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3 **Evaluating the effectiveness of ‘MCQ development workshop using**  
4 **cognitive model framework —a pre-post study**

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11 **Abstract**

12 A workshop on MCQ development using cognitive model framework was  
13 conducted for health educators from Aga Khan University (AKU) and other  
14 academic institutions. The aim was to develop the skill of preparing MCQs for  
15 assessing higher cognitive levels. A pre-post study was conducted, participant  
16 satisfaction was evaluated and pre-post test scores were used to assess learning  
17 capability of the workshop participants. Out of the 19 who attended the workshop,  
18 16 participated in the pre- and post-tests and were included in the study through  
19 convenience sampling. The total duration of the study was six months. There was a  
20 significant difference in the overall pre-post test scores of the participants with a  
21 mean difference of  $-4.176 \pm 4.83$  ( $p$  value  $< 0.05$ ). A significant difference was  
22 observed in the mean pre-post test scores of junior faculty ( $-6.350 \pm 4.5829$ ;  $P$   
23 value = 0.02). The mean pre-test scores of junior faculty were significantly lower  
24  $4.950 \pm 2.83$  as compared to the senior faculty  $10.417 \pm 1.56$  ( $P$  value = 0.001).

25 Active participation in faculty development workshops may lead to enhancing  
26 skills for preparing one-best MCQs based on international guidelines.

27 **Keywords:** multiple choice questions, faculty development

28

## 29 **Introduction**

30 Assessment of health professionals' education heavily relies on multiple choice  
31 questions (MCQ). Peer review and review by educational experts ensures quality  
32 of one best MCQs. However, during the MCQ review it was observed that most of  
33 the questions developed by the faculty assess the knowledge at recall level and fail  
34 to follow the guidelines laid by the National Board of Medical Examiners  
35 (NBME).<sup>1</sup>

36 MCQs are considered an appropriate tool to not only measure a candidate's  
37 ability to recall and comprehend but can also be designed to measure higher  
38 order thinking skills such as application and analysis.<sup>2</sup> Well-constructed MCQs  
39 test reasoning at higher levels and, therefore, can discriminate between high and  
40 low-achievers.<sup>3</sup> <sup>4</sup>The construction of MCQs to assess higher levels of  
41 comprehension and analysis is a challenging task which requires both sufficient  
42 knowledge and training.

43 A multiple choice question comprises a stem which may perhaps be a clinical  
44 scenario. It is followed by a number of options which are related to the stem, and  
45 only one option may be correct (one correct type MCQ) or the best (one-best type  
46 of MCQ). To be awarded marks, the students' task is to identify the most  
47 appropriate option.<sup>5</sup>

48 MCQs with flaws lead to errors in interpretation of test scores and may undesirably  
49 affect the pass rate of the students. To ensure reliability and validity of tests, items  
50 constructed must be free of errors.<sup>6</sup> Flawed items have an overall impact on the  
51 performance of students. The structural flawlessness of MCQs can be improved by  
52 the level of experience.<sup>6</sup>

53 Maximum errors are attributed to the MCQs' structure, followed by inaccuracies in  
54 the stem and vignette of the MCQs.<sup>7</sup> It is reported that items developed by those  
55 faculty members who have not undergone faculty development training lack  
56 quality. This is an evidence to the value of faculty development in generating  
57 quality items.<sup>8</sup>

58 It has been observed that the questions being used in examinations held at  
59 institutional levels are not following international guidelines for developing one  
60 best MCQs, which, however, may be significantly improved by conducting  
61 formal workshop on MCQ development. Internationally accepted guidelines and  
62 a multidisciplinary review lead to improved quality of items.<sup>9</sup>

63 The objectives of this study were to explore the perceptions of workshop  
64 participants regarding achievement of workshop objectives, content covered, and  
65 facilitation skills, and to determine if participation in the workshop helped them  
66 gain new knowledge and skills.

67

## 68 **Methods**

69 It was a pre-post study conducted at the Aga Khan University (AKU) in which  
70 faculty from AKU (Medical College, School of Nursing and Allied Health), as  
71 well as other academic institutions offering undergraduate and postgraduate health  
72 science education, participated in a workshop on how to construct effective one-  
73 best MCQs. Both senior (assistant professor and above) and junior faculty (below  
74 assistant professor) attended the workshop. This evaluation is based on  
75 Kirkpatrick's model to analyse and evaluate the impact of educational training at  
76 level 1 and 2.<sup>10</sup>

77 Gagne's nine events of instruction were used to design the workshop: seek  
78 attention, inform learners of objectives, recall prior learning, present learning

79 material, provide support to learner, perform individually or in a group and provide  
80 feedback, measure performance and promote retention and transfer.<sup>11</sup>

81 The instructional approach of the workshop was based on flip class methodology.  
82 Prior to the face-to-face session of the workshop, the chapter on One Best type  
83 MCQ construction from the NBME guidelines was shared with all the registered  
84 participants. Questions to stimulate prior knowledge and check basic  
85 understanding of the concept was assessed through the pre-workshop readings  
86 which were posted on an online discussion forum created on Padlet. The purpose  
87 of this discussion forum was to assess the participants' knowledge regarding basic  
88 rules on constructing One-Best MCQs and to engage students outside the  
89 workshop.

90 To determine if the participants acquired new knowledge, a pre-test was held just  
91 before starting the three-hour workshop and a post-test was held on completion of  
92 the workshop. In the pre/post-test the participants were asked to categorise MCQs  
93 according to the Blooms level of learning being assessed by the MCQ and identify  
94 flaws based on general rules for one best answer items as given in the NBME  
95 guidelines.

96 Total number of participants in the workshop were 19; convenience sampling was  
97 done and data of only 15 participants was included in the quantitative analysis. All  
98 candidates who sat the pre- and post-test and participated in the entire workshop  
99 were included in the study. Participants who did not attend the entire workshop and  
100 did not complete both the pre- and post-test were excluded from the study. Data to  
101 measure acquisition of new knowledge was collected by using pre/post-test  
102 questionnaire and perceptions of the workshop participants regarding achievement  
103 of workshop objectives, content covered and facilitation was acquired by the  
104 workshop evaluation form.

105 Ethical approval was sought from the Aga Khan Ethical Review Committee.  
106 Anonymity and confidentiality of the data were maintained.  
107 Data was analysed using SPSS version 19; descriptive analysis was applied to  
108 compute mean  $\pm$  standard deviation percentages. Pre- and post-test scores were  
109 compared using independent sample and Paired sample t-test.

110

## 111 **Results**

112 Both junior 5 (45.5%) and senior faculty 9 (27.3%) participated in the workshop,  
113 information for 5 participants was missing. From the medical college 5 (27.2%) of  
114 participants were from basic sciences, 6 (31.8%) were from clinical sciences, 4  
115 (22.7%) were nurses and 2 (9%) were from the department of medical education;  
116 whereas information for 5 participants was missing.

117 Figure 1a shows the rating of the participants on workshop objectives and content;  
118 about 13 (72%) rated it as excellent, 4 (25%) good and 2 (3%) rated satisfactory.

119 Figure 1b depicts the rating of participants of the knowledge gained and  
120 understanding of the content of the workshop, about 10(54%) rated it as excellent,  
121 8 (45%) good and 1 (1%) satisfactory. Similarly, figure 1c, indicates the rating of  
122 participants for presentations at workshop; about 14 (74%) rated it as excellent, 4  
123 (24%) good and 1 (2%) satisfactory.

124 We observed a significant difference in the overall pre-post-test scores of the  
125 participants with mean difference ( $-4.176 \pm 4.83$ ). A significant difference was  
126 observed in the mean pre-post-test scores of junior faculty ( $-6.350 \pm 4.5829$ ; p  
127 value = 0.02). For senior faculty no significant difference was noted in their mean  
128 pre-post-test scores (P value = 0.666).

129 The mean pre-test scores of junior faculty were significantly lower  $4.950 \pm 2.83$  as  
130 compared to the senior faculty  $10.417 \pm 1.56$  (P value 0.001). However, there was

131 no significant difference in post-test scores of junior ( $11.3 \pm 5.3$ ) vs senior faculty  
132 ( $11.08 \pm 3.78$ ) ( $p$  value  $> 0.05$ ).

133 No significant difference was noted in the mean post-test scores of junior faculty  
134 and senior faculty.

135

### 136 **Conclusion**

137 Faculty development workshop improved one best MCQs writing skills based on  
138 NBME guidelines. A significant difference was observed in the mean pre-post-test  
139 scores of junior faculty. Such workshops are conducted to improve the MCQ  
140 writing skills of faculty members.

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143 **Conflict of interest:** None to declare

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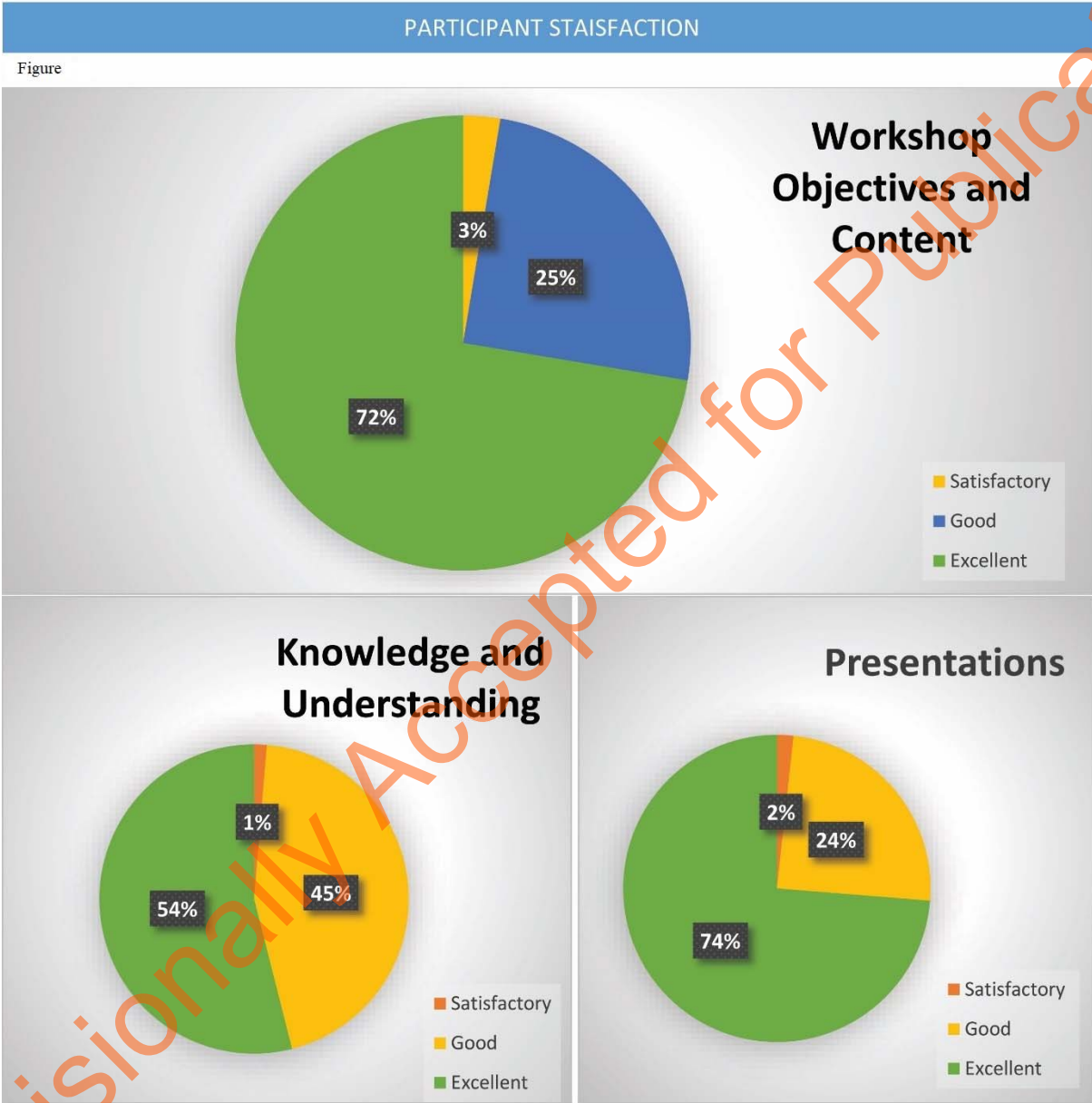
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183 **Figure 1: Participants satisfaction rating on workshop objectives and content**  
184 **(1a) knowledge and understanding (1b) and presentation (1c).**

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