

# Aligning Clinical Assessment with Course Elements in Prosthodontic Dentistry: A South African Case

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*Abstract:* Clinical tests were introduced as an additional clinical assessment tool in the prosthodontics curriculum of the fourth-year undergraduate dentistry program at one South African university. This study compared the relationship between the students' performance in the clinical tests and daily clinical grades on the one hand with their theoretical performance on the other. It also explored the perceptions of the academic staff on the validity of clinical tests as an assessment tool. The analysis of the students' test results showed insignificant relationships between their clinical daily grades and their grades for assessing theory. However, clinical assessment via tests is well accepted by the course staff, and they perceived them to be more reliable than daily clinical grades as assessment methods. The findings of the study support other studies that concluded that the daily grades of dental students poorly correlate with their competency exams module. The findings also relate well to the lecturers' views that clinical tests were more reliable as a clinical assessment tool than the students' daily clinical grade.

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*Keywords:* prosthodontics, prosthodontics education, clinical education, assessment, clinical assessment, constructive alignment, dental education, South Africa

*Submitted for publication 5/7/12; accepted 8/14/12*

Among the many challenges facing modern dental schools, particularly those in South Africa as a nation in the making, one of the most prominent is the development of appropriate assessment systems.<sup>1</sup> Prosthodontic Dentistry (PRO400) is a one-year module in the fourth-year undergraduate program in a dental school in the Western Cape Province with a large clinical component. A major portion of the program involves regular assessment of the students' clinical management of patients as they are required to develop the knowledge, skills, and attitudes necessary to equip them to be competent, independent practitioners at graduation.<sup>2</sup>

Pellegrino et al.<sup>3</sup> suggest that the three most important aims of assessment are to assist learning, to measure individual achievement, and to evaluate programs. Besides the attainment of a clinical mark (grade), clinical assessment serves to identify weaker performance so that study interventions can provide students with the tools to evaluate their progress. Therefore, students' clinical grade in Prosthodontic Dentistry provides a record of their abilities and

progress, but it also points to feedback on their performance. PRO400 module outcomes require the clinical assessment of students to include theoretical knowledge, clinical skills, and the ability to apply theoretical knowledge in the context of communities with urgent developmental and health needs. Unfortunately, due to large student numbers and part-time clinical supervisors, clinical assessment is increasingly challenging to control and implement.

The outcomes of the PRO400 module were recently modified in an attempt to be more specific and relevant to societal needs, while the content was divided into appropriate themes. Similar to what Gravett and Geyser<sup>4</sup> described regarding the reaction of some universities when called upon to develop outcome-based programs, knowledge was merely reorganized and repackaged in the PRO400 module, but there was no significant shift towards integrated outcomes. Clear disparities remained among module outcomes, what was taught, and what was assessed. However, staff development focused on teaching strategies and theoretical assessment methods to promote the alignment of learning outcomes,

teaching strategies, and the assessment of modules. This training resulted in the PRO400 module being “reshaped” in order to create an environment to better promote active student learning and to include teaching strategies such as case discussions, tutorials, and small-group work (during lectures). As students have been increasingly expected to construct meaning from what they do in order to learn,<sup>5</sup> the next step was to ensure that the assessment was aligned with the learning outcomes by the introduction of internal moderation. Lecturers in the department assisted with this by ensuring that objective structured clinical examinations (OSCEs) and written papers were relevant and well aligned with the outcomes of the module.

However, a departmental evaluation identified that there was still inadequate alignment between students’ clinical performance and their theoretical performance. In essence, most of the students’ clinical marks were significantly higher than their theory marks. This discrepancy in PRO400 was described as being that although clinical assessment was aligned in theory with the learning outcomes, this alignment did not occur in practice. An important reason for this was that clinical instructors focused mostly on practical procedures, thereby neglecting both actual clinical teaching and ways to help the students relate theory effectively to clinical procedures. This was largely in accordance with Henzi et al.’s<sup>6</sup> findings that although daily clinical observation of dental students is one of the primary forms of assessing their learning, faculty members perceived these assessment methods as not particularly valuable to student development. As all methods of assessment have strengths and intrinsic flaws, the use of multiple observations and several different assessment methods over time can partially compensate for flaws in any one of them.<sup>7</sup>

After reviewing relevant literature and building on the departmental inquiry, the faculty introduced clinical tests as an additional clinical assessment

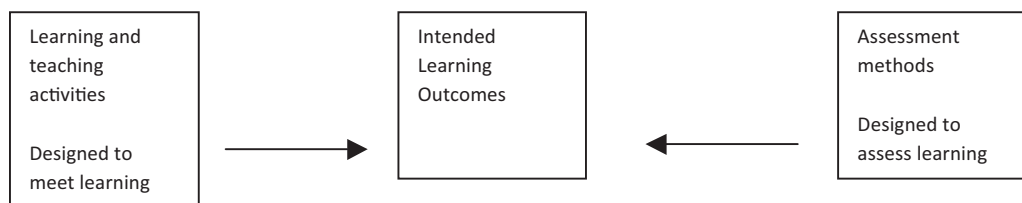
method. The purpose of introducing the clinical tests was to ensure that all students were assessed fairly, theoretical knowledge was included in the assessments, and weaker learning performance was identified for remedial support. Our study compared the relationship between the students’ performance in the clinical tests and daily clinical grades on the one hand with their theoretical performance on the other. It also explored the perceptions of the academic staff on the validity of clinical tests as an assessment tool.

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## Concepts and Context

The theory of constructive alignment regards the total teaching and learning context as a system in which all contributing factors and stakeholders reside.<sup>8,9</sup> To understand such a system, one needs to identify and understand the constituting parts of the system and how they interact and affect one another. For a teaching and learning system, constructive alignment ultimately enable lecturers to predict how the teaching system will react under modification.<sup>9</sup> Constructive alignment is the underpinning concept behind the current requirements for program specification, declarations of Intended Learning Outcomes (ILOs), and assessment criteria, as well as the use of criterion-based assessment. There are two parts to constructive alignment: students construct meaning from what they do to learn, and teachers align the planned learning activities with the learning outcomes (Figure 1).<sup>10</sup>

One key to reflecting on teaching in higher education is to consider how students learn. Learning is thus constructed as a result of the learner’s activities and the learning activities that are most appropriate to achieving the curriculum objectives and result in a deep approach to learning.<sup>11</sup> Students generally try to adapt their learning approaches to



**Figure 1. Aligning learning outcomes, learning and teaching activities, and the assessment**

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what they perceive as the requirements of teachers and particularly what the final assessment may entail. If teaching and assessing are done in a way that encourages a positive working atmosphere, allowing students to make mistakes and learn from them, these processes may encourage students to adopt deeper approaches to learning.<sup>12</sup>

In South Africa, the socioeconomic and policy contexts pose enormous challenges for assessment practices in higher education.<sup>4,13,14</sup> In addition, there are numerous pressures on higher education, threatening the use of formative assessment.<sup>15</sup> These pressures include an increasing concern with attainment standards, leading to greater emphasis on summative assessment outcomes; an increase in student/staff ratios, leading to a decrease in attention being given to individuals; curricular structures changing towards greater unitization, resulting in more frequent assessments of outcomes and less opportunity for formative feedback; and the demands on academic staff in addition to teaching, which include the need to be seen as research-active, generating additional funding, and to be involved in public service and intrainstitutional administration.<sup>15</sup>

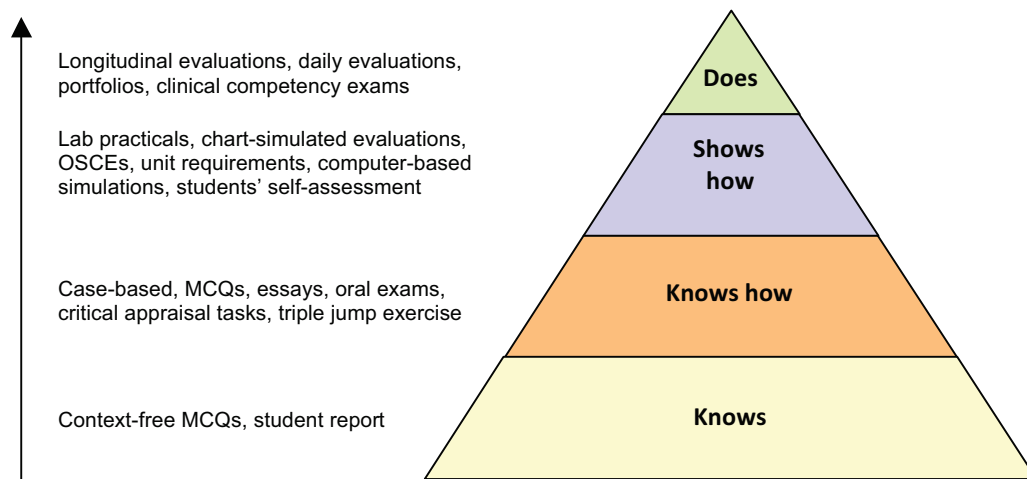
In addition to these pressures, student diversity is increasingly evident. Traditionally, student diversity has been associated with race, gender, and cultural differences,<sup>14</sup> but recent literature points to characteristics such as age, physical traits, sexual orientation, ethnic and religious background, socioeconomic status, place of origin, social and political affiliations, and seniority as well as experience, education, and training.<sup>16</sup> Variance in assessment practices may help teachers to address students' diverse backgrounds, learning styles, and needs.<sup>14,16</sup> Also, in medical education, the use of multiple methods of assessment seems to address several limitations of individual assessment formats.<sup>7</sup> In South Africa, the Health Professions Council (HPCSA) specifies content guidelines for the dental curriculum and its assessment. While the HPCSA framework has the advantage of promoting consistency between the curriculum and the assessment, each dental school makes its own decisions about the methods and standards of assessment.

Learning, for the most part, does not seem to depend on innovative teaching strategies as student learning is mainly driven by assessment.<sup>11,12</sup> Also, methods of assessment influence students' conceptions of learning and their approaches to learning.<sup>2,4</sup> It has been argued that if the aim is to change students' learning, the methods of assessment need to

be changed.<sup>14</sup> The purpose of assessment clearly determines the kind of assessment used as well as the assessment tools, and any mismatch between purpose and tools will negatively impact learning.<sup>11,17,18</sup>

In medical education, the use of multiple methods of assessment has been reported to help overcome many of the limitations of individual assessment formats.<sup>7</sup> Race<sup>19</sup> argues that the wider the diversity in the methods of assessment, the fairer the assessment should be to all students. Ultimately, the goal of assessment in health professions education 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 health care providers interact with patients.<sup>19-21</sup>

Miller proposed examples of assessment techniques in medical education and demonstrated how students could be assessed on various levels of the professional competence pyramid (Figure 2).<sup>22</sup> At the "does" level, the student is expected to execute the core tasks and responsibilities of a health care provider in "real" or very realistic working conditions, with limited instructor support over an extended period of time. The aim is to determine whether the student has mastered the fundamental competencies for unsupervised practice and whether he or she can reproduce these skills on a consistent level of performance over a period from several weeks to several months. Assessment techniques at this level emphasize the direct observation of performance and review representative work samples by means of various techniques, including the portfolio and clinical competency examinations in a variety of formats. Albino et al.<sup>20</sup> used Miller's framework to identify assessment techniques that were unique to dental education, yet consistent with Miller's definitions of levels and associated measurement strategies. The majority of knowledge assessment at the predoctoral level should be at the level of "knows how" and "shows how," with "does" featuring at the postgraduate level only. "Shows how" could also be described as the students demonstrating competence in the assessment pyramid<sup>20</sup> (Figure 2). Competence in this sense is referred to as the quality of being functionally adequate or having sufficient knowledge, judgment, and skills for a particular duty.<sup>21</sup> The concept of competence implies the capabilities to determine when it is appropriate to carry out a task, as well as to be able to complete the task successfully. This will involve performance of broader, more generic tasks,



**Figure 2. Miller's pyramid of professional competence with examples of assessment techniques used in medical education**

such as planning, clinical reasoning, and contingency management with awareness of the psychosocial context and set within an ethical framework. The skills needed are not merely the technical ability to perform clinical tasks, but also to apply them to new situations—the latter being of critical importance in the South African context with its diverse range of societal needs and challenges for health care.

Contrary to this, the dental clinical assessments assess predoctoral students at the level of “does” due to the nature and extent of their clinical scope.<sup>19</sup> Therefore, assessment at the level of “does” happens in the PRO400 clinical tests as well. Students treat patients with limited supervision by qualified dentists. Virtually all commentaries and expert opinions on performance assessment in education regarding the health professions indicate that not only the recall and recognition of specific facts and the demonstration of technical skills should be assessed, but also the students' capacity to synthesize information within a given context and its application in unique situations that require critical thinking and problem-solving.<sup>21</sup>

Berrong et al. (cited in Albino et al.<sup>20</sup>) examined the relationship between daily grades for clinical work in which students received a rating for each patient procedure and performance on twenty-six

clinical competency exams on which students worked without instructor coaching. These researchers found that the hundreds of daily grades that each senior student received in an academic year correlated poorly with performance during competency exams in which students worked without instructor “rescue” unless the patient was in danger of irreversible damage. In the case of the PRO400 module, similar observations resulted in exploring this matter in more depth. The study by Berrong et al. suggested, among other things, that competency exams were a more reliable means of assessment of students' capacity to perform core skills than the traditional daily grade.

## Methods

In the PRO400 module, the aim was to confer clinical skills, and for this reason it was important to do so objectively. This is where the concept of “blueprinting” became useful.<sup>23</sup> Blueprinting indicates that assessment needs to be conducted according to a replicable plan as it ensures that the assessment content is mapped carefully against learning objectives to increase validity. It also needs to generate alignment between subject content or student competencies

and the assessment items. In addition to ensuring adequate relevance and sampling, blueprinting helps to identify test instruments as appropriate to the construct and content of the assessment.<sup>23-25</sup>

The American Board of Internal Medicine recommended the use of the mini Clinical Evaluation Exercise (mini-CEX) to assess the clinical competence of trainees.<sup>26,27</sup> Mini-CEX is a method for simultaneously assessing the clinical skills of medical students and offering them feedback on their performance. Important strengths of the mini-CEX are that it evaluates the trainee's performance with a real patient; assesses the performance and provides educational feedback; and presents trainees with a complete and realistic challenge.<sup>27</sup> In this study, the mini-CEX was modified in the case of the PRO400 module to include both clinical and theoretical assessments.

A mixed methods approach<sup>28</sup> was used to collect data on the changed assessment scenario of the PRO400 module. The concurrent triangulation strategy was employed to attempt to cross-validate the findings, and data collection (both quantitative and qualitative) was done simultaneously. The convergence of the findings was considered a way to strengthen the knowledge claims of the study or to explain any lack of convergence.<sup>29</sup> Record reviews and interviews were used as the main sources of data, while a purposive sampling strategy was used to include lecturing staff participants with a wide range of clinical assessment experience. In this study, three full-time lecturers were selected on account of their involvement in fourth-year clinical tests, as well as on the grounds of their varied clinical and teaching experience. All three lecturers are responsible for undergraduate clinical supervision and teaching. Open-ended questions<sup>29</sup> were used for interviews with lecturers who were asked to comment about particular assessment events. These responses were classified, categorized, and grouped together in emerging themes. The analytical abstraction method<sup>29</sup> was used to assist with the qualitative data analysis. First, the basic level of data analysis was done in the narrative form, followed by the second and more complex level of data analysis into themes. The emerging themes were identified as clinical tests, student performance, alignment of theory and clinical assessment, and personal influence on supervisors' assessment practices and attitudes.

For quantitative data, the theory marks of PRO400 students were collected from two written tests, spot tests, and the final examination from students' records. There were 110 students in the

year-group class, but one student was excluded from the study because of discontinuation at midyear, so total number in the study was 109. Clinical test marks were collected from the clinical tests performed in the particular year, while the clinical daily mark was collected from the clinical mark the students had obtained in that same year. Parametric tests, measures of variation, and measures of average were applied to the quantitative data. Ethical clearance for this study was given by the Research Committee of the University of the Western Cape.

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## Results

### Quantitative Results

The clinical test marks of the students (n=109) in the PRO400 module were compared to their theory marks (Figure 3) of the same year. Also, the average clinical daily marks were compared to students' theory marks (Figure 4). Figure 3 indicates a relationship between the clinical tests and the theory marks. On the line of equality, the clinical tests equalled the theory marks. Above the line, more students performed better in their clinical tests than in their theory. Below the equality line, fewer students' theory marks were better than their clinical test marks. What was derived (from Figure 3) is that forty-five students' clinical test marks were 10 percent higher than their theory marks. Only eight students' theory marks were 10 percent higher than their clinical test marks.

The graph in Figure 4 shows the relationship between the clinical daily marks and the theory marks. As can be seen in that figure, there was no relationship between the students' clinical daily marks and their theory marks. Figure 5 shows the relationship between the clinical test and the difference between the clinical test marks and the theory marks. Clearly, as clinical test marks increased, the difference increased between the clinical test marks and the theory marks. As the clinical test marks decreased, the difference between the clinical test marks and the theory marks decreased.

The results from the quantitative analysis are shown in Table 1. The average of the average theory marks was 47 percent, the average of the average clinical test marks was 55 percent, and the average of the clinical daily marks was 63 percent. The standard deviation (average difference from the mean) was 8.5 percent for the theory marks, 8.5 percent for the clinical

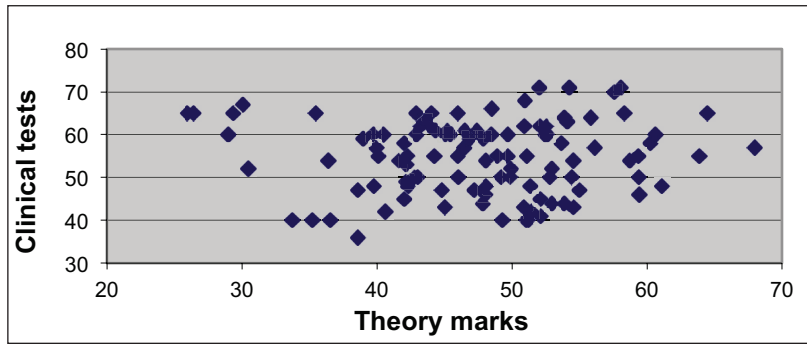


Figure 3. Clinical test marks versus theory marks (n=109)

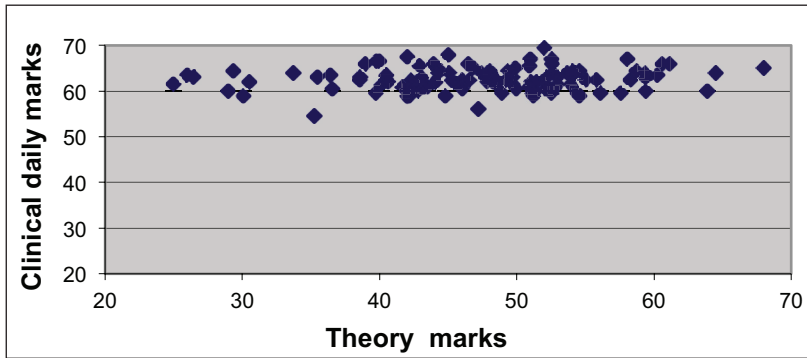


Figure 4. Clinical daily marks versus theory marks (n=109)

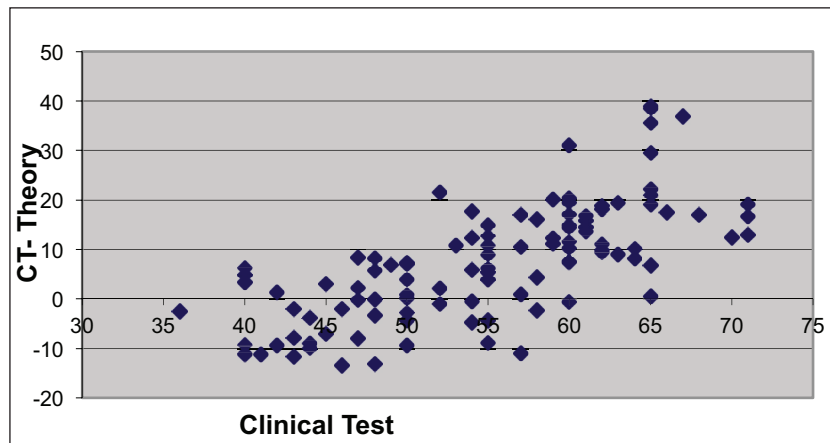


Figure 5. Clinical test marks versus the difference between the clinical test marks and theory marks (n=109)

**Table 1. Quantitative results comparing the average theory marks, clinical test marks, and clinical daily marks in the PRO400 module**

|  | Average Theory Marks | Clinical Test Marks | Clinical Daily Marks |
|--|----------------------|---------------------|----------------------|
| Average                                    | 47.3854              | 54.8692             | 62.6169              |
| Standard Deviation                         | 8.4958               | 8.4508              | 2.5360               |
| Minimum                                    | 24.9702              | 36.0000             | 54.5000              |
| p25  | Q1                   | 42.2897             | 48.0000              |
| p50  | Q2                   | 48.0691             | 55.0000              |
| p75  | Q3                   | 52.6900             | 61.0000              |
|  | Maximum              | 67.9993             | 71.0000              |
| Parametric coefficient of variation        | 0.1793               | 0.1540              | 0.0405               |
| Q2-Q1                                      | 5.7794               | 7.0000              | 1.5000               |
| Q3-Q2                                      | 4.6209               | 6.0000              | 1.5000               |
| Interquartile range                        | 10.4003              | 13.0000             | 3.0000               |
| N P coefficient of variation nonparametric | 0.216361             | 0.236364            | 0.048                |

cal tests, and 2.5 percent for the clinical daily marks. The standard deviation of the clinical daily mark was much lower than the standard deviation value of the theory mark and the clinical test mark. The interquartile range (IQR) of the clinical daily marks was 3 percent, the IQR for the clinical tests was 13 percent, and the IQR for the theory marks was 10 percent.

From the data shown in Figure 3, it appeared that the students generally performed better in the clinical tests than in their theory, which included tests and examinations in PRO400. Few students' clinical test marks equalled their theory marks, which explains the findings of the graph (Figure 3). Since the clinical tests included a theoretical component, it appeared that the students' clinical performance exceeded their theoretical performance. During the daily clinical sessions, it was expected that the clinical supervisors would allocate marks to the students based on clinical performance and some application of the relevant theory. From Figure 4 it can be seen that students' clinical daily performance exceeded the theory marks and that there was no relationship between students' clinical daily marks and their theory marks. The assumption was that a limited amount of theory was included in these clinical daily sessions. The students' performance in clinical tests obviously related better to students' theoretical performance than to their clinical daily marks.

## Qualitative Results

**Level 1: basic level of analysis.** All three lecturers in the PRO400 module agreed that the clinical test was more accurate and standardized compared to the previous clinical assessments. The reasons for

this emerged in their comments, as in this example: "When we do the CT [clinical tests] compared to the normal clinics, we are forced to look at all the aspects to be assessed and mark these accordingly and appropriately. The tool demands this of us, even though this is expected in normal session too; we tend to give general marks" (Lecturer 3). All three lecturers also commented on the positive attributes of the clinical tests as an assessment tool, as in this example: "The most positive attribute is that there are two examiners: they discuss the students' performance, they reach consensus with the students' mark; two examiners make the CT more reliable and accurate and sometimes the students (not all of them) prepare for it" (Lecturer 1).

The lecturers varied in their responses as to whether the students' performance in the daily clinical sessions corresponded with their performance in their clinical examinations. All the lecturers agreed that they experienced that the students' clinical test marks were lower than their clinical daily marks. Some of the reasons mentioned were as follows: "Clinical daily mark is obviously higher. You are not so critical; you tend to include more questioning for clinical tests compared with other clinical assessments" (Lecturer 2).

The respondents agreed that the theoretical and clinical assessments were not aligned. Some suggestions were made to improve the alignment of theory and clinics. Two of the respondents indicated that their participation in the clinical tests has influenced the way in which they assessed the students clinically. Their explanations were as follows: "I'm asking more questions. Personally, I started to link the theory and

clinical application for the students to make it easier for the students” (Lecturer 2); and “Yes, it influenced the way I assess, teach, approach, and guide the students clinically. It puts our interaction with the staff and students on the ‘spot’—more professional, less casual, more serious if there is a clinical test. It puts us clinical staff [involved in clinical tests] in a different ‘space,’ e.g., how we feel, approach, and how we prepare for the clinics. Clinical tests are a good thing. You also check on yourself and do more readings to keep you updated—strangely so—and we tend to discuss amongst staff; so yes, we are influenced in our teaching now more by the clinical tests” (Lecturer 3).

**Level 2: higher level analysis.** A higher level analysis of data, which is of an interpretive nature, is concerned with what is meant by the response and what is inferred or implied.<sup>30</sup> These interpretations were also linked to relevant literature in order to make understanding easier.

According to the results, all the respondents strongly agreed that the clinical tests were more accurate and standardized compared to any other clinical assessment used within the Prosthodontics Department. Two examiners responsible for the clinical tests promoted the reliability and validity of the clinical test as an assessment tool that is aligned with the clinical learning outcomes for PRO400. The examiners score the student separately first and then discuss and come to agreement on recommendations for how the clinical tests can be improved; these included refining the guidelines for supervisors, allocating sufficient time, and incorporating weightings for unequal and difficult procedures or patients.

The lecturers were of the opinion that more detailed guidelines should be included in clinical tests. This corresponds with the research by Newble et al.<sup>31</sup> in which the authors first defined what is to be tested, dividing it into three steps. The first two steps define the range of competencies (exit or terminal objectives) that students must know or be able to perform at the end of the course of study. The third step identifies the sample of competencies to be tested in the assessment procedure. Using these steps as guidelines, the Prosthodontics Department could probably redefine the guidelines associated with the clinical tests. In addition, clear communication between students and tutors and clarity of criteria and standards appear to be essential components of effective assessment, including self-assessment.<sup>32</sup>

The respondents agreed that the alignment of theory and clinical assessment is an area that could

be improved. Better alignment of these areas needs to be developed, and the respondents’ suggestions to this effect included more clinical teaching and the need for students to make the connection between theory and practice. This corresponds with Bowen<sup>33</sup> who emphasized that clinical supervisors have to help students to relate theory to clinical application. This finding is also consistent with Hays,<sup>21</sup> who maintains that clinical teachers should engage actively in domain groups, ensuring that the relevant material from their clinical discipline is appropriately integrated with teaching and assessment—not only in the modules of a single year but throughout the entire course. It is crucial to recognize that students, due to their limited clinical experience, may be unable to integrate theory and practice and to make connections.<sup>34</sup> It is therefore expected of the clinical supervisor, having the necessary clinical experience, to assist students in closing the gap. Lecturer 2, for instance, made a particular comment in this regard: “personally I started to link the theory and clinical application for students to make it easier for them.”

Two lecturers admitted that the clinical tests have influenced the way in which they assessed the students clinically. Throughout the interview, the respondents indicated that these clinical tests had changed how they prepare for the session and how they teach. They also pointed out how it had changed their overall behavior with regard to assessment and clinical teaching. Being involved in clinical testing, the supervisors were able to experience the students’ clinical competencies and theoretical knowledge, while they were able to identify the areas in need of development. The respondents realized that a gap existed between theory and practice and indicated possible methods of closing this gap.

**Emerging themes.** The respondents indicated that they assumed different roles when they participate in a clinical test. Some of the comments indicated that supervisors actually changed their approach to assessment during a clinical test: “You [the supervisor] are in a different frame of mind” (Lecturer 2); “You as a supervisor are more critical” (Lecturer 2); and “You are harsher in your judgment of students” (Lecturer 1). From our involvement in clinical testing, it appeared as if the supervisors distanced themselves from the students in order to be more objective when allocating marks during a clinical test. One of the respondents added that there is a “seriousness” about the session that seems to transform the supervisor into a more objective assessor.



On the question of taking on different assessment roles, a study by Fugill<sup>34</sup> indicated that assessors took on a variety of marking roles dependent on their personalities and experience. The markers were extremely concerned about internal and external reliability and their ability to be objective. Similarly, from the interviews in our study, it appeared that the experienced and senior lecturers were less personal in their responses compared to the other interviewees. This could either be the result of senior faculty members not being involved in the undergraduate teaching as much as the other (younger) respondents, or alternatively, it could point towards some form of maturity in the experience of being an internal and external clinical examiner. One younger respondent commented that “questioning the student and giving the students bad marks are not always nice and then this results in that you have to explain this to the students” (Lecturer 1). It appears that this lecturer might not be comfortable with constructively giving feedback to the students or prefers not to have any role in assessment for fear of harming their relationship.<sup>20</sup>

From the qualitative data, it also became clear that the supervisors had their own perceptions of how students experienced clinical tests. Some of these perceptions included the following: “The students enjoy the clinical tests; they know the impact of the clinical tests and prepare for it” (Lecturer 3); “Students expect the clinical tests to happen and they are informed about it. Sometimes the students (not all of them) prepare for it” (Lecturer 1); “Students are lax; they do not prepare and for the weak students who move under the radar the clinical tests are a good indication of who the real weak students are” (Lecturer 3); and “The clinical test allows the full-time staff to assess the very weak student who is always running away from them to part-time staff as it is easier with them” (Lecturer 3). Concerns about the students were highlighted in the following comments: “For the students the clinical tests add additional stress; they become more focused on getting the answers during the clinical test correct and less concerned about their patient” (Lecturer 1); “Students with difficult patients are being disadvantaged; it influences the clinical test” (Lecturer 1); “Students are not able to link theory and practice. When we introduce theory it is foreign; then we expect them to apply it—it is very difficult, even at fourth-year level” (Lecturer 3); and “Pressures of poor laboratory work influence the students’ performance” (Lecturer 1).

The clinical test as an assessment tool was clearly well accepted by the lecturers, and they agreed

that it was evidently more reliable and accurate than the clinical daily grade assessment method. These findings relate well to that of a study referred to by Albino et al.<sup>20</sup> that reported daily grades were poorly correlated with competency exams (a similar principle as in the clinical test of the PRO400). From the findings in our study, it also appeared that there is an improved correlation between clinical test marks and theory marks than between daily clinical marks and theory marks. This finding also related well with the lecturers’ views that the clinical tests were more reliable as a clinical assessment tool than the daily clinical mark. All the lecturers agreed that the theory and clinical assessments in PRO400 were not aligned and suggested that clinical teaching could be improved by linking the theory to the practical application thereof.

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## Discussion

What became clear from the study is that prior to the introduction of clinical tests, there was little or no relation between students’ clinical marks and their theoretical performance in tests and examinations. In most instances, students’ clinical year mark (the average mark that a student obtains during clinical sessions) was higher than their theoretical mark. This would contribute to the training of dental students merely as technicians and not as good clinicians with the ability to reason and solve problems in clinical situations—which seem crucial in community-based health contexts. As clinical reasoning is one of the competencies required from dentists to succeed, students in the PRO400 module inevitably needed to integrate their theoretical knowledge with their clinical skills. By aligning the clinical performance and the theoretical performance, the students would be able to treat their patients with greater competence.

What the study also has shown is the advantage of introducing clinical tests as an additional form of assessment. It involves authentic clinical procedures on real patients, which are commonplace in the dental undergraduate curriculum, thereby encouraging learning “in context.”<sup>36</sup> In PRO400, as with most other undergraduate dental students in this particular dental school, students practice in clinical contexts. These clinics are run by general practitioners assisted by clinicians with expertise in particular procedures; this organization seems to be effective as clinical contexts provide students with the opportunity to treat patients as if they were in actual general dental

practice settings. Irrespective of the clinic, students are required to present a comprehensive treatment plan to address the needs of the patient in a holistic manner. Clinical skills are thus assessed on a continuous basis via the inspection of each step of the work performed (clinical daily grade).

As this study has pointed out, the challenges faced in the continuous assessment of clinical disciplines include the relatively subjective nature of the clinical process and the individual variation between assessors.<sup>1</sup> Macluskey et al.<sup>35</sup> and Plasschaert et al.<sup>36</sup> concluded that continuous clinical assessment can fail to identify those students who are underperforming, allowing them to continue without developing a reasonable level of competence or self-confidence. The clinical tests introduced for all fourth-year dental students as well as formal feedback, which included the discussion of criteria and formats, seemed to have enhanced the teaching and learning processes in the PRO400 course.

Well-defined outcomes and competences, explicit assessment criteria, and informing students of the expected performance levels clearly helped students develop the confidence to take greater responsibility for their own development and personal progress. Harden<sup>8</sup> has emphasized that students should be encouraged to accept some responsibility for assessing their own competence. This justified the setting of clinical tests by full-time prosthodontic faculty members who were familiar with clinical assessment requirements, formal weightings of procedures, and the theoretical knowledge to be assessed with regard to each procedure. Furthermore, what seemed to have paid off in the course of this study was promoting interrater reliability, consistency, and fairness by involving two examiners for each clinical assessment, while new clinical tests were administered by two full-time prosthodontics staff members. To further improve interrater reliability of clinical assessments, examiners were later paired, and the examiners marked students' work independently before conferring with each other.<sup>4,13</sup>

The poor relation between the clinical and theoretical performance of fourth-year students in the PRO400 module were partly explained by this study. The clinical assessment tool that was previously used did not match the aim of the clinical assessments in the module and confirmed the observation by Biggs<sup>9</sup> that surface learning will inevitably be the result if assessments do not clearly reflect the objectives of a curriculum.

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## Conclusion

Three points can be made regarding the findings from this study. First, the quantitative results highlighted the weak correlation between students' performance in the clinical test with their clinical daily grades. It also highlighted a stronger correlation of the students' performance in the clinical tests with their theoretical performance. It can thus be assumed that if prosthodontics students' performance in their clinical tests and theory strongly correlates, then course alignment is stronger. If the same assumption is made that correlation (in quantitative terms) equals alignment, it could also be concluded that the daily clinical performance is not well aligned with the clinical tests or theory.

Second, from the qualitative findings we concluded that perceptions of the prosthodontics faculty members were that clinical daily assessment and theory were nonaligned. However, in their view there was evidently a better alignment of the clinical tests and theory. Clinical tests in this particular case were thus well accepted by the faculty and considered to be more accurate than the allocation of clinical daily grades. What we examined in the clinical test (clinical performance and theoretical application) seems consistent with the outcomes of the particular module, and the clinical daily grade poorly reflects the students' abilities. This seems so because theory is not consistently tested as it is probably influenced by the supervisor's subjectivity (as only one supervisor assesses). However, it may be difficult to disregard the use of clinical daily grades because of time constraints, supervisor availability, students' clinical quotas, and large student classes.

Finally, although the primary aim of introducing the clinical test as an additional clinical assessment method was to better align educational practices in the prosthodontic module, it also appeared to have positively influenced the clinical teachers' behavior to a certain extent. When we explored the faculty members' views about the clinical test, they all reflected on their individual assessment practices. It thus appears that qualitative research approaches within the dental education field could assist and encourage clinical teachers to become more reflective on their teaching. Reflection is an important stage in clinical teachers' professional growth and of major importance in the context of a developing country with public communities where dental students need to be prepared for working in a variety of clinical contexts.

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## REFERENCES

1. Tennant M, Scriva J. Clinical assessment in dental assessment: a new method. *Aust Dent J* 2000;45(2):125-30.
2. Manogue M, Brown G, Foster H. Clinical assessment of dental students: values and practices of teachers in restorative dentistry. *Med Educ* 2001;35:364-70.
3. Pellegrino W, Chudowsky N, Glaser R. Knowing what students know: the science and design of educational assessment. Washington, DC: National Academy Press, 2003.
4. Gravett S, Geysler H. Teaching and learning in higher education. Pretoria: Van Schaik, 2004.
5. Biggs J. Aligning the curriculum to promote learning. Paper presented at Constructive Alignment in Action: Imaginative Curriculum Symposium, LTSN Generic Centre, 2002.
6. Henzi D, Davis E, Hendricson W. North American dental students' perspectives about their clinical education. *J Dent Educ* 2006;70(4):361-77.
7. Epstein R. Assessment in medical education. *New Engl J Med* 2007;356(4):387-96.
8. Harden R. Assess clinical competence: an overview. *Med Teach* 1979;1(6):289-96.
9. Biggs J. What the student does: teaching for enhanced learning. *Higher Educ Res Devel* 2012;31(1):39-55.
10. Brabrand C. Constructive alignment for teaching model-based design for concurrency: a case study on implementing alignment. Paper presented at TeaConc, Aarhus, Denmark, 2007.
11. Houghton W. Engineering subject centre guide: learning and teaching theory for engineering academics. Loughborough: HEA Engineering Subject Centre, 2004.
12. Biggs J. Teaching for quality learning at university: what the student does. 2<sup>nd</sup> ed. London: Open University Press, 2003.
13. Beets PAD. Towards integrated assessment in South African higher education. In: Bitzer E, ed. Higher education in South Africa: a scholarly look behind the scenes. Stellenbosch: Sun Media Publishers, 2009.
14. Botha N. Intercultural space in higher education curricula. In: Bitzer E, Botha N, eds. Curriculum inquiry in South African higher education: some scholarly affirmations and challenges. Stellenbosch: Sun Media Publishers, 2011.
15. Yorke M. Formative assessment in higher education: moves towards theory and the enhancement of pedagogic practice. *Higher Educ* 2003;45:477-5.
16. Cross M. Institutionalizing campus diversity in South African higher education: review of diversity scholarship and diversity education. *Higher Educ* 2004;47:387-410.
17. Cross M, Johnson B. Establishing a space of dialogue and possibilities: student experience and meaning at the University of the Witwatersrand. *S Afr J Higher Educ* 2008;22(8):302-21.
18. Rust C, O'Donovan B, Price M. A social constructivist assessment process model: how the research literature shows us this could be best practice. *Assess Eval Higher Educ* 2005;30(3):231-40.
19. Race P. The art of assessing. *New Academic* 2007;4(3).
20. Albino J, Young S, Neumann L, Kramer G, Andrieu S, Henson L, et al. Assessing dental students' competence: best practice recommendations in the performance assessment literature and investigation of current practices in predoctoral dental education. *J Dent Educ* 2008;72(12):1405-31.
21. Hays R. Assessment in medical education: roles for clinical teachers. *Clin Teach* 2008;5:23-7.
22. Miller G. The assessment of clinical skills/competence/performance. *Acad Med* 1990;65(9):63-7.
23. Gilgun J. Qualitative methods and the development of clinical assessment tools. *Qual Health Res* 2004;14(7):1008-19.
24. Mossey P, Newton J, Stirrups D. Defining, conferring, and assessing the skill of the dentist. *Br Dent J* 1997;182(4):124-5.
25. Hamdy H. Blueprinting for the assessment of health care professionals. *Clin Teach* 2006;3(3):175-9.
26. Wass V, Van der Vleuten C, Shatzer J, Jones R. Assessment of clinical competence. *Lancet* 2001;357:945-9.
27. Norcini J. The mini clinical evaluation exercise (mini-CEX). *Clin Teach* 2005;2(1):25-30.
28. Creswell J. Research design: qualitative, quantitative, and mixed methods approaches. 2<sup>nd</sup> ed. London: Sage, 2003.
29. Gillham B. Case study research method. 2<sup>nd</sup> ed. London: Continuum, 2003.
30. Crafford S, Bitzer E. Consumer learning for university students: a case for curriculum. *Higher Educ Res Dev* 2009;28(4):443-55.
31. Newble D, Dawson B, Daughinee D, Page G, Macdonald M, Swanson D, et al. Guidelines for assessing clinical competence. *Teach Learn Med* 1994;6(3):213-20.
32. Winning T, Lim E, Townsend G. Student experiences of assessment in two problem-based dental curricula: Adelaide and Dublin. *Assess Eval Higher Educ* 2005;30(50):489-505.
33. Bowen J. Educational strategies to promote clinical diagnostic reasoning. *New Engl J Med* 2006;355(21):2217-25.
34. Fugill M. Teaching and learning in dental student clinical practice. *Eur J Dent Educ* 2005;9:131-6.
35. Macluskey M, Hanson C, Kershaw A, Wight A, Ogen G. Development of a structured clinical operative test (SCOT) in the assessment of practical ability in the oral surgery undergraduate curriculum. *Br Dent J* 2004;196(4):225-8.
36. Plasschaert A, Manogue M, Lindh C, McLoughlin J, Murtomaa H, Nattestad A, Sanz M. Curriculum content, structure, and ECTS for European dental schools. Part II: methods of learning and teaching, assessment procedures, and performance criteria. *Eur J Dent Educ* 2007;11:125-36.