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Implementing Formative Assessment at the Workplace: A Contribution to the Students' Achievement

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Abstract: Nurturing formative assessment at the workplace is worthwhile to enhance students' learning in real performance. Mini Clinical Evaluation Exercise (mini-CEX) is a work based assessment conducted at the community clinic during Family Medicine posting at the Faculty of Medicine of The National University of Malaysia. As part of formative assessment, students would be given immediate feedback after performing the first mini-CEX to improve their performance in the following mini-CEXs examination.

This study was designed to evaluate the final year medical students' achievement in formative assessment at the workplace.

A quasi-experimental with repeated intervention methodological design by analysing a the scores of a group of 232 final year medical students who performed in mini-CEX 1 without receiving a feedback (intervention), and the scores after receiving a feedback in mini-CEX 2 and mini-CEX 3. This study was conducted at the Family Medicine Department in Faculty of Medicine, The National University of Malaysia. The data were analysed using the Statistical Package for the Social Sciences (SPSS) Version 19.0. A One-Way Repeated Measures ANOVA was conducted to compare mean scores in three mini CEXs (mini-CEX 1 and mini-CEX 2 and mini-CEX 3).

The mean score of the students' achievement was 5.35±0.84 on the mini-CEX 1; 5.8±0.82 on the mini-CEX 2; and 5.79±0.78 on the mini-CEX 3. The ANOVA showed that the mean scores were significantly different, $F(2,462) = 34.36$, $p<0.0005$). Further analyses showed that there were significant improvement of the students' achievement in mini-CEX 2 or mini-CEX 3 compare to mini-CEX 1 ($p<0.0005$). However, result showed a non-significant improvement between mini-CEX 2 and mini-CEX 3.

We concluded the element of feedback at the end of mini-CEX's in the formative assessment may contribute to the improvement of the students' achievement. The authenticity of the mini-CEX assessment and the reliability of the mini-CEX scores might explained to the poor students' achievement. Further analyses are critical to explore the content of the feedback and its relation to the students' achievement.

Keywords: Formative assessment; Work-based assessment; Mini-Clinical Evaluation Exercise; Feedback

Introduction

Formative assessment

Formative assessment is an important component in the medical curriculum to measure clinical competencies among undergraduate medical student. Formative assessment is defined as utilizing the judgement on student performance during assessment to improve student competency (Sadler 1989). Student learning may be assisted, perhaps through feedback. Information generated through feedback may enhance learning to both the lecturers and the students.Ilgen and Davis (2000) and Kluger and DeNisi (1996) proposed the combination of formative assessment and feedback should be merge for better effect.

Mini-Clinical Evaluation Exercise (mini-CEX)

Medical competencies can be achieved by testing the ability of medical student in integrating knowledge, skills and attitude (Daelmans *et al*. 2004). The mini-CEX assessment entailed direct observation by an examiner of a student's performance in real clinical setting such as clinics and wards. The element of feedback is a crucial part at the end of mini-CEX to augment the educational impact to the students. Providing feedback is deemed valuable to improve trainee's performance (Norcini and Burch 2007). Both lecturer and student would identify strengths, areas for development and suggest an action plan.

Mini-CEX assessment process during Family Medicine Posting

Mini-CEX is a work-based assessment and a part of formative assessment to promote students learning in their clinical performance. Students are required to demonstrate their cognitive skills, patients' examination skills or communication skills related to the task. Students' knowledge and skills in term of diagnostic or therapeutic decisions would be assessed by family physicians as examiners. Each student will be given different case or task and assessed by different examiners. The score will be given based on the standardised mini-CEX form. Students will be given a feedback as part of formative assessment after performing the first mini-CEX to improve their performance in the following mini-CEXs examinations.

Objectives

The objective of this study was to evaluate the final year medical students' achievement in formative assessment at the workplace.

Material and Methods

A quasi-experimental with repeated intervention methodological design by analysing a the scores of a group of 232 final year medical students who performed in mini-CEX 1 without receiving a feedback (intervention), and the scores after receiving a feedback in mini-CEX 2 and mini-CEX 3. This study was conducted at the Family Medicine Department in Faculty of Medicine, The National University of Malaysia.

The data were analysed using the Statistical Package for the Social Sciences (SPSS) Version 19.0. A One-Way Repeated Measures ANOVA was conducted to compare mean scores in three mini CEXs (mini-CEX 1 and mini-CEX 2 and mini-CEX 3).

Results and Discussion

Table 1. Descriptive Statistics

	Mean	Std. Deviation	N
Mini CEX 1	5.35	.84	232
Mini CEX 2	5.80	.82	232
Mini CEX 3	5.79	.78	232

Table 2: Mauchly's Test of Sphericity

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Mini CEX	.990	2.304	2	.316	.990	.999	.500

Table 3. Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Mini CEX	Sphericity Assumed	30.196	2	15.098	34.357	.000	.129
	Greenhouse-Geisser	30.196	1.980	15.248	34.357	.000	.129
	Huynh-Feldt	30.196	1.997	15.118	34.357	.000	.129
	Lower-bound	30.196	1.000	30.196	34.357	.000	.129
Error(Mini CEX)	Sphericity Assumed	203.024	462	.439			
	Greenhouse-Geisser	203.024	457.441	.444			
	Huynh-Feldt	203.024	461.377	.440			
	Lower-bound	203.024	231.000	.879			

Table 4. Pairwise comparisons

Mini CEX	Mini CEX	Mean Difference	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-.445*	.059	.000	-.561	-.330
	3	-.438*	.064	.000	-.564	-.313
2	1	.445*	.059	.000	.330	.561
	3	.007	.062	.911	-.115	.129
3	1	.438*	.064	.000	.313	.564
	2	-.007	.062	.911	-.129	.115

The mean score of the students' achievement was 5.35±0.84 on the mini-CEX 1; 5.8±0.82 on the mini-CEX 2; and 5.79±0.78 on the mini-CEX 3 (Table 1). A non-significant result showed in the Mauchy's Test of Sphericity ($p>0.05$) (Table 2). The ANOVA showed that the mean scores were significantly different, $F(2,462) = 34.36$, $p<0.0005$) (Table 3). Further analyses showed that there were significant improvement of the students' achievement in mini-CEX 2 or mini-CEX 3 compare to mini-CEX 1 ($p<0.0005$). However, result showed a non-significant improvement between mini-CEX 2 and mini-CEX 3 (Table 4).

Discussion

Improvement in students' achievement in mini-CEX

Compulsory feedback session is one of the crucial elements at the end of mini-CEX assessment. The students might have wrong interpretations to their performances without feedback. Feedback received at the end of mini-CEX 1 could be beneficial to the students in order to perform better in their respective mini-CEX. It was support by Sadler (2010) regarding the importance of feedback in formative assessment. During the feedback session, information about the discrepancies between the students' performances and the lecturers' expectations and a manner to lessen the discrepancies would be discussed. Feedback given by the assessors provide insights to the students on their clinical strengths and weaknesses (Burch *et al*. 2006). Giving feedback should be constructive in order to lead to a positive reaction from the students. Regular workshops as part of staff development activities were conducted to train the lecturers to improve their skills in giving feedback. They had been exposed on the theoretical aspect of giving feedback and participated in role-play activities. Based on these, the impact of training to the lecturers can be further improved by focusing more on their roles as examiners and evaluators. Lecturers also had been exposed on the strategies, types and techniques of giving feedback from the literature. Role-plays activities related the theories with the actual simulated scenarios followed by comment and discussion to improve the individual skills. However, the workshop could be improved by including students' perception on the content of the feedback during the training. Perhaps, direct student involvement during the role play may provide a better scenario.

In medical education, Pendleton's Rules which encouraging interactive feedback were used as conventional method of feedback (Chowdhury and Kalu 2004; Pendleton *et al*. 1984). Even though this study had shown a promising result in term of students' improvement, systematic review had found that there is no direct effect between feedback and work-based assessments (Saedon *et al.* 2012). There were few other factors that might be contributed to the result. Firstly, the element of teaching and learning in the family medicine posting such as lectures, seminars and clinical attachment during daily practice clinic with their respective supervisor may give a positive improvement to students' performance. Secondly, some group of students had already been exposed and trained in their previous posting before entering the family medicine posting. There were some possibilities that those student may get a similar cases during mini-CEX which they already learned from the previous postings.

Authenticity and Reliability of the work-based assessment

The results showed a non-significant improvement between mini-CEX 3 and mini-CEX 2. There are a few possibilities that may explain to the result. Firstly, the advantage of authentic work-based assessment had exposed the student into real clinical setting. Mini-CEX may produce high authenticity rate because the case assigned to the students are purely dependable on the patients who seek treatment at the community clinic on the examination day. However, students' result in each mini-CEX are varied despite of feedback intervention because of poor standardization on the case complexities. Feedback intervention given after each mini-CEX might be only can fully utilized by the student related to the specific case discussed. Those students who performed on task that was considered easy cases may performed better compared to when they got a moderate or difficult cases in another mini-CEX. Carr (2006) agreed that implementing

mini-CEX requiring more planning and scheduling into either clinic to reduce significant effects on clinical service.

Secondly, the reliability of the mini-CEX assessment may influence the result. Including scores in mini-CEX may contribute to low reliability (Norcini *et al.* 2003). Reliability refers to the precision of measurement or the reproducibility of the scores obtained with the examination (Van der Vleuten 2000). There were few possible factors that may jeopardize the reliability in the work-based assessment. Firstly, clear and explicit scoring items in the checklist could avoid the examiners from making subjective decisions about the students' competencies. Without proper scoring checklist, it could increase the examiners' subjectivity towards the students. Development of objectives and structured checklist could minimize the subjectivity and enhance the inter-rater reliability among examiners (Newble 2004). Current checklist in mini-CEX only contained rating scale for the lecturers to choose which are excellent, good, satisfactory, borderline or fail for each parameters of clinical competencies. However, the lecturers still need to give scores on the students' performance for purpose of continuous assessment. Subjective judgments on rating scale may increase a variation of scores among the examiners. However, the subjectivity could be improve by introducing marking rubric in each rating scale.

Thirdly, all lecturers were involved in the postgraduate master student teaching at the community clinic. Ideally, level of expectations toward undergraduate students should be lower than postgraduate students on the similar cases. However, there was a possibility for some examiners to have high-level of expectation towards the undergraduate students. Different levels of expectation exposed the assessment to the poor inter-rater reliability (Besar *et al.* 2012). A borderline candidate could either pass or fail after being rated by two different examiners. Poor inter-rater reliability could be considered intrinsically unfair to the students (Bould *et al.* 2009). It may occur despite of having standardized and structured scoring checklist. Wilkinson *et al.* (2003) found that standardizing the examiners had more significant effect to improve inter-rater reliability compared with improving the task and scoring checklist. Kottner and Dassen (2008) defined inter-rater reliability as a specific aspect of reliability referring to the degree of measurement error due to bias caused by different raters or observers rating the same person or object. Good inter-rater reliability among examiners should be maintained to improve the reliability. Having a series of examiner training prior to assessment might overcome the problem. Research suggested that examiner training could improve the inter-rater reliability. Examiners training is an essential component to ensure the reliability (Khera *et al.* 2005). The objectives of the training include reviewing the assessment process, scoring checklist and align the examiners' expectations to improve the inter-rater reliability.

Conclusions

We concluded that the element of feedback at the end of mini-CEX's in the formative assessment may contribute to the improving of the students' achievement. The authenticity of the mini-CEX assessment and the reliability of the mini-CEX scores might explained to the poor students' achievement. Further analyses are critical to explore the content of the feedback and its relation to the students' achievement.

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