li>• PBL class activity: Slide identification and case studies on radiographic interpretation of dental caries</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 30: Interpretation of dental caries</li> </ul>
Week 7	<ul style="list-style-type: none"> <li>• Extraoral Radiography</li> <li>• PBL class activity: Slide identification on extraoral radiography</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 23: Extraoral radiography</li> </ul>
Week 8	<ul style="list-style-type: none"> <li>• Film processing and Film duplication</li> <li>• PBL class activity: case studies on film duplication</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 9: Dental x-ray film processing</li> <li>• Explore website: <a href="http://xerostardental.com">http://xerostardental.com</a></li> </ul>
Week 9	<ul style="list-style-type: none"> <li>• Second Examination</li> </ul>	
Week 10	<ul style="list-style-type: none"> <li>• Occlusal radiograph</li> <li>• Localization techniques</li> <li>• PBL class activity: Role-play on localization technique</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 21: Occlusal and localization techniques</li> </ul>
Week 11	<ul style="list-style-type: none"> <li>• Panoramic radiograph</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 22: Panoramic radiograph</li> </ul>

Week 12	<ul style="list-style-type: none"> <li>• Panoramic anatomy</li> <li>• Panoramic artifact</li> <li>• PBL class activity: Slide identification on panoramic radiographs</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 28: Normal anatomy-panoramic film</li> </ul>
Week 13	<ul style="list-style-type: none"> <li>• Alternate oral and maxillofacial</li> <li>• Imaging Modalities</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 24: Digital radiography</li> </ul>
Week 14	<ul style="list-style-type: none"> <li>• Review for the final Exam</li> </ul>	
Week 15	<b>Comprehensive Final Exam</b>	

### Planner for ADS 326 Dental Radiology II (Laboratory)

Week	Topic (Laboratory)	Reading Assignments
Week 1	<ul style="list-style-type: none"> <li>• Dental Photography</li> </ul>	<ul style="list-style-type: none"> <li>• Handouts: Dental photography</li> </ul>
Week 2	<ul style="list-style-type: none"> <li>• Placement of intraoral radiographs on partner</li> </ul>	<ul style="list-style-type: none"> <li>• Lab Exe.6: Infection control and student partner practice</li> <li>• Lab Exe.7: Special Clients and student partner practice</li> <li>• Chapter 12: Patient relations and the dental radiographer</li> <li>• Chapter 13: Patient education and the dental radiographer</li> <li>• Chapter 14: Legal issues and the dental radiographer</li> <li>• Chapter 15: Infection control and the dental radiographer</li> </ul>
Week 3	<ul style="list-style-type: none"> <li>• Bisecting angle techniques</li> <li>• Special clients</li> <li>• Radiographic interpretation</li> </ul>	<ul style="list-style-type: none"> <li>• Lab Exe. 4: Periapical techniques-bisecting angle</li> <li>• Lab Exe. 12: Radiographic interpretation</li> </ul>
Week 4	<ul style="list-style-type: none"> <li>• Continue bisecting angle technique</li> </ul>	<ul style="list-style-type: none"> <li>• Review reading from week 3</li> </ul>
Week 5	<ul style="list-style-type: none"> <li>• Complete lab exe. 4 and 12</li> </ul>	<ul style="list-style-type: none"> <li>• Review readings from week 3 and 4</li> </ul>

Week 6	<ul style="list-style-type: none"> <li>• Continue bisecting angle technique</li> </ul>	<ul style="list-style-type: none"> <li>• Review reading from week 3, 4, and 5 (bisecting angle techniques, special clients, radiographic interpretation)</li> </ul>
Week 7	<ul style="list-style-type: none"> <li>• Lateral jaw and cephalometric radiography</li> </ul>	<ul style="list-style-type: none"> <li>• Handout: Extraoral radiography</li> </ul>
Week 8	<ul style="list-style-type: none"> <li>• Flash printer identification and duplication procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Handout: Duplication procedures</li> </ul>
Week 9	<ul style="list-style-type: none"> <li>• Complete extraoral radiography and film duplication</li> </ul>	
Week 10	<ul style="list-style-type: none"> <li>• Occlusal radiography and dist-oblique periapicals</li> </ul>	<ul style="list-style-type: none"> <li>• Lab Exe. 13: Supplemental radiographic techniques</li> </ul>
Week 11	<ul style="list-style-type: none"> <li>• Panoramic procedures</li> <li>• Panoramic errors</li> </ul>	<ul style="list-style-type: none"> <li>• Lab Exe. 14: Panoramic radiographic techniques</li> </ul>
Week 12	<ul style="list-style-type: none"> <li>• Panoramic anatomy and artifacts</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 28: Normal anatomy-panoramic film</li> </ul>
Week 13	<ul style="list-style-type: none"> <li>• Complete all labs and series</li> </ul>	

Appendix C  
ADS 212 Applied Dental Materials

**Appendix C**  
**ADS 212 Applied Dental Materials**



**Jordan University of Science and Technology**  
**College of Applied Medical Sciences**  
**Department of Allied Dental Sciences**

**ADS 212:** Applied Dental Materials

**Course Hours:** 3 Credit hours

**Curriculum Level:** Allied Dental Science/ Second year/ First semester

**Instructor:**

**Course Hours:** Lecture: Sunday & Tuesday 9:00 am-9: 50 am  
Lab: Thursday

**Course Description:** An introduction to dental materials with emphasis on restorative materials and techniques commonly used in dental practice and/or required for use by the dental hygienist. An overview of current trends in dental materials is presented.

**Method of Delivery:** Lecture, discussion, assigned reading, case studies, assigned writing, handouts, laboratory, demonstration, literature reviews and two written critiques.

**Required Text:**

Gladwin, M.A ., Bagby, M. D. Clinical Aspects of Dental Materials.(2000). Philadelphia:  
Lippincott Williams & Wilkins.

**Course Requirements:**

Examination 1:	15%
Examination 2:	15%
Quizzes:	10%
Two Critique Papers:	20%
Lab Requirements:	20%
Final Examination:	20%

**Method of Evaluation:**

1. Students must attend 100% of all scheduled classes or risk not being successful in completing this course.
2. Examination 1 and 2 .
3. There will be 6 quizzes scheduled on Tuesdays, each worth 10 points each.
4. Two written critiques related to the subject of dental materials utilizing refereed journals. Each critique is worth 10% of the semester grade.
5. Laboratory processes and products are worth 20% of the semester grade.

Late assignments will be calculated as follows:

- One day late: 10%
  - Two days late: 20%
  - Three days late: 30%
  - Late penalties will be deducted from the individual assignments.
6. Final examination is worth 20% of the semester grade.

**Special Attention:**

Rules for maintaining a safe laboratory environment

- Wear safety glasses or shields, gloves, masks, bonnets and lab coats.
- Laboratory dress includes a lab coat, close-toed shoes, secured hair, trimmed short nails.
- Each student is expected to assist during cleanup.
- Gum chewing is not allowed in the laboratory.
- Food and drink beverages are not allowed during laboratory/lecture.

**Materials Needed for Class:**

1. Lecture: Textbook.
2. Lab: Personal protective equipment (gloves, safety glasses, masks, lab coat, bonnet) and plastic container/shoebox.
3. Secure hair, wear shoes not sandals, remove all jewelry, wear pants to cover legs and have short nails for personal safety and hygiene.

### **Statement of Student Responsibilities and Accountability**

**Attendance:** Due to the unique responsibilities associated with becoming a competent professional person and healthcare provider, attendance and class participation are required. Should an absence be necessary, please note the following:

1. The student should contact the course instructor or department secretary by telephone immediately. The course instructor phone number is (xxx-xxx), and the department secretary phone number is (xxx-xxx).
2. A note from a physician, student health center nurse must be submitted to constitute an excused absence.
3. No exception, each unexcused absence will result in a grade penalty of one percentage point deducted from the final grade.
4. Make up quizzes and exams for unexcused absences will not be given.
5. Late arrivals (10 minutes) after class has started are considered unexcused absences.

**Meeting Established Deadlines:** All course related assignments are to be submitted to the course instructor on the established due date. Work submitted after the established deadlines will be penalized. All course makeups and tests must be completed within two weeks (14 days) from the date of the excused absence. Students are encouraged to keep a duplicate copy of all written assignments submitted.

**Plagiarism:** All academic work submitted to fulfill a course requirement is expected to be the result of each student's own thought, research, and self-expression. A student will have committed plagiarism if he/she reproduces someone else's work without acknowledging its source. Examples of source which must be acknowledged include: published articles, chapters of books, computer programs, graphic representations, research papers and any other types of work from a source not so generated as to part of the public domain.

### **General Course Objectives**

Following the completion of this course, the student should be able to:

1. Describe the electrical, physical and the biological characteristics of dental materials.
2. Identify and identify the physical properties of dental materials.
3. Explain safety procedures related to each dental material product introduced.
4. Identify the different formulations of gypsum products.
5. Differentiate between the elastomeric impression materials and inelastic impression materials.
6. Explain the importance of using of dental cements from low to high viscosity materials.
7. Discuss the indications and selection of restorative materials.
8. Demonstrate skill in rubber dam placement and suture removal.
9. Observe the demonstration and define the relationship between removable partial denture construction, removable denture construction and crown and bridge construction
10. Discuss polishing agents characteristics and uses.

## Specific Weekly Objectives

Following the completion of this course, the student should be able to:

### **Week 1: Introduction to Course and Orientation and Classification of Dental**

#### **Materials**

1. Compare and contrast the physical, chemical and mechanical properties of dental materials.
2. Define terminology: stress, strain, tension, tensile strength, shear, shear strength, compression, compressive strength, yield strength, ultimate strength.

### **Week 2: Properties of Dental Materials and Introduction to Gypsum Products**

3. Differentiate between adhesive and cohesion.
4. Differentiate between corrosion and tarnish.
5. Identify, describe and manipulate the six types of gypsum products.
6. Differentiate between plaster, stone, and investment manufacturing processes and chemical names.
7. Select the proper uses of gypsum products in dentistry.
8. Recognize errors in technique when using gypsum products and how to correct.
9. Use gypsum products to make casts, models and investment of wax patterns.
10. Operate a model trimmer in a safe and healthy manner.

### **Week 3: Aqueous Elastomers Reversible and Irreversible Hydrocolloids and Non-**

#### **Aqueous Elastomers**

11. Handle and store gypsum products in according to manufacture instructions.
12. Identify, describe and manipulate irreversible and reversible hydrocolloid.
13. Differentiate between sols and gels.

14. List the uses of alginate impression.
15. Compare the advantages and disadvantages of using alginate impression material.
16. Name factors that control setting time of hydrocolloids.
17. Differentiate between irreversible and reversible hydrocolloid.
18. List the uses of reversible hydrocolloids.
19. Compare the advantages and the disadvantages of reversible hydrocolloid impression material.
20. Disinfect and store alginate impressions properly if they cannot be poured immediately.
21. Compare major types of elasomeric impression materials in terms of composition, characteristics and uses in dentistry.
22. List the uses of nonaqueous elastomers.
23. Compare the advantages and disadvantages of nonaqueous elastomers.
24. Name factors that control setting time of nonaqueous elastomers.
25. Proportion, manipulate and make impressions using nonaqueous elastomers.

#### **Week 4: Inelastic Impression Material**

26. Describe rigid dental materials by their characteristics.
27. Recognize impression compound and zinc oxide-eugenol impression pastes in terms of their composition, characteristics, and uses in dentistry.
28. List the uses of inelastic dental materials.
29. Compare advantages and disadvantages of inelastic dental materials.
30. Observe the procedure of customizing a stock tray with wafer compound for denture impressions.

31. Observe the manipulation of stick compound.
32. Mix ZOE impression paste for use as a corrective impression.
33. Construct an inlay wax pattern on a stone die.
34. Take bite registrations using base plate and disinfect according to manufacture's direction.

#### **Week 5: Elastomeric Acrylic Resin Thermoplastics and Suture Removal**

35. Remove suture.
36. Identify and describe the various synthetic resins used in dentistry.
37. List properties of poly (methacrylate).
38. Recognize the various uses of methyl methacrylate.
39. Describe trimming and finishing acrylic products.

#### **Week 6: Unfilled Resin and Filled Resin (Composite Bonding Agents/ Sealant I)**

40. Construct a mouthguard and tooth-whitening tray.
41. Differentiate between injury vs. accident.
42. Classify dental injury by severity.
43. Compare major types of unfilled resins in terms of composition, characteristics and uses in dentistry.
44. List uses of unfilled resins.

#### **Week 7: Composite Bonding Agents/Sealant II)**

45. Place pit and fissure sealants.
46. Identify how bonding between a composite resin and tooth structure is achieved.
47. Describe the manipulation of an acid etch composite resin.
48. Analyze placement legalities of composite resin.

49. Describe the polymerization curing processes.
50. List the types of acid used in the acid etch technique.
51. Select the appropriate fluoride formulation for use on a patient with composite restoration.
52. Place, trim, and finish a Class III composite restoration.
53. Identify varnishes, liners, sealers, pulp capping, sealant, luting agents and bases by viscosity.

### **Week 8 and 9: Dental Cements**

54. Describe zinc phosphate, zinc oxide-eugenol Type I, II, III, polycarboxylate, resins cements by advantages, disadvantages, uses, and composition.
55. Differentiate between a temporary and permanent luting agent.
56. Site advantages and disadvantages of dental cements.

### **Week 10: Glass Inomer**

57. Classify glass ionomers by ingredients and viscosity.
58. Describe advantages and disadvantages, uses and composition of glass ionomers.
59. Recognize brand name glass ionomers.
60. Manipulate, place, trim and finish a Class III and V glass ionomer restoration.

### **Week 11: Dental Amalgam**

61. List composition and properties of metals in amalgam.
62. Identify types and components of amalgam.
63. Describe setting reactions and failures in amalgam.
64. Describe manipulation of dental amalgam.
65. Recognize the advantages and disadvantages of amalgam restoration.



66. Differentiate between acute and chronic mercury exposure.
67. Place, condense carve and burnish a class I amalgam restoration.
68. Place a rubber dam.

### **Week 12: Dental Metallurgy, Metal Alloys Used in Dentistry**

69. Identify and describe the components of dental gold, white gold alloy, nonprecious metal alloys, cast chromium alloys, titanium implants and surgical steel.
70. Differentiate between tarnish and corrosion.
71. Identify the metal elements most resistant to tarnish and corrosion.
72. Differentiate between soldering and welding.
73. Recognize the periodontal implications of metal allergy/sensitivity.
74. Classify metals by karat and fineness.
75. Polish silver, gold and a class I amalgam restoration.
76. State the desirable properties and composition of any inlay wax.

### **Week 13: Abrasive Polishing Agents and Toothpaste Bleaching Agents**

77. List abrasive agents in order of abrasivity.
78. Recall the ingredients in dentifrices.
79. Name four uses for dentifrices.
80. Recognize professional products approved for in office tooth whitening.
81. Differentiate between vital and non-vital bleaching.
82. Compare the indications and the contraindications for tooth whitening.

### **Week 14: Crown and Bridge Construction**

83. Define crown and bridge vocabulary, wax pattern, sprue, hygroscopic setting, expansion, vacuum investing, debubbler, pickling.

84. Describe the casting of the gold inlay or crown.
85. List steps in denture reline.
86. Observe the denture construction procedure.
87. Define terminology: polishing, abrasion, and trimming/finishing, grit.
88. Identify the uses of porcelain in cosmetic dentistry.
89. Disadvantages of porcelain and ceramic.
90. Describe finishing of porcelain and ceramic restorations.

### **Laboratory Objectives**

1. Construct two models and casts from rubber models.
2. Construct one set of study models in plaster on a lab.
3. Construct one set of diagnostic casts in cast stone on a lab partner.
4. Construct an athletic mouth guard.
5. Construct a bleaching splint.
6. Place unfilled resin on a plastic tooth.
7. Place filled resin in a class III preparation in a plastic tooth.
8. Place metal modified glass ionomer restorative material in a class I buccal preparation in a plastic tooth.
9. Place amalgam restorative material in a class I occlusal preparation in a plastic tooth.
10. Place single punch rubber dam on a chair mount manikin.
11. Observe a demonstration on the preparation and use of reversible hydrocolloid.
12. Observe a demonstration on preparation of a stock tray with cake and stick compound.
13. Mix and prepare dental cements from low to high viscosity.

14. Prepare inelastic: periodontal dressing. Place periodontal dressing on a lab partner.
15. Prepare nonaqueous elastomers: polyether, polyvinyl siloxane (addition reaction)  
polyvinyl siloxane (condensation reaction). And remove sutures from a 2"×2" gauze.
16. Polish silver, gold, and a class I amalgam restoration.
17. Trim and finish composite and glass ionomer restorations

**Planner for ADS 212 Applied Dental Materials (Didactic Period of Instruction)**

Week	Topic (Didactic Period of Instruction)	Activity/Assignments
Week 1	<ul style="list-style-type: none"> <li>• Orientation</li> <li>• Classification of dental materials</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 1</li> <li>• Handouts: Classification of dental materials</li> </ul>
Week2	<ul style="list-style-type: none"> <li>• Properties of dental materials</li> <li>• Introduction to gypsum products</li> <li>• PBL class activity: case studies on dental materials and elastomers</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 2 and 3</li> <li>• Chapter 8 and 27</li> <li>• Explore website: <a href="http://www.brooks.af">http://www.brooks.af</a></li> </ul>
Week 3	<ul style="list-style-type: none"> <li>• Quiz 1</li> <li>• Aqueous elastomers reversible and irreversible hydrocolloids</li> <li>• Non-aqueous elastomers</li> <li>• PBL class activity: Demonstration reversible hydrocolloid</li> <li>• PBL class activity: Case studies on gypsum</li> <li>• PBL class activity: Case studies on elastomers</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 9 and 30</li> <li>• Chapter 8</li> </ul>
Week 4	<ul style="list-style-type: none"> <li>• Examination 1</li> <li>• Inelastic impression material</li> <li>• PBL class activity: Demonstration of</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 8</li> </ul>

	<p>compound custom tray</p> <ul style="list-style-type: none"> <li>• PBL class activity: Case studies on inelastics</li> </ul>	
Week 5	<ul style="list-style-type: none"> <li>• Quiz 2</li> <li>• Elastomers acrylic resin thermoplastics</li> <li>• Acrylic resin/ thermosets</li> <li>• PBL class activity: Case studies on inelastic/waxes</li> <li>• PBL class activity: Case studies on acrylic resin</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 18 and 10</li> <li>• Chapter 11</li> <li>• Explore website: <a href="http://www.deiitalia.it">http://www.deiitalia.it</a></li> </ul>
Week 6	<ul style="list-style-type: none"> <li>• Article Critique 1 Due</li> <li>• Unfilled resin and filled resin</li> <li>• Composite bonding agents/ sealants I</li> <li>• PBL class activity: Case studies on composite bonding agents/sealant</li> <li>• PBL class activity: Discussion on the assigned article for critique</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 5 and 22</li> </ul>
Week 7	<ul style="list-style-type: none"> <li>• Quiz 3</li> <li>• Composite bonding agents/ sealants II</li> <li>• PBL class activity: Case studies on composite bonding agents/ sealant</li> </ul>	<ul style="list-style-type: none"> <li>• Review the reading from week 6</li> </ul>
Week 8	<ul style="list-style-type: none"> <li>• Examination 2</li> <li>• Dental cements I</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 7 and 24</li> </ul>

	<ul style="list-style-type: none"> <li>• PBL class activity: Case studies on dental cements</li> </ul>	
Week 9	<ul style="list-style-type: none"> <li>• Quiz 4</li> <li>• Dental cements II</li> <li>• PBL class activity: Case studies on dental cements</li> </ul>	<ul style="list-style-type: none"> <li>• Review reading from week 8</li> </ul>
Week 10	<ul style="list-style-type: none"> <li>• Article critique 2 due</li> <li>• Glass inomer type I, II, III</li> <li>• PBL class activity: Case studies on glass inomer</li> <li>• PBL class activity: Discussion of the assigned article for critique</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 5 and 7</li> </ul>
Week 11	<ul style="list-style-type: none"> <li>• Quiz 5</li> <li>• Dental amalgam</li> <li>• PBL class activity: Case studies on amalgam</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 6</li> <li>• Handout: Mercury</li> <li>• Explore website: <a href="http://www.algonet.se">http://www.algonet.se</a></li> </ul>
Week 12	<ul style="list-style-type: none"> <li>• Dental metallurgy</li> <li>• Metal alloys used in dentistry</li> <li>• PBL class activity: Case studies on dental alloys</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 10</li> </ul>
Week 13	<ul style="list-style-type: none"> <li>• Quiz 6</li> <li>• Abrasive polishing agents</li> <li>• Toothpaste/ bleaching agents</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 13, 17, and 29</li> </ul>

	<ul style="list-style-type: none"> <li>• PBL class activity: Case studies on abrasive agents</li> </ul>	
Week 14	<ul style="list-style-type: none"> <li>• Crown and bridge construction</li> <li>• PBL class activity: Case studies on crown and bridge construction</li> <li>• Review for the Final Examination</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 10</li> </ul>
Week 15	<ul style="list-style-type: none"> <li>• Final Examination</li> </ul>	

**Planner for ADS 212 Applied Dental Materials (Laboratory)**

Week	Topic (Laboratory)	Activity/Assignments
Week 1	<ul style="list-style-type: none"> <li>• Laboratory safety and laboratory requirements</li> <li>• Process Vs. product explanation</li> </ul>	
Week 2	<ul style="list-style-type: none"> <li>• Weight and measurements</li> <li>• Gypsum products</li> <li>• Introduction and pouring of rubber molds</li> </ul>	<ul style="list-style-type: none"> <li>• 1 adult in stone, 1 adult in plaster</li> <li>• Rubber molds in process work</li> <li>• Rubber mold due in week 5</li> </ul>
Week 3	<ul style="list-style-type: none"> <li>• Alginate impression</li> <li>• Aqueous irreversible hydrocolloids</li> </ul>	<ul style="list-style-type: none"> <li>• Practice taking and pouring alginate impression on a partner</li> <li>• Chapter 25</li> <li>• 1 study model in plaster on peer</li> <li>• 1 diagnostic cast in stone on peer</li> </ul>
Week 4	<ul style="list-style-type: none"> <li>• Nonaqueous elastomers</li> </ul>	<ul style="list-style-type: none"> <li>• Prepare elastomers work on alginate impression: (process work)</li> </ul>



Week 5	<ul style="list-style-type: none"> <li>• Periodontal dressing</li> </ul>	<ul style="list-style-type: none"> <li>• Mix periodontal dressing: (work process)</li> <li>• Suture removal</li> <li>• Take alginate impression</li> <li>• Rubber Molds Due</li> </ul>
Week 6	<ul style="list-style-type: none"> <li>• Mouth guard</li> <li>• Construct bleaching splint</li> </ul>	<ul style="list-style-type: none"> <li>• Construct mouth guard and bleaching splint: (product work)</li> </ul>
Week 7	<ul style="list-style-type: none"> <li>• Model trimming</li> <li>• Unfilled and filled resins</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 28</li> <li>• Mix filled resins: (process work)</li> <li>• Mix unfilled resin or sealant: (product work)</li> </ul>
Week 8	<ul style="list-style-type: none"> <li>• Dental cements</li> </ul>	<ul style="list-style-type: none"> <li>• Mix dental cements: (Process work)</li> <li>• Take on alginate impression</li> <li>• Construct mouthgurd and bleaching splint</li> </ul>
Week 9	<ul style="list-style-type: none"> <li>• Dental cements (cont.)</li> </ul>	<ul style="list-style-type: none"> <li>• Mix dental cements: (Process work)</li> <li>• Take alginate impression</li> </ul>

		<ul style="list-style-type: none"> <li>• Construct mouth guard and bleaching splint</li> </ul>
Week 10	<ul style="list-style-type: none"> <li>• Glass Inomer Type I and II</li> </ul>	<ul style="list-style-type: none"> <li>• Manipulate glass inomer: (process work)</li> <li>• Mouth guard due</li> </ul>
Week 11	<ul style="list-style-type: none"> <li>• Amalgam</li> </ul>	<ul style="list-style-type: none"> <li>• Manipulate amalgam: (Process work)</li> <li>• Rubber dam application</li> <li>• Gypsum product trimmed with wax bite due</li> </ul>
Week 12	<ul style="list-style-type: none"> <li>• Gold and silver</li> </ul>	<ul style="list-style-type: none"> <li>• Polishing: gold and silver (process work)</li> </ul>
Week 13	<ul style="list-style-type: none"> <li>• Open Lab</li> </ul>	
Week 14	<ul style="list-style-type: none"> <li>• Composite and Glass Inomer</li> </ul>	<ul style="list-style-type: none"> <li>• Trim and polish composite and glass inomer: (process work)</li> </ul>

## **Appendix D**

### **Rubric for Evaluation of Journal Article Critique**

## Rubric for Evaluation of Journal Article Critique

**Guidelines:** The two articles assigned for critique are worth 20% of the final grade. The article critique should be 2-page paper following the outlines described below:

	<u>Points</u>
• Description of the study	/20
• Strengths and weaknesses of the study	/15
• Data analysis methods	/15
• Interpretations of findings	/15
• Implications for dental practice	/20
• Format	/15
- APA Format	/5
- Within 2-page limit	/5
- Grammar, spelling, punctuation, paragraph unity	/5
	<hr/>
	/100

## **Appendix E**

### **Allied Dental Sciences Program Curriculum Management Plan**

## **Allied Dental Sciences Program Curriculum Management Plan**

The following plan details when and by what process the curriculum review occurs in the Medical Applied Sciences College/Allied Dental Science Department. The chair of the department is responsible for seeing that proposed curricular changes are implemented.

- 3 meetings /semester for clinical curriculum review in addition to one final meeting at end of university year.
- Review of students' course completion (end of each semester)
- Pre-academic year faculty meeting held annually in September
- Faculty retreated held annually in June
- Review students' exit results (faculty retreat)
- Annual University assessment report, due in June of each year (reviewed at pre-academic year meeting)
- Review students' evaluations of courses (each semester)
- Review of competencies-curriculum matrix
- Program review (every 5 years-completed in Fall semester)
- University catalog/course description changes (every 2 years-completed in fall semester)

## Allied Dental Sciences Program Curriculum Management Schedule

### FALL

- Pre-academic year meeting (September): Curriculum update
- Clinical meetings (monthly)
- Review assessment report (September)
- Course completion review (January)
- Students' evaluation of courses (January)
- Catalog changes (every 2 years)
- Program review (every 5 years)

### SPRING

- Pre-semester meeting (February)
- Clinical faculty meetings (monthly)
- Final clinical faculty meeting (May)
- Course completion review (early June)
- Students' evaluation of courses (June)
- Faculty retreated (mid-June)
  1. Curriculum
  2. Students' exit
  3. Competencies
  4. Course completion rates
  5. Goals, philosophy, strategy plan

## SUMMER

- Assessment report due (July 1)
- Course completion review (late July)
- Students' evaluation of courses (September)