Formative assessment promotes learning in undergraduate clinical clerkships

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Introduction. Clinical clerkships, typically situated in environments lacking educational structure, form the backbone of undergraduate medical training. The imperative to develop strategies that enhance learning in this context is apparent. This study explored the impact of longitudinal bedside formative assessment on student learning in a medical clerkship.

Methods. We studied a class of 4th-year students completing a 14-week medical clerkship at the University of Cape Town in South Africa. Clinician educators assessed student performance during weekly bedside teaching sessions using blinded patient encounters (in which students had no prior knowledge of the patient's diagnosis or access to the clinical records). Student feedback was standardised using performance rating scales. The impact of formative assessment on student learning was determined from questionnaire responses.

Results. A total of 575 formative assessments took place during the study period. Students perceived blinded patient encounters to be a valuable learning activity that improved their clinical reasoning skills and assessed progress fairly. They reported that feedback helped inform them of their level of competence and learning needs, motivated them to read more, and significantly improved their participation in patient-centred learning activities. Participating clinicians agreed that this formative assessment strategy enhanced the learning potential of bedside teaching sessions.

Conclusions. Longitudinal formative assessment, using blinded patient encounters, was successfully integrated into undergraduate clerkship bedside teaching. According to both students and staff this assessment strategy enhanced bedside learning and improved student participation in patient-centred learning activities during the clerkship.

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Clinical clerkships form the backbone of undergraduate medical education. Unfortunately these apprenticeship attachments are often poorly structured and of variable learning value.[1] Furthermore, patient encounters frequently fail to provide opportunities to exercise clinical reasoning skills, a core outcome of training, because students usually encounter patients who have already been assessed by the attending staff. Students may therefore not engage in sufficient problem-solving activities to develop the expected level of clinical reasoning expertise.[2]

Educational practices that improve clerkship learning in authentic health care settings are clearly needed. A strategy that may provide students with better-quality authentic problem-solving activities is the use of 'blinded' patient encounters in which students interview and examine patients without access to their clinical records.[3]

Feedback, the critical element of formative assessment, may also enhance clerkship learning[1] by informing students of their progress, advising them regarding learning needs, and motivating them to engage in learning activities.[4] While the rationale for feedback is clear, objective evidence that the desired outcomes are achieved in the clinical clerkship context is lacking.

Review of undergraduate clinical clerkships at the University of Cape Town (UCT) found that poorly structured formative assessment often resulted in academically weak students being unaware of their limited competence and usually not seeking assistance during clerkship attachments. In addition, students mostly engaged in patient encounters after consulting patient records. These findings, similar to international experience, prompted the implementation of a bedside formative assessment (BFA) strategy in the revised MB ChB programme launched in 2002. This article describes staff perceptions of the utility and educational value of this strategy in a resource-constrained setting, and student perceptions of the impact of this strategy on clerkship learning.

Methods

Participants

Fourth-year students completing a 14-week Medicine clerkship in 2 training hospitals (rotation A or B) during 2002 participated in the study. Clinician educators, all specialist physicians with at least 5 years of teaching experience, conducting weekly bedside teaching sessions, were invited to participate in the study.

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Student name and number:										**Assessed by:**
Date when case seen:										**Signature of tutor:**
Clinical problem addressed:										**Date:**
										Final grade:
Clinical diagnosis made:										*Please complete the diagnostic assessment below and award a final overall mark for the presentation*
	POOR			**ADEQUATE**			**GOOD**			**SPECIFIC COMMENTS**
BASIC CLINICAL SKILLS The student is able to report a coherent, concise history of the presenting complaint and other relevant information.	1	2	3	4	5	6	7	8	9	
The student is able to report the important, relevant clinical examination findings concisely and coherently.	1	2	3	4	5	6	7	8	9	
DIAGNOSTIC REASONING SKILLS The student is able to identify, interpret and use the relevant clinical information to synthesise a pathophysiologically plausible clinical diagnosis, presented as a concise, coherent clinical assessment.	1	2	3	4	5	6	7	8	9	
KNOWLEDGE The student is able to discuss a plan of investigation, selecting cost-effective tests /procedures. The student should be able to discuss the likely or actual results of such investigations.	1	2	3	4	5	6	7	8	9	
The student is able to discuss a treatment plan for the clinical problem presented. The student should understand the basis of treatment suggested.	1	2	3	4	5	6	7	8	9	

Fig. 1. University of Cape Town Department of Medicine Clinical Clerkship Formative Assessment Feedback Form – bedside presentation.

Implementation

Clinician educators who volunteered to participate in the study attended 2 workshops in which the principles and purpose of formative assessment were discussed and a structured feedback form (Fig. 1) was designed. Participating clinician educators selected observed blinded patient encounters (BPEs) as the preferred BFA strategy.

During clerkship attachments students participated in 3 bedside teaching sessions per week. These small-group activities focused on patient encounters presented by students. Formative assessment was integrated into 1 bedside teaching session per week. Students undertook directly observed BPEs during a bedside teaching session. Clinician educators provided feedback at the end of each session. Performance ratings did not contribute to the end-of-year summative assessment score.

Study outcomes

The study outcomes were grouped into 2 broad categories, viz. students' perceptions of: (*i*) the educational value of BPEs;

(*ii*) the role of feedback in promoting learning; and (*iii*) the impact of BFA on learning behaviour; and staff perceptions of the feasibility and educational value of BFA. Students and staff completed anonymous self-administered questionnaires in which responses were rated using a 5-point Likert scale. Students also submitted a record of the number of BFA events undertaken. In addition, student performance was recorded in the final summative assessment process, which included 4 observed real patient encounters, a written examination and a structured portfolio interview.

Data analysis

Data were entered onto Excel spreadsheets and analysed using Statistica 6 software (StatCalc Inc, Tulsa, USA). Differences in means were tested using the Mann-Whitney *U*-test. Confidence intervals (CIs) were set at 95%. Differences in categorical variables were tested by chi-square analysis. Statistical significance was set at $p \leq 0.05$. Questionnaire responses were grouped into 2 categories, viz. Agree, which included 'Strongly agree' or 'Agree' responses, and Disagree, which included 'Disagree' or 'Strongly disagree' responses.

Results

Participants

The demographic and academic profile of students ($N = 155$) in the 2 rotations did not differ significantly. Seventeen of 36 physician educators (47.2%) volunteered to participate in the study; a greater number (11 of 17 v. 6 of 19) were attached to rotation A hospitals ($p = 0.047$).

Questionnaire response rates

Completed questionnaires were returned by 135 students (87.1%) and 13 staff members (76.5%). Reports of the number of BFA events undertaken were submitted by 130 students (83.9%).

Implementation of BFA

Over 14 weeks students undertook a mean (95% CI) of 4.4 (4.1-4.8) BFA events. Rotation A students engaged in more events (5.7 (5.3 - 6.1)) than rotation B students (3.2 (2.8 - 3.6)) ($p < 0.0001$). On average, BFA events were completed per bedside teaching session; this did not differ significantly between groups.

Analysis of outcomes

Educational value of BFA. Most students (95.6%) recognised the learning value of BFA, reported that BPEs had improved their clinical reasoning skills (88.2%), and agreed that BPEs were a fair way of assessing in-course progress (62.8%). Rotation A students more often expressed the latter opinion (85.3% compared with 65.7%, $p = 0.008$) (Fig. 2).

Role of feedback in promoting learning. At least 70% of students acknowledged the informative, advisory and motivational role of feedback (Fig. 2). Knowledge of own competence was the only factor that differed significantly between rotations A and B; 79.4% compared with 61.2% ($p = 0.02$).

Impact of BFA on learning behaviour. More than two-thirds of students reported an increase in preparatory reading for bedside teaching sessions (71.9%) and patient clerking using the blinded encounter technique (69.6%). Changed learning behaviour, both preparatory reading (79.4% v. 64.2%, $p = 0.049$) and the use of blinded clerking (80.9% v. 58.2%, $p = 0.004$), was more frequently reported by rotation A students.

Feasibility and educational value of BFA. Most participating clinician educators agreed that assessment could be satisfactorily integrated into bedside teaching sessions (Fig. 3). They acknowledged the educational value of longitudinal structured formative assessment and endorsed the use of BPEs as a valid way of monitoring student progress during clerkships.

Student performance in the final summative assessment process. Student performance in the final composite summative assessment process did not differ significantly between groups A and B.

Discussion

Within resource-constrained environments, typical of developing-world countries, the utility of educational innovations is largely determined by the balance achieved between the resource demands of the method and the perceived benefits thereof. This study shows that longitudinal in-course formative assessment, with immediate feedback, can be successfully implemented in a resource-constrained setting. While the use of workplace-based multiple real patient encounters is an increasingly popular formative assessment strategy in the developed world,[5] descriptions of its use in the developing world are lacking. The strategy described in this paper did not require any additional staff resources and was successfully integrated into an existing bedside teaching programme.

This article also expanded on existing work by exploring students' perceptions of the impact of this type of assessment strategy on clerkship learning. Students readily appreciated the learning value of formative assessment, in particular the role of feedback in informing them of their own level of competence and guiding them regarding personal learning needs. The vast majority also attributed an improvement in clinical reasoning skills to the use of BPEs, the basis of the assessment strategy. This represents a better student appreciation of the educational value of this strategy than previously reported,[3] and highlights the importance of determining perceptions within specific contexts of implementation rather than assuming similar perceptions worldwide.

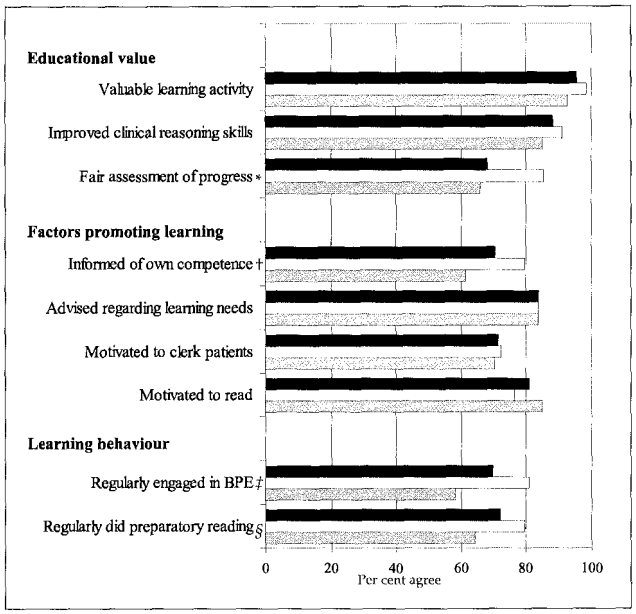

*Fig. 2. Perceptions of 4th-year medical students (N = 135) at the University of Cape Town regarding the educational value and learning impact of bedside formative assessment using blinded patient encounters. ■ = All students, □ = Rotation A students, ▒ = Rotation B students. Chi-square analysis: *p = 0.008, †p = 0.02, ‡p = 0.004, §p = 0.05.*

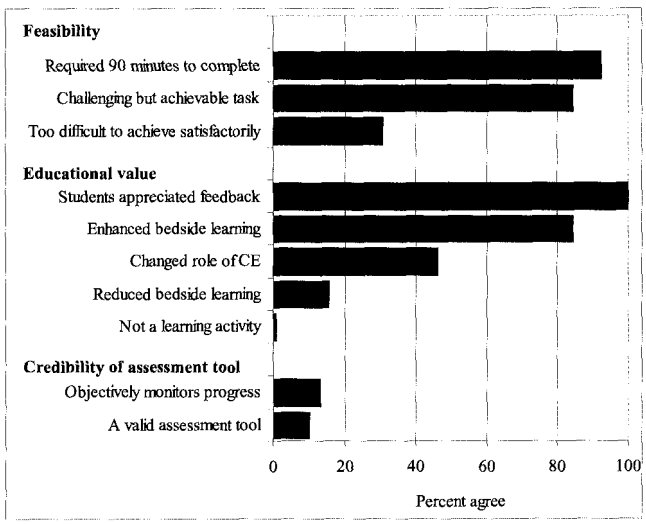

Fig. 3. Perceptions of clinician educators (N = 13) at the University of Cape Town regarding the feasibility, educational value and credibility of 4th-year medical student bedside teaching sessions in which formative assessment and learning activities were integrated (CE = clinician educator).

Owing to the voluntary staff recruitment design of the study, students in rotation A were exposed to significantly more formative assessment events. Interestingly, these students considered themselves better informed of their own level of competence. This suggests that knowledge of own competence may be a key mechanism by which feedback impacts on learning. This observation, not previously reported in the clerkship learning context, is congruent with Albert Bandura's social cognitive theory,[6] in which he proposed that people's perception ('self-efficacy') of their own ability to deal with different situations is central to their actions.

Furthermore, our study suggests that formative assessment may impact on student learning behaviour. Again, the impact was more frequently reported by students who undertook more formative assessment activities. While summative assessment clearly drives student learning behaviour,[7] this has not been previously documented for clinical formative assessment strategies. Although the use of student opinion as a measure of changed behaviour is a recognised limitation of the study, the significant difference reported supports the conclusion.

Most clinician educators participating in this study recognised the educational value of the assessment strategy and reported successful integration thereof into bedside teaching sessions. Importantly, almost half reported a change in role from 'teacher' to 'facilitator of learning'. This fundamental change, a basic tenet of current adult learning theories,[8] represents a remarkable shift within 1 academic year. While these clinicians account for only one-third of all staff teaching in the course, and therefore probably represent the enthusiastic end of the spectrum, the findings do suggest that changing perceptions may be detectable early on when educational initiatives are introduced. A larger cohort of clinician educators would need to be studied to confirm this finding.

Finally, a major concern regarding this study was that valuable bedside teaching time would be used for assessment and feedback. While the final results demonstrate that student performance was not adversely influenced, it could be argued that formative assessment is of little value since it did not improve academic performance. Caution should be exercised when making this statement. The inability of this study to demonstrate a relationship between feedback and better academic performance may reflect the lack of a true control group in the study, the bias of the summative assessment composition (focus on knowledge acquisition rather than clinical competence) or a need for more sustained feedback before a measurable impact on performance can be expected to be observed.

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