

Original Research Article

Self-monitoring in third year medical students' haematology clerkships

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ABSTRACT

Background: Self-monitoring by medical students is important for continued learning and development. It results in self-awareness and improved performance. It requires self-motivation, attentiveness and curiosity. However, students don't have skills for self-monitoring when they enter university. These need development. The objective of the study was to evaluate the use of an online formative assessment, on subsequent summative examination performance in haematology clerkships among third-year medical students.

Methods: Results of a formative, multiple choice question (MCQ) quiz were correlated with results of end of clerkship (EOC) summative examinations (free-response short-answer progressive disclosure questions-PDQ, and spotter-MCQ). t-ratio was calculated between students who took the quiz (responders) and non-responders. Descriptive statistics, Pearson correlations (r), and Chi square (χ^2) were performed.

Results: Of 241 students 75 (31.1%) took the quiz. t-ratio was 1.864 ($P>0.05$). Mean scores for EOC were higher for responders. Failure rate was higher for non-responders. Between the EOC-PDQ and EOC-spotter, for the whole group ($N=241$), $r=0.414$, for non-responders, ($N=166$), $r=0.376$, and responders $r=0.473$. For the responders, correlations between the quiz and PDQ, $r=0.376$, and between quiz and spotter, $r=0.222$. χ^2 was significant at $P<0.05$.

Conclusions: Quiz exercises are useful self-monitoring strategies. However online exercises require self-motivation. Students may not wish to do exercises that don't count for summative scores. They should be encouraged to engage in these learning exercises. Timing is important. For the majority of students, the quiz was done the same week as PDQ for another course. Students chose to prioritize and concentrate on the summative PDQ. These exercises in themselves, would be useful time management lessons.

Keywords: Correlations, Formative assessment, Quiz, Self-monitoring

INTRODUCTION

Self-monitoring is an important part of doctors' activities and needs to be cultivated among medical students. It has been well defined by researchers. "Refers to the ongoing habit of seeking, integrating, and responding to both external and internal data about one's performance".¹ It is characterized by self-reflection, and self-auditing: "An ability to attend moment to moment, to our own actions; curiosity to examine the effects of those actions; and

willingness to use those observations to improve behavior and patterns of thinking in the future".¹ Students need to monitor their studies and study habits and not just rely on external feedback from teachers. However, when they enter university they do not have this skill and they need to be taught and encouraged to self-monitor and critically reflect on their own learning.² External feedback eg. from teachers can offer useful information about people's performance, however this feedback may not necessarily guide ongoing self-monitoring: the responsibility at the end of the day is up to individuals.¹ Self-awareness

results in behavioural changes that improve performance.¹ Indeed self-awareness has been described to facilitate cognitive processes in the subcortical brainstem region which is important in establishing alertness, motivation, decision making and interpersonal interactions, and memory retrieval.¹

Students use different study strategies: eg. re-reading and cramming material, study partners and study groups, and self-testing.³ Re-reading and self-testing were shown to be positively associated with Grade point average, as was scheduling of study time.³ Quiz exercises evaluate how well students know the course content, and also enhance learning itself.³ Ramirez showed an improvement in test scores in a Physiology course, after a self-assessment online multiple choice question (MCQ) exercise.⁴ Students were able to direct and focus their studies and strengthened their weaker aspects. This study looks at use of an online MCQ quiz as a self-monitoring exercise among third-year medical students during haematology clerkships. It uses the quiz exercise, (with the feedback being given as scores), as an example of self-assessment of knowledge (in preparation for summative examinations). Is the, voluntary, formative, online quiz exercise a useful strategy and does it help in the students' performance in subsequent summative scores or are there other factors that play a part?

Throughout the academic year (third year), students do clerkships where they rotate through the different sub-specialties of the department of para-clinical sciences, i.e. Anatomical pathology, Chemical pathology, Haematology, Immunology, and Microbiology every four weeks. (Para-clinical sciences bridge the gap between the pre-clinical years i.e. years 1 and 2, and the clinical years, i.e. years 4 and 5). At the end of each rotation they take end of clerkship (EOC) examinations which constitute part of their final course grade. At the same time, students take two other courses in semester-1 and one other course in Semester-2 (delivered by a hybrid of didactic lectures and problem-based learning: PBL). At the end of these other three courses students take a summative progressive disclosure questions (PDQ) examination, which integrates all the sub-specialties involved in PBL (as above, and including Pharmacology and Public Health).⁵ At the end of each semester are final end of course examinations.^{6,7}

These are fully packed courses and there is limited time Face-to-Face to deal with all issues and students are encouraged to seek their lecturers for help. Generally, students who are noted to approach staff for help voluntarily are the students who are already high-achievers.⁷ An online self-monitoring quiz was thus created. This exercise was hoped to encourage students to engage more, especially the low-achieving students. (All students have access to a computer and my-elearning. Students have no previous formal on-line quiz exercises in para-clinical sciences. Furthermore, clerkships only start from third year).

The objective of the study was to evaluate the use of an online formative assessment on subsequent, summative examination performance in haematology clerkships among third-year medical students.

METHODS

Approval was obtained from the university's Faculty of Medical Sciences Ethics Committee and the office of The Dean. Third-year students in the academic year 2014-2015, took a non-compulsory, self-monitoring, online (my e-learning), MCQ quiz (for formative purposes only), a few days to a week before their paper-based EOC haematology examination (spotter-in MCQ format, (same format and style as the online quiz), and PDQ-free response, short answer format) (for summative grades). The online quiz was available on a specific day, for a specified time. (It was preceded by a quick checklist asking the students if they had read and gone through the clerkship material and resources. It also informed them they were encouraged to seek the help of staff where required). Students each had only one attempt at the online quiz, (which was timed). With each student's attempt, test items and options were shuffled. Feedback was given immediately on the computer in the form of scores. Results of the online quiz scores were correlated with results of the summative EOC examinations. The scores of those who took the quiz (responders) and those who did not (non-responders) were compared. The quiz scores for high-achievers in the EOC summative examinations, (Honours/distinctions) and low achievers (scored <50%) were compared. (At the university, in assessments, a score of less than 50% is a fail, 50-69% is a pass, 70-74% pass with second-class honours, 75-79%, pass with first-class honours, and $\geq 80\%$ pass with distinction). Descriptive statistics (SPSS), Pearson correlations (r) were performed. t-ratio was used to check for responder/non-responder bias. Chi square (χ^2) was performed.⁸

RESULTS

Of the 242 students registered in the course, 241 took the EOC examination. Of the 241 students, 75(31.1%) took the online quiz. Figure 1 shows the range of scores for the online quiz for the responders. Scores ranged from 0 to 23 out of 25 (92%). Table 1 shows the mean, lowest and highest scores of responders (N=75) and non-responders (N=166) in the quiz and EOC examinations. The mean scores for the EOC-PDQ and EOC-spotter are higher for the responders than non-responders. (ie for EOC-PDQ 53.2% versus 49.2% and for EOC-spotter-MCQ, 56.4% versus 52.7%). t-ratio between responders and non-responders was 1.864 which was not sig at $P > 0.05$. For the whole group (N=241), the correlations between the EOC-PDQ and EOC-spotter was $r = 0.414$, (significant at 0.01 level – 2-tailed), and for the non-responders, the correlations between the EOC-PDQ and EOC-spotter (N=166), $r = 0.376$ (significant at 0.01 level - 2-tailed).

Table 1: Descriptive statistics of EOC MCQ/PDQ and online quiz results.

Quiz responders (N=75)	Quiz NON-responders (N=166)				Total (N=241)							
	Lowest score	Highest score	Mean	Std	Lowest score	Highest score	Mean	Std	Lowest score	Highest score	Mean	Std
Online Quiz (Max score-25)	0 (0%)	20 (80%)	11.8 (47.2%)	4.76757	NA				NA			
Eoc Pdq (Max score-25)	4.35 (17.4%)	22 (88%)	13.38 (53.2%)	4.05358	2.61 (10.4%)	21.5 (86%)	12.30 (49.2%)	4.18248	2.61 (10.4%)	22 (88%)	12.64 (50.6%)	4.1643
Eoc Spotter (Max score-10)	2 (20%)	8 (80%)	5.64 (56.4%)	1.56516	1 (10%)	10 (100%)	5.27 (52.7%)	1.55076	1 (10%)	10 (100%)	5.39 (53.9%)	1.5614
t ratio	1.864*											

*P > 0.05

Table 2: Correlations between EOC-PDQ/spotter, and online MCQ (and with controlling for EOC-spotter).

Control variables			EOC PDQ /25	Online quiz /25	EOC spotter /10
-None ^a	EOC PDQ/25	Correlation	1.000	0.376	0.473
		Significance (2tailed)		0.001	0.000
		Df	73	73	73
	Online quiz (Mcq)/25	Correlation	0.376	1.000	0.222
		Significance (2tailed)	0.001		0.056
		Df	73	0	73
	EOC spotter /10	Correlation	0.473	0.222	1.000
		Significance (2tailed)	0.000	0.056	
		Df	73	73	0
EOC spotter /10- ^b	EOC PDQ/25	Correlation	1.000	0.315	
		Significance (2tailed)		0.006	
		Df	0	72	
	Online quiz (Mcq) /25	Correlation	0.315	1.000	
		Significance (2tailed)	0.006		
		Df	72	0	

a-cells contain zero order (Pearson) correlations, b-partial correlations

Table 3: Correlations between EOC-PDQ/spotter, and online MCQ (and with controlling for EOC-PDQ).

Control variables			Online quiz mcq /25	Eoc spotter /10	Eoc pdq/25
-None ^a	Online quiz mcq /25	Correlation	1.000	0.222	0.376
		Significance (2tailed)		0.056	0.001
		Df	0	73	73
	Eoc spotter (Mcq)/10	Correlation	0.222	1.000	0.473
		Significance (2tailed)	0.056		0.000
		Df	73	0	73
	EOC pdq /25	Correlation	0.376	0.473	1.000
		Significance (2tailed)	0.001	0.000	
		Df	73	73	0
EOC pdq /25- ^b	Online quiz mcq /25	Correlation	1.000	0.054	
		Significance (2tailed)		0.645	
		Df	0	72	
	Eoc spotter (Mcq) /10	Correlation	0.054	1.000	
		Significance (2tailed)	0.645		
		Df	72	0	

a-cells contain zero order (Pearson) correlations, b-partial correlations

Correlations were higher for the responders compared to non-responders between the EOC-PDQ and EOC-spotter for the responders (N=75) correlations are shown in Table 2 and Table 3.

In Table 2, correlations between the EOC-PDQ and EOC-spotter was $r = 0.473$, (significant at 0.01 level – 2-tailed and between EOC-PDQ and online MCQ-quiz was $r = 0.376$. Between the EOC-spotter and the online MCQ-

quiz was $r = 0.222$. When controlling for the spotter, between the EOC-PDQ and online MCQ-quiz $r = 0.315$. In Table 3, correlations between the EOC-PDQ and EOC-spotter was $r = 0.473$, (significant at 0.01 level – 2-tailed and between EOC-PDQ and online MCQ-quiz was $r = 0.376$. Between the EOC-spotter and the online MCQ-quiz was $r = 0.222$. When controlling for the EOC-PDQ, between EOC-spotter and online MCQ-quiz, $r = 0.054$. Table 4 compares pass rates for the responders and non-responders, as well as the low-achieving and high-

achieving students in the responders versus non-responders.

The failure rate was higher for the non-responders compared to the responders. (For the EOC-PDQ, 51.8% versus 44%, and for the EOC-spotter-MCQ, 25.3% versus 30.7%) There were more high-achievers in the group of responders. (For the EOC-PDQ, 21.3% versus 14.5%, and for the EOC-spotter-MCQ, 33.3% versus 18.7%). Chi square (χ^2) was significant at $P < 0.05$.

Table 4: Comparison of EOC MCQ/PDQ results for students who did/not take the online quiz.

Test	Quiz responders (N=75)			Quiz NON-responders (N=166)			(Total (N=241))		
	Fail	Pass		Fail	Pass		Fail	Pass	
	Low achievers <50%	All passes $\geq 50\%$	High achievers ($\geq 70\%$)	Low achievers <50%	All passes $\geq 50\%$	High achievers ($\geq 70\%$)	Low achievers <50%	All passes $\geq 50\%$	High achievers ($\geq 70\%$)
Online Quiz	36 (48%)	39 (52%)	9 (12%)	NA			NA		
EOC Pdq	33 (44%)	42 (56%)	16 (21.3%)	86 (51.8%)	80 (48.2%)	24 (14.5%)	119 (49.4%)	122 (50.6%)	40 (16.6%)
EOC Spotter (Mcq)	19 (25.3%)	56 (74.7%)	25 (33.3%)	51 (30.7%)	115 (69.3%)	31 (18.7%)	70 (29.0%)	171 (71.0%)	56 (23.2%)
(χ^2) Chi square	15.25			15.99			23.14		
	P<0.05			P<0.05			P<0.05		

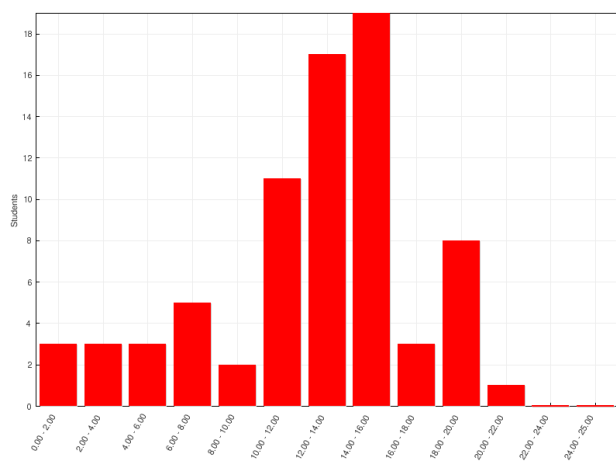


Figure 1: Bar graph of students' performance in online quiz – (n=75).

DISCUSSION

Only a third of the students took the online quiz(responders). Interestingly, the same group of students, in a paper-based PBL-self assessment analysis (where they rated their own performance in PBL activities), 74% responded.⁹ This emphasizes the point made earlier that students may choose not to do anything

that has no grade even if it benefits them ultimately.⁷ This self-monitoring exercise was for formative purposes only. Some educators recommend that activities like self-assessment be just for formative purposes only. Others recommend that self-assessment scores be used for summative purposes too. They have the view that if the marks are “meaningful”, and have a consequence, students will engage more eg. if the marks count for summative assessment more students will engage more.¹⁰

The mean scores for the EOC examinations for the responders were higher than the non-responders suggesting that the exercise was useful. Self-monitoring and self-assessment are useful for students to judge whether or not they are capable of or have achieved what is necessary to complete tasks successfully.¹¹

Indeed Robinson et al showed that mock examinations (mock OSCE), helped students in their final summative examinations, as it significantly improved their confidence as well as reduced their anxiety.¹² This quiz exercise also gave the students an opportunity to see the format of the summative spotter-MCQ examination, giving them practice “under timed, examination” conditions. Knowing what to expect in an examination, can help students to plan how to study, and can also give them direction eg. what to study.¹³

There were quiz responders who did not get a passing grade in the EOC. A question could be asked how seriously they indeed took the quiz exercise. Since it was just for self-monitoring, could it be that they may have just looked to see if they recognise the material rather than thoroughly doing the exercise completely and seriously? Students who don't have skills for self-regulation "may misconstrue the autonomy" of on-line learning and thus may not be able to accomplish the objectives of the online exercises.¹⁴ Indeed it has been said that self-assessment by students in a learning context is different from one for summative purposes.¹⁵

The feedback in the quiz exercise was immediate, in the form of scores. Good feedback clarifies goals, motivates and increases students' self-esteem, pushing students to close the gap between what they know and what they are expected to know.¹⁶ In the study, there were quiz responders who failed both the online quiz and the EOC examinations. These may indeed be low-achieving students. Could it also be, as suggested by David Nichol, (since the feedback in the exercise was in the form of grades), that feedback given as scores, accurate as it was, may actually have negative effects on the self-esteem of low-achieving students, hence they were not motivated by the exercise?¹⁶ In earlier papers, Nichol, reporting on Butler, said that giving grades as feedback may have less effect than giving feedback as comments, and on the other hand, later in 1988, Butler reported that students may actually pay less attention to comments when given comments and grades as well.¹⁶ Students must actively engage with the external feedback.¹⁶ The feedback given in scores was meant to be objective letting students know where they were and encourage them to correct what they didn't know.

As the quiz was online, a question of access to computers may be raised, since only a third were responders. All students have access to a computer in the library, and certainly most if not all have their own private computers/laptops. They all have access to and can navigate my e-learning. However, students had no previous formal experience with online quiz exercises. Interestingly some students who did not take the quiz, came to the office of the first author, to ask questions, or revision sessions. One even said she did not take the quiz as the timing was difficult. Perhaps if the quiz could be available later in the evening. (It was originally available from 2-4pm Wednesday afternoon, a slot actually scheduled for haematology private-study, then moved to 4-6.30pm at the request of some of the students). Furthermore, for about half the class of 241 students, the EOC examinations fell in the same week as the class PDQ (summative) for the other courses. Students prioritize to study for the major summative examinations and pay less attention to the EOC examinations. The PDQ is higher stakes than the EOC, constituting a major percentage of the final course grade. Unfortunately, the haematology clerkship rotation is only 4 weeks long, time is a

constraint. Changing dates of the online quiz would be difficult. Indeed this was similar to Hartwig et al's study, where the majority of students also prioritized to study what was "soonest".³ In the same study, Hartwig also showed that the majority of students did their studying in the evening and reported that their studying was most effective in the evening.³ Furthermore, the majority of the students reported that they cram for the examinations just before and don't space out their studying. With online activities, students may lose motivation when the schedule is difficult and they fail to follow it.¹⁷ That being said, self-regulated learners are better at managing their time, deadlines, and how to prioritize online tasks.¹⁸ Interestingly at Qassim University, Sharaf et al, showed that medical students preferred online learning as they were of the view that the electronic version of team based learning was superior to copy-based version and that it better prepared them for examinations and group skills and examinations.¹⁹

The students who didn't take the quiz, could these be the students who generally don't engage anyway even in Face-to-Face sessions, and may have feared that taking the quiz would expose their lack of knowledge? While online exercises give students "control" of their study time, these on-line self-monitoring exercises require a good deal of self-motivation and curiosity. Self-monitoring in general, requires the student's active participation in the intervention, taking responsibility for measuring and evaluating their behaviors.²⁰ Not only does it require self-motivation, and curiosity, but also attentiveness, and habits of mind.¹ It does require practice too. "A latent skill in need of awakening."²¹ In White's study, the students in third year clerkships found that they had to motivate themselves after two years in medical school where faculty directed their learning.²¹ They were unprepared to take responsibility for their learning. This may be true too in our study where clerkships only start from third year as well. This self-monitoring quiz exercise, would have afforded an opportunity for honest self-reflection and analysis, helping students note their strengths and weaknesses before the summative EOC examinations, which is a valuable learning experience.²² Regular self-monitoring exercises would be useful as they help students improve as they review, plan and essentially take responsibility for their own learning.²³ Indeed in a web-based learning environment, Chang, showed that students who used self-monitoring strategies out performed those who did not.¹⁷ Much work has been done on self-monitoring in on-line and blended learning.¹⁸ Self-regulated learners adjust their learning strategies as situations require, and motivate themselves in the face of distractions, seeking assistance where needed.¹⁸

Accurate self-assessment is important. Inaccurate self-assessment can slow the development of students.²⁴ Quiz exercises are objective forms of self-assessment and self-monitoring. They provide accurate feedback quickly. Good feedback is important for students to clarify goals

and consolidating what they know with what they need to know.¹⁶ As noted before, self-assessment scores on the other hand, don't necessarily predict performance in final summative examinations. High achieving students tend to under-rate themselves where-as low achieving students over-rate themselves in exercises where students have to rate their performance.²⁵⁻³⁰

For quiz-responders, the mean scores were higher than non-responders in both the EOC-spotter and the PDQ. For the responders the correlation was higher between the quiz and free-response PDQ than between quiz and spotter (MCQ). Similar to what Hartwig showed: who showed that self-testing has been reported to be beneficial for different assessment modalities.³ There were more high-achievers in the quiz-responder than non-responder group, again suggesting that the formative quiz was helpful. However, this may also mean that these high-achiever responders are students that are already highly motivated. This was similar to findings in Shaban's study.¹¹ Students who took a pre-examination quiz performed significantly better in examinations than the non-responders. It was also suggested that low-achieving students perhaps lack appreciation and understanding of the need for self-assessment exercises, and need to be taught and encouraged to engage. It should also be remembered that other factors may affect performance in examinations. In Shaban's study, preparedness and anxiety were mentioned.¹¹ However, in Ramirez's study, practice MCQ exercises before a physiology examination, were reported as being contributory to improved examination scores.⁴ In the non-responder group, there were indeed some high-achievers too in the summative EOC (PDQ/MCQ). They may be using other study strategies and ran out of time and did not get a chance to do the online exercise. The students who did not take the online quiz, hence may even have felt that they did not need it. However, self-deception, denial and delusion may hinder successful self-monitoring.¹

There is a significant percentage of students who failed the EOC examinations, or achieved high grades, from both the responder and non-responder groups. This may also further suggest differences in study strategies.³ Perhaps both high and low-achievers choose the same method of study, however the high achievers use them more effectively. Or there are other factors that determine the final grade. Eg. intelligence, prior experience, degree of motivation, which override the type of study strategy as suggested by Hartwig.³ Indeed low-achievers were shown to cram the course content before the test: high-achievers were shown to space out their studies.³ Perhaps as Cook suggests, one needs to decide which students will benefit from what type of self-monitoring exercise.³¹

Limitations of the study was, this study did not analyze the other study habits and strategies of students. It was however preceded by a quick checklist: asking students if they had reviewed the relevant material (class notes, material on my elearning etc), and evaluating their

readiness to take the/a quiz. It also emphasized that this was to be an individual not group effort. The exercise did make the teacher aware of possible scheduling changes that may need to be effected. It provided information that can be used in "shaping teaching".¹⁶ College students may be "fixed" on their study strategies based on previous experience and efforts to implement interventions this late in the programme may not be totally successful. Self-monitoring was found to increase with what students thought as task importance.³² Students who self-monitored performed better than students who were instructor-monitored.³³

- The study did not formally analyze the views of the students on the self-monitoring exercise, although some did ask questions afterwards on some questions they struggled with in the quiz.
- The study did not correlate the quiz results with the results of the integrated multispecialty summative PDQ examination (which for some of the students fell in the same week on the Friday after the Wednesday of the quiz). However, in a previous study, the same researchers showed strong correlation between the haematology components of the Final multispecialty integrated examinations and the integrated end of course examinations.⁶
- The study did not analyze the students' responses based on the Bloom's Taxonomy level of the examination questions
- Gender differences among students' who took the quiz or did not take the quiz were not analyzed. Generally the majority of students in the class were female, and about 21years old.
- The quiz exercise was done once only before the summative examination. Perhaps it would be beneficial to have a couple of them, to show whether a student is improving or not. Ramirez et al showed improvement in average scores with repeated testing: showing that the repeated feedback from the quiz led to better learning and retention.⁴ Perhaps too, this study provides an opportunity for even designing pre-testing or diagnostic quizzes early on, although time would be a limiting issue, in this already packed programme.
- This was a single-institution study with a smaller number of responders than non-responders.

CONCLUSION

Students should be motivated to participate even if there is no grade attached: and they should know that it is a useful learning exercise with nothing to lose but a lot to gain. Taking responsibility for their own learning helps students learn more, instead of just concentrating on their final grades. The exercise did provide the teacher with feedback, information about the students' strengths and weaknesses, as well as an opportunity for the teacher to monitor the students' self-monitoring activities: which is helpful in designing curriculum and class activities going forward. The exercise indeed was a way to evaluate what

students know, but also to motivate and encourage them too, to generate thought, and offer them a different study strategy, which was new to them. Learning to online self-monitor needs to be encouraged further as universities are supplementing face-to-face learning with online learning (blended learning). MCQ testing online, is a good way to monitor students' knowledge.

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