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## Success on Multiple Choice Examinations: A Model and Workshop Intervention

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### Abstract

Our theoretical model first identifies the context in which students experience difficulties with complex multiple choice examinations (MCE) and then provides a structured approach to facilitate the development of critical thinking and metacognitive skills. Based on our model, we also designed a brief educational workshop, now in videotaped format. Workshop participants were taught that multiple choice (MC) questions assess lower and higher level critical thinking skills, and appropriate techniques for study and MC test-taking. To encourage the transfer of appropriate learning, participants then processed deeply, practiced, and mastered these messages through MC test simulations. On anonymous questionnaires, participants reported increased knowledge concerning the process and content demands of complex MCE, as well as improved confidence and new behavioural skills.

### Résumé

Notre modèle théorique définit d'abord le contexte dans lequel les étudiants éprouvent de la difficulté à passer un examen à choix multiple complexe (ECM), et ensuite il propose une approche structurée pour faciliter le développement de la pensée critique et des capacités métacognitives. Nous avons aussi conçu, à partir de notre modèle, un bref atelier d'information, qui est maintenant disponible sous forme de vidéo. Les participants à cet atelier ont appris que les questions à choix multiple (CM) évaluent les capacités d'analyse critique inférieures et supérieures; ils ont également appris des techniques précises pour se préparer aux examens à choix multiple et pour les passer. Pour faciliter le transfert des connaissances pertinentes, les participants ont procédé à des simulations d'examens à CM, qui leur ont permis d'assimiler profondément les messages, de les appliquer et de les maîtriser. Répondant à un questionnaire anonyme, les participants ont indiqué qu'ils parvenaient à mieux comprendre le processus et à mieux saisir la matière de ECM complexes et qu'ils acquéraient davantage de confiance en eux-mêmes et de meilleures habitudes.

Complex multiple choice examinations (MCE) are a popular form of assessment of student knowledge and aptitude across diverse pedagogical domains ranging from introductory courses to graduate school admission tests (Aiken, 1987; Cizek, 1994; Skakun, Maguire, & Cook, 1994). Despite the need to utilize high level critical thinking skills during study and MC test-taking, research shows that high school and beginning university students often learn novel material using lower level thinking and study skills such as repetition, memorization, and summarization (Brown & Campione, 1978; Feldt & Ray, 1989; McDermott, Wood, & Willoughby, 1995; Perry, 1981; Thomas & Bain, 1982). Moreover, the metacognitive awareness of the need to alter strategies to accommodate complex task demands, and the ability to do so, appear to develop slowly (Brown & Campione, 1978; Hartley, 1986; McDermott et al., 1995; Perry,

1981; Rosenthal, McKnight, Soper, & Baudouin, 1996; Thomas & Bain, 1982). Our experiences in teaching and counselling at post-secondary institutions suggest that the impact of unreadiness for MCE is multifaceted, potentially resulting in impaired academic performance, emotional distress, decreased motivation, and premature drop out (also see Perry, 1970).

Although most universities offer generalist study skills programs, we note that students often fail to discern the higher level cognitive and metacognitive processes that underlie successful performance on MCE (Watkins, 1982). Moreover, there is a dearth of published information about programs specifically targeted to improve performance on MCE through the development of critical thinking skills. To address this gap, we carried out a needs assessment of our target group: undergraduate students doing poorly on MCE. We questioned students informally during one-to-one meetings or small group sessions about their expectations and experiences surrounding MCE and their approaches to preparation and test-taking. Specifically, we asked students to detail their past experience with MCE, their expectations for performance, their cognitions (both positive and negative) during preparation and test-taking, how they prepared for MCE versus essay style exams, and their accuracy in predicting exam grades. We determined that many students fail to recognize that well-designed MCE can assess both lower level thinking skills (such as the recognition and recall of information) *and* higher level thinking skills (including the ability to apply, synthesize, and integrate material). Not surprisingly, these students predominantly used lower level study strategies. We further interviewed students who typically did well on complex MCE and noted their strategies and cognitions. In contrast, we perceived these students to be well equipped cognitively and metacognitively to master the course curriculum. In general, these students seemed better able to conceptualize and synthesize information, to identify important versus less important material, to prioritize study time, and to be aware of when they had mastered the material.

Several themes for success on complex MCE emerged from the interviews. First, heightened anxiety and hyperarousal interfere with study and test-taking; positive attributions set the stage for success. Second, students require a basic knowledge of MC test-taking strategies (e.g., dealing with combination items such as "all of the above"; time allocation on the test, etc.). Third, students benefit from an understanding of the higher level cognitive demands of the MC test process. Often, they require some experience with MC test-taking to recognize the complexity of the demands. Fourth, to meet the high level demands, students must develop mastery level study skills. Finally, repeated practice with feedback is necessary to reinforce skill acquisition. Consequently, we developed a theoretical model to represent the multifaceted process that we

suggest underlies successful performance on MCE, and converted it into an educational workshop.

#### THE MULTIPLE PROCESS MODEL

Our interviews revealed that many university students perform poorly on initial complex MCE *and* fail to improve performance on subsequent MCE, despite investing hours of effort. Without intervention, the potential exists for negative attributions about self and/or professor, with cognitive, affective, and behavioural consequences, resulting in repeated negative experiences (Perry, 1970). To alter this pattern, our model argues for the necessity of making explicit to students the context in which university teaching and evaluation are grounded. That is, students must understand that MCE are constructed to assess high level thinking skills, thereby drawing upon their cognitive, metacognitive, and affective resources throughout the learning cycle. This recognition that low level learning strategies are insufficient for MC task demands may prompt the development of more suitable attributions and study behaviours. Because students may require intervention in several domains, our model has five facets: Expectations and Anxiety, Test-Taking Strategies and Simulated MCE, Teaching Sophisticated Thinking Skills, Mastery Learning Strategies, and Repeated Practice with Reinforcement. Central to our model is the premise that students must be encouraged to deeply process information (see Figure 1).

In developing our model, we also reviewed research from cognitive psychology to determine how learners process and synthesize complex material ( Craik & Lockhart, 1972; Craik & Tulving, 1975; Gibbs, 1981; Hartley, 1986; Nickerson, 1988-1989; Thomas & Bain, 1982; Weinstein & Mayer, 1986) and examined the literature addressing the content and process demands underlying MCE (e.g., Aiken, 1987; Appleby, 1990; Benjamin, Cavell, & Shallenberger, 1984; Dolly & Williams, 1986; Fleet, Goodchild, & Zajchowski, 1990; Shatz & Best, 1987; Skinner, 1983; Spiers & Pihl, 1987). Our review suggests that complex material is best learned using high level cognitive and metacognitive strategies that enable students to richly encode material, to integrate knowledge via the processes of assimilation and accommodation, and then to retrieve material. Mastery of material likely is facilitated by information reduction, reorganization, and restructuring (e.g., chunking and hierarchical organization), as well as by elaboration and positive imagery.

#### DESCRIPTION OF THE WORKSHOP

To encourage attendance, we advertised a single session (2-hr) workshop that promoted student success on MCE through experiential, student-

### Student Experience

- i. Low level expectations and superficial processing strategies for MCE
- ii. Negative experience on MCE
- iii. Perceived threat of MCE (i.e., anxiety, low confidence, expectation of poor performance)

### Interventions

*Facet 1:* Identification of Negative Cycle Of MC Experience; Attitude Inoculation; Modelling Positive Counterstrategies

*Facet 2:* Presentation of MC Test-Taking Strategies; Application through Test 1 Simulation

*Facet 3:* Analysis of Complex MC; Processing Levels of Critical Thinking through Test 1 Scoring

*Facet 4:* Teaching Mastery Learning Strategies; SQ3R

*Facet 5:* Repeated Practice through MC Test 2 Simulation; Reinforcement of New Attitudes, Knowledge, Behaviour through Test 2 Scoring

### Student Outcome

- i. Increased confidence re MCE
- ii. Shift to deeper processing strategies (e.g., SQ3R)
- iii. Increased mastery of complex MCQ

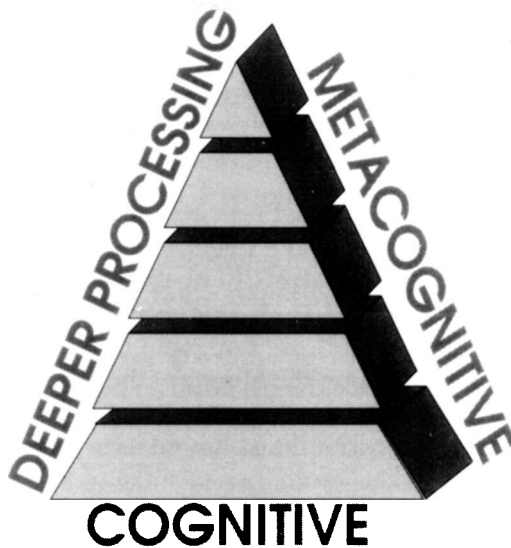


Figure 1.

*The Multiple Process Model as Represented Through a Workshop Intervention.*

centred activities. We told students that there would be opportunities to apply new knowledge and receive immediate feedback through simulated MC testing. This message attracted undergraduate and graduate students from diverse disciplines and programs (e.g., psychology, commerce), with approximately 50 students attending each of the first eight workshops. Although most were seeking to improve performance on MCE in academic courses, some were preparing for graduate admission examinations (e.g., GMAT, GRE, LSAT, MCAT).

Our workshop format consisted of five cumulative sections, corresponding to our theoretical model, designed to encourage cognitive, metacognitive, and affective development. We taught participants that MCE assess varying levels of critical thinking skills and require deep processing. To encourage transfer of appropriate learning (Morris, Bransford, & Franks, 1977), we provided opportunities to deeply process, practice, and master this message through two simulated MCE.

#### *Facet 1: Expectations and Anxiety*

*Ice breaker: Expectations for the workshop and MCE.* We opened by asking participants their reasons for attending, past experiences with MCE, and strategies used for preparation or test-taking. In support of our model, students' responses reflected many misunderstandings surrounding MCE, as well as considerable anxiety. Typically, students did not recognize that MCE comprised more than low level recall and recognition items (Watkins, 1982). Moreover, like Thomas & Bain (1982), their study strategies mainly encompassed superficial processing of material and were uniformly applied regardless of evaluation format (i.e., objective or essay style).

*Attitude inoculation: Eliciting and processing "confidence killer" statements.* We asked participants to share the negative, anxiety-ridden cognitions that accompany experiences with MCE. We then exposed them to similar defeatist comments gathered from students during prior workshops (e.g., "I'm going to throw up!" or "I'm going to miss a box and fail the whole test!"). By drawing upon the humor of the exaggerated examples, we defused some anticipatory anxiety and identified distorted patterns of thinking. Participants' contributions allowed us to identify the cycle that linking negative thoughts, escalation of anxiety, fixation of negative beliefs, and negative influence has on MCE outcome. We then modeled positive counterstrategies: challenging catastrophic predictions; generating more coping-focused, realistic, and confidence-enhancing statements; and decreasing anxiety through deep breathing and visualization of success (Burns, 1980; Meichenbaum, 1977).

### *Facet 2: Test-Taking Strategies and Simulated MCE*

*Basic test-taking strategies for MCE.* We distributed a two-part hand-out compiled from Canadian sources (Fleet et al., 1990; Taylor, Avery, Brandow, & Strath, 1988). The first part described strategies to assist test-takers in the interpretation of instructions, in the processing of question stem qualifiers and absolutes, and in the maintenance of emotional equilibrium. The second part provided a 10-step answering system designed to encourage deeper processing of the MC question (Craik & Lockhart, 1972; Craik & Tulving, 1975) and prediction of the possible answer. We then recommended that participants apply this system during the first test-taking simulation.

*First test-taking simulation: Mount St. Vincent University reading and MC test.* Participants studied (4 min) a brief passage entitled The Mission Statement of Mount St. Vincent University (1993) and completed (6 min) a corresponding six-item MCE (Wetmore & Bowering, 1995). Participants were *not* informed that the MCE included questions of increasing cognitive complexity.

### *Facet 3: Teaching Sophisticated Thinking Skills*

*Scoring the first test: Critical analysis of levels of complexity of MC questions.* Our model suggests that successful performance derives, in part, from the understanding that complex MCE are constructed to assess a range of critical thinking skills. During the scoring of the first test, we introduce these skills as the “Levels of Multiple Choice” (adapted with permission from Appleby, 1990). The least sophisticated skill (i.e., Level 1) requires *simple recall/recognition* of information. Level 2 involves *memorization* of a set of characteristics, with *assigning of priority* of importance to elements. Level 3 requires *sequencing* events in time or in magnitude (e.g., chronological relationships). Level 4 requires *application* of knowledge (e.g., diagnosis of disease). Level 5 involves the *identification of similarities and differences and the conceptualization of relations* (e.g., analogies). Level 6, the most sophisticated skill, requires the *synthesis* of information (e.g., integrating knowledge, drawing inferences). In processing the test, we linked each of the six questions to its corresponding level of MC, elaborated on the type of thinking skills required for success, and diagrammatically illustrated the cognitive response process. Thus, our theoretical synthesis of Appleby (1990), Bloom (1956), and Craik (Craik & Lockhart, 1972; Craik & Tulving, 1975) was extended into a practical teaching application. After scoring the test, participants said that they had been preparing as if MCE assessed only recognition and recall (e.g., using memorization and rote learning). Not surprisingly, participants now had different attributions for their errors on questions from Levels 4-6.

#### *Facet 4: Mastery Learning Strategies*

*Strategies for deeper processing: SQ3R.* Once participants realized the cognitive complexity demanded by MCE, they were primed to modify their study behaviour. We then introduced SQ3R (i.e., Survey, Question, Read, Recite, and Review) (Robinson, 1961) as a method to enhance reading and retention, identification and processing of concepts, and ultimately the integration and synthesis of course content. Participants were instructed to skim the passage, formulate general questions, read for identification and comprehension of concepts, attempt to answer their own questions, summarize material, and anticipate MCQ. These activities contribute to students' ability to analyze their depth of processing of the material, an important metacognitive skill.

#### *Facet 5: Repeated Practice with Reinforcement*

*Second test-taking simulation: Mood disorder reading and MC test.* Participants studied (6-min) a one-page passage entitled Mood Disorders (Wetmore & Bowering, 1995) and completed (10-min) a corresponding 12-item MCE (Wetmore & Bowering, 1995). Participants were forewarned that the test would emphasize questions from Levels 4—6, and urged to apply their new knowledge concerning SQ3R, MC test-taking strategies, and the critical thinking skills required for success. We also asked students to monitor how these new strategies increased their depth of processing.

*Scoring the second test: Reinforcement of new attitude, knowledge, and behaviour.* Again, we scored each test item referring to the corresponding level of MC. Even participants who had performed very poorly on the first test generally improved their scores. Many articulated that their learning strategies had shifted (e.g., from re-reading and rote memorization to chunking and identification of main points/concepts). They expressed newfound confidence in their ability to handle complex MC (e.g., the questions were no longer viewed as "tricky" and "out to get them" but, rather, required the use of complex processes to select the correct answer). We interpreted their comments as reflecting deeper processing of the material and development of critical thinking skills.

#### PROGRAM EVALUATION: EFFECTIVENESS OF WORKSHOP INTERVENTION

After summarizing the key points of our workshop, we measured participants' satisfaction via anonymous questionnaires completed at the end of the session. They were asked to identify the *most* and *least helpful* components of the workshop, and using a 5-point scale (1 = Poor, 5 = Excellent) to rate the workshop's *quality*, *amount* of information, *usefulness* of information, *method of presentation*, and *overall workshop rating*.

To accommodate the demand for the workshop (now over 400 participants), the live presentation had been transferred onto a professionally

edited videotape of approximately 90 minutes (Wetmore & Bowering, 1994). We selected at random four workshops presented during 1993 to 1996, two of which were the videotaped version and two the live version, and analyzed the feedback questionnaires ( $n = 110$ ). (Note that three respondents skipped one question on the form.) One-way ANOVA's indicated that the four versions did not differ significantly in quality [ $F(3,105) = 0.58, p = .63$ ], amount [ $F(3,106) = 0.46, p = .71$ ], usefulness [ $F(3,106) = 1.90, p = .13$ ], or overall workshop rating [ $F(3,100) = 1.14, p = 0.34$ ]. Although the method of presentation was significant [ $F(3,106) = 3.57, p = .0165$ ], Scheffé tests failed to reveal the source of the difference ( $p$ 's  $> .05$ ). With a mean overall rating of 4.5 on a 5-point scale, evaluations were consistently favorable for both presentation types (see Table 1). Clearly, the video format is both cost effective and has ensured consistency over time.

The questionnaire for workshop 4 added a new category: ratings of self-confidence regarding MCE pre- and post-workshop. Participants reported that their confidence improved significantly from before ( $M = 2.2$ ) to after ( $M = 3.9$ ) the workshop [ $t(14) = -10.5, p < .0001$ ].

Finally, an open-ended section on the questionnaire allowed comments on changes in knowledge and attitudes. The most frequently indicated helpful components were the levels of multiple choice, opportunities for application through repeated testing, and SQ3R. Many students wrote that all components were helpful and did not answer the question concerning the least helpful component. For example, one participant wrote "The workshop was very helpful and the information will be *extremely* helpful in all areas of study. Thank you sooo much!" Also supporting the improved ratings of self-confidence, and thus the value of attitude inoculation, were responses that revoked previously held negative beliefs and indicated increased motivation.

In summary, the response to our workshop has been overwhelmingly positive, including requests for the videotape from other universities. Students' comments (over a 5-year period) indicate that the workshop has identified many of their difficulties with MCE and provided a forum to rectify these problems. Underaddressed, however, is whether there is transfer of training from the workshop to performance on MCE in university courses. Difficult to partial out is the influence of variables such as student's intellectual ability, lifestyle commitments, and classroom climate. Nonetheless, unsolicited feedback from participants and faculty confirms that the workshop *has* improved performance on MCE. It would be valuable to know which components are particularly effective in mediating the improvement. (We suspect that the key components are recognition of the levels of complexity being tested and acquisition of mastery level study skills.) Additionally, we queried whether there will be long-term maintenance of the new knowledge, attitudes, and behaviours.



TABLE 1  
*Summary Ratings as a Function of Workshop Presentation*

Question	Workshop			
	1 Video n = 26	2 Live n = 47	3 Live n = 22	4 Video n = 15
Overall Rating				
<i>M</i>	4.4	4.6	4.4	4.5
<i>SD</i>	0.6	0.5	0.1	0.5
<i>R</i>	3-5	3-5	2-5	4-5
Quality				
<i>M</i>	4.5	4.5	4.5	4.3
<i>SD</i>	0.5	0.6	0.6	0.6
<i>R</i>	4-5	3-5	3-5	3-5
Amount				
<i>M</i>	4.4	4.6	4.4	4.5
<i>SD</i>	0.5	0.7	0.2	0.5
<i>R</i>	3-5	3-5	3-5	4-5
Usefulness				
<i>M</i>	4.3	4.6	4.5	4.5
<i>SD</i>	0.7	0.6	0.2	0.5
<i>R</i>	3-5	3-5	3-5	4-5
Method				
<i>M</i>	4.1	4.6	4.7	4.1
<i>SD</i>	0.8	0.6	0.7	0.8
<i>R</i>	2-5	3-5	2-5	2-5

Note: A higher score (5 point scale: 1 = Poor, 5 = Excellent) indicates a more positive evaluation.

Informal follow-up even a year later of some participants suggests that they have persisted in application of our techniques even though confronted by the competing demands of many university courses and the limited time for studying (also see Watkins, 1982). Long-term stability may not be surprising given that our workshop addressed some obstacles to behaviour change, including awareness of relevant information (e.g., levels of multiple choice), inoculation, and repeated modeling of appropriate behaviours.

#### CONCLUSIONS

Our Multiple Process model and workshop intervention address students' unreadiness for MCE through exposure to deeper processing strategies and the training of critical thinking skills. Questionnaire data suggest that even a brief (2-hour) intervention can increase participants'

awareness of the complexity of MCE, improve self-confidence, and promote deeper processing skills. Given the popularity of MCE, students require comprehensive instruction about both its content *and* process demands. These findings have implications for counselling psychologists and teaching faculty: Learning how to prepare effectively for complex MCE may be linked to mastery of the course curriculum and the development of critical cognitive and metacognitive skills—primary objectives of post-secondary institutions.

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This research was supported in part by the Natural Sciences and Engineering Research Council of Canada grant 121804 to the first author. We also acknowledge the Department of Student Affairs, Mount St. Vincent University for their financial support in developing the videotaped version of the workshop. Portions of this paper were presented at the meeting of the Canadian Association of College and University Student Services and the Atlantic Association of College and University Student Services, St. John's, Newfoundland in June 1994 and at the meeting of the Canadian Psychological Association, Charlottetown, Prince Edward Island in June 1995.