

Teachers' mindsets in medical education: A pilot survey of clinical supervisors

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ABSTRACT

Purpose: Current medical education models maintain that competencies such as professionalism and communication can be taught; however, some argue that certain attributes that make up these competencies, such as empathy, are fixed. Teachers' implicit theories, or mindsets (beliefs about the fixed versus learnable nature of human attributes) have been shown to impact their teaching and assessment practices; but little work has explored mindsets in medical education. We examined clinical supervisors' mindsets of two cognitive attributes (intelligence and clinical reasoning) and two affective attributes (moral character and empathy).

Methods: Clinical supervisors ($n = 40$) from three specialities completed a survey designed to measure mindsets using two existing instruments for intelligence and moral character and 18 new items for clinical reasoning and empathy. Participants completed the survey twice for test-retest reliability ($n = 25$).

Results: New items had satisfactory psychometric properties. Clinical supervisors' mindsets were mixed. Only 8% of participants saw clinical reasoning as fixed while more saw empathy (45%), intelligence (53%), and moral character (53%) as fixed – running counter to current educational models that characterize these attributes as learnable.

Conclusion: This study provides evidence supporting the use of these new tools to measure mindsets that may help to better understand the impact of mindsets on medical education.

Introduction

In recent years, the competency-based medical education (CBME) approach has gained traction. The CBME model aims to improve patient care and safety by emphasizing longitudinal learning and the development of key competencies (Frank et al. 2015). Current educational frameworks such as CanMEDS, ACGME competencies, and the UK's General Medical Council's Outcomes for Graduates operate under the assumption that competencies, such as communication and professionalism, are dynamic in nature and thus can be taught and learnt over time (Swing 2007; Frank et al. 2015; Generic Professional Capabilities Framework 2017).

In practice, teaching and assessing competencies and their underlying attributes have proven challenging within the standard medical learning environment (Huddle 2005; Stepien and Baernstein 2006). For example, educational programs aimed at enhancing empathy – which is considered a critical aspect of both communication and professionalism (Frank et al. 2015; Sulzer et al. 2016) – have been criticized for addressing its cognitive and behavioral components while often leaving out its affective components (Sulzer et al. 2016). Some have even suggested that these attributes are not teachable at all. For example, Jeffrey and Downie (2016) argue that reducing empathy to a technical, measurable construct does not tap into its true definition (Collier 2012; Jeffrey and Downie 2016), while Pence (1983) writes that attributes such as compassion originate from inherent attitudes and emotions and cannot be taught in the same way as other components of

Practice points

- This study provides validation support for the use of two new scales measuring mindsets in medical education.
- Clinical supervisors hold both fixed and growth mindsets for the attributes of empathy, moral character and intelligence. Most hold growth mindsets for clinical reasoning.
- Fixed mindsets contradict current educational models that characterize these attributes as learnable.
- Future research is needed to investigate how mindsets may be impacting teaching and assessment in medical education.

medical competence (Pence 1983). These authors suggest that certain affective components of competencies may be fixed, and while these assertions remain controversial, it is possible that clinical supervisors in medical education hold similar opinions. If so, these beliefs run counter to the current educational approach and may have implications for teaching and assessment practices.

Beliefs about whether or not an attribute is learnable have been referred to as implicit theories or mindsets (Dweck et al. 1993). According to Dweck et al. (1993) individuals can be classified as having either fixed or growth mindsets. Those with fixed mindsets believe that human attributes are set traits that cannot be taught – you have what you have. Those with growth mindsets believe that

human attributes are developmental and, therefore, can be taught – you have what you have learned (Dweck et al. 1995a). Mindsets have also been shown to be domain-specific, for example one might hold a growth mindset for intelligence, and a fixed mindset for the attribute moral character (Dweck et al. 1995a).

Mindsets have been found to influence both learning and teaching (Dweck et al. 1995a; Butler 2000; Rattan et al. 2012). Students who believe that intelligence can develop over time (growth mindsets) are more likely to persevere and ultimately learn (Dweck et al. 1995a). Teacher mindsets have been shown to impact their teaching, assessment and feedback strategies, which in turn influence motivation and achievement in students (Butler 2000; Rattan et al. 2012; Canning et al. 2019). For example, teachers with fixed mindsets tend to evaluate students based on an initial score rather than on performance changes over time (Butler 2000). As well, teachers holding fixed mindsets have been found to use comfort-oriented feedback strategies with struggling students as opposed to encouragement-oriented feedback leading to decreased motivation and engagement in students (Rattan et al. 2012). Beyond education, mindsets can impact social judgments. Individuals with fixed mindsets tend to form strong and fast impressions that are maintained over time and across situations (Chiu et al. 1997), decreasing their ability to detect change (Heslin et al. 2005; Tam et al. 2010). Those with growth mindsets on the other hand tend to place greater weight on situational factors when making a judgment, creating conceptual room for growth and development (Chiu et al. 1997).

Drawing on this literature, it is possible that clinical supervisors could perceive some components of competencies as fixed – therefore potentially influencing their approach to teaching, assessing, and monitoring for progress of competencies. Given the developmental approach of CBME, it is imperative to explore how clinical supervisors understand competencies and their components as fixed or learnable. As a first step to investigating the role of mindsets in CBME, we set out to examine clinical supervisors' mindsets regarding the malleability of human attributes related to medical education. As mindsets have been found to be domain-specific (Dweck et al. 1995a), the study focuses on four different attributes which are common foci for selection, teaching, and assessment in medical education and are key components of the competencies communication, professionalism and medical expert (Frank et al. 2015). We selected two attributes from the cognitive domain (one generic – intelligence – and one more specific to medical practice – clinical reasoning), and two from the affective domain (one generic – moral character – and one more specific to medical practice – empathy), to examine whether clinical supervisors are more likely to view affective attributes as fixed compared to cognitive attributes. In addition, we aimed to provide preliminary validation support for two adapted measures assessing mindsets for the attributes clinical reasoning and empathy.

Method

Population and recruitment

The principal investigator (VD) contacted postgraduate program directors in Otorhinolaryngology, Anesthesia,

Neurology, Obstetrics & Gynecology, and Psychiatry at McGill University (Canada). Postgraduate program directors were asked to circulate an email invitation to clinical supervisors in their programs. The email invitation included a brief description of the study and a link to an online survey. The programs selected represented a range of disciplines that place differing relative emphasis on the technical and relational aspects of care. The main goal of this study was to explore mindsets of clinical teachers and to provide validity evidence supporting some measures of mindset adapted to the medical education context. If successful, we intended to use these measures in a future study exploring mindsets as a mediating factor within an experimental design conducted at the same institution. In order to ensure that we would not be overburdening potential participants, we decided to approach different postgraduate programs for these two studies.

Procedure

The online survey, available through the survey software LimeSurvey (LimeSurvey GmbH, Hamburg, Germany), was administered at two separate time points to examine test-retest reliability. Participants were invited to access the survey between November 28th – December 31st, 2017 for the first administration, and between January 16th – January 31st, 2018 for the second. Potential participants received an email with a description of the study and a link to the survey. The link brought the participants to a consent form, which they were required to agree with in order to proceed with the study.

Following survey completion, participants were given the choice to provide their email to receive a \$20 gift card for completing the first administration, to receive a \$50 gift card and agree to be contacted again for the second administration, or not to provide an email and decline compensation altogether. Email addresses of those who chose to receive gift cards were placed into password-protected files separated from their survey responses. These files were used to send the gift cards electronically and to contact the participants who agreed to complete the second administration.

The study was approved by the Ethics Committee of McGill University Institutional Review Board (IRB Study Number: A02-B08-17B).

Item development

Dweck et al. (1995a) developed two, three-item measures to assess implicit theories (mindsets) (i.e. entity (fixed) versus incremental (growth)) for intelligence and moral character (Dweck et al. 1995a). These items have garnered validity evidence and have been used in multiple studies (Dweck et al. 1995a, 1995b). In order to select the terms used to represent the attributes clinical reasoning and empathy, our team proposed multiple synonyms which were then discussed with five medical education experts from McGill University's Centre for Medical Education. Six terms were proposed for clinical reasoning (clinical judgment, clinical reasoning, clinical problem-solving, clinical acumen, clinical interpretation, decision-making) and seven terms were proposed for empathy (empathy/ability to empathise,

compassion, humaneness, insight, affectivity, warmth, understanding/ability to understand). Following discussions with local medical education experts, we selected three terms for each attribute (i.e. clinical reasoning and empathy) for piloting, based on their usage and potential distinctiveness. For clinical reasoning the chosen terms were 'clinical reasoning', 'decision-making' and 'clinical judgement'. For empathy the chosen terms were 'empathy', 'warmth' and 'compassion'. Items in the initial item pool were developed using the same sentence structure found in Dweck et al.'s (1995a) scales (Dweck et al. 1995a), with the replacement of the phrasing 'a person' with 'a physician'. Three items were developed for each synonym resulting in a total of 18 items.

The final survey consisted of 24 items including Dweck et al.'s (1995a) two original scales measuring intelligence (3-items) and moral character (3-items) mindsets, 9 newly developed items measuring clinical reasoning (clinical reasoning, decision-making, clinical judgement) mindsets, and 9 newly developed items measuring empathy (empathy, warmth, compassion) mindsets (Dweck et al. 1995a). Consistent with Dweck et al.'s (1995a) measures, respondents were required to indicate their agreement with each item on a Likert-scale ranging from 1 (*strongly agree*) to 6 (*strongly disagree*). Participants also completed a brief demographic questionnaire reporting age, gender, specialty, number of years in a supervisory role, number of years in an assessor role, and the estimated number of residents (postgraduate trainees) assessed during their career.

Data analysis

To explore the properties of the new scale items for clinical reasoning and empathy mindsets, we computed item means and standard deviations, inter-item correlations, and corrected item-total correlations with the goal of selecting the three best performing items for each question of the three-item sentence structure (i.e. highest item-total correlations to ensure scale homogeneity) (Streiner et al. 2015). The best performing items were then selected, subscores were created, and we examined each scale's internal structure (internal consistency) and relationship with other variables (inter-scale correlations and test-retest reliability using intraclass correlation coefficients based on single-measurement rating, absolute-agreement and two-way mixed-effects models (Koo and Li 2016)).

To characterize participant mindsets, we calculated average scores and standard deviations for each scale, as well as the proportion of participants in each of the categories defined by Dweck et al. (1995a) as fixed (average score across three items ≤ 3), growth (average score across three items ≥ 4), and indeterminate (average score across three items falls between 3 and 4) (Dweck et al. 1995a). To determine how consistent participants were in their mindsets across attributes, we computed the proportions of individuals who held the same mindset (fixed, growth, indeterminate) for all four attributes. We conducted all analyses using SPSS for Windows version 24 (IBM, Armonk, NY).

Results

Participant characteristics

Three postgraduate program directors (in Otorhinolaryngology, Neurology, and Obstetrics and Gynecology) agreed to forward our invitation email to their clinical supervisors. The email was circulated to 41 clinicians in Otorhinolaryngology, approximately 50 clinicians in Neurology, and an unknown number of clinicians in Obstetrics and Gynecology. Forty-one participants completed the first survey administration (representing a response rate of 32% for Otorhinolaryngology and approximately 28% for Neurology), of which 25 also completed the second survey administration. Data from one participant were not analyzed due to missing data on the items focused on mindsets. Of 40 participants, 14 (35%) were from the department of Neurology, 13 (33%) from Obstetrics and Gynecology, 13 (33%) from Otorhinolaryngology. Their mean age was 47 years (Standard Deviation (SD) = 13) and 24 (62%) participants were male. On average, clinical supervisors had 18 years (SD = 12) of experience supervising, 17 years (SD = 12) of experience assessing residents and reported having assessed an average of 114 residents (SD = 101). The only significant difference found between participant characteristics in both administrations was the estimated number of residents assessed (168 vs. 80; $t(37) = 15.98$, $p < .001$). Participant characteristics are reported in detail in Table 1.

Scale validation

All items for the new scales - empathy and clinical reasoning mindsets - had satisfactory psychometric properties (see Table 2).

For each attribute (clinical reasoning and empathy) we selected the three items with the highest item-total correlation. Three items per scale were chosen to correspond with the original scale structure developed by Dweck et al. (1995a). For a list of items used to measure clinical supervisors' mindsets, including selected items for the new scales, clinical reasoning and empathy, see Table 3.

All scales after item reduction had high internal consistency, with Cronbach's α of 0.98 for intelligence, 0.92 for moral character, 0.95 for clinical reasoning, and 0.94 for empathy. They all had moderate to good test-retest reliability across a 1–2 month time period: $r = 0.55$ (clinical reasoning), $r = 0.72$ (empathy), $r = 0.74$ (intelligence), and $r = 0.73$ (moral character).

Clinical supervisor mindsets about the malleability of the four attributes were, to some extent, domain-specific although moral character and empathy mindsets were strongly correlated ($r = 0.83$; $p < .01$; Table 4).

Examination of clinical supervisors' mindsets (Figure 1)

The majority of clinical supervisors held growth mindsets for clinical reasoning (88% growth vs. 8% fixed; $M = 4.6$; $SD = 0.9$). For the remaining three attributes, however, clinical supervisors held more fixed mindsets than growth: intelligence (53% fixed vs. 43% growth; $M = 3.4$; $SD = 1.2$),

Table 1. Participant characteristics.

	All Participants N = 40	Participants in only one administration N = 15	Participants in both administrations N = 25
Age			
Mean (SD)	47 (13)	49 (13)	46 (13)
Range	31–72	31–72	31–71
N respondents	39	15	24
Gender			
Male, <i>n</i> (%)	24 (62%)	9 (64%)	15 (60%)
Female, <i>n</i> (%)	15 (39%)	5 (36%)	10 (40%)
N respondents	39	14	25
Specialty			
Neurology, <i>n</i> (%)	14 (35%)	5 (33%)	9 (36%)
Obstetrics + Gynecology <i>n</i> (%)	13 (33%)	8 (53%)	5 (20%)
Otorhinolaryngology, <i>n</i> (%)	13 (33%)	2 (13%)	11 (44%)
N respondents	40	15	25
Experience in Supervising (years)			
Mean (SD)	18 (12)	19 (12)	17 (11)
Range	1–43	3–40	1–43
N respondents	40	15	25
Experience in Assessing Residents (years)			
Mean (SD)	17 (12)	17 (12)	16 (12)
Range	1–43	1–40	3–43
N respondents	39	14	25
Estimated Number of Residents Assessed			
Mean (SD)	114 (101)	168 (137)	80 (48)*
Range	10–500	10–500	12–200
N respondents	39	15	24

*Significant difference found using a t-test ($p < .05$) between participants in a single administration and participants in both administrations.

†No significant differences were found for mindsets when analyzed by demographic characteristics, analyses available upon request.

empathy (45% vs. 35%; $M = 3.5$; $SD = 1.0$), and moral character (53% vs. 25%; $M = 3.3$; $SD = 1.0$).

Regarding individual participants' consistency across the four attributes, two participants (5%) held fixed mindsets for all four attributes, seven (18%) held growth mindsets for all four attributes, no participants were indeterminate on all four attributes, and 31 (78%) were mixed (i.e. different mindsets for different attributes). No significant differences were found between mindsets when analyzed by demographic characteristics (analyses available upon request).

Discussion

The purpose of this study was to explore clinical supervisors' mindsets for attributes that are common foci of selection, teaching, and assessment in medical education. We sought to examine whether components of competence considered to be affective were more likely than cognitive components to be seen as fixed. To achieve this we used two established measures, one for intelligence (cognitive) and one for moral character (affective) mindsets developed by Dweck et al. (1995a) and two newly developed scales assessing clinical reasoning (cognitive) and empathy (affective) mindsets (Dweck et al. 1995a). Average scores on each scale were used to categorize participants as holding fixed mindsets (those who believe that attributes are set), growth mindsets (those who believe attributes are dynamic), or indeterminate mindsets (those whose scores fall between the cut-offs of the first two categories). In the cognitive domain, the majority of participating physicians believed that clinical reasoning can be learned, while a majority felt that intelligence was fixed. In the affective domain, participants were split, with a slight majority viewing moral character and empathy as fixed. Similar to previous findings, participants' mindsets varied based on the attribute being evaluated, with some participants seeing

one attribute as fixed and another as learnable (Dweck et al. 1995a).

While we do not suggest that specific attributes are either fixed or learnable, it is critical to consider how the clinical teachers responsible for the implementation of educational models, including teaching and assessment practices, understand the attributes highlighted as educational targets and performance dimensions within these models. CBME involves designing curricula with learning activities that cover all the required competencies, monitoring their development through frequent individualized assessment, and tailoring subsequent learning activities accordingly, including through remediation. (Frank et al. 2010; Holmboe et al. 2010). A high prevalence of fixed mindsets may not necessarily be problematic for intelligence in the context of CBME – as intelligence, under the guise of academic ability, is used for selection and is not a learning outcome for undergraduate or postgraduate medical education. However, prevalent fixed mindsets regarding empathy and moral character – components of the communication and professionalism competencies – could have significant influence. Why expend time and resources to teach attributes that are perceived to be fixed? Why provide feedback to improve a presumably fixed trait? Why remediate?

Literature outside of medical education may help to provide insight into how fixed mindsets within the teaching role may influence pedagogical practices and behavior. For example, there is some evidence from educational sciences, that teachers holding fixed mindsets use less effective feedback strategies, which in turn can decrease student motivation (Rattan et al. 2012). Feedback is a critical component of assessment-for learning in CBME models (Holmboe et al. 2010). In addition, teachers holding fixed mindsets have been found to focus on and find value in their students' final marks, in contrast to those with growth mindsets who place more value on students' progressive achievements (Kraker-Pauw et al. 2017). As current educational models emphasize the developmental trajectory of

Table 2. Psychometric properties of new items measuring clinical reasoning and empathy mindsets.

		Mean/6	SD/6	Corrected item-total correlation	Inter-item correlations for clinical reasoning items									
					J1	J2	J3	CR1	CR2	CR3	D1	D2	D3	
Clinical reasoning items														
J1	A physician has a certain amount of clinical judgement and they really can't do much to change it	4.43	0.93	0.90	1.00	0.65	0.80	0.85	0.84	0.86	0.86	0.83	0.86	
J2	A physician's clinical judgement is something about them that they can't change very much	4.40	1.11	0.69		1.00	0.64	0.73	0.60	0.52	0.64	0.61	0.75	
J3	A physician can learn new things, but they can't really change their clinical judgement	4.45	0.90	0.90			1.00	0.86	0.91	0.81	0.84	0.86	0.84	
CR1	A physician has a certain amount of clinical reasoning ability and they really can't do much to change it	4.53	0.91	0.92				1.00	0.91	0.80	0.80	0.87	0.85	
CR2	A physician's clinical reasoning ability is something about them that they can't change very much	4.63	0.90	0.93					1.00	0.89	0.85	0.92	0.85	
CR3	A physician can learn new things, but they can't really change their basic clinical reasoning ability	4.53	0.96	0.90						1.00	0.93	0.90	0.85	
D1	A physician has a certain amount of decision-making ability and they really can't do much to change it	4.45	0.90	0.91							1.00	0.83	0.87	
D2	A physician's decision-making ability is something about them that they can't change very much	4.60	0.93	0.92								1.00	0.91	
D3	A physician can learn new things, but they can't really change their basic decision-making ability	4.55	1.09	0.93									1.00	
Empathy items														
W1	A physician's warmth is something very basic about them and it can't be changed very much	3.45	1.01	0.85	W1	W2	W3	E1	E2	E3	C1	C2	C3	
					1.00	0.89	0.73	0.75	0.63	0.65	0.80	0.78	0.81	
W2	Whether a physician is warm or not is deeply ingrained in their personality. It cannot be changed very much	3.40	1.11	0.89		1.00	0.77	0.76	0.65	0.66	0.87	0.82	0.81	
W3	There is not much that can be done to change a physician's warmth	3.55	1.15	0.63			1.00	0.50	0.43	0.46	0.58	0.56	0.57	
E1	A physician's empathy is something very basic about them and it can't be changed very much	3.50	1.16	0.90				1.00	0.88	0.88	0.88	0.84	0.79	
E2	Whether a physician is empathetic or not is deeply ingrained in their personality. It cannot be changed very much	3.45	1.24	0.83					1.00	0.86	0.85	0.75	0.80	
E3	There is not much that can be done to change a physician's empathy	3.63	1.17	0.82						1.00	0.80	0.72	0.75	
C1	A physician's compassion is something very basic about them and it can't be changed very much	3.38	1.15	0.93							1.00	0.88	0.84	
C2	Whether a physician is compassionate or not is deeply ingrained in their personality. It cannot be changed very much	3.50	1.11	0.87								1.00	0.75	
C3	There is not much that can be done to change a physician's compassion	3.63	1.03	0.87									1.00	

Bolded terms indicate selected items for new scales.

learner achievement, could the fixed mindsets of clinical supervisors impede this goal? A further concern is related to longitudinal assessment (either through longitudinal supervision by the same physician or through learner hand-over), promoted by current CBME models (Holmboe et al. 2010; Guidelines for Educational Handover in Competence by Design 2018). Those holding fixed mindsets have been reported to be less likely to detect change (Heslin et al. 2005; Tam et al. 2010), which would threaten the validity

Table 3. Scale items for clinical reasoning, empathy, intelligence, and moral character mindsets.

Clinical reasoning items	
1. A physician has a certain amount of clinical reasoning ability and they really can't do much to change it	
2. A physician's clinical reasoning ability is something about them that they can't change very much	
3. A physician can learn new things, but they can't really change their basic decision-making ability	
Empathy items	
1. A physician's compassion is something very basic about them and it can't be changed very much	
2. Whether a physician is warm or not is deeply ingrained in their personality. It cannot be changed very much	
3. There is not much that can be done to change a physician's compassion	
Intelligence	
1. You have a certain amount of intelligence and you really can't do much to change it	
2. Your intelligence is something about you that you can't change very much	
3. You can learn new things, but you can't really change your basic intelligence	
Moral character	
1. A person's moral character is something very basic about them and it can't be changed very much	
2. Whether a person is responsible and sincere or not is deeply ingrained in their personality. It cannot be changed very much	
3. There is not much that can be done to change a person's moral traits (e.g. conscientiousness, uprightness and honesty)	

Table 4. Inter-scale correlations.

	Moral character	Clinical reasoning	Empathy
Intelligence	0.50†	0.41†	0.52†
Moral Character	1.00	0.36*	0.83†
Clinical Reasoning		1.00	0.44†
Empathy			1.00

*Correlation is significant at the 0.05 level.

†Correlation is significant at the 0.01 level.

of assessments designed to assess progress towards competence.

Although the influence of mindsets in teaching and assessment in medical education has yet to be explored, there are some existing findings that could be reinterpreted when considering mindsets, suggesting a potential link. In terms of teaching, programs targeting empathy tend to focus on its cognitive and behavioural rather than affective aspects (Sulzer et al. 2016), which could be speculatively due to designers considering the cognitive and behavioural aspects as learnable and the affective components as fixed. In terms of feedback, Burack et al. (1999) documented that some physicians felt that providing direct feedback to students displaying negative professional attitudes was futile because these constituted a student's (fixed) personality (Burack et al. 1999). In terms of longitudinal assessment, Dory et al. (2018) found that some assessors justified using stable benchmarks for attributes they saw as fixed (generic competencies), and benchmarks that evolve as training progresses for attributes they saw as malleable (medical expertise). Together with the literature on mindsets in other fields discussed earlier, these tentative findings in medical education environments warrant further research to explore the actual impacts of mindsets on teaching and assessment in medical education.

Should further research confirm that fixed mindsets are associated with suboptimal teaching and assessment strategies, and more importantly learning outcomes, the next step would be investigating whether interventions could mitigate these impacts. For example, faculty development could focus on modifying mindsets to better align with the current medical educational models. There is some evidence from domains outside of medical education suggesting that mindsets can be shifted from fixed to more growth-oriented mindsets. For example, in the field of education, Heslin et al. (2005) demonstrated that those holding fixed mindsets could be trained to adopt a growth mindset through methods of self-persuasion. The growth mindset workshop used in this study comprised five components: (1) presenting scientific research on the ability to change, (2) inducing counter attitudinal idea generation (e.g. "why is it important to realize that people can develop their abilities?" (3) counter attitudinal reflection (e.g. "what is an

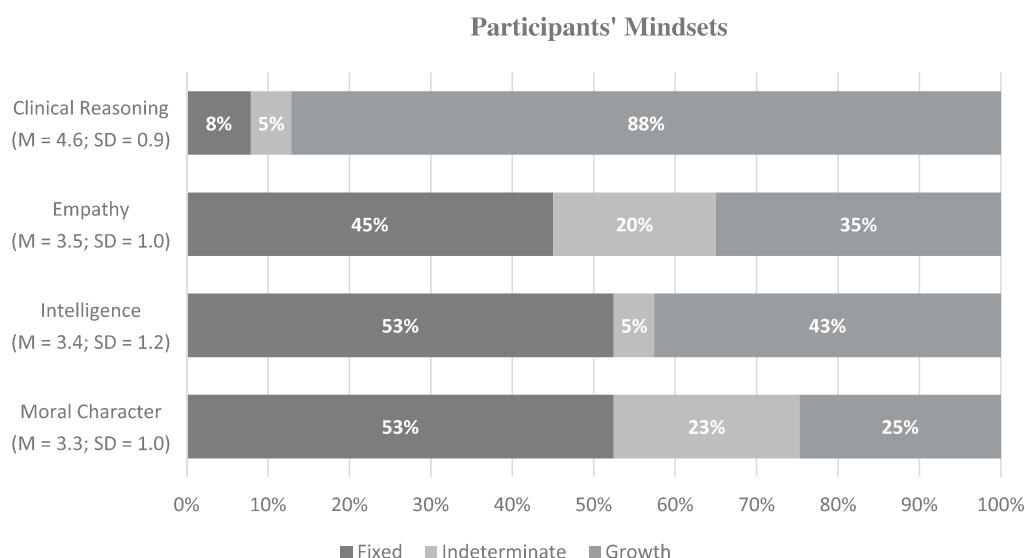


Figure 1. Proportion of participants classified as holding a fixed, growth, or indeterminate mindset for the four attributes.

area in which you once had a low ability, but now perform quite well? How were you able to make this change?”), (4) counter attitudinal advocacy (e.g. write an email offering advice to a struggling hypothetical protégé “Pat” about how abilities can be developed), and (5) cognitive dissonance induction (e.g. “when have you observed somebody learn to do something that they had been convinced this person could never do?”). These techniques could be easily adapted for the attributes relevant to medical education.

Research exploring potential impacts of fixed mindsets as well as faculty development assessing any change in mindsets requires the development of instruments to measure mindsets of relevant attributes in clinical practice. The items developed on clinical reasoning and empathy for the purposes of our study had internal consistencies that were similar to those found in previous studies of the original scales (Dweck et al. 1995a; Chiu et al. 1997; Levy et al. 1998). Test re-test scores were lower in the current study than in previous studies. However, this difference may be accounted for by the use of a longer test-retest period (1–2 months) in the present study, than in previous studies (2 weeks) (Dweck et al. 1995a). The proposed scales on clinical reasoning and empathy demonstrated good psychometric properties and could be adopted for use in future work.

There are several limitations that should be considered when interpreting our results. First, this study had a small sample size consisting of clinical supervisors recruited from only three medical specialties at a single university. Our university is a large one with 70 postgraduate residency programs delivered across three major hospitals and multiple smaller community-oriented clinical settings, thus representing a broad range of institutional cultures. Implementation of CBME is ongoing across this network, with varying levels of adoption, as would be typical of many other medical schools. Future research could focus on the generalizability of the findings reported here – in larger, broader, samples. Larger studies should also examine potential socio-demographic factors influencing mindsets. Although we found no relationship between mindsets and gender, age, or experience, this could be due to our small sample size. Secondly, the representativeness of our sample within each medical specialty is difficult to gauge; given the nature of our approach to recruitment, we are only able to estimate response rates. While our response rates of around 30% for Otolaryngology and Neurology are within the range of those commonly found for physicians (anywhere from 6–70% depending on the recruitment strategy (Brtnikova et al. 2018)), we had no information that would have enabled us to compare responders and non-responders. Thirdly, our study explored the attributes clinical reasoning and empathy, and although they represent important aspects of patient care, it would be of interest to explore the mindsets held by clinical supervisors towards other relevant attributes described in formal competency frameworks, and their relationship to teaching and assessment practices (Swing 2007; Frank et al. 2015; Generic Professional Capabilities Framework 2017).

In summary, the present findings demonstrate that although clinical supervisors’ mindsets differ between attributes, the prevalence of fixed mindsets is high for empathy and moral character, despite their inclusion in

competency frameworks. Future research could expand on the current study to explore how teachers’ and supervisors’ mindsets influence medical selection, training, and assessment. Given that evidence suggests that mindsets can be modified by educational interventions (Heslin et al. 2005), any potential concerns could then be addressed by faculty development, particularly as CBME is implemented. This study presents two new medically relevant mindset measures with some supporting validity evidence, which opens the door to research on the impact of mindsets as well as on interventions to modify them.

Ethical approval

This study received ethical approval from the Institutional Review Board of McGill University’s Faculty of Medicine (IRB #: A02-B08-17B).

Acknowledgements

We would like to thank the program directors who agreed to circulate our invitation email, members of the Institute of Health Sciences Education at McGill University, Drs Sylvia Cruess, Richard Cruess, Robert Sternszus, Evelyn Constantine, Lorraine Bell, for their assistance developing scale items, the clinical supervisors who participated in this study, Stephanie Gumuchian, research assistant, who provided assistance in drafting this manuscript, and Dr. Stuart Lubarsky for his feedback on a draft version of the manuscript.

Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

Glossary

Implicit theory or mindset: Beliefs as to whether an attribute is learnable or not. One can be categorized as holding a fixed or growth mindset. Those holding fixed mindsets believe that human attributes are set traits, those holding growth mindsets believe that human attributes can be developed over time.

Dweck CS, Hong Y-Y, Chiu C-Y. 1993. Implicit theories individual differences in the likelihood and meaning of dispositional inference. *Pers Soc Psychol Bull.* 19(5):644–656.

Funding

This project received funding from the Centre for Medical Education Innovation and Research Seed fund at McGill University.

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