

## REVIEW ARTICLE

# Clinical assessment strategies for competency-based education in prosthetic dentistry

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**Abstract**

Reflective practice is viewed as a theoretical and pedagogical concept in higher education having several diverse approaches and interpretations. The most important aspect of reflective practice is that it is a necessary quality assurance aspect of higher education which should occur recurrently and at different stages of the program. It usually entails an evaluation of advanced instructions which has become the norm in an educational setting, in order to improve the learning outcomes. Reflective practice must therefore be seen as a tool which allows continuous improvement, modifications, and changes to educational approaches, which include theoretical and clinical assessment strategies. Academics in prosthetic dentistry at a research-led university reflected on their current assessment strategies used in the senior undergraduate dental program as part of a quality assurance process and its global comparability. This paper aims to share and explain the importance of reviewing assessment strategies in higher education, especially in such a clinical program using reflective practice as a framework. Different assessment strategies used over a 5-year period are explored and their different structures, expectations, and appropriateness for a clinical program are reported from the literature. The concerns were addressed in a cyclical manner within this framework, and Blooms and blueprinting implemented where appropriate. We conclude that without a validated definition and framework for regular reflective practices, and guidelines to modify the included assessment strategies, the quality assurance within a competency-based dental program may be compromised.

**KEYWORDS**

assessment for success, assessment styles, assessment for learning, clinical assessment strategies, dynamic assessments, entrustable professional activity, independent practice, reflective practice, validity of assessments, workplace-based assessment

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## 1 | INTRODUCTION

To prepare the graduating dentist for the 21st century, dental faculties should ensure that their curriculum and subsequent assessments are aligned not just to each other but also to the expectations of global standards in higher education. This implies in preparing a graduate that is responsive, competent, and adequately prepared for independent practice. Dental faculties are required to constantly review their curriculum and different assessment strategies underpinned by reflective practices (RPs), evidence-based research, and discipline-specific developments. Similarly, review boards globally expect faculties to do the same as an essential practice of professional competence.<sup>1</sup> Evidence-based research is defined as “the means by which evidence is gathered” and having the main goal of its inclusion within a clinical program to guide clinical practice and subsequently offering patients better-quality care.<sup>2–4</sup> In addition, using high-quality evidence-based research makes it translatable, and may then be used to modify or change classroom teachings, assessment strategies, and/or clinical practices.<sup>2–6</sup>

Assessment, a socially interpretive act, forms an integral part of any educational program with multiple stakeholders, be it part of the undergraduate or postgraduate curriculum, in any discipline or at any institution globally.<sup>7–9</sup> The assessment policy of a program is governed by important aspects, such as, whether it is dynamic, meaningful, relevant, and comprehensive and these characteristics should be considered when it is being evaluated. Moreover, reflection is necessitated by a changing landscape, such as the inclusion of online lecture recordings and tests and evidence-based additions such as digital work.<sup>10</sup> It is acknowledged that assessments impact on behavior, including clinical behavior.<sup>9</sup> Thus, determining and reflecting on the relevance of these assessment strategies will highlight the role in facilitating students’ active and critical engagement with epistemologies in their clinical settings.<sup>9</sup> This paper therefore sets out to review the different assessment strategies within this clinical program using evidence-based concepts such as RP. To this end, this paper first reviews relevant literature followed by a description of the different clinical assessment methods used in this Department of Prosthetic Dentistry at a research-led South African university, and how these have been reviewed against the framework of RP.

## 2 | LITERATURE REVIEW

RP, defined as “learning through and from experience towards gaining new insights of self and practices” is

thus an appropriate approach and framework for this review.<sup>10,11</sup> The goal of RP is to also inform faculty about the strengths and weaknesses of the different assessments currently included in these clinical modules and their impact on student learning.<sup>11–13</sup> RP allows for students’ knowledge to be critiqued while considering their socio-cultural contexts, especially within the clinical settings.<sup>13</sup> RP is integral to all learning perspectives, including self-regulated and lifelong learning, as well as therapeutic relationships and professional development and expertise.<sup>11,12</sup> The traditional competitive ranking of students using assessments has long been reformed and its progressive “gap-bridging” position is encouraged to ensure that all students learning differences are addressed.<sup>10</sup>

For RPs to be effective, it must be viewed, valued, and more importantly accepted as a means of collective as well as individual learning.<sup>14</sup> Assessment in a program intends to highlight the development and learning of students, while guiding the educator on how to improve clinical and classroom practices. What is equally important is that the necessary criteria and opinions and criticisms from relevant stakeholders, such as student evaluations, faculty input, assessment marks, and the opinions of experts, must be considered and implemented when changing, modifying, or eliminating old assessment strategies.<sup>9,10</sup> Therefore, to ensure the clinical assessment strategies within the senior undergraduate prosthetic course in a South African Dental School remains relevant within its competency-based curriculum, a review of the current assessment approaches/styles was undertaken.

With the transition from a traditional content-based education to competency-based education, a common understanding would set the stage for this transformation. The definition of competency has evolved and now includes much broader aspects such as the ability to perform the appropriate procedures supported by understanding, training, and professional values.<sup>15</sup> Moreover, competence is a transition and not an end point.<sup>15</sup> Dreyfus and Dreyfus describe such a path to competence as a continuum of skill acquisition, highlighting the movement from novice, beginner, competent, proficient, to expert performance, with one’s skill acquisition reaching different levels in various disciplines.<sup>16</sup> With this in mind, reviewing clinical assessments in the dental undergraduate curriculum should align with these principles.

For graduates at this particular dental school to be competent at graduation, they must demonstrate competence in their knowledge, skills, and values. Moreover, the process of moving from novice to being competent is regarded as a journey of independence, thus clinical assessments of senior dental students need to reflect evidence of independence and independent clinical practice.<sup>17</sup>

The old traditional view of assessments described as “Assessment drives learning”<sup>7</sup> has evolved within this type of competency-based education. The focus is to ensure greater involvement and responsibility on the part of students. “Assessment for learning” brings the student into the process of valuation by explicitly inviting them to take ownership when processing feedback through reflection and self-evaluation.<sup>18–20</sup> Through self-assessment, students are challenged to identify strengths as well as gaps in knowledge, skills, and values. Using critical thinking and problem solving, students are encouraged to develop strategies for filling in the gaps, a skill they will carry forward throughout their professional careers. In other words, assessment is no longer a domain exclusively under the control of faculty; instead, it becomes a joint responsibility of faculty and student.<sup>18</sup>

In health professions education, the use of multiple methods of clinical assessments addresses several of the limitations of individual assessment formats.<sup>21</sup> In addition, validity of assessments requires the implementation of numerous assessment methods.<sup>18,21</sup> Ultimately, the goal of assessment in education within the health profession is to determine students’ capacity to integrate and implement the various domains of learning that collectively define competent practice, over an extended period of time, with day-to-day consistency in a work environment that approximates the actual work setting where healthcare providers interact with patients.<sup>22,23</sup> To deal with various patient complexities and the issue of evaluators subjectivity, having multiple data points over time with multiple assessors provides a solution.<sup>22,23</sup>

More importantly, it is known that students learn differently as they come from very different cultural and educational backgrounds which guide their style of learning.<sup>10,21</sup> Thus, by including different assessment techniques, the different learning styles of diverse groups of students may be accommodated, avoiding negative outcomes.<sup>10,23</sup> It is also important to reflect the best practice and innovation in education to satisfy the learning needs of students, while at the same time recognizing the roles and support issues for academic staff.<sup>22,23</sup>

## 2.1 | Framework for reviewing clinical assessments

The RP framework (RPF) included guided reflection and feedback, and for this review, these guidelines were used to institute changes, and it followed several of these reflective cycles.<sup>12</sup> The process of reflection or the RPF is described in Figure 1.<sup>12</sup>

The RPF is a simple three-stage outline with three components that include: planning, doing and reviewing

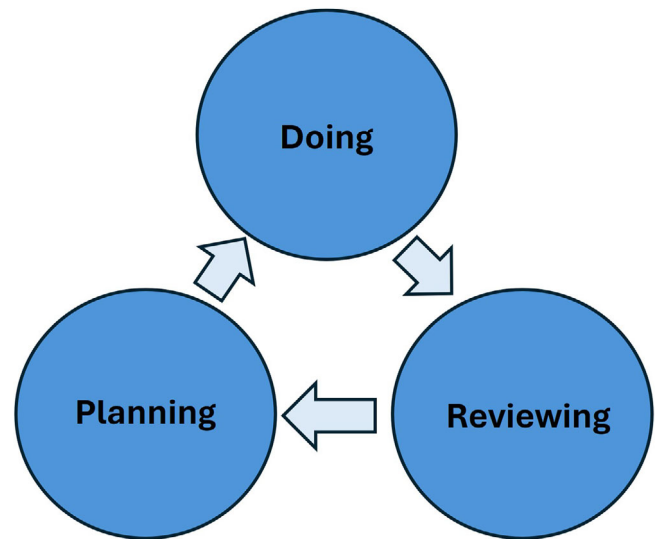


FIGURE 1 Basic three stage model of reflective practice.

(Figure 1).<sup>12</sup> RP is a cyclical process that allows change, modifications, or alternate practices related to teaching and/or clinical practices, similar to the action research framework and cycles (Figure 1).<sup>10,24</sup> The RPF is a process of systemic reflection, inquiry, and action to assess professional practices. It thus consists of several cycles, and has a spiraling design, not linear, similar to the action research framework.<sup>10,12,24</sup> It is described in greater detail by Schon cited by Pang, emphasizing taking the “researchers in practice” approach.<sup>10</sup>

The Department of Prosthetic Dentistry at this researched university has gone through several of these sessions on reflection and RP cycles annually, and guided by evidence to change, modify, and improve on the types of written or sit-down classroom tests, modified mini-clinical evaluation exercise clinical tests, and clinical competency-based exams, for example, a denture examination.<sup>12,21,25</sup> Several of these RP sessions were included for the senior students to ensure readiness for independent clinical practice.<sup>26</sup>

For this paper, the RP cycles focus on and indicate the changes related to the senior clinical assessments, thus we report on the clinically related modifications.<sup>10,12</sup> As stated previously, following global evidence and trends, the idea to include several diverse types of assessments clinically was the initial plan.<sup>21</sup> On initial reflection and critical evaluation of the current clinical assessment system in the prosthetic setting, it showed that a change should be included as it needed to be guided by existing best evidence, thus the necessity to adopt an evidence-based assessment system.<sup>2–6</sup>

Several *reflection-on-action* cycles to re-evaluate and modify the clinical assessment strategies in 5th year, following comments from students and colleagues who learn and work in these clinics.<sup>10,27</sup> The basis for using this

type of framework was to develop an understanding of the clinical situation and related concerns as expressed by the parties involved so that future modifications can be informed.<sup>10,12</sup> The stages of “planning” (called noticing), “doing” (referred to as processing), and “reviewing” (described as action) were followed over a period of 5 years in the prosthetics clinic.<sup>12</sup> Thus, the different reflection-on-action cycles described below relate to how changes and modifications were made to the clinical tests conducted in the prosthetic clinic.<sup>10,27</sup>

### 2.1.1 | Reflections on practices for a clinical test

These reflections refer to *noticing* what has been done for clinical tests in this senior class over this 5-year period and were shared during feedback sessions.<sup>12</sup>

1. Students provided feedback in their annual module evaluations related to the marks given by staff in the prosthetic clinic for clinical procedures and sessions and that it ranged between 60% and 69%.
2. Students felt that their clinical tests were scheduled while each of them was at different stages of denture making, making the test experiences easier for some compared to others.
3. Module coordinator observed how the anxiety levels of students spiked for these tests and related this to the unannounced clinical test (and knowing the negative impact on learning and clinical performance), decided to address this aspect.
4. Also, all educators expressed concern regarding students sharing test questions with students taking the clinical test later.

The feedback received was then classified into three categories:

1. If feedback was from others, for example, students, Self-monitoring by all staff (departmental and sessional clinical educators), and If it occurred due to critical incidents or events analyzed that occurred in this setting.<sup>12</sup>

From this classification, it can be stated that the above feedback stems from all the categories.<sup>12</sup> And that this type of “noticing” from feedback explained above from 1 to 4 can occur at any stage of reflection.<sup>12</sup> This feedback was *processed*, and *actions* taken to rectify each situation.

To ensure a more objective clinical assessment and mark allocation, it was decided to include more than

one educator for clinical tests. In addition, a clinical test sheet was included with a rubric for each student (which was shared and discussed in class and prior to the test) for greater objectivity and transparency regarding mark allocation.<sup>28</sup> Other changes addressing reflections included:

3. 1. For the senior students, and due to their experience, these students were tested on any procedure they were completing for either partial or complete removable dentures.
2. Clinical tests were scheduled for the class to ease anxiety; thus, the students knew exactly when they were going to have the clinical test in prosthetics.

So, at this stage, we were addressing several concerns: two examiners were included for objectivity, the tests were scheduled, and a rubric that was appropriate for 5th year was included. But most importantly, due to the expectations regarding the level of clinical experience, these students were tested on any procedure (complete or partial removable dentures).

1. The utilization of Bloom’s taxonomy as a guide to phrase the clinical test questions at an appropriate level for the 5th year class was considered for this cycle.<sup>29,30</sup> It was decided to include a bank of questions that could guide educators to question students which would be varied. In addition, the blueprinting format was used to include questions for the different levels of students’ clinical expertise.<sup>30–33</sup>

The goal of RP is to inform future actions, starting with the intention to change and indicating the purpose and deliberate nature of these actions, as shown above.<sup>12</sup>

Reflection and its *reflection-on-action* cycles are very similar to the cycles of action research where this type of value judgement created opportunities to increase the depth of understanding of the clinical situation and its challenges.<sup>10,12,24</sup> What needs to be highlighted though is that at the heart of reflection is the support and challenge from others such as the students and clinical teachers guiding us to improve and ensure more meaningful actions. This type of guided reflection can only occur when there is support and encouragement for greater improvement in professional practices.<sup>12</sup>

### 2.2 | Review of current clinical assessment strategies

As part of the prosthetic dentistry program, assessments for all the years from 2nd to 5th year are categorized into



formative and summative; and the different individual types included under each category are:

1. Formative types (F):

Clinical session, objectively structured clinical evaluation (OSCE), computer-based test; scheduled written (face-to-face) test; clinical test, portfolio, examination dentures.

1. Summative types (S):

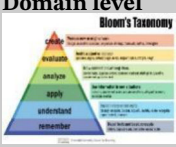
Scheduled written (face-to-face or online) examination, practical examination, clinical test, examination denture, OSCE: computer-based types and OSCE: station-based types (including modified OSCE types).

The above-listed assessment types have been implemented in the Department of Prosthetics over the last 5 years. In the 5th year of study, which is a clinical year, several different types of assessments are included as per departmental policy and research evidence.<sup>21,34,35</sup> The teachings are very specific where theoretical knowledge related to procedures and materials are shared in class, and these are demonstrated and explained in more detail in the clinical setting.

Clinical assessments completed in the clinical setting with a patient present are criterion-referenced as explained below. These clinical assessments referred to as workplace-based assessments thus focus on comprehensive patient care and related clinical activities.<sup>36</sup> The criteria largely focus on the students' theoretical *knowledge*, and clinical *skills* by assessing procedures completed by them and their *attitude* or professionalism in this setting toward their patients, peers, and clinical teachers.<sup>36</sup> These assessments are thus still more formative, and as such the evaluation of students' performance include quantitative and qualitative components. The mini-clinical evaluation exercise developed by Norcini was modified to include clinical and theoretical assessment of dental students.<sup>34,35</sup> These clinical tests (formative and summative type) are conducted where students are assessed for working independently under the same criteria mentioned previously.<sup>26</sup>

A more detailed rubric for the 5th year clinical test is used as a guideline as required for this level of study.<sup>28</sup> These clinical tests are conducted for both complete and partial removable denture prostheses. Clinical assessments may be viewed as low-stress situations when the rubric is shared with students (as in this case) and when they know the exact date the test is scheduled for, unlike previously when there was no rubric, and the test was unannounced. Clinical assessments for the final year dental students in prosthetics include multiple assessment types, guided by appropriate rubrics for their level of study.<sup>28</sup> In addition,

TABLE 1 Blueprinting for assessments.

Domain level	Question (in paper)	Marks (of paper)	Module learning outcome
	1. Knowledge		
	1. Comprehension		
	1. Application		
	1. Analyze		
	1. Evaluate		
	1. Create		

the level of the questions included for 5th year students are organized following blueprinting, Miller's pyramid, and are phrased using Bloom's taxonomy and only included questions that focus on phrasing from the last three levels (Table 1).<sup>29–33</sup>

At the 5th year clinical stage of the program, the purpose of the clinical assessments is to ensure that the students are competent and ready for independent practice. Competencies and institution required graduate attributes are included and mapped against the assessments (Table 2). In addition, the 5th year students are expected to clinically construct a set of complete dentures independently. This is the closest example of an entrustable professional activity (EPA), where students must demonstrate their ability to work independently with little or no supervision and guidance.<sup>26,37</sup> For this EPA, students are entrusted to complete this task based at the highest level of Miller's assessment pyramid (the "doing"), and so display clinical competency and readiness for independent practice.<sup>26,30,37</sup>

Different summative assessments impact differently on student learning; besides the written papers (face-to-face or even online), testing students' clinical knowledge and skills was modified from a slideshow to station-based OSCEs to the current one-station OSCE with all questions placed at this station and where students determine time spent per question.<sup>38–40</sup> Slideshow OSCEs were initially a way of revising knowledge, but these are more difficult to align to reality, thus the move to station-based OSCEs.<sup>39</sup> For all clinical years for example, these station-based OSCEs are adjusted to the appropriate levels underpinned by sound educational principles such as blueprinting, Miller's pyramid and questions framed according to Bloom's taxonomy.<sup>28,29,31,38–40</sup> These station-based OSCEs, including the modified type, are well planned and in collaboration with the Department of Prosthetic Dentistry. More importantly, with these types of OSCEs, several factors need to be considered to ensure success with a positive impact on student learning.

TABLE 2 Linking assessment practices to the graduate attributes.

Graduate attribute (competency)	Advanced prosthetic dentistry module			
	Case-based discussion	Clinical daily assessment (WBA)	Clinical tests (WBA)	Exam denture/clinical competency exam (EPA/WBA)
Inquiry-focused and knowledgeable	✓	✓	✓	✓
Critically and relevantly literate	✓			✓
Autonomous and collaborative	✓		✓	✓
Ethically, environmentally, and socially aware and active		✓	✓	✓
Skilled communicators	✓	✓	✓	✓
Interpersonal flexibility and confidence to engage across differences	✓	✓	✓	✓

Abbreviations: EPA, entrustable professional activity; WBA, workplace-based assessment.

However, this type of station-based OSCE, which is considered more realistic, is definitely more cumbersome to prepare and conduct. This type of modification of the OSCEs conducted over the years may also be described as an example using the reflection-to-action cycles, as with the clinical tests outlined above.<sup>12,39</sup>

For this paper, all the assessments used in the department in the clinical years over the last 5 years were reviewed and measured for appropriateness against acceptable guidelines by global standards and examples.<sup>38</sup> This has never been done directly before, though several changes and modifications to the assessment methods have been instituted over the last 5 years. These were based on students' feedback following annual module evaluations, colleagues, external examiners, and the health professions council review committees.

It can be confirmed that RP is an important stage in a teachers' professional growth.<sup>34</sup> More importantly, that RP should be a compulsory stage in any educational program as it can ensure quality assurance of a module or program and assist learners to adopt a deeper approach to learning.<sup>10,12</sup> The current assessments highlight this type of evaluation. Instead of imposing external regulation through faculty dominance of assessment, EPAs and workplace-based assessment bring the student into the act of reflection on assessment, leading to self-assessment, and intrinsic motivation to perform at competence and beyond.<sup>18,36,37</sup> These assessment methods contribute to fostering independent self-regulation, a crucial goal for healthcare professionals. When students are actively involved in assessing their own progress, they are more likely to develop a genuine desire to excel and perform at a high level of competence. This intrinsic motivation can fuel continuous improvement and drive students to exceed minimum competency standards, striv-

ing for excellence in their chosen field. Moreover, it is also in line with the university's assessment policy.

### 3 | CONCLUSIONS

The paper concludes that without a validated definition and framework for regular reviewing and guidelines to modify the current assessment strategies, the quality assurance within a competency-based dental program may be compromised. To this end, the Department of Prosthetic Dentistry has used the reflection-to-action framework of RP and extended the blueprinting format to clinical assessments.

### 4 | RECOMMENDATIONS

Successful reflection requires individuals to have explicit outcomes for such a process, but more so, they must acknowledge its importance for personal growth, professional practice, and lifelong learning. The paper concludes with recommendations for departments having similar programs (both locally and globally) to review their assessment strategies with the end-goal to prepare senior students for independent clinical practice and for the global setting.

The next step would be reviewing the examiner's influence on the scoring of both clinical tests and OSCEs and the objectivity required for this phase of student assessments. Moreover, a more comprehensive framework may be considered when evaluating these, such as the self-regulated model, as it may guide educators with the potential barriers. The impact of these assessments on the development of students clinically and their skills seriously needs re-evaluating. In addition, a clinical audit of work completed by these senior students could possibly

highlight concerns; but at the same time, the awareness of such evaluations could guide students to strive harder clinically.<sup>41</sup> Furthermore, the changing landscape of teaching to include new unused procedures as in digital work, already introduced at 2nd year level, but not completely embedded in the entire program as in the senior years, introduces new exciting challenges.

## AUTHOR CONTRIBUTIONS

Contributed to protocol, data collection and analysis, and manuscript preparation and finalization (55%): Saadika B. Khan. Contributed to protocol, data collection and analysis, and manuscript preparation and finalization (45%): Ronel Maart.

## ACKNOWLEDGMENTS

The authors thank Dr Bashier Kathree for his comments and insight with this manuscript.

## CONFLICT OF INTEREST STATEMENT


The authors declare no conflicts of interest.

## DATA AVAILABILITY STATEMENT

The information used or reflected on for this paper are available from the corresponding authors on reasonable request. However, the required information for reflexive practice on assessments are included in this article.

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**How to cite this article:** Khan SB, Maart R. Clinical assessment strategies for competency-based education in prosthetic dentistry. *J Dent Educ*. 2024;1-8. <https://doi.org/10.1002/jdd.13746>