Clinical Education of the Nuclear Medicine Undergraduate

PEER REVIEWED PAPER

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ABSTRACT

Introduction: There has been little reported in the literature with respect to the benefits extended to student academic learning by clinical contact despite broad recognition of the role academic learning has in improving clinical learning.

Methodology: A test / retest study design was employed to assess the academic performance of first year Nuclear Medicine students immediately prior to and after their first clinical placement.

Results: Matched pairs of test one and test two scores for each student demonstrated a positive correlation with a correlation coefficient of 0.70. Bland-Altman analysis demonstrated a mean difference between test one and test two matched pairs (Δscore) of 9.1% (95% CI: 4.7% to 13.6%) and 97.4% of differences within the 95% limits of agreement. The paired t test demonstrated statistically significant differences between matched pairs ($P = 0.0002$).

Conclusion: This study provides evidence that clinical learning provides the context in which students can better comprehend theory. There is significant value gained from first year clinical placements of Nuclear Medicine undergraduates to improve academic marks by fostering deeper understanding of key concepts.

INTRODUCTION

Clinical experience for Nuclear Medicine undergraduates plays an integral role in developing student skills and knowledge base in preparation for a 'seamless' transition to professional practice post graduation. The clinical placement offers an environment in which all stakeholders work collaboratively to satisfy the expected graduate attributes.[1]

The introduction of the professional development year (PDY) has changed the educational goals for the Nuclear Medicine undergraduate somewhat given that, rather than preparing students to be competent and qualified practitioners, students are being prepared for the interim stage of PDY technologist. Thus, a decrease in clinical placement demands is not prohibitive of attainment of these educational goals.

Intuitively, students may learn more from clinical placement toward the end of their course when they have acquired increased levels of professionalism and theoretical understanding. Crucial to student education is presenting information within the context that they are applied, facilitating understanding of concepts.[3] The University of Sydney[4] demonstrated an improved clinical performance of second year students in response to an introduction of first year theory aimed at assisting students to conceptualise theory and develop clinical skills more rapidly. Reduced clinical placement hours might be justified for first year clinical placements when the loss in skill development is minimised and by aligning academic teaching strategies to foster deeper understanding of key concepts thereby accelerating clinical skill development. At CSU, clinical education weeks have been reduced from 28 weeks to 24 weeks by halving the first year clinical hours. Likewise, the University of Sydney has halved the first year clinical placement weeks for the 2005 intake. There have been similar trends across the health care industry.

This discussion has been presented from the perspective of academic learning providing benefits to clinical learning. Little has been reported with regard to the benefits clinical learning extends to a students academic progress. Coles[3] reports the value to student education gained from presenting information within the context that they are applied, facilitating understanding of concepts and this was the basis of the University of Sydney[4] strategy to re-assess content delivery in their first year cohort. Coles' principle, however, might be more appropriately applied in reverse where the clini-

cal learning provides the context in which students can better understand the theory. One might question whether a reduction in or delay of clinical placements might negatively impact on the understanding a student gains in theoretical learning which, in turn, might undermine clinical skill development.

The Research Question

Does first year clinical placement for Nuclear Medicine undergraduates improve academic performance?

METHODOLOGY

A quality assurance activity was undertaken with first year Nuclear Medicine students. In preparation for their mid year, four week clinical placement, students were provided academic tuition on the basic principles and practice of Nuclear Medicine consistent with the principles outlined by Adams, Kilburn-Watt and Cowell.[4] In theory, the clinical learning experience would be more fruitful if the student had some basic foundation of academic understanding. Student understanding of these topics was formally assessed by examination in the week preceding the four week clinical placement. Students were offered no formative feedback on examination performance and were not permitted to keep the examination papers.

During the first class following clinical placement (six weeks after the initial exam) students were provided summative feedback on examination performance. Students were asked whether they felt their performance would have been better if the clinical placement was prior to the examination. The general feeling of students is that clinical provided them with better understanding and, for some, understanding of concepts for the first time. As several students articulated, every day on clinical placement they understood another examination question.

Without notice and without opportunity for preparation, the students were given the same examination questions under the same examination conditions. Students were told they were not obliged to undertake the examination and that participation or non participation would not impact negatively on their subject assessment. All students, regardless of their participation, were awarded a final examination assessment mark of their original mark plus the class mean improvement if marks were higher. The original mark would stand if the overall class performance was poorer in the second examination. Only two students (2/40) did not participate in the second examination; one due to illness and the other after withdrawing from the course at the end of clinical placement. Bias was considered where some students may have reinforced their learning by reviewing material after the examination but immediate departure for clinical placement made available time scarce.

The F test analysis of variances was used to determine statistically significant differences within grouped data. Bland-Altman analysis[5] and the paired t test were used to assess agreement between pairs. A P value less than 0.05 was considered significant. Confidence inter-

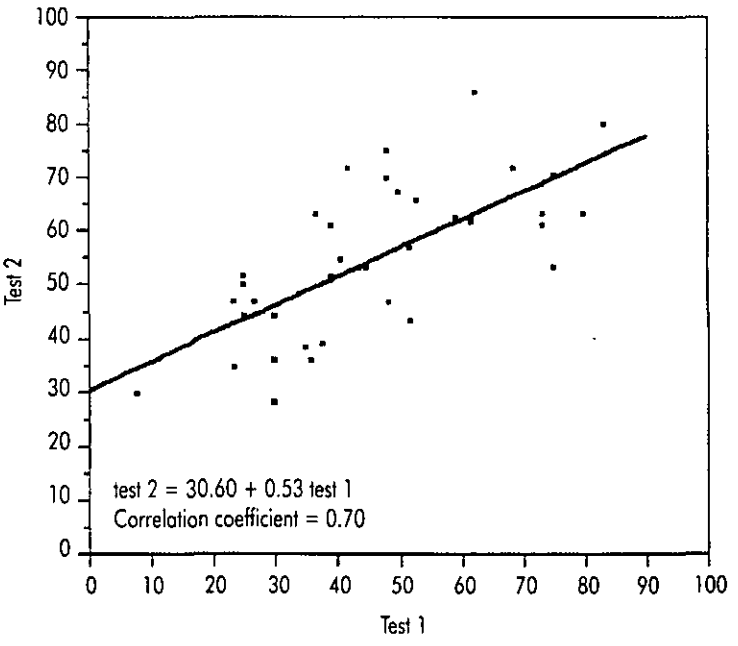

Figure 1: Bivariate fit of test 1 results versus test 2 results showing a positive correlation (P < 0.001).

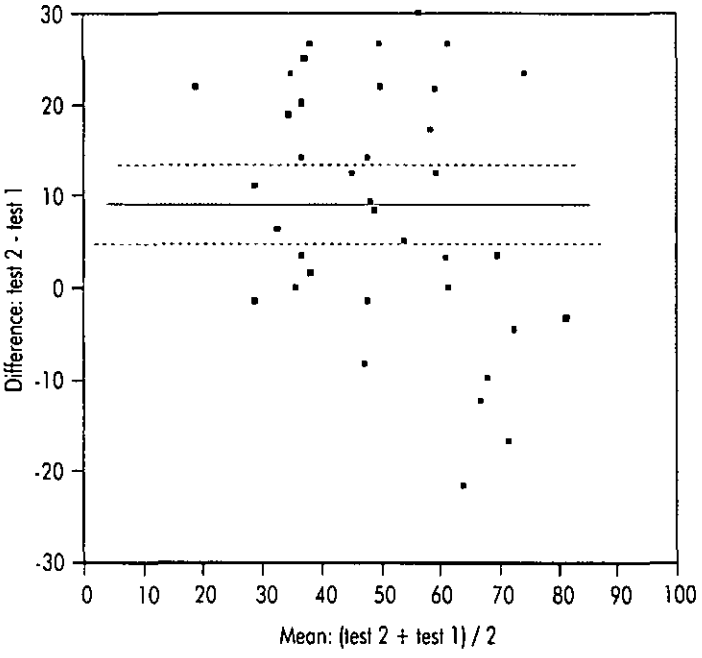

Figure 2: Bland-Altman analysis of test one and test two matched pairs.

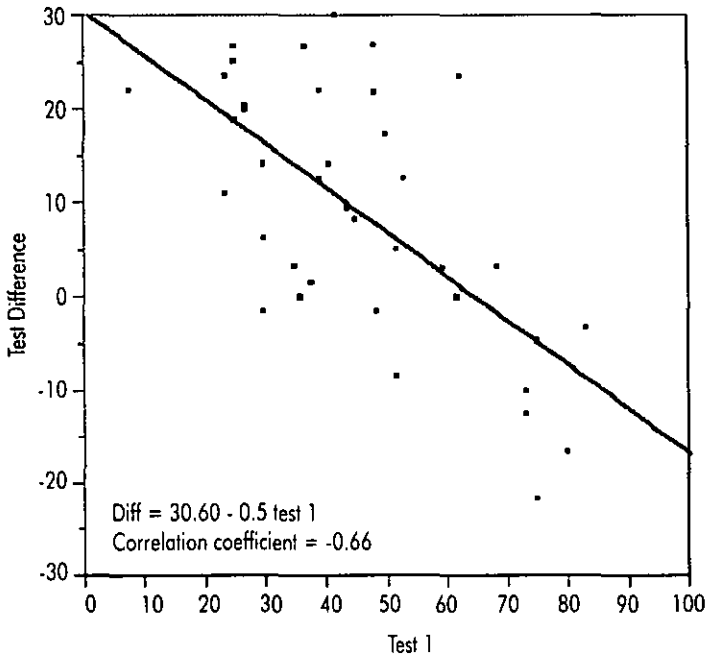

Figure 3: Bivariate fit of Δscore versus test one scores. vals (CI) were employed with 95% confidence.

differences were noted for student GPA, UAI/TER and test one scores while no statistically significant difference was noted for test two scores and gender (Table 1). As expected, a statistically significant difference was noted between the mean Δscore for negative values (-7.3%) compared to positive values (15.8%) ($P < 0.0001$). Similarly, a statistically significant difference was noted between the mean Δscore for values less than or equal to the mean Δscore of 9.1% (-2.8%) compared to values greater than 9.1% (19.8%) ($P < 0.0001$).

Table 1: Summary of variables stratified according to direction of Δscore (positive or negative. One should note that zero was treated as negative Δscore. 95% confidence intervals are expressed in parenthesis. P values represent significance of the statistical difference for values tabulated in adjacent columns.

	Negative Δ score	*P* value	Positive Δ score
Mean GPA	4.9 (4.0 - 5.8)	= 0.07	4.1 (3.8 - 4.4)
Mean UAI/TER	79.1 (73.5 - 84.8)	= 0.023	72.3 (66.6 - 78.0)
Test 1 (%)	62.5 (50.1 - 74.9)	= 0.0015	38.6 (33.1 - 44.1)
Test 2 (%)	♂ 55.2 (44.8 - 65.5)	= 0.87	♂ 54.4 (48.9 - 59.9)
Gender (%)	= 54.5 = 45.5	= 0.91	= 55.6 = 44.4
Mean Δ score	-7.3 (-12.2 - -2.4)	< 0.0001	15.8 (12.4 - 19.3)

RESULTS

Matched pairs of test one and test two scores for each student demonstrated a positive correlation with a correlation coefficient of 0.70 (Fig. 1). The correlation coefficient, however, does not provide an adequate insight into the relationship between matched pairs. Bland-Altman analysis was performed (Fig. 2) to examine the relationship between differences in matched pair scores and the mean test score of individuals. The Bland-Altman analysis demonstrated a mean difference between test one and test two matched pairs (Δscore) of 9.1% (95% CI: 4.7% to 13.6%) with a range of -21.7% to 30%. A positive Δscore indicates that test two was greater than test one. The 95% limit of agreements included 97.4% of data points, however, the paired t test demonstrated a statistically significant difference between matched pairs ($P = 0.0002$).

A weak negative correlation (correlation coefficient = -0.32) was shown between Δscore and the student grade point average (GPA) ($P = 0.051$). A weak negative correlation (correlation coefficient = -0.30) was also shown between Δscore and the student university admission index (UAI) / tertiary entrance ranking (TER) ($P = 0.08$). The mean Δscore was 9.3% for males and 9.1% for females although no statistically significant difference was noted ($P = 0.96$). While no statistically significant correlation was noted between Δscore and test two scores ($P = 0.64$), a statistically significant negative correlation was noted between Δscore and test one scores ($P = 0.0001$) (Fig. 3). This finding suggests lower test one scores are associated with greater improvement in test two.

In an attempt to identify predictors of students benefiting academically from clinical placement, GPA, UAI/TER, gender, test one scores and test two scores were stratified as a negative Δscore or positive Δscore (zero was treated as negative). Statistically significant

DISCUSSION / CONCLUSION

While the mean improvement in individual scores for the test/retest was 9.1%, not all students demonstrated an improvement in results. In 22.5% (9/40) of students, results were lower for the retest. Some performances were inhibited because their clinical placement did not reinforce their understanding of specific topics. For example, some departments only perform basic procedures while paediatric departments infrequently perform many adult procedures, limiting potential advantage to the student in the majority of examination questions.

Despite students performing well in the original test also performing well in the retest, a negative Δscore was shown to correlate with higher test one scores ($P = 0.0015$). This finding supports the proposition that some students are well adapted to learning theory academically, relying on study and revision to prepare and refresh for examination; a luxury denied by this test/retest scenario. On the other hand, the majority of the student cohort relies on clinical practice to reinforce, or perhaps to understand for the first time, the theory

taught in class. This prompted an evaluation of relationships between Δscore and student UAI/TER and GPA. While no statistically significant correlation was demonstrated between student UAI/TER and GPA, each was independently predictive of Δscore (P = 0.0008 and 0.02 respectively) with those students having a lower UAI/TER and / or GPA most likely to demonstrate improved academic results following clinical placement.

This study demonstrates that clinical learning provides the context in which most students can better understand theory, potentially facilitating more rapid development of clinical skills. There is significant value in first year clinical placements for Nuclear Medicine undergraduates at CSU to improve academic marks via fostering deeper understanding and reinforcement of theory. This may provide a 'flow on' effect, improving clinical skill development in subsequent clinical placements, further reinforcing academic understanding.

REFERENCES

1. Wotton, K & Gonda, J 1999, Redesigning clinical experience for undergraduate nursing students: an innovative model, HERDSA Annual International Conference, July, Melbourne.
2. Hughes, C 1998, *Practicum learning: perils of the authentic workplace, Higher Research and Development*, vol. 17, no. 2, pp. 229-239.
3. Coles, C 1989, T*he role of context in elaborating learning, in Learning in medical schools: a model for the clinical professions*, eds. J, Balla, M, Gibson, A, Chang, University Press, Hong Kong.
4. Adams, E, Kilburn-Watt, E & Cowell, S 1998, The earlier the better: an evaluation of changes to teaching year 1 nuclear medicine, *J Nucl Med Technol*, vol. 26, no. 4, pp. 278-282.
5. Bland, J & Altman, D 1986, S*tatistical methods for assessing agreement between two methods of clinical measurement*, Lancet, vol. 8, no. 1, pp. 307-310.