



Challenges in Clinical Performance of Dentistry Clinicians: Towards Strengthening Areas of Outcomes or Competencies

Arvin B. Laguna

Adventist University of the Philippines

ablaguna@aup.edu.ph

ABSTRACT

The study investigated the phenomenon of challenges and difficulties in the clinical performance of students in a university, accounting for the frequency of weaknesses and errors of clinician students during clinical training as observed by the faculty in terms of their knowledge, practical skills and attitudes. All eighteen faculty clinical consultants who were supervising the 7 Clinical Departments in the College of Dentistry in a university were invited to participate in the study, wherein questionnaires were given in two stages to identify and recall the frequency of occurrence of errors or weaknesses in the clinical performance of student clinicians in the 3rd and 4th year proper levels of the Dentistry Program. The seven Clinical Departments included the Restorative Dentistry Department, Oral Diagnosis Department, Periodontics Department, Oral Surgery Department, Endodontics Department, Prosthodontics Department, and the Pediatric Dentistry Department. The findings revealed several errors or weaknesses in clinical performance of students and some of these weaknesses were seen by the clinical consultants to be frequently performed. Some of these are critical in the proper training of future dentists and thus interventions in the target outcomes in the clinical training program, as well as target outcomes and competencies in the area of pre-clinical training, were recommended to be addressed.

Keywords: Challenges, Difficulties Weaknesses, Clinical Performance, Outcomes, Competencies, Interventions, Target Outcomes.

INTRODUCTION

The problem with a problem is that it's not going to solve itself. Different approaches to solving different problems have been proposed by various authorities and experts in the fields of science, mathematics, psychology, and management. Hundreds, if not thousands of books have been written, giving not only general suggestions but also specific step-by-step procedures on how to systematically approach a problem.

Problems abound and they continue to appear and develop and worsen and recur in almost all aspects of the human existence. Problems are a perennial problem of humans. They are also a given part of their lives, and, are dependent on the perspectives of the person whether one

would consider something a problem or not. Nevertheless, whatever situation humans exist in, whatever problems they encounter, they try and aspire, in one way or another, to solve the problems.

As have been mentioned, problems occur, and the Clinical Department of a College of Dentistry of a university is not without one. This department is exceptionally complex with a lot of components to deal with. One of these components is the clinician, the student in the Dentistry program that performs diagnosis, treatment and management of patients while under the supervision of a faculty, known as the Clinical Instructor. All movements of these clinicians, while in the clinics, can be summarized into one word, “performance”, and, it is this aspect of the entire Clinical Department that this study looked into.

The performance of clinicians has always been under the watchful eye of the Clinical Instructors. Every day, Clinicians would bring in patients where they manage the different oral and dental conditions that are encountered in them, and every day, old and new problems in the clinical performance of students are observed by the Clinical Instructors. It would be a rarity where a day would pass without any perceivable problem in performance. Such problems also create further problems and compound the already daunting task of finishing the clinical requirements of students that is needed for graduation. Aside from that, these problems in clinical performance also create an uncertainty in the quality of students that are being trained and produced by the school.

Clinical performance in Dentistry can be defined as any act of doing a required task that is measured against a set standard within the realm of the clinical training program in Dentistry. The clinical performance of students can be broken down into three aspects, the Theoretical Knowledge, which is under the cognitive domain, the practical skills, contained within the psychomotor domain, and the attitudes, which are covered by the affective domain. These domains are basic components that make up the entire learning requisites of students within the bounds of the objectives and mission of the College of Dentistry for the Doctor of Dental Medicine Program. Furthermore, these learning requirements that are expected of students are guided by standards, of which, the levels are collegially determined by the faculty and resolved by the dean. The standards for the clinical training with regards to knowledge, skills and attitudes that are required of students in a particular university are embodied within the Manual of Clinical Policies of 2015.

Even with the presence of such copies of a Manual of Clinical Policies in each department of the clinics, problems still occur in terms of the performance of student clinicians. Weaknesses during discussions and presentation of cases, errors and failures in the practical delivery of diagnosis and treatment, as well as weaknesses in the desired attitudes when managing patients and during interactions with their colleague clinicians are being observed and witnessed by the faculty during clinical training. These weaknesses would form part of the perceived expected critical outcomes or qualities that Clinical Instructors believe should be included in the formation of a beginning practicing dentist.

Faced with these situations, the researcher who is also a member of the faculty of the College of Dentistry of a university, investigated the phenomena of weaknesses, errors, flaws, and failures in the clinical performance of students. After which, the data gathered were analyzed to come up with recommendations that would strengthen outcomes in an Outcome-based Education (OBE) structured program and the creation of an OBE Clinical Training Manual for Dentistry.

LITERATURE REVIEW

Clinical Performance in Dentistry

Clinical performance is one of those unique parameters that one would find in a tertiary level of education. While most tertiary programs would involve heavily with measuring only the academic performance of students, the Doctor of Dental Medicine Program is one in a group of programs where both academic and clinical performances are measured, and both are critical. Albino et. al. (2008) stressed the importance of assessments in the Dental Medicine and Dental Surgery programs as “critical components for a successful education in the skills, knowledge, affective processes and professional values” in the field of Dentistry.

Factors in the Clinical Performance of Students

Understanding of the teaching-learning process is vital for one to be able to assess accurately. Although methods for assessment are innumerable, the dream for an accurate assessment by teachers is far from perfect. A lot of factors come into play in the teaching-learning process. Al-Amri, Al-Madi, Sadig, Ahmedani, and Salame (2012) mentioned that factors of faculty, course material, learning resources and student support services have an impact in on a dentistry student’s performance. Ihm, Lee, Kim, Jang, and Jin (2013) identified student factors of grade point average, eligibility tests, self-esteem, learning and interpersonal skills can be considered as having influence in performance. Humphrey, Skelton, West, and

MacPherson(2004) have shown that integration of subjects in the curriculum is essential and is considered a factor in clinical performance of students. They further added that an integrated curriculum prepares the students better in solving patients' problems and incorporating new concepts and therapies into patient management.

Educational System Factors

Educational systems and structures play a major role in the preparation of students for productive roles in society. Bar-Yam, Rhoades, Sweeney, Kaput, and Bar-Yam (2002) mentioned that as awareness for improvement of students changes with time, the complexity of the education system must adapt to these changes too. They mentioned that there is “no simple, single uniform approach that can be applied for significant improvements in the system to occur.” They further explained that “any strategy for change must contend with the diverse factors that affect the education system, the interaction of its parts, and the intricate interdependencies within it and with its environment.” The teacher, the student, and the curriculum design are some of the factors that have been discussed as relevant for change in the education system.

Barton (2003) in Musial, Nieminen, Thomas, and Burke (2009) identified the 14 most significant factors that affect student achievement. Half of them are “in-school” factors that include the curriculum, the teacher’s knowledge and skills, the teacher’s experience, the class size, the available technology, and the school’s safety.

One model that is worth mentioning when education system factors are being discussed is the Cambridge Model (Rethans, Norcini & Baron-Macdonald, 2002) which was developed as an off-shoot of Miller’s Pyramid (Miller, as cited in Taylor, 2013).

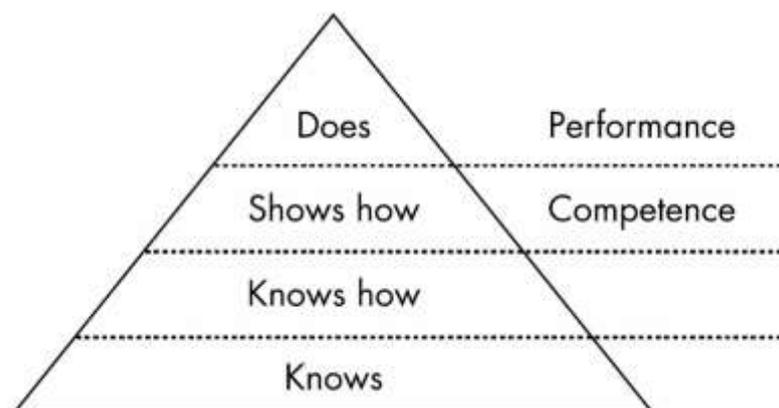


Figure 1. **Miller’s Pyramid.**

As described by Taylor (2013), Miller’s explanation of the pyramid would start at the base where the individual would first assimilate knowledge only. At this stage the learner simply knows but cannot apply the information. Progression to the “knows how” level is achieved when the individual can use that information and apply it to a particular situation. Further development up the pyramid is achieved when the individual can demonstrate this ability, and so they are deemed to be competent at that particular procedure. When the individual achieves the tip of the pyramid they can now perform the actual procedure.

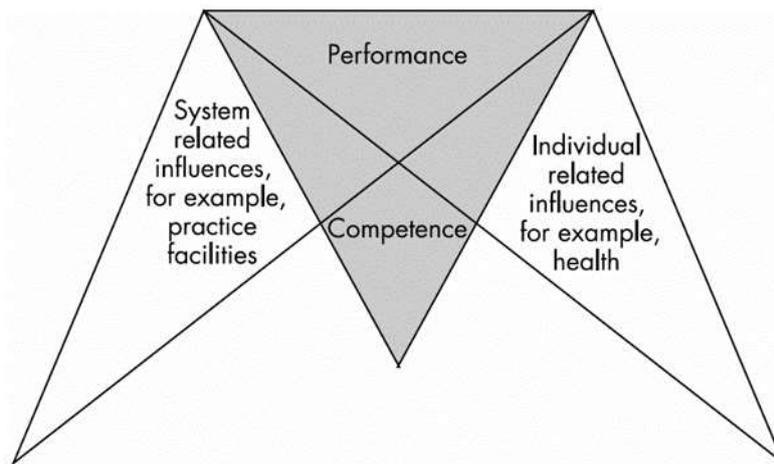


Figure 2. **The Cambridge model for delineating performance and competence.**

Taylor (2013) described the Cambridge Model as focusing on performance where authors Rethans, Norcini & Baron-Macdonald argue that competency can be assessed in simulated clinical conditions but that performance is the actual clinical practice. This Model only considers the upper two levels of Miller’s pyramid and describes three factors which may impact on an individual’s performance; (a) competence, the influence of factors of the (b) individual and of the (c) system.

Learning Domains

Learning domains comprise the areas in the curriculum that teachers are targeting for the development of students. They are the central core for which all the surrounding factors act upon. These learning domains have been introduced during the middle part of the last century and have been recognized by experts and authorities as sound concepts in the teaching-learning process. They have been classified into three types, the cognitive domain which covers the mental knowledge activities, the psychomotor domain which encompasses the practical

physical skills, and the Affective domain that involves the attitudes and values of the individual. Benjamin Bloom first classified the cognitive domains in the 1950's, while Krathwohl, Bloom, and Masia (1964) joined together to come up with the Affective domains. In the 1970's, Simpson, Harrow and Dave individually pursued the creation of the psychomotor domains in the education of an individual. (California State University, Sacramento, n.d.)

The concept of these domains is what educators want of their students to learn. They are contained within the statements of educational objectives that are found in a course syllabus, and, are arranged in a hierarchical order from the less complex to the more complex of learnings. The levels are sequenced so that one learning level must be mastered before the next level can be reached or performed (Huitt, 2011).

The affective domain, on the other hand, by Krathwohl, Bloom, and Masia included the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes. The five major categories are listed below from the simplest to the most complex behavior (Krathwohl, Bloom and Masia as cited in Clark, 2014).

The psychomotor domain introduced by Simpson covers physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution. The seven major categories are presented below from the simplest behavior to the most complex one (Simpson as cited in Clark, 2014).

Assessment

Assessment is an act of making judgments about students' learning. It is designed to evaluate the level of attainment of knowledge, behaviors or skills of students. They are used to facilitate learning and provide information about student's performance in addition to formal recognition of attainment of knowledge or skills. Assessments are usually the main focus for students, and the driving force for them to engage in the learning process (Taylor, Grey, Satterthwaite, 2013). Musial et al. (2009) described assessment as a data-gathering activity in which the assessor-teacher interacts with the learner in order to clarify and understand what the learner needs. It is also a form of judging where the assessor is focused on the degree to which a learner has attained some standard, benchmark, or level of achievement. They continued that assessment requires the learner to be placed in a specific setting or environment that is intended to enable

the learners to show what they know or can do, as well as what a learner may not know or cannot do.

Performance Assessment

Performance assessments are designed to evaluate the individualized growth and development taking place inside the classroom. They systematically document what children know and can do based on activities they engage in, they permit an individualized approach to assessing abilities and performance, they provide valuable, in-depth information for parents, administrators, and other policy makers, and lastly, performance assessment evaluates thinking skills such as analysis, synthesis, evaluation, and interpretation of facts and ideas — skills which standardized tests generally avoid (Meisels, 2014).

Brockart (2016) mentioned that while a test is efficient in gathering evidence about students' knowledge of concepts, performance assessment is a better tool for measuring what students can do with their knowledge of concepts. Effective performance assessments empower students in applying what they know to solve a problem or to demonstrate a skill. In performance assessments, the work or product created by students is assessed through observation and judgment and the tool is guided by a rubric.

METHODS

Research Design

The descriptive research design was employed in this study. According to Fraenkel, Wallen, and Hyun (2012) “descriptive studies describe a given state of affairs as fully and carefully as possible where the most common descriptive methodology is the survey. The survey method summarizes the characteristics of individuals or groups (abilities, preferences, behaviors, and so on) or physical environments (capabilities).”

The study utilized the survey method in gathering data regarding the Faculty members' personal observation of the weaknesses and errors (challenges) of student clinicians while in their clinical training. The observation described what weaknesses and errors are committed, as well as the frequency of these errors to highlight the ones that need immediate attention and emphasis, whether correction inside the classrooms or correction within the protocols, systems or organizational setup of the Dentistry Clinical Training Program.

Population and Sampling

The respondents in this study included the faculty members of a College of Dentistry. From the total of 27 faculty members, 18 are considered Clinical Instructors, and all 18 of these Clinical Instructors were invited to participate in the study, where purposive sampling was utilized. The Clinical Instructors were distributed among the seven virtual (7) clinical departments that included the Restorative Dentistry Department, Oral Diagnosis Department, Periodontics Department, Oral Surgery Department, Endodontics Department, Prosthodontics Department, and the Pediatric Dentistry Department.

The Clinical Instructors included men and women with ages ranging from 23 to 50, and are experts or specialists in the fields of Oral Surgery, Endodontics, Periodontics, Prosthodontics, Orthodontics, Cosmetic Dentistry and Pediatric Dentistry.

Instrumentation

A survey instrument was prepared to gather data from the Clinical Instructors of a College of Dentistry. The self-structured instrument that was used included information about the observed errors and weaknesses in the clinical performance of students. The survey questionnaire run two phases, where the first phase elicited identification of weaknesses and errors, while the second and last phase recorded the frequency of occurrence of the weaknesses and errors using Lickert scales. The survey instruments were handed out to all the eighteen (18) Clinical Instructors, after which the data were tallied and analyzed.

Statistical Treatment of Data

Descriptive statistics were employed in the study, where specifically, mean and frequency distribution were utilized to describe the status of clinical performance of student clinicians in a College of Dentistry. The resulting figures from statistical treatment highlighted the weaknesses and errors (challenges) that need attention and emphasis in the soonest possible time.

RESULTS

The presentation and analysis of data gathered from responses of the Clinical Instructors of a College of Dentistry, and the interpretation of the results were based on specific problems raised in the study.

Weaknesses and Errors of Clinicians during Training

1. There were a lot of weaknesses and errors that were found during the clinical training of students that were observed by the UPHSD-COD faculty. These weaknesses, errors, flaws and failures in the clinical performance were categorized in terms of Theoretical Knowledge, Practical Skills, and Attitudes. The weaknesses were also observed by the clinical instructors across the clinical departments of Restorative Dentistry, Oral Diagnosis, Periodontics, Oral Surgery, Endodontics, Prosthodontics, and Pediatric Dentistry.

Frequency of Weaknesses and Errors of Clinicians during Training

2. In terms of highlighting the clinical performance weaknesses and errors in accordance with their frequency of occurrence there were several that were identified, and some of these include:

1) Restorative Dentistry Department

In the Restorative Dentistry Department there were several “Frequently Observed” and “Occasionally Observed” weaknesses in theoretical knowledge. The findings include theoretical knowledge weakness in areas of restorative dentistry principles and theories, manipulation and handling of composite material, liner and bonding agent; precautions, manipulation and handling of Amalgam material; charting (of patient’s information sheet), verification of occlusion after filling, cavity excavation procedures, and understanding of asepsis protocols in restorative dentistry.

One particular weakness that clinical instructors have observed is that some students do not know how an exposed pulp (during preparation) looks like. Although the mean score is low, errors like these may be considered unacceptable as these present complications that may lead to devitalization of the tooth pulp.

In the area of practical or psychomotor weakness, the data also revealed “Frequently Observed” and “Occasionally Observed” weaknesses. Some of these include weakness in areas of tooth preparation design, amalgam carving, and clinical tooth isolation procedures.

There was one skill error, albeit having a low mean score, which was observed and may also be considered unacceptable, was the observation of an incidence of a pulp exposure by a student.

For the part of weakness in attitude, there were some items that were “Frequently Observed” and “Occasionally Observed” by the clinical instructors. Some of these include attitude weakness like laziness in performing proper clinical procedures, too much dependence on the

clinical instructor as regards decision making in clinical cases, self-centered decisions and lack of empathy when it comes to patient care wherein they would prioritize their own requirements rather than the actual needs of patients, lack of respect to patients' time, and disobeying clinical protocols and guidelines whether intentional or not.

2) Oral Diagnosis Department

In the realm of the Oral Diagnosis Department there were some "Frequently Observed" and "Occasionally Observed" weaknesses in theoretical knowledge. The findings include theoretical knowledge weakness in areas of charting (incorrect entries in the chief complaint and history of present illness), dental health education (inability to properly educate the patient regarding etiologies, prevention, prognosis and treatment options), and dental anatomy (inability to identify teeth and their landmarks).

For the part of weakness in attitude, there were some items that were "Frequently Observed" by the clinical instructors. Some of these include attitude weakness like self-centered decisions to treat needed requirements instead of addressing the chief complaint, especially complaints of pain, and being irresponsible in their performance of duty as officers-of-the-day.

3) Periodontics Department

In the Periodontics Department there were a few "Frequently Observed" and "Occasionally Observed" weaknesses in theoretical knowledge. The findings include theoretical knowledge weakness in areas of bleeding indices, diagnosis, calculus identification, probing, and oral hygiene instructions.

In the area of practical or psychomotor weakness, the data also revealed "Occasionally Observed" weaknesses. Some of these include weakness in areas of scaling procedures and preservation of the integrity of the gingiva (gingival lacerations were observed).

For the part of weakness in attitude, there were some items that were "Frequently Observed" by the clinical instructors, but most of these pertain to protocols and guidelines that have already been presented in the previous clinical areas. There was one weakness in attitude that is worth mentioning here and that is disobeying some instructions in the periodontal form.

4) Oral Surgery Department

In the Oral Surgery Department there were several "Frequently Observed" and "Occasionally Observed" weaknesses in theoretical knowledge. The findings include theoretical knowledge weakness in areas of radiographic analysis, diagnostic tests, medical history analysis and

interpretation, preparation and utilization of surgical armamentaria, and anatomical landmark identification.

In the domain of practical or psychomotor weakness, the data also revealed “Frequently Observed” and “Occasionally Observed” weaknesses. Some of these include weakness in areas of radiograph development, handling of target teeth, and preservation of the integrity of adjacent structures.

For the part of weakness in attitude, there were some items that were “Frequently Observed” by the clinical instructors, but most of these pertain to protocols and guidelines that have already presented in the previous clinical areas. There was one weakness in attitude that is worth mentioning here and that is going into a slight panic when the “flap” word is mentioned.

5) Endodontics Department

In the Endodontics Department there were several “Frequently Observed” and “Occasionally Observed” weaknesses in theoretical knowledge. The findings include theoretical knowledge weakness in areas of access preparation, diagnosis and treatment analysis, instrument and equipment utilization, and anatomical landmark identification.

In the domain of practical or psychomotor weakness, the data also revealed “Frequently Observed” and “Occasionally Observed” weaknesses, but most of these were already presented in the previous clinical areas. There were two weaknesses in skill that is worth mentioning here and these are improper rubber dam handling and fracture of instruments inside the canal.

For the part of weakness in attitude, none were worth mentioning as most of them were minor errors and were already cited in the previous clinical areas.

6) Prosthodontics Department

In the Prosthodontics Department there were several “Frequently Observed” and “Occasionally Observed” weaknesses in theoretical knowledge. The findings include theoretical knowledge weakness in areas of instrument preparation, anatomical landmark identification, centric jaw relationships, denture polishing and setting of artificial teeth.

In the domain of practical or psychomotor weakness, the data also revealed “Frequently Observed” weaknesses. Some of these include weaknesses in areas like settings in centric and vertical jaw relationships, impression taking, denture base preparations and processing, and balancing the occlusion.

For the part of weakness in attitude, most of them were already mentioned in the previous clinical areas, although two are worth mentioning and these are laziness in cleaning their work

area (Frequently Observed) and hardheadedness in presenting diagnostic and master casts with no bases (Very Frequently Observed).

7) Pediatric Dentistry Department

In the Pediatric Dentistry Department there were several “Frequently Observed” and “Occasionally Observed” weaknesses in theoretical knowledge. The findings include theoretical knowledge weakness in areas of mixed-dentition analysis, cephalometric tracing, and labeling of diagnostic casts. One weakness stands out as “Very Frequently Observed” and that is in properly labeling diagnostic casts.

In the domain of practical or psychomotor weakness, the data also revealed “Frequently Observed” weakness and this is in the area of pediatric patient management during treatment. For the part of weakness in attitude, none were worth mentioning as most of them were minor errors and were already cited in the previous clinical areas.

Table 1. Restorative Department: Frequency of Weaknesses in Theoretical Knowledge

Weaknesses in Theoretical Knowledge	Mean	Interpretation
1. Does not know how to fill up the clinic form when presenting a case to the clinical instructor	2.166667	Occasionally
2. Does not know what asepsis protocols to follow in Resto	2.333333	Occasionally
3. Does not know what instruments are needed and so the instruments are lacking/missing during the actual treatment procedures	1.833333	Occasionally
4. Does not know what instruments and materials are needed when pulp is exposed and so the instruments are lacking/missing during pulp exposure incidents	1.833333	Occasionally
5. Does not know that they cannot throw/leave excess amalgam or mercury in the sink. Does not know the dangers of improper amalgam/mercury disposal	2.333333	Occasionally
6. Inability to answer questions in Restorative/Operative Dentistry	2.166667	Occasionally
7. Does not know how a properly polished Amalgam looks like	2.333333	Occasionally
8. Does not know when to put a liner	1.666667	Occasionally
9. Does not know when to put a base	1.666667	Occasionally
10. Does not know that he/she needs to check the occlusion after filling	1.5	Occasionally

11. Does not know how an exposed pulp (during prep) looks like	1.333333	Rarely
12. Does not know what to do after iatrogenically exposing a pulp	1.666667	Occasionally
13. Does not know that they cannot leave the bonding agent bottle open while in the middle of a procedure	2.166667	Occasionally
14. Does not know how to take a composite material out of its syringe container and so the container is contaminated with saliva	2.666667	Frequently
15. Weak retention of theoretical details that have been taught alr	2.333333	Occasionally

Table 2. **Restorative Department: Frequency of Weaknesses in Practical Skills**

Weaknesses in Psychomotor Skills	Mean	Interpretation
1. Failure to prepare S-curve properly	2	Occasionally
2. Iatrogenic pulp exposure	1	Rarely
3. Failure to prepare a proper outline form	1.833333	Occasionally
4. Over extension of prep	2	Occasionally
5. Poor anatomy during carving of Amalgam	2.333333	Occasionally
6. Incorrect isolation of tooth while doing tooth prep	2.666667	Frequently
7. Does not spread thinly the dentin bonding agent using air	2	Occasionally

Table 3. **Restorative Department: Frequency of Weaknesses in Attitudes**

Weaknesses in Attitudes	Mean	Interpretation
1. Lack of empathy when treating patients. Wasting of patient's time due to clinician's inefficiency; ignoring other dental needs of patients because they just want to finish their requirements	1.833333	Occasionally
2. Too dependent on teachers to tell them what to do or how to manage a case	2.333333	Occasionally
3. Coming to clinic unprepared to manage a specific case	1.666667	Occasionally
4. Breaks protocols and guidelines – Not in their proper decorum/uniforms. Failure to follow complete decorum for uniforms even when it was mentioned already in the orientation	1.833333	Occasionally
5. Breaks protocols and guidelines – does not fill up the clinic form when presenting a case to the clinical instructor even when it was mentioned already in the orientation	2.166667	Occasionally

6. Breaks protocols and guidelines – does not follow asepsis protocols in Resto even when it was mentioned already in the orientation	2.5	Frequently
7. Breaks protocols and guidelines – does not prepare the needed or required instruments in Resto even when it was mentioned already in the orientation	1.833333	Occasionally
8. Breaks protocols and guidelines – does not prepare the needed instruments and materials when pulp is exposed and so the instruments are lacking/missing during pulp exposure incidents even when it was mentioned already in the orientation	1.833333	Occasionally
9. Breaks protocols and guidelines – Does not know that they cannot throw/leave excess amalgam or mercury in the sink even when it was mentioned already in the orientation	2.5	Frequently

DISCUSSION

The Dean and Faculty of the College of Dentistry should critically consider for integration or adoption the proposed interventions for Dentistry program enhancement, in both the pre-clinical and clinical areas, with basis from the summary of findings of this study.

The proposed interventions in competencies and outcomes are clustered among the different departments of the College and were too many to fit this 18-page summary. These include, among others, putting emphasis in class discussion of certain topics that are critical in the clinical training, integrating clinical protocols in classroom discussion, creation of a higher standard for a passing bar in pre-clinical practical examinations in simulation, training students to become independent learners, training students for professionalism, revisiting the protocols and policies in the clinics and making sure that they are properly implemented, revision of clinical requirements from number-based to a comprehensive patient-care training, creation of a separate subject or course that would bridge the transition from pre-clinical training to clinical training, creation of incentives and stronger penalties for the proper enforcement of clinic policies, creation of laboratory components for subjects/courses that need laboratory training, and a closer monitoring of students in clinical training.

Conclusion

The following conclusions are drawn as evidences from the study have revealed that:

1. There are weaknesses, errors, and failures in the clinical performance of students and some of these may be considered unacceptable and needs to be addressed.

2. Some of the weaknesses, errors, and failures in the clinical performance of students were frequently observed by the clinical instructors. Some of these are critical in the proper training of future dentists and thus interventions in the clinical training program, as well as in the area of pre-clinical training are warranted.

REFERENCES

- Al-Amri, M., Al-Madi, E., Sadig, W.M., Ahmedani, M.S., and Salameh, Z.(2012). Significance of primary factors influencing students' performance at the College of Dentistry, King Saud University, Saudi Arabia. *Journal of Dental Education*, 62(8), 816-821.
- Albino, J.E.N., Young, S.K., Neumann, L. M., Kramer, G. A., Andrieu, S.C., Henson, L. (2008) Assessing dental students' competence: Best practice recommendations in the performance assessment literature and investigation of current practices in Predoctoral Dental Education. *Journal of Dental Education*, 72(12), 1405-1435.
- Bar-Yam, M., Rhoades, K., Sweeney, L. B., Kaput, J., and Bar-Yam, Y. (2002). *Complex Systems Perspectives on Education and the Education System*, New England Complex Systems Institute. Retrieved from <https://necsi.edu/changes-in-the-teaching-and-learning-process-in-a-complex-education-system>
- Bloom, B. S. (1956). *Taxonomy of Educational Objectives: The Classification of Educational Goals*, New York: David McKay.
- Brockart, S. (2016). *Performance assessment: What is it and why use it?*. Retrieved from <https://medium.com/inspired-ideas-prek-12/performance-assessment-what-is-it-and-why-use-it-1394712c5d3>
- California State University, Sacramento (n.d.). Bloom's taxonomy. Retrieved from <https://www.csus.edu/indiv/e/estiokom/bloomstaxonomy.pdf>
- Clark, D. (2014). *Bloom's Taxonomy of Learning Domains*. Retrieved from <http://www.nwlink.com/~donclark/hrd/bloom.html>
- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to Design and Evaluate Research In Education (8th ed.)*, New York: McGraw-Hill.
- Huitt, W. (2011). *Bloom et al.'s Taxonomy of the Cognitive Domain*. *Educational Psychology Interactive*. Valdosta, GA: Valdosta State University. Retrieved from <http://www.edpsycinteractive.org/topics/cognition/bloom.html>
- Jung-Joon Ihm, Gene Lee, Kack-Kyun Kim, Ki-Taeg Jang, and Bo-Hyoung Jin (2013). Who Succeeds at Dental School? Factors Predicting Students' Academic Performance in a Dental School in Republic of Korea, *Journal of Dental Education*, 77(12), 1616-1623.

Krathwohl, D. R., Bloom, B. S., and Masia, B. B. (1964). *Taxonomy of Educational Objectives: The Classification of Educational Goals*, New York: David McKay.

Meisels, S. J. (2014). *Performance Assessment*. Retrieved From <http://teacher.scholastic.com/professional/assessment/perfassess.htm>

Musial, D., Nieminen, G., Thomas, J., and Burke, K. (2009). *Foundations of Meaningful Educational Assessment*, New York: McGraw-Hill

Rethans, J., Norcini, J., & Baron-Macdonald, M. (2002). The relationship between competence and performance: Implications for assessing practical performance. *Medical Education*, 36(10), 901-909.

Taylor, C. L., Grey, N., and Satterthwaite, J. D. (2013). Assessing the Clinical Skills of Dental Students: A Review of the Literature, *Journal of Education and Learning*, 2(1), 20-31. doi: 10.5539/jel.v2n1p20