Original Article

Can a Flexible Medical Curriculum Promote Student Learning and Satisfaction?

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Abstract

Introduction: Medical education is trending towards an outcome-based curriculum that prepares medical graduates to excel in a rapidly evolving, team-centred healthcare delivery system. The Mayo Medical School (MMS) has recently redesigned its curriculum to introduce early clinical relevance, optimise course integration, provide flexibility and promote active learning. This study aims to evaluate the role that curricular flexibility plays in students' perceived learning, satisfaction and performance. Materials and Methods: First-year students completed a 5-point Likert scale survey regarding satisfaction with and perceived learning from various components of the flexible curriculum during 2 different academic blocks. Students' academic performance was assessed by a National Board of Medical Examiners (NBME) Subject Examination after each block. Results: In comparing student-rated satisfaction and perceived learning from didactics versus other curricular components for Block 3 (Pathology and Immunology) and Block 5 (Gross Anatomy and Radiology), students rated didactics higher in all cases in which there was a statistically significant difference in the ratings. There was a statistically significant positive correlation between the amount learned and satisfaction for all curricular components with the exception of Block 5 independent study. During Block 3, only interest in the subject matter correlated positively with the NBME score, while during Block 5, only time spent in class correlated negatively with the NBME score. Conclusions: Although various components of the flexible curriculum do not appear to affect satisfaction and perceived learning, their potential influence on graduate outcomes, in terms of delivering healthcare providers who are patient-centred, creative thinkers and compassionate leaders should not be discounted.

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Introduction

Medical students today are taught in a competitive environment that fosters the acquisition of knowledge and individual responsibility. However, in recent times, the importance of teaching students to give patient-centred care, work in interdisciplinary teams, employ evidence-based practice, apply quality improvement methods and utilise informatics has come to the forefront of discussions on medical education. This shift in the focus of medical education requires curriculum reform.[1-4]

An outcome-based approach to curriculum design is gaining widespread support.[5] This approach shifts the emphasis toward the final learning outcomes that students should be able to demonstrate at the end of a course rather than the traditional focus on the input and the educational process itself.[6]

Like many other institutions, Mayo Medical School (MMS) has moved towards an integrated outcome-based curriculum. Curriculum redesign was initiated by revising the school's mission statement which asserts: *The Mayo Medical School will use the patient-centered focus and strengths of the Mayo Clinic to educate physicians to serve society by assuming leadership roles in medical practice, education and research*. This mission statement was then used to formulate the graduate outcomes which include training 1) outstanding scholarly clinicians/scientists/ educators who place the needs of the patient first; 2) compassionate physicians who value diversity; 3) effective

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leaders who improve the processes and outcomes of healthcare; 4) promoters of wellness, in themselves and others; and 5) creative thinkers who advance medicine through innovation and education.[7] With these outcomes in mind, the curriculum was designed to establish early clinical experience, promote active learning, optimise course integration throughout the entire curriculum and provide repetitive exposure of concepts.

The first 2 years of the MMS curriculum consists of didactic blocks 6 weeks in length (120 contact hours each) that emphasise basic science material with clinical integrations, and incorporate teamwork and leadership (Fig. 1). Each didactic block is followed by a 2-week period of selective experiences that represent self-selected academic enrichment activities. This flexible portion of the curriculum allows students to explore various aspects of medicine such as community service, palliative medicine, research and healthcare policy. During this time, students have no didactic commitments. Students can choose an established selective experience or propose their own.

Having the flexibility to choose unique activities for 20 weeks of the academic year offers students the opportunity to individualise learning programmes to suit their needs and interests. We hypothesise that curriculum flexibility increases students' perceived learning and satisfaction with their medical education.

Materials and Methods

This study included first-year MMS students (Class of 2010). Students were asked to complete a questionnaire based on a 5-point Likert scale. Student questionnaire responses as well as academic performances at the end of 2 didactic blocks were used in data analysis. Block 3 (Normal Function) was selected to represent intense didactic experience which consisted of a graduate level immunology course and introduction to basic concepts of pathology, whereas Block 5 (Human Structure) represented an integrated course of gross anatomy and radiology with an extensive laboratory dissection component (Fig. 1).

The questionnaire assessed students' time allocation for various block activities, their perceived learning and satisfaction with various curricular components and their interest in course content. Objective assessment of academic performance was determined by the National Board of Medical Examiners (NBME) Subject Examinations in Pathology and Anatomy at the end of Blocks 3 and 5, respectively.

Questionnaire responses were used to compare perceived learning and satisfaction associated with each of the curricular components. NBME scores were correlated with time allocation, interest in didactic material and use of free time. The top and bottom quartiles of students based on NBME scores were analysed for differences in their interest in the subject matter, time allotment, perceived learning and satisfaction with various curricular components.

Data analysis for mean difference, matched pairs analysis, Spearman's correlation and Wilcoxin Rank Sum correlation was determined using JMP Version 7 and SAS Version 9.1 software (SAS Institute Inc., Cary, NC, USA, 2007) programs. Approval for this study was granted by the Mayo Foundation Institutional Review Board (Protocol ID: 06-005415).

Results

The questionnaire was completed by 43 out of 43 first-year medical students (response rate = 100%) following the selective periods after Blocks 3 and 5.

Figure 2a illustrates the mean score on a 5-point Likert scale of student satisfaction with each of the curricular components from Blocks 3 and 5. The patterned columns signify that a statistically significant difference exists between the rating for that curriculum component and the didactic rating using a matched-pair analysis. As illustrated in Figure 2a, when a statistically significant difference was found between the score for didactics and the score for various other curricular components, didactics received the higher score.

Figure 2b illustrates the student-perceived learning from each of the curricular components from Blocks 3 and 5. Again, the patterned columns signify a statistically significant difference between the rating for that curricular component and the didactic rating using a matched-pair analysis. Figure 2b likewise demonstrates that in all cases in which a statistically significant difference was found, didactics received a higher rating for perceived learning than other curricular components.

Figures 3 and 4 show the comparison between perceived learning and satisfaction for Blocks 3 and 5, respectively. The patterned columns represent a statistically significant positive Spearman's correlation between learning and satisfaction for each curricular component. It is evident from the figures that there was a statistically significant positive Spearman's correlation for all of the curricular components in Block 3, and all but Independent Study in Block 5.

Table 1 shows whether or not NBME scores correlated with time usage and/or interest in subject matter based on Spearman's multivariate analysis (n = 43). Table 1 reveals that during Block 3, only interest in the subject matter had a statistically significant positive correlation with the NBME score, while during Block 5, only time spent in class had a statistically significant negative correlation with the NBME score.

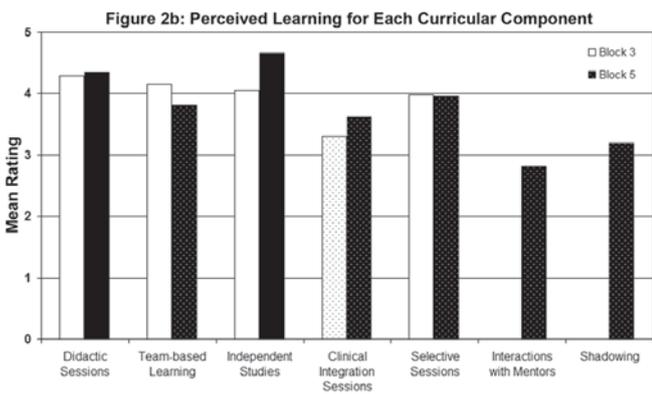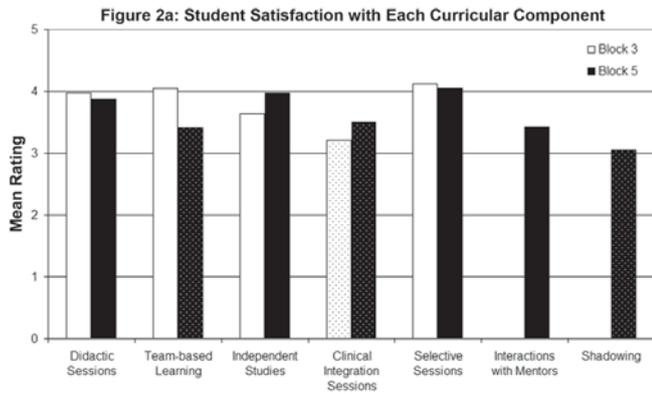Fig. 1. Curriculum map of Year 1 at Mayo Medical School.

Fig. 2. Student satisfaction (2a) and perceived learning (2b) with each curricular component, assessed by mean score on a 5-point Likert scale questionnaire. Responses are shown for both Block 3 and Block 5. The patterned columns signify that a statistically significant difference exists between the rating for that curriculum component and the didactic rating using a matched-pair analysis.

Note: The original questionnaire was modified between Block 3 and Block 5 to improve its usefulness. During this time, a "not applicable" option was added to the mentor portion of the questionnaire, and a separate shadowing portion was added to the questionnaire. The original questionnaire included shadowing as part of clinical integration. Thus, no Block 3 data is available for mentoring or shadowing.

Fig. 3. The comparison between student-perceived learning and satisfaction for each curriculum component in Block 3. The patterned columns represent a statistically significant positive Spearman's correlation between learning and satisfaction for each curricular component.
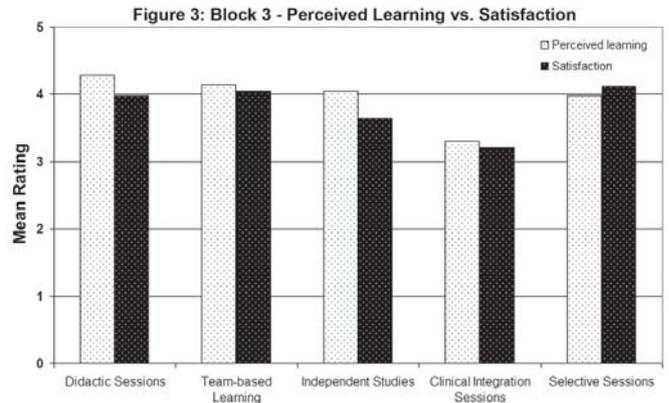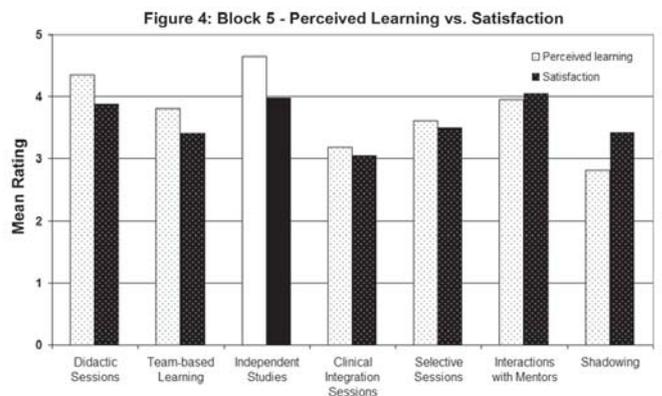

Fig. 4. The comparison between student-perceived learning and satisfaction for each curriculum component in Block 5. The patterned columns represent a statistically significant positive Spearman's correlation between learning and satisfaction for each curricular component.

Table 2 analyses the top and bottom quartiles of students based on NBME score for differences in time usage, perceived learning, satisfaction and interest using Wilcoxon Rank Sum analysis (n = 11 in each quartile). Table 2 shows that in Block 3, only the amount of time spent studying independently differed (negative correlation) between the top and bottom quartiles of students. However, in Block 5, perceived learning from studying independently and interest in the subject matter both differed (positive correlations) between the extreme quartiles of students.

Discussion

One of the goals of the MMS curriculum reform effort was to limit didactic contact time in order to offer the opportunity for other varied learning experiences. It was thought that student satisfaction and perceived learning would thus increase with exposure to a variety of learning methods.

Student Satisfaction with Each Curricular Component

Students were generally more or equally satisfied with didactics compared with other curricular components. During Blocks 3 and 5, students were less satisfied with classroom clinical integration sessions. In addition, during Block 5 they were also less satisfied with shadowing and team-based learning activities. Student satisfaction ratings of independent study and selective experiences were similar to the satisfaction ratings of didactics (Fig. 2a). It is not uncommon for medical students in particular to reflect a preference for the didactic approach to teaching and learning.[8] Studies based at the School of Public Health and Community Medicine, University of New South Wales suggest that medical students tend to value a more teacher-directed rather than a self-directed strategy as is commonly employed in an outcomes-based curriculum.[8] Classroom integration as well as shadowing and team-based activities support learner centredness and once again detract from the tradition of didactic instruction.

Student Perception of Learning from Each Curricular Component

During Block 3, students perceived that they learned the most from the didactic portion of the curriculum; however, only clinical integration activities received a statistically significant lower score. In Block 5, the didactic portion of the curriculum received a statistically significant higher rating for perceived learning than all other curricular components with the exception of independent study; however, this higher rating for independent study was not statistically significant ($P = 0.0569$) (Fig. 2b).

Correlation between Perceived Learning and Satisfaction

A statistically significant positive correlation between perceived learning and satisfaction in all curricular components was found in both Blocks 3 and 5 with the exception of independent study in Block 5 (Figs. 3 and 4). It is uncertain why this positive correlation is not significant but it may be related to the larger number of hours spent studying independently during Block 5. The mean time spent studying independently during Block 3 was 10 to 20 hours/week whereas the time spent studying independently in Block 5 was 20 to 30 hours/week. Thus, some students may have rated their satisfaction lower based purely on the significant time commitment.

In addition, there are other important differences between the blocks that may account for the discrepancy between perceived learning from and satisfaction with independent study in Block 5. During Block 3 students had multiple didactic courses, while in Block 5 students had only 1 integrated Gross Anatomy and Radiology course. Students had approximately 30 hours/week of contact time in Block 3 compared to 20 hours/week in Block 5. The sheer increase in volume of subject matter in Block 5, combined with a laboratory component, may have been responsible for the significant increase in time spent studying independently and the subsequent decrease in student satisfaction.

Students also gave shadowing lower ratings during Block 5. This may at least partially be accounted for by the large volume of material to be learned during this block resulting in a significant decrease in student shadowing activities (only 28% of students shadowed during Block 5 compared to 51% during Block 3).

Impact of Flexibility on Performance

It was originally hypothesised that performance might decrease if students spent their free time shadowing instead of using this time for exam preparation. However, when comparing NBME scores to student responses regarding utilisation of free time (studying versus shadowing), there was no statistically significant difference in either block. Evaluation of performance on the Pathology NBME examination between those who shadowed in an area

Table 1. Correlation of Time Usage and Interest with NBME Score Based on Spearman's Multivariate Analysis (n = 43)

	Block 3	Block 5
Time spent in class	No	Yes (R = -0.3457, P = 0.0232)
Time spent studying independently	No	No
Time spent shadowing	No	No
Interest in the material	Yes (R = 0.3087, P = 0.0496)	No

R represents Spearman's correlation value

Table 2.   Difference between Top and Bottom Quartiles of Students According to NBME Exam Score With Regard to Time Usage, Perceived Learning, Satisfaction and Interest in the Subject Matter

	Block 3	Block 5
Time spent in didactic sessions	No	No
Time spent studying independently	Yes (MD = -0.71, *P* = 0.0520)	No
Time spent shadowing	No	No
Time spent in selective activities	No	No
Perceived learning from didactic sessions	No	No
Perceived learning from independent studies	No	Yes (MD = 0.545, *P* = 0.0267)
Perceived learning from selective activities	No	No
Satisfaction with didactic sessions	No	No
Satisfaction with independent studies	No	No
Satisfaction with selective activities	No	No
Interest in material	No	Yes (MD = 1.091, *P* = 0.0268)

MD: mean difference; statistical significance determined using Wilcoxon Rank Sum

related to pathology or immunology and those who shadowed in other fields also showed no statistically significant difference (Table 1).

Predictors of Performance

Time usage, shadowing and interest in course material were evaluated as possible predictors of performance. It was anticipated that spending more time studying in class and independently would result in an improved NBME score than if the time was spent shadowing. However, neither Block 3 nor 5 showed any correlation between NBME exam score and time spent shadowing or time spent studying independently (Table 1). The results showed that in Block 5, however, students with higher NBME scores spent less time in the classroom. This statistically significant *negative* correlation between student performance and time spent in class may be related to students' preference for independent study time when confronted with such a large volume of materials.

Student interest in the material was a positive predictor of performance during Block 3 but not in Block 5 (Table 1). The lack of a statistically significant correlation in Block 5 may be due to a generally high interest level from all students, as students are interested in obtaining a solid foundation in anatomy and recognise its value in the clinical setting.

Analysis of Student Performance

In terms of interest, time allocation, perceived learning and satisfaction with didactics, independent study and selectives, the only significant difference between the top and bottom quartiles during Block 3 was related to independent study. The bottom quartile of the class studied more outside of class in order to learn the assigned material. In Block 5, the top quartile of students perceived that they

learned more during independent study and had greater interest in the learning material (Table 2).

Conclusions

These results do not necessarily mean that didactic teaching methods are the most effective; the following must first be considered. Firstly, it is possible that students had a difficult time assessing their perceived learning from newer, more innovative teaching methods such as selectives or team-based learning activities. It might have been easier for them to rate learning strategies with which they were already very familiar (i.e. didactics and independent study).

Secondly, students may have based their ratings on the amount they learned for test preparation purposes considering exam performance was the most recently assessed outcome. However, the other curriculum components could have been beneficial in achieving other outcomes such as becoming compassionate physicians, effective leaders and creative thinkers. These outcomes may not have been considered when ranking perceived learning but are nonetheless important qualities to develop and outcomes for which the curriculum was created.

Lastly, students may not have learned information relevant to the final exam during a specific curriculum component but they may have learned, for example, that they do not want to pursue a future career in a specific field or that they really enjoy research or healthcare policy. These insights are difficult to quantify.

This study did show that student satisfaction with didactics was higher than satisfaction with shadowing experiences and classroom clinical integration activities and similar to satisfaction with independent study and selective experiences. Thus, satisfaction was variable among more structured and more elective curricular components.

This study was designed to evaluate the effect of various curricular components that introduce flexibility into the medical curriculum with regard to student satisfaction and perceived learning and the association with objective examination scores. However, this study was not designed to assess the effectiveness of the curriculum in meeting the graduate outcomes for which it was created as part of an outcome-based curriculum. Thus, although some of the curricular components that create flexibility in the medical curriculum do not appear to affect satisfaction and perceived learning of first-year students as demonstrated in this study, their potential influence on graduate outcomes, in terms of delivering healthcare providers who exhibit outstanding creativity in scholarly activity, provide compassionate and patient-centred care and are effective leaders, should not be discounted.

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