Have Motivation Theories Guided the Development and Reform of Medical Education Curricula? A Review of the Literature

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Abstract

Purpose

Educational psychology indicates that learning processes can be mapped on three dimensions: cognitive (what to learn), affective or motivational (why learn), and metacognitive regulation (how to learn). In a truly student-centered medical curriculum, all three dimensions should guide curriculum developers in constructing learning environments. The authors explored whether student motivation has guided medical education curriculum developments.

Method

The authors reviewed the literature on motivation theory related to education and on medical education curriculum development to identify major developments. Using the Learning-Oriented Teaching model as a framework, they evaluated the extent to which motivation theory has guided medical education curriculum developers.

Results

Major developments in the field of motivation theory indicate that motivation drives learning and influences students' academic performance, that gender differences exist in motivational mechanisms, and that the focus has shifted from quantity of motivation to quality of motivation and its determinants, and how they stimulate academic motivation. Major developments in medical curricula include the introduction of standardized and regulated medical education as well as problem-based, learner-centered, integrated teaching, outcome-based, and community-based approaches. These curricular changes have been based more on improving students' cognitive processing of content or metacognitive regulation than on stimulating motivation.

Conclusions

Motivational processes may be a substantially undervalued factor in curriculum development. Building curricula to specifically stimulate motivation in students may powerfully influence the outcomes of curricula. The elements essential for stimulating intrinsic motivation in students, including autonomy support, adequate feedback, and emotional support, appear lacking as a primary aim in many curricular plans.

Dramatic changes in medical education over the years have affected the design and content of curricula, including methods of teaching and learning, assessment, and the competencies required of doctors.[1,2] Educational psychology tells us that learning processes can be mapped on three dimensions: cognitive (what to learn), affective or motivational (why learn), and metacognitive regulation (how to learn).[3] The *cognitive* component of learning involves those thinking activities that people use to process content, including selecting, relating, concretizing, and applying information.[3,4] The *affective* component involves coping with the feelings that arise during learning and may affect the progression of a learning process positively, neutrally, or negatively.[3,4] This component includes aspects of motivation. The *metacognitive regulation* component involves orienting, planning, monitoring, testing, diagnosing, adjusting, evaluating, and reflecting on the student's learning behavior and approach.[3,5,6] The Learning-Oriented Teaching (LOT) model suggests that in a truly student-centered medical curriculum, all three of these dimensions should guide curriculum developers in constructing learning environments.[7]

The medical school curriculum should cover the topics and issues that align with the intended outcomes and serve the needs of society, content experts, and students. Content concerns—the cognitive or "what to learn" dimension—have dominated curricular reform for a long time. A variety of educational theories have influenced curriculum development. How best to present materials, structure and integrate elements of the curriculum, sequence topics, apply methods, and assess students have been important issues of deliberation.[8] Each of these issues appears to address predominantly the processing of information.[6]

Styles of learning in medical education have been affected by the introduction of problem-based learning (PBL) and related methods, which focus on the metacognitive regulation or "how to learn" dimension.[9–11] Additionally, the affective or "why learn" dimension has received some attention. For example, studies have shown that students "like" PBL better than traditional teaching methods.[12–14] This appears to be a by-product of particular curricula, however, rather than part of a systematic approach to build a curriculum model that predominantly focuses on motivating students to learn.

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We believe that students' levels and types of motivation may be larger determinants of their individual outcomes than particular methods of teaching and deserve serious attention from curriculum developers.[15] As student motivation can be influenced by the construction of a curriculum,[16] in this article, we explore and analyze how motivation theory has affected curriculum development in medical education.

Motivation determines thought and action—it influences why behavior is initiated, persists, and stops, as well as what choices are made.[17] In an academic setting, motivation and learning are integrally related;[18] this means that for learning to take place, motivation is important.[19] Motivation in education is also important for deep learning and good academic performance as well as positive learner well-being and satisfaction.[20–22] In the case of medical education, these are expected to contribute toward students' becoming good doctors. Yet, despite the implicit understanding of motivation's importance, research directly studying motivation in medical education is scarce.[23]

To begin to address this gap, we conducted a review of the literature to explore how the motivation dimension of learning has guided curriculum development in medical education. Because this is a potentially broad topic, we answered the following research question: Has student motivation been an important element in guiding curricular changes and reforms in medical education?

Method

To examine our research question, we reviewed selected sources in the literature of both motivation theory and medical education curriculum development. This review was not performed as a comprehensive, systematic review because our goal was to answer a focused research question.

To identify and construct a history of motivation theories published through 2010, R.A.K. conducted online searches in June 2009 and June 2011 via Google Scholar and PsycINFO, using the keywords *motivation theory* and *motivation theories.* She reviewed the texts on motivation and motivation theories[24,25] that were cited by the articles found via these searches. After R.A.K. made a comprehensive list of the theories and identified those relevant to student motivation, all of the authors discussed the list. Those described in this review were included by consensus among the authors.

To identify the literature on and construct a history of curriculum developments in medical education, we relied on the subject expertise and experience of three of the authors (E.C., K.V.M., O.tC.) to make a comprehensive list of the major curricular reforms. In June through July 2011, R.A.K. searched PubMed and Google Scholar, entering each reform as a key word, to identify the first articles published on each of the major curricular reforms. Additional articles describing more details of these curricular reforms were suggested by K.V.M., O.tC., E.C., and G.C.

We then explored the extent to which each curricular reform was guided by motivation theory. We selected the LOT model as a framework within which to view the various medical education curriculum developments because it is derived directly from the three components of learning processes described in educational psychology.[3,7] Using the LOT framework, R.A.K. rated the published descriptions of each curricular reform according to how much it was oriented toward cognitive, motivational/affective, and metacognitive elements of learning. She scored the motivational element on the basis of implicit or explicit mention of consideration of student motivation in the design of the model. K.V.M. and O.tC. reviewed her ratings and confirmed them or suggested changes, which were finalized after consensus was achieved by the authors.

Results

We present our findings as a narrative of the development of motivation theories and the recommendations that can be derived from these theories for education. We then summarize the history of medical education curriculum development and highlight the components of the LOT model captured by different curricular developments. Our main focus is on the motivational component of learning.

Short history of motivation theory

The development of theories of motivation is a fairly recent phenomenon, dating back only to the 20th century. Below, we provide a short history of motivation theory.

Need to achieve theory (1938). This theory was based on Murray's observation that people have differing tendencies, called "the need to achieve," to "overcome obstacles, to exercise power, to strive to do something difficult as well as and as quickly as possible" (cited by Franken[24]). Murray devised the Thematic Apperception Test to measure variations in human motivation and described a dynamic, time- and context-dependent construct of motivation. He did not view motivation as a fixed trait but as one that could be manipulated to enhance learning.

Drive theory (1943). Hull's drive theory of learning proposed that needs drive behavior in a way that results in fulfillment of these needs, thus maintaining a steady state in the body (cited by Weiner[25]). Hull even developed a formula for calculating motivation.

Theory of hierarchy of needs (1943). Maslow's[26] theory was based on the relative importance of the different needs in a person's life. Maslow proposed that basic human drive or motivation ultimately reflects a need for self-actualization (i.e., the fulfillment of one's potential), which comes into action only if one's underlying basic needs—physiological, safety, love and belonging, and esteem—are satisfied. The need for education and academic achievement can be viewed as reflective of the wish to develop as an individual and, thus, would fall into the self-actualization level of needs.

Method for scoring achievement motivation (1953). McLelland and his colleagues[27] developed a precise method for scoring achievement motivation. McLelland et al demonstrated that a generalized motivation exists in every individual that can predict his or her

behavior in a wide variety of situations. The underlying motivational construct seems stable and predictive for behavior.

Expectancy-value theory (1966). Atkinson[28] proposed that every individual has both a "motivation to succeed" and a "motivation to avoid failure"; the individual's overall motivation is a resultant sum of these two dimensions. He found that motivation is dependent on motive, expectancy of success or failure, and incentive value of success or failure. He also devised a formula to measure the quantity of motivation of an individual in a given situation. He predicted that motivation and effort would be the strongest when reaching the target was neither too easy nor too difficult.

Motive to avoid success theory (1968). Horner[29] added a gender aspect to motivation by suggesting that women showed lower achievement motivation than men because women had a greater "fear of success" than did men. This fear, according to Horner, grows out of consideration of the consequences of success, which for women may mean loss of friends, femininity, and popularity.[29] Spence and Helmreich (1978; cited by Beere[30]) compared men and women on their achievement motivation and showed that men scored higher on a desire for intellectual challenge and competitiveness, whereas women scored higher on a desire to work hard. Horner and Spence and Helmreich paved the way for establishing gender-related differences in motivation, which have also been observed in current research.[31,32]

Attribution theory (1974). This theory is concerned with "how individuals interpret events and how this interpretation relates to their thinking and behavior."[33] Weiner[33] identified ability, effort, task difficulty, and luck as the most important factors affecting attributions for achievement.

Social cognitive theory (1977). Bandura[34] proposed that people function as contributors to their own motivation, behavior, and development within a network of reciprocally interacting influences. The concept of self-efficacy is central to social cognitive theory (SCT), meaning that an individual's judgments of self-efficacy determine how much time and effort he or she invests in an activity. Thus, people generally undertake, perform, and persist at activities that they believe themselves to be capable of performing and avoid those that they feel incapable of performing.[34]

Self-determination theory (1985). Deci and Ryan[20–22,35] proposed that a person's behavior is determined not only by level of motivation but also by the quality or type of motivation. They described two types of motivation: *intrinsic* motivation, which makes a person pursue an activity out of personal interest, and *extrinsic* motivation, which makes a person pursue the activity to obtain a reward or to avoid loss or punishment. Self-determination theory (SDT) puts forward intrinsic motivation as the desired type of motivation as studies found it to lead to deep learning and better outcomes.[20–22] Intrinsic motivation is built on the individual's inherent needs of autonomy, competence, and relatedness[20–22]:

- The need for *autonomy* describes the need to feel that "I am doing it because I want to."
- The need for *competence* describes the feeling that one has the capability to achieve one's desired goals.
- The need for *relatedness* describes being able to relate to or matter to significant others (i.e., parents, teachers, friends, peer group) in one's life through work, actions, and achievement. (In medical education, patients could also be "significant others."[15])

These three needs—autonomy, competence, and relatedness—must be satisfied for a person to be intrinsically motivated. SDT steered research on motivation toward quality of motivation. We have explained SDT in more detail here than we did the other theories because SDT is considered to be very relevant in medical education.[15,23,36–38] We expand on applications of this theory in this article's Discussion.

Goal Theory (2000). Made popular by Pintrich,[39] goal theory explains individuals' motivation on the basis of two goal orientation types: mastery and performance. *Mastery* goal orientation occurs when the individual's goals are focused on mastering, learning, and understanding the task, whereas *performance* goal orientation occurs when the individual's goals are focused on performing better in comparison with others at the task.

Conclusions and recommendations for medical education. The conclusions and recommendations for medical education that we derived from these different motivation theories are summarized in Table 1. As this short history shows, as motivation theories have developed, their focus has shifted from consideration of only the quantity of motivation[24,25,27,28] to consideration of the quality of motivation.[20,33,34,39] A large body of general education literature exists about intrinsic and extrinsic motivation and how to enhance intrinsic motivation. This shift in focus is also reflected in the fact that the theories currently considered most relevant in addressing motivation—SDT, SCT, goal theory, and attribution theory—all take a qualitative approach. Thus, in keeping with current understandings, the focus in medical education should not be solely on enhancing the quantity of motivation in our students but also on improving its quality.

A short history of curriculum development in medical education

In this section, we turn to selected developments in medical education models and curricula that have been significant and consider whether they were guided by the cognitive, affective/motivational, and/or metacognitive regulation dimensions of learning. At the outset, we would like to note that the developments mentioned below have not been uniform across all medical schools or all countries. Within agreed-on standards of quality, each medical school follows its own philosophy and mission and integrates the changes that are suitable for its ideology and context. Also, not all of the curricular changes discussed here have been brought into practice completely; some may still be in developmental stages.

Apprenticeship model (18th–19th centuries). Most of the written history of the development of medical education dates back to the 18th century in the United States[40] and earlier in Europe.[41] Medical education in the United States started mainly as an apprenticeship model[40] that was dependent on the practitioner–teacher under whom the apprentice obtained training and was not regulated by any authoritative body. This model seems to have been based on improving the cognitive and

Table 1
Conclusions and Recommendations for Education Derived From Theories of Motivation

Theory (author)[ref]	Year	Conclusions	Recommendations derived by the authors for education
Need to achieve theory (Murray)[24]	1938	Motivation of students is context- and time-dependent.	It is important to consider student motivation because it can be enhanced by educators.
Drive theory (Hull)[25]	1943	Needs drive behavior, which results in satisfaction of these needs.	Understanding students' needs can help educators arrange curricula in ways that enhance student motivation.
Hierarchy of needs theory (Maslow)[26]	1943	"Self-actualization," i.e., fulfilling one's potential, is a need, which comes into action only if one's basic needs are satisfied.	If educators desire students to work up to their potential, students' basic needs (physiological, safety, love, esteem) should be satisfied.
Method for scoring achievement motivation (McLelland et al)[27]	1953	There is a generalized motivation which is stable in all situations. It is inborn or depends on childhood experiences.	It is important to focus on motivating students to learn during childhood and through high school.
Expectancy-value theory (Atkinson)[28]	1966	An individual's overall motivation is a sum of her motivation to succeed and her motivation to avoid failure. Motivation is dependent on motive, incentive value of success/failure, and expectancy of success/failure.	It is important to provide optimal challenges to students to motivate learning, as their efforts are strongest when faced with a task that is neither too easy nor too difficult.
Motive to avoid success theory (Horner)[29]	1968	Women have an additional dimension in motivation, called "fear of success."	Gender differences in motivation should be considered while planning curricula.
Attribution theory (Weiner)[33]	1974	Individuals attribute their successes and failures to different factors, which can be internal or external. These attributions determine their further motivation and behavior toward the task.	To be able to motivate students, educators need to understand to what students attribute their successes or failures.
Social cognitive theory (Bandura)[34]	1977	Individuals control their own motivations and behavior within the network of their social environment.	To be motivated for a task, including learning, an individual needs to feel self-efficacious at this task.
Self-determination theory (Deci and Ryan)[20–22,35]	1985	An individual can have two types of motivation: intrinsic and extrinsic. Intrinsic motivation is the desirable type of motivation for all activities, including learning/education. Rewards drive extrinsic motivation and reduce intrinsic motivation.	To enhance intrinsic motivation among students, educators should satisfy students' needs for autonomy, competence, and relatedness.
Goal theory (Pintrich)[39]	2000	Goal orientation drives an individual's motivation. Mastery goal orientation focuses on mastering a task, whereas performance goal orientation focuses on being better than others.	Mastery goal orientation is the preferred type of orientation in students.

metacognitive regulation components of learning.

Flexner model (1910). Licensure became the norm in Europe in the 1800s.[41] In the United States, curricular reform efforts aimed at ensuring that all medical teaching schools met common standards of quality intensified after Abraham Flexner's report to the Carnegie Foundation in 1910.[2,42,43] Flexner recommended that the entry qualification for medical study should be a bachelor's degree in science and that the medical curriculum should consist of two years of basic sciences followed by two years of (practical) clinical education involving close contact with patients.[42] These curricular changes were based on improving the cognitive component of learning. Flexner's view of the importance of basic sciences in the medical curriculum influenced medical education not only in the United States, Canada, and some parts of Europe,[44] but also in Asia.[45] Following the Flexner Report, the separation of basic sciences and clinical education grew so profound[40] that reports emerged that students were finding it difficult to see how the study of basic sciences was relevant to their goal of becoming a doctor and were, thus, losing their interest in the study of medicine.[8,46]

Case Western Reserve University model (1952). In 1952, Case Western Reserve University adopted an integrated approach to medical education. The central themes included teaching based on problem solving, students accepting responsibility for their own education, faculty subject committees (rather than departments) designing the curriculum as a continuum, interdisciplinary teaching, and integrating basic sciences with clinical sciences.[8,47–49] The concepts of problem solving and integrating disciplines were developed further in other universities at a later time.[8] This model was geared toward the cognitive and metacognitive regulation

components; the consideration of the motivation component was implicit.

PBL model (1968). A major development in curricular approaches to learning medicine was the introduction of a PBL model, based on the assumption that problem-solving skills form the basis of being a good diagnostician and health care provider.[50] One important theme underlying PBL is elaborating students' prior knowledge.[37,51,52] In this model, information is presented to the students in the form of clinical cases or health-related problems. The students are asked to delve into the relevant information from basic, clinical, and social sciences and connect this information with their existing knowledge. In PBL, students are expected to own the responsibility for learning; further, teachers are expected to make a transition from disseminating information to facilitating learning.[37] Thus, PBL was also built around the concept of self-directed learning, which serves the metacognitive regulation of learning.[6,50,53] This model's goals and the original published description do not include any consideration of student motivation, except its assessment as a part of the selection procedure for admission.[37,50] Motivation of students has been mentioned in the PBL context as an advantage.[50] We conclude that consideration of motivational processes, especially in the context of small-group and application-oriented learning, was implicit. Thus, this model was based on improving the cognitive and metacognitive components of learning, and the improvement of the motivational component became apparent as the model was implemented.[37,51]

Integrated curriculum model (1995). Integrated curricula were established with the aim of placing each discipline and the matter taught by it in the context of all other disciplines or in the broader context of medical education.[54] Within this approach, *horizontal* integration meant integration across the medical subjects taught in a particular year or phase of the program, and *vertical* integration meant integration of preclinical and clinical sciences.[54–56] Vertically integrated curricula were introduced with the aim of placing basic sciences in the context of clinical practice and to introduce early student contact with patients.[54,56–58] One of the stated advantages of early contact with real patients is stimulating student motivation for learning.[54,59,60]

Outcome-based education model (1998). Outcome-based education uses the desired outcomes of the educational program as the basis for developing a curriculum.[61] The development of the curriculum is thus based on answers to the question, "What sort of doctors do we want to produce?"[62] This type of model can address outcomes beyond the individual learner achievement, such as meeting the health needs of society. The CanMEDS[63] and Accreditation Council for Graduate Medical Education[64] competency frameworks provide further tools to establish outcome-based education in practice and ways to assess this model objectively. Although developed to guide medical education at the postgraduate or graduate level, these competencies have provided important models for undergraduate programs as well.[65] This model targeted the cognitive and metacognitive regulation components.

Spiral curriculum model (1999). Harden[66] in 1999 described how a spiral curriculum, first described by Bruner in 1960, can be created in medical education. According to Harden, repetitive organization of content and the overall structure of the curriculum are neglected in medical curricula. This model tried to correct for this particular deficiency in its new approach. A spiral curriculum allows for building of knowledge in layers—that is, moving from simple facts to a more complicated understanding, thus revisiting topics iteratively. More recently, Z-shaped curricula[58,67] have been described; these are based on vertical integration of basic and clinical sciences. This model was designed to improve the cognitive and metacognitive regulation components; the consideration of the motivational component was implicit.

Experience-based learning model (2004). The experience-based learning model (first described by Eraut[68] in 2000 as learning in the workplace) is based on the concept of "participation in practice."[60] It is related mainly to clinical learning, and the learning spectrum ranges from passive observation to performance of the tasks of a doctor.[60] Students are given responsibility for patients in a graded manner, which helps them gain hands-on experience in context-based scenarios and develop confidence in their competence. It also allows them to learn from their peers and from others in the environment. The model is consistent with an emphasized metacognitive component of learning, and it considers the motivational component as well.

Longitudinally integrated clerkships model (2005). The longitudinally integrated clerkships (LICs) model[69] is a recent curricular development in medical education. Its aim is to create doctors who are broadly educated across the key competencies of medicine, have the knowledge and skills to enter graduate training, and exhibit high levels of professionalism and patient-centered orientation. LICs combine patient care across various disciplines, in the way patients experience care; the focus is on following patients, so as to understand the course and complexity of their illnesses and to enable formation of continuity in doctor–patient relationships. This model's consideration of motivation is implicit. This model is still in the development and testing stages—the first cohorts of students from this curriculum model graduated recently. Thus, this model's effects and effectiveness remain to be demonstrated.

Summing up developments in medical education curricula. In 1984, Harden et al[70] proposed the SPICES model for planning or reviewing a curriculum. It describes the factors supporting a move to either end of the continuum of the following curriculum characteristics: student-centered/teacher-centered (S); problem-based/information-gathering (P), integrated/discipline-based (I); community-based/hospital-based (C); with electives/uniform (E); and with a systematic approach/apprentice-based approach (S).[70] SPICES predates some of the models we presented above, but it offers a helpful guide for summing up the major developments in medical education curricula, which are as follows:

1. Practitioner/teacher-dependent teaching has changed to more standardized teaching formats.[44,70]
2. Unregulated, subjective teaching or training approaches have changed to more standard, objectives-based teaching approaches, which follow a curriculum.[44]

3. Specialty- and discipline-based educational approaches have been replaced by more integrated approaches in some medical schools.[8]
4. Teacher-centered curricula and approaches have given way to approaches that emphasize learner-centered teaching.[2,70]
5. Isolated teaching of basic and clinical sciences is being replaced by integrated teaching approaches.[70]
6. The view that competence requires only diagnostic and management skills has evolved to a more broad-based educational approach that includes competencies such as communication skills, collaboration skills, and professionalism.[44]
7. Knowledge-based assessment has evolved toward competency-based assessment.[44]
8. Hospital-based training has changed at some medical colleges to include community-based or rural practice-based training.[70]

Motivation and medical education

As noted earlier, the LOT model describes three components of learning: cognitive, affective/motivational, and metacognitive regulation.[7] If we view developments in medical education curricula from the perspective of the LOT model, we observe that, in general, curricular developments have been largely based on improving the cognitive component of learning (Table 2). Whereas developments like PBL, integrated curricula, outcome-based education, experience-based learning, and LICs are designed to improve the metacognitive regulation component of learning, most of these approaches also incorporate affective outcomes. Consideration of the motivational component in many curricular changes has, however, been implicit or recognized in retrospect, or is still in development (e.g., experience-based learning model).[60]

From our review of the literature, it appears that student motivation has not been a predominant driver of curriculum reform. Mainly, it has implicitly been assumed as a natural by-product and outcome in medical education. We did not find many explicit writings on student motivation in the medical education literature; one of the most elaborate pieces that considers motivation dates back to 1961.[71] We could not establish that medical curriculum developers have often deliberately paid attention to student motivation. Nevertheless, some medical education developments, such as the PBL model and the integrated curriculum model, have resulted in stimulation of student motivation[55,59] as a side benefit. In these models, the motivational aspect has been explicitly adopted and is now considered an aspect of those developments.

Discussion

In this review, we found that student motivation has not been a predominant driver of curricular reform in medical education. Examining the concepts described in the different motivation theories shows that motivation theorists have often emphasized the importance of motivation in learning and education. However, developers of medical education curricula have appeared to undervalue the importance of paying deliberate attention to motivation.

It is important to incorporate concepts in student motivation as an integral part of the foundation of medical curricula, particularly the concept of stimulating intrinsic motivation among medical students (i.e., learning for the sake of learning and patients) rather than extrinsic motivation (i.e., learning to be rewarded with good grades, honors, success, or money). Intrinsic motivation has been shown to lead to better learning, performance, and well-being among medical students.[32,72]

According to SDT, supporting students' needs of autonomy, competence, and relatedness is essential to stimulate their intrinsic motivation and inculcate a true love for learning and practice.[21,22] Nonfulfillment of these needs can have consequences for medical trainees' career decisions; for example, a Netherlands-based study, in which postgraduate doctors in training were interviewed, found such nonfulfillment to lead to consideration of withdrawing from specialist training.[73] Some curriculum models—like PBL, vertical integration, experience-based learning, and LICs—do address issues of student interests and motivation. What appear to be given less attention in curricular planning are enhancing student autonomy, providing emotional support to students, and giving importance to providing effective feedback[71] on students' learning.

Table 2

Curricular Trends in Medical Education and Their Orientation Toward the Three Components of Learning, as Suggested by the Learning-Oriented Teaching (LOT) Model[7]

		Oriented to component*		
Date of origin	Curricular trend[ref]	Cognition	Motivation	Metacognitive regulation
18th–19th centuries	Apprenticeship model[40]	++	—	+
1910	Flexner model[2, 43]	++	—	—
1952	Case Western Reserve University model[47]	++	+, implicit	++
1968	Problem-based learning model[50]	++	+, implicit	++
1995	Integrated curriculum model[54–57]—horizontal and vertical	++	+, implicit	++
1998	Outcome-based education[61]	++	—	++
1999	Spiral curriculum model[66]	++	+, implicit	++
2004	Experience-based learning model[60]	++	++, in development	++
2005	Longitudinally integrated clerkships (LICs) model[69]	++	+, implicit	++

* Level of orientation toward specific component: + indicates low, ++ indicates high. For motivation, the authors have also indicated whether the orientation is implicit, stated, or in development.

Feedback needs to address the gap between what students have understood and what the teacher has expected them to learn; that is, feedback should be provided on the process of learning and not just in the form of grades.[74] Hattie and Timperley[74] have outlined how feedback provided to students may not be effective; they have also described a model for giving effective feedback. The Cleveland Clinic Lerner College of Medicine's curriculum is an example of a "feedback-rich" model that is aimed at improving student competence through formative feedback, as no summative grades are given.[75] One of the challenging issues for stimulating student motivation is the existence of control-oriented teaching[37] and assessment systems stemming from the (perhaps too narrow) understanding that "assessments drive learning."[76] It is important to use assessments to give feedback on performance and gaps in knowledge and skills if the ultimate objective of a curriculum is to foster student learning.[6] If feedback is not given on these assessments in an effective way, however, educators risk stimulating among students greater extrinsic motivation, which is driven by grades. Thus, the current medical education system through some means fortifies students' motivation while it also erodes their motivation through other means. In particular, not much attention is paid to stimulating the desired kind of motivation, as recommended by SDT, which is intrinsic motivation.[22] Quality of motivation, therefore, suffers in the trade-off.

It is time to ask ourselves to reflect on the kind of students and future doctors we would like our medical schools to produce: those who are intrigued by and interested in medicine and, thus, in lifelong learning, or those who carry superficial knowledge and, thus, require incentives and regulations to keep up with new advances in the science and practice of medicine. Medical educators, patients, and society[77] desire doctors who are interested in the study and practice of medicine and who like caring for and relating to patients, not doctors whose main goal is achieving external rewards and recognition. We predict that adopting a teaching philosophy designed to stimulate intrinsic motivation in medical students could lead to doctors who engage in lifelong learning (autonomously instead of being controlled by licensure and rules), which is so important in the practice of medicine. Even if society and the working conditions of the health care system are not geared toward stimulating intrinsic motivation among doctors, we as educators may at least shape our curricula to contribute to it. In two recent publications,[15,16] we have offered many suggestions regarding how to apply motivation theory (SDT) in practice in medical education and curriculum development.

Limitations

The most important limitation of this review is that we reached our conclusions on the basis of only the published literature on curricular reform. It is possible that curricular reforms taking place at individual schools, which are as yet unpublished, have incorporated elements of student motivation. We are also aware that we have been unable to elaborate fully all the theories of motivation or the rich history of medical education, both because the topics are complex and because our intention was to include only the details relevant to student motivation in medical education.

Conclusion

Curriculum development in medical education has focused on fostering the cognitive component of learning and sometimes on fostering the metacognitive regulation component of learning; however, developments in medical education appear to have undervalued student motivation, an aspect of the affective component of learning. Attention to student motivation should form an integral part of the foundation of medical curricula. The elements essential for stimulating intrinsic motivation in students which should be included in curricular planning are student autonomy, adequate feedback on learning, and emotional support. We propose that specifically integrating stimulation of student motivation (both its quality and quantity) into the way medical education is planned, delivered, and assessed could be a useful educational philosophy for the future.

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