

THE ASSOCIATION BETWEEN CANMEDS ROLE-SPECIFIC IMPLICIT THEORIES OF INTELLIGENCE AND PLANNING FOR RESIDENT REMEDIATION

MSc. Thesis – E. Tannenbaum; McMaster University – Health Science Education

THE ASSOCIATION BETWEEN CANMEDS ROLE-SPECIFIC IMPLICIT THEORIES OF INTELLIGENCE
AND PLANNING FOR RESIDENT REMEDIATION

By: EVAN TANNENBAUM, BSc, MD

A thesis submitted to the School of Graduate Studies in Partial Fulfillment of the Requirements
for the Degree Master of Science in Health Science Education

MSc. Thesis – E. Tannenbaum; McMaster University – Health Science Education

McMaster University MASTER OF SCIENCE IN HEALTH SCIENCE EDUCATION (2019) Hamilton,
Ontario, Canada

TITLE: The association between CanMEDS Role-specific implicit theories of intelligence and
planning for resident remediation

AUTHOR: Evan Tannenbaum, BSc (McGill University), MD (University of Toronto)

SUPERVISOR: Dr. Sandra Monteiro

COMMITTEE MEMBERS: Dr. Walter Tavares and Dr. Matt Sibbald

NUMBER OF PAGES: 80

Lay Abstract

Motivational theory proposes that individuals hold personal theories about how intelligence or ability develops. Motivational theory has been used to explain why some trainees in the learning environment tend to focus on *developing* competence and others focus on *demonstrating* it. The observation of these opposing dimensions of motivation, that some people appear motivated to develop competence while others appear to be motivated only to demonstrate it is often explained by one's implicit theories of intelligence: the belief that intelligence (hereafter defined as ability and capacity) is something that is either fixed or something that can improve with practice. In the context of medical education, we are seeing a shift towards an emphasis on demonstrating competence in specific clinical tasks, compared to the more traditional focus on time-based achievement. Accompanying this shift, is a need for frequent assessment of resident performance in the workplace. In the field of medical education, motivational theory has been used to explain why these workplace-based assessments can be used to "game" assessment systems, where trainees pick and choose which tasks they want to have assessed by their supervisors in order to appear more competent than they actually are. This gaming phenomenon can make relying on these types of assessments to make accurate judgments about resident performance problematic. It is especially important when these assessments are used to identify those that fall below the standard and require extra training to remediate an observed lack of knowledge/ability.

Research in motivational theory outside of medical education has shown that people hold different beliefs regarding different types of knowledge/ability: some types are viewed as more "fixed" than others. We also know that these beliefs tend to dictate whether one chooses to *develop* competence or *demonstrate* it. Through my experience working on the Board of Examiners, I observed that trainees with professionalism deficits typically were assigned stricter remediation plans, which was attributed to the fact that the Board members believed that professionalism was harder to remediate than other types of deficits, including those related to Medical Expert knowledge and skills. I chose to explore this phenomenon using motivational theory. The purpose of this thesis was to determine whether those involved in residency

training (both residents and teachers) viewed certain physician competencies as more “fixed” than others, and whether these views may be related to different types of remediation plans.

I used a questionnaire that measures people’s theories of intelligence about the Medical Expert Role (related to knowledge and clinical skills) and the Professional Role (related to professionalism and conduct in the workplace). I then presented participants with six simulated cases of underperforming residents and asked the respondents how they would develop a remediation plan for the residents depicted in the cases. The results showed that people felt the Professional Role was more fixed than the Medical Expert Role and those views corresponded with a stricter remediation plan for cases depicting residents with Professional Role issues. Overall, the results suggest that remediation planning correlates with implicit theories of intelligence.

Abstract

This thesis explores two components of motivational theory that have been unexplored in the context of medical education. First, we applied the notion of motivational dimensionality to physician competence. Previous research on implicit theories of intelligence demonstrated that people hold different beliefs regarding different aspects of intelligence/ability, instead of a global mindset. We applied this to the CanMEDS Framework and showed that respondents held different theories of intelligence regarding the Professional and Medical Expert Role. Second, we aimed to determine if one's implicit theories are related to their decisions around remediation planning. We hypothesized that respondents would view remediation as either an opportunity for a resident to develop competence or as an opportunity for them to demonstrate their fundamental lack of ability. Here, we showed that one's own beliefs, or theories of intelligence, not only mediate how they behave in the training environment, but also mediate how they manage others.

In the first of two studies, we measured implicit theories amongst residents, faculty, and experts in medical education at McMaster University regarding both the Professional and Medical Expert CanMEDS Roles and asked them how much effort would be required for a resident to remediate performance deficits in either Role. The second study took place at University of Toronto and involved a similar design. Residents and faculty in the Department of Obstetrics and Gynaecology were invited to participate in a study that measured implicit theories of intelligence and then asked respondents to develop remediation plans for residents described in case vignettes. Drawing on experience in the Board of Examiners, 6 cases were developed, 3 that represented Medical Expert deficits, and 3 that described Professional deficits. The results showed that respondents viewed the Professional Role as relatively more "fixed" than the Medical Expert Role. Those views corresponded to stricter remediation planning, characterized by a short duration of remediation, stricter consequences of failure, and a lower perceived likelihood of success paired with a higher perceived likelihood of Professional deficits in the future.

These results supported the hypotheses that the implicit theories of intelligence differ according to the dimension of physician competence in question. Professional was considered to be more fixed, relative to Medical Expert, and in keeping with the theorization, the resultant remediation plans appeared more as an opportunity to *demonstrate* a fundamental lack of ability than an opportunity for the resident to *develop* competence. These findings are consistent with those in other studies, where a fixed theory of intelligence was associated with a “helpless” behaviour pattern, characterized by low persistence, and challenge avoidance. We were able to show that one’s implicit theories extend beyond the self and can influence how an individual manages the education of another. This work sheds light on some of the factors that man influence remediation decision-making and adds to the conversation surrounding professionalism as competency versus an attribute.

Acknowledgements

I would like to thank my thesis committee, Dr. Sandra Monterio, Dr. Walter Tavares, and Dr. Matthew Sibbald, for their support and feedback through this process.

Table of Contents

1.0	INTRODUCTION:	13
2.0	BACKGROUND:	14
2.1	Remediation:	14
2.2	Achievement goal orientation:	17
2.3	Origins of the theory of achievement goal orientation:	17
2.4	The evolution of achievement goal orientation:	18
2.5	Three-factor model:	19
2.6	The effect of the environment on achievement goal orientation	19
2.8	Application of AGO to medical education contexts:	21
2.9	Exploring the construct of goal orientation:	22
2.10	Motivational Theory and Remediation	24
2.11	Research Objectives	25
3.0	CHAPTER 2: STUDIES 1 AND 2	27
3.1	BACKGROUND:	28
3.1.1	Theoretical Framework:	28
3.1.2	Dimensionality in achievement goal orientation:	29
3.2	STUDY 1: “HOW DO IMPLICIT THEORIES OF INTELLIGENCE CORRELATE WITH EFFORT REQUIRED FOR RESIDENT REMEDIATION?”	30
3.3	STUDY 1 OBJECTIVES:	30
3.4	STUDY 1 RESEARCH QUESTIONS:	30
3.5	STUDY 1 PROCEDURE:	32
3.6	STUDY 1 RESULTS:	35
3.7	STUDY 1 DISCUSSION:	37
3.8	STUDY 2: “DO DIFFERENCES IN IMPLICIT THEORIES OF INTELLIGENCE ACCORDING TO CANMEDS ROLE CORRELATE WITH REMEDIATION PLANNING IN THAT ROLE?”	39
3.9	STUDY 2 OBJECTIVES:	39
3.10	STUDY 2 RESEARCH QUESTIONS:	39
3.11	STUDY 2 PROCEDURE:	40
3.12	STUDY 2 RESULTS:	43
3.13	STUDY 2 DISCUSSION:	49

4.0	CHAPTER 3: DISCUSSION AND CONCLUSIONS	53
4.1	DISCUSSION:	54
4.2	Dimensionality in physician competence	54
4.2	Remediation planning and its association with implicit theories of intelligence	55
4.2	Can achievement goal orientation explain why we can or cannot rely on workplace-based assessment to detect underperformers:	57
4.4	While undergoing remediation, can we expect WBA to function as a teaching tool:	58
4.5	Implications for Competence Committees and Assessment Portfolios:	60
4.6	Motivational Misalignment:	62
5.0	CONCLUSION:	64
6.0	REFERENCES:	65
7.0	APPENDICES:	74
7.1	Appendix 1: Study 1 Materials (including modified ITIS-S)	74
7.2	Study 2 Materials	76

List of Tables and Figures

Tables and Figures	Page Number
Table 1: (From Dweck and Leggett, 1988) Theories, Goal, and Behaviour Patterns in Achievement Situations	18
Table 2: Demographic characteristics of respondents (Study 1)	36
Figure 1: Mean ITIS-S Subscale Scores According to CanMEDS Role	36
Table 3: Correlations between implicit theories of intelligence and effort for remediation	37
Table 4: Demographic characteristics of respondents (Study 2)	44
Figure 2: Mean ITIS-S Subscale Scores According to CanMEDS Role	45
Figure 3: Remediation Planning According to Role	47
Table 5: Correlations between implicit theories of intelligence and questions regarding remediation planning	48

Declaration of Academic Achievement

I, Evan Tannenbaum, declare that this thesis and the work presented in it are my own and have been generated by me as the result of my own original research.

1.0 Introduction:

One of the key components of medical training is the management of underperformance, which is commonly referred to as remediation (Lacasse et al., 2019). Remediation typically involves the development of a formalized, trainee-specific learning plan for those who have been identified as underperformers. Remediable or underperforming trainees sit at the low-end of the spectrum of performance. Those trainees who have significant deficits in their knowledge, abilities, or interpersonal behaviours require extra time to hone the knowledge/skills required to complete their program's training requirements. On the other hand, stellar trainees sit on the other end of the spectrum, and in today's training environment, may actually complete residency faster than the expected rate (ten Cate, Gruppen, Kogan, Lingard, & Teunissen, 2018). Judgements related to the advancement or remediation of trainees are driven by experiences in workplace contexts.

Workplace-based assessments (WBAs), are those that involve expert faculty raters (assessors) judging authentic trainee performance of clinical tasks in the workplace (Norcini & Burch, 2007a; Holmboe et al., 2010). These types of assessment methods are prone to various types of error, including both rater-based biases (Gingerich, Regehr, & Eva, 2011; Gingerich, Schokking, & Yeates, 2018) and ratee based biases, which can take the form of assessment "gaming" (Gaunt Anne et al., 2017). These sources of error can impact our ability to make accurate judgments on performance. By ignoring or failing to address these sources of error, we risk advancing underperformers (Barrett et al., 2016). Achievement goal orientation theory (S. Dweck, 1986) is one lens through which researchers have explored why some trainees game assessment systems (Gaunt Anne et al., 2017) and some use assessment as a learning opportunity (Fokkema et al., 2013). While this understanding can help us explain some of the behaviours affecting the reliability and validity of assessment data (a problem involving learner diagnosis), it has not been explored in the context of managing the underperforming learner. This thesis explores how achievement goal orientation theory can be used to understand how underperforming trainees are managed in the setting of remediation.

While motivational theories such as achievement goal orientation have been applied to the use of assessment in the workplace, there are aspects of motivational theory, such as dimensionality (i.e., differences in motivational goals according to topic of study or domain of competency; Hughes, 2015) that can help explain how achievement goal orientation informs decisions surrounding remediation planning, when one must determine how to manage *another's* training, rather than their own. This is important because many have noted that deficits in certain domains of physician competence are perceived to be harder to remediate than others (e.g., Guerrasio & Aagaard, 2014), but we lack a theoretical understanding as to *why* that may be. Is it because people believe that certain dimensions of competency (or CanMEDS Roles) are more amenable to improvement compared to others? Are some deficits relatively more *fixed* than others? The aim of this thesis was to explore motivational dimensionality in the context of medical education and determine whether measures of motivation correlated with the way in which doctors plan for remediation of underperforming residents. I first expand on the working definitions of various concepts incorporated into the research question. The research question and design are then expanded upon in Chapter 2.

2.0 Background:

2.1 Remediation:

In any curricula, including the traditional model and a competency-based model (CBME), there must be a formal process in place to manage underperforming learners.

Underperformance can manifest in many ways, including knowledge deficits (e.g., inability to develop appropriate management plans), and interpersonal issues, such as lapses in professionalism (e.g., plagiarism) or communication issues (Rumack, Guerrasio, Christensen, & Aagaard, 2017). The process whereby underperforming learners are managed is most commonly referred to as “remediation”, which can be described as: “additional teaching above and beyond the standard curriculum, individualized to the learner who without the additional teaching would not achieve the necessary skills for the profession (Guerrasio et al., 2014, p.803).” The issue is not a small one. Underperformance is faced by up to 28% of trainees

across the undergraduate and postgraduate (residency) years (Guerrasio, Garrity, & Aagaard, 2014) and a subset of those identified will undergo informal remediation within their programs, while others will require formal remediation. For example, a 10 year review of the Post-Graduate Board of Examiners at the University of Toronto showed a remediation rate of 3% (Zbieranowski, Takahashi, Verma, & Spadafora, 2013). While most trainees are successful in remediating their performance deficits, some persist, which can lead to academic probation and dismissal from a residency program. Unsuccessful remediation can occur in up to 17% of those undergoing formal remediation (Zbieranowski et al., 2013), though the rates are variable (M. Silverberg et al., 2015).

In postgraduate (residency) training, underperforming learners are identified in several ways. Some residents are identified informally, such as via emails or telephone calls to the Program Director (Resnick, Mullen, Kaiser, & Morris, 2006), while others are identified using assessment data (Zbieranowski et al., 2013). A phone call to the Program Director may follow one or several critical events that occur in the workplace that show, for example, a critical lack of knowledge. On the other hand, formal assessment data, such as daily encounter cards or In-Training Evaluation of Residents (ITERs) may paint a picture of consistent underperformance over longer time periods, that requires attention in the form of either informal or formal remediation.

There exists some variability in the description and classification of resident underperformance, due to differences in the frameworks used to describe physician competence. For example, in Canada, the CanMEDS Framework (J. Frank, Snell, & Sherbino, 2015) serves to deconstruct physician competency into the various CanMEDS Roles (J. Frank et al., 2015), and in the United States, the Accreditation Council for Graduate Medical Education (ACGME) Core Competencies are used (Turner et al., 2016). In the parlance of CanMEDS (J. Frank et al., 2015), most learner deficits tend to fall into the category of Medical Expert (Bhanji et al., 2015) or Professional (Snell et al., 2015; Lacasse et al., 2019; Turner et al., 2016; Zbieranowski et al., 2013). Most of the issues cited in the literature surrounding communication are often related to disruptive interprofessional communication, rather than patient communication or documentation, therefore these are categorized as Professional Role (Snell

et al., 2015) deficits, as opposed to Communicator (Neville et al., 2015), which primarily addresses the patient-physician relationship.

Once identified, trainees are evaluated by their residency program and then placed on a customized learning plan that can include coaching, feedback, and frequent assessment in order to foster growth and document progress or lack thereof. Each type of deficit can be managed differently. For example, poor surgical ability can require time in the surgical skills lab, lack of medical knowledge can require targeted tutorials, and professionalism issues can be dealt with using reflective exercises and coaching. However, there is variability in the quality of evidence supporting the effectiveness of these interventions as outlined by Lacasse et al. For example, regarding remediation of knowledge deficits, there is a strong body of evidence in support of tutoring and academic assistance, compared to a weak body of evidence to support the use of test-taking skills training (Lacasse et al., 2019). Similarly, many have reported that professionalism deficits are harder to remediate (Sullivan, Murano, Comes, Smith, & Katz, 2011a), yet we lack a theoretical understanding of why that may be true or why people perceive it to be true.

In the next section I will introduce motivational theory and discuss how it has been used in medical education research to-date. As mentioned previously, achievement goal orientation is a theory that describes two distinct sets of behaviours depending on one's implicit theories of intelligence. Those that believe that ability/intelligence are fixed and cannot change with practice tend to adopt a performance goal orientation and a helpless behaviour pattern, characterized by challenge avoidance and low persistence. On the other hand, those that believe that intelligence/ability is malleable (i.e., can improve with practice) tend to adopt a learning goal orientation and a mastery behaviour pattern, characterized by challenge-seeking and persistence in the face of failure (S. Dweck, 1986). The studies described in Chapter 2 explore how subtle differences in the perception of the Professional (Snell et al., 2015) and Medical Expert (Bhanji et al., 2015) Roles (as being either fixed or malleable) relate to significant differences in the way that remediation is planned, according to Role.

2.2 Achievement goal orientation:

2.3 Origins of the theory of achievement goal orientation:

A theory of Achievement Goal Orientation (AGO) was first proposed by Carol S. Dweck (S. Dweck, 1986) to describe how motivational factors influenced children's engagement with cognitive tasks. There are two broad categories of goal orientation, essentially defining what students want to achieve: (1) learning or (2) performance. Taking a learning (or mastery) goal orientation, individuals aim to increase their abilities and gain competence in a new task. Taking a performance-goal orientation, individuals seek to demonstrate competence and receive positive judgements, while avoiding negative judgements of their abilities. (Dweck & Leggett, 1988). Dweck theorized these two motivational profiles were related to an individual's theory of intelligence: the belief that intelligence/ability is either malleable (incremental theory) or fixed (entity theory). Those with an incremental theory of intelligence, believe that intelligence and competence can be increased with practice and hard work. These individuals tend to adopt a learning or "mastery" achievement goal orientation. In contrast, those with an entity theory of intelligence, believe that intelligence and competence cannot change, regardless of effort. These individuals tend to adopt a performance achievement goal orientation (Payne, Youngcourt, & Beaubien, 2007).

Dweck and Licht also hypothesized that the behaviours displayed by learning- and performance-oriented schoolchildren were related to the complexity of the task at hand. To test their hypothesis, they performed an experiment that involved a novel learning task with either a confusing or a straightforward section in the introduction to the learning activity. Dweck and Licht proposed that learning-oriented children would display a mastery-oriented behaviour pattern in the face of confusion or challenge, but performance-oriented children would display a helpless pattern. As predicted, when the introduction to the experimental task contained the straightforward section, both learning- and performance-oriented individuals performed equally well. In the absence of confusion or challenge, goal orientation did not affect behaviour. However, when the introduction contained the confusing section, learning-oriented

children outperformed their performance-oriented peers, with 71.9% reaching the standard, compared to 34.6%, respectively (Licht & Dweck, 1984). This experiment illustrated how children with learning goal orientations persevered with increased effort and practise (i.e., the mastery-oriented behaviour pattern), while performance goal-oriented children fixated on lack of ability and failed to persevere (i.e., helpless behaviour pattern). Such findings highlight the potential role for motivation or personal goals in driving outcomes, such as assessment scores. Table 1 summarizes these findings.

Table 1: (from Dweck and Leggett, 1988) *Theories, Goals, and Behaviour Patterns in Achievement Situations:*

<i>Theory of intelligence</i>	<i>Goal orientation</i>	<i>Perceived present ability</i>	<i>Behavior pattern</i>
Entity (intelligence is fixed)	Performance (goal is to gain positive judgements/avoid negative judgements of competence)	High	Mastery oriented (seek challenge; high persistence)
		Low	Helpless (avoid challenge; low persistence)
Incremental (intelligence is malleable)	Learning (goal is to increase competence)	High or low	Mastery oriented (seek challenge that fosters learning; high persistence)

2.4 The evolution of achievement goal orientation:

Following the study of AGO in children, research in the organizational business literature and higher education began focusing on AGO and its relationship to training, performance, and

feedback in the adult population. The next sections will explore some of the relevant advancements in the study of achievement goal orientation and motivational theory, including: the division of performance goal orientation into two sub-orientations, the effect of the environmental context on one's achievement goal orientation, and differences in within-subject achievement goal orientation according to the dimension of competency being assessed.

2.5 Three-factor model:

Early studies of the original two-factor model had mixed results; some showed a benefit, while others showed the opposite (Kaplan & Maehr, 2007). To address these discrepancies, a key insight offered by the organizational literature was the further division of performance-goal orientation: 1) prove-performance, which was characterized by behaviours aimed at minimizing negative judgements, and 2) avoid-performance, which was characterized by behaviours aimed at gaining positive judgements. VandeWalle proposed the now three-factor model of AGO (Vandewalle, 1997) improved researchers' abilities to explore the downstream consequences of AGO on learning, workplace outcomes, and other complex tasks. Whereas performance-orientation was previously considered universally maladaptive, more recently, that has been brought into question. It is now generally accepted that the performance-avoidance (i.e., avoiding negative judgements) is considered maladaptive, but the prove-performance orientation (i.e., seeking positive judgements) can be beneficial in certain situations, as it can be associated with the motivation to reach a pre-specified performance expectation. It is still generally accepted that the learning goal orientation is associated with an adaptive behaviour pattern in the classroom/workplace (Kaplan & Maehr, 2007; Simzar, Martinez, Rutherford, Domina, & Conley, 2015; Watson et al., 2013).

2.6 The effect of the environment on achievement goal orientation

Further research in AGO theory showed that AGO is affected by external factors, rather than being a strictly intrinsic quality. Whereas previously, AGO was thought to be a product of some intrinsic quality, researchers showed that it can also be related to the environmental

context. That is, one's motivations can change according to the environment in which they are training and working. A 2007 meta-analysis by Payne, Youngcourt, and Beaubien included 157 studies from 1979-2002 and explored the effect of external factors on goal orientation and outcomes related to training and job performance, according to goal orientation. These outcomes differed according to timing. For example, short term outcomes include feedback seeking during training. On the other hand, long-term outcomes can include job-performance outcomes on a longer time-scale.

Payne and colleagues identified studies showing that the achievement goal orientation of the environment may act as an enabling factor that either encourages individuals to apply effort and persistence in complex tasks or work to avoid negative consequences of poor performance. Their work showed that the learning climate can *induce* a goal-orientation irrespective of one's trait-AGO (i.e., their intrinsic motivations to either improve or demonstrate competence). That is, a learning-oriented person can be manipulated, in a sense, to exhibit performance-associated behaviours, such as challenge-avoidance, if the environmental context, is performance-oriented. Their analysis showed a positive effect on learning outcomes when the environment or state-AGO and an individual's trait-AGO were aligned (e.g., state-learning AGO – individual's trait-learning AGO) and a weakly positive, negative, or insignificant effect on learning when state-AGO and an individual's trait-AGO were misaligned. Therefore, a context driven, state-AGO may act synergistically with an individual's trait-AGO.

This effect of state-AGO on future task performance was illustrated in a study by Kozlowski et al. (2001), where undergraduate students were oriented to a novel task (a computer-based radar-tracking simulation) with either a learning-goal: to use the training session as an opportunity to learn and master the task, or a performance goal: to try and perform at their greatest capacity during the task. The study measured how changes in knowledge, self-efficacy, and performance differed according to goal orientation-priming. Establishing a state-learning-goal orientation in the training program was associated with better

outcomes on knowledge, self-efficacy, and accomplishment, compared to state-performance-goal orientation (Kozlowski et al., 2001). Seemingly paradoxically, setting the stage for learning and improvement, as opposed to asking individuals to try and perform at their maximal ability, may activate mastery-associated behaviour patterns and lead to optimal learning outcomes. Conversely, inducing a performance-orientation (e.g., to be the best in one's training cohort) may activate helpless behaviour patterns, including challenge-avoidance, leading to poorer learning outcomes.

2.8 Application of AGO to medical education contexts:

Researchers in the field of medical education have begun exploring motivational theory as it applies to assessment. For example, Gaunt et al. explored the interaction between state- and trait-AGO with a qualitative study exploring how surgical residents engage in feedback and assessment. They found that residents who perceived WBA as an opportunity to improve, sought out corrective feedback. Residents who perceived WBA as a test of competence, were found to “play the game” by seeking out positive feedback and avoiding corrective feedback in assessment (Gaunt Anne et al., 2017). Trainee motivation to engage with WBAs differed according to the perceived role of WBA in their training environment: as a vehicle for growth or a measurement tool, used to evaluate competence. The authors labeled the behaviours associated with state-performance AGO as: “playing the game”. When residents play the game by *proving* competence through preferentially selecting supervisors that grade less harshly and choosing cases reflection good performance and *avoiding* incompetence judgements by choosing to have poor work performance go unassessed. These behaviours have been documented in other medical and surgical specialties as well (Viney, Rich, Needleman, Griffin, & Woolf, 2017).

Related to longer-term outcomes, there is some evidence in the health professions that trait-AGO correlates with academic performance, (Alrakaf et al., 2015), and that state-AGO is related to performance on novel tasks, including surgical skills (Gardner, Diesen, Hogg, &

Huerta, 2016; Gardner, Jabbour, Williams, & Huerta, 2016). For example, regarding trait-AGO Alrakaf et al. (2015) found that there was a correlation between learning-oriented students and performance on pharmacy knowledge tests. Similarly, two experiments that were conducted by Gardner et al. (2016, 2016) demonstrated that differences in state-AGO were associated with differences in surgical skill acquisition. The authors randomized students to be introduced to a surgical skill training session with either a learning- or a performance-orientation. They found that priming learning-orientation was associated with a greater increase in surgical skill acquisition, compared to priming a performance- orientation. Acquisition of knowledge and skills, therefore, may be optimized by creating a learning-oriented environment.

2.9 Exploring the construct of goal orientation:

Within medical education research goal orientation is treated as a unidimensional construct, where learners or practicing physicians are measured along a continuum of learning, from low to high, or performance-goal orientation from low to high. Outside of the field of medical education, however, AGO is being theorized as a multi-dimensional construct (Costa & Faria, 2018; Mascaret, Falconetti, & Cury, 2016; Tempelaar, Rienties, Giesbers, & Gijsselaers, 2015; Wang, Wang, Wang, Wang, & Tang, 2011). A learner may be *both* learning-oriented and performance-oriented to varying degrees (Dweck, Chiu, & Hong, 1995). In the context of medical education, we might think of a surgical resident as being learning oriented because they desire to become a competent surgeon that is able to treat patients safely, however they can be performance-oriented in their desire to achieve high assessment scores and appear to be competent in order to secure a job after residency. When we tie it back to implicit theories of intelligence, which serve as the foundations for one's achievement goals, it seems counterintuitive that someone can believe intelligence is *both* fixed and malleable, yet empirical evidence supports the idea that respondents can endorse both fixed and malleable theories. This phenomenon is exemplified in the study of feedback-seeking behaviour by Janssen and Prins, where a significant correlation was found between the learning-approach-

and performance-avoidance-goal orientations, which indicates that learners are not simply learning- or performance-oriented; rather both, to varying degrees (Janssen & Prins, 2007).

Not only can learning and performance-goal orientations be thought of as two distinct dimensions, motivation may also differ according to the *dimension* of the construct of interest (e.g., verbal communication vs. math abilities). In recent publications, Dweck recognizes this and suggests that dimension-specific scales are more appropriate than global scales for studies exploring correlations between implicit theories and specific skills/abilities (Dweck, 2000). Gunderson et al. measured individuals' implicit theories of intelligence regarding various dimensions of competency. Gunderson et al. found that respondents can hold, an entity theory regarding ability, for example in math, and an incremental theory regarding ability in reading and writing (Gunderson, Hamdan, Sorhagen, & D'Esterre, 2017). These results mirrored previous studies showing that theory of intelligence can vary according to subject (in grade-school) (Leslie, Cimpian, Meyer, & Freeland, 2015). Additionally, Hughes showed that 26.0 % of respondents held an entity (fixed) theory of intelligence regarding visuo-spatial ability, compared to 7.1 % regarding verbal ability and 11 % regarding honesty (Hughes, 2015). These findings highlight a significant gap in our current understanding of the CanMEDS Roles (J. Frank et al., 2015) from a motivational perspective. There is an assumption in CBME that capacity within each Role (J. Frank et al., 2015) is amenable to change and that this change can be nurtured using similar approaches: frequent observation and assessment of performance. Yet this assumption has not been empirically tested from a motivational standpoint; we do not know how implicit theories of intelligence may differ according to Role (J. Frank et al., 2015). Based on current evidence, we can assume that there are measurable differences in implicit theories of intelligence according to CanMEDS Roles. This is important because it may help us better understand why remediation plans vary, or why remediation in general has variable impact when dealing with a trainee who has deficits related to professionalism (Guerrasio, Garrity, et al., 2014), as opposed to one with deficits in medical knowledge.

2.10 Motivational Theory and Remediation

Research on remediation of residents has shown that Medical Expert (Bhanji et al., 2015) and Professional (Snell et al., 2015) deficits are the most common causes for residents requiring formal remediation (Zbieranowski et al., 2013). Medical Expert (Bhanji et al., 2015) deficits typically manifest as gaps in knowledge or skills related to the specialty. These can include inability to gather a relevant history or synthesize a management plan, amongst others. Professionalism issues include disruptive behaviours, which include lying, cheating, or aggressive communication with peers and other health professionals, as well as other types of time-management issues including tardiness and unexplained absences from clinical duties (Guerrasio, Garrity, et al., 2014; Lacasse et al., 2019; Resnick et al., 2006). Thus, “underperformance” spans myriad competencies and characteristics, some of which may be more likely to change over time, compared to others. Nevertheless, deficits in nearly all these types of deficits are typically managed with formal remediation, with the belief that they can be remedied through a targeted teaching approach. However, based on what we know about motivational theory, as it pertains to feedback and assessment, it is likely that one’s achievement goals surrounding the various aspects of physician competence may influence their approach to remediation. If one believes that professionalism is a relatively fixed trait, how will they approach the remediation of one of their trainees? Will remediation serve as an opportunity to help the trainee grow, or will it be viewed as an opportunity to document a fundamental lack of ability and justify consequences such as dismissal?

Indeed, though all aspects of physician competency, as outlined by CanMEDS (J. Frank et al., 2015), are treated as equally teachable, it has been proposed that certain physician competencies are more “intrinsic” (fixed) than others. This may even be true within the same CanMEDS Role (J. Frank et al., 2015). While most would likely agree that knowledge is something that can improve through teaching and learning, there is an ongoing debate surrounding whether skilled surgeons are *born or taught* (Sadideen, Alvand, Saadeddin, & Kneebone, 2013; Siska et al., 2015). Recent empiric evidence suggests that some trainees appear to lack the ability to improve with training (Alvand, Auplish, Gill, & Rees, 2011;

Grantcharov & Funch-Jensen, 2009) and that surgical skill is related to certain, innate abilities such as visuospatial perception (Louridas, Szasz, de Montbrun, Harris, & Grantcharov, 2016). Therefore, those teachers that hold an entity (fixed) theory of intelligence regarding surgical abilities may assign remediation plans that serve to prove their preconceived notions regarding a fundamental lack of ability on the part of the trainee.

A similar discussion is occurring regarding the Intrinsic Roles (J. Frank et al., 2015), including Professional (Snell et al., 2015). There are some who believe that professionalism is related to intrinsic traits, as opposed to being a competency that can be taught (Eckles, Meslin, Gaffney, & Helft, 2005; Leffel, Oakes Mueller, Curlin, & Yoon, 2015; Sullivan, Murano, Comes, Smith, & Katz, 2011b), which has led to marked variability in the teaching and assessment of professionalism in health professions education (Bennett, Ingraham, Schneider, Saadeh, & Vercler, 2017; Kelly, Gruppen, & Mullan, 2017). These differences in the teaching and assessment of professionalism may stem from epistemic variability. That is, some believe professionalism is comprised of a set of behaviours that one can learn to exhibit, and others believe that professionalism is socially-constructed and is influenced by context-specific factors including the environment, and person-specific factors (Baird & Vanstone, 2017). There is no clear answer. While it is easy to accept that the definition of “showing up on time” is clear and observable, the same cannot be said about the definition of “integrity”. Beyond definitions, it is arguably simpler to measure “showing up on time”, than to measure “integrity”.

2.11 Research Objectives

With this complexity in mind, from a remediation perspective, numerous studies have shown that professionalism issues are harder to remediate than other types of deficits (e.g., medical knowledge) (Guerrasio, Garrity, et al., 2014; Papadakis et al., 2005). It is possible then, that “not all CanMEDS Roles (J. Frank et al., 2015) are created equal”. Motivational dimensionality describes how certain traits and skills can be thought of differently, according to one’s implicit theories of intelligence. From what is known about motivational theory as it

pertains to learning and assessment, we can predict that when residents underperform, their management may differ, depending on the type of deficit. Those who develop plans for resident remediation may feel differently about how to manage knowledge deficits, compared to professionalism deficits. Will remediation of Roles thought to be more “fixed” than others be more in line with a performance-goal orientation, which aims to demonstrate competence (or lack thereof), or a learning-goal orientation, which focuses on development of competence?

In my thesis, I propose that these observed differences are related to one’s implicit theories of intelligence. That is, those who believe ability in the Medical Expert Role (Bhanji et al., 2015) is something that can change, are more likely to prescribe a remediation plan that is reflective of that. In contrast, those who believe that ability in the Professional Role (Snell et al., 2015) is unlikely to change will prescribe a remediation plan that is more suited to confirming a fundamental lack of ability on the behalf of the trainee. Based on Dweck’s theorization, I expect that when ability is thought to be likely to change the remediation plan would be longer and with less strict consequences, in order to allow time for the resident to demonstrate growth. Conversely, when ability is thought to be unable to change, the remediation plan may be shorter with strict consequences, to provide an opportunity to document low ability in advance of dismissal. To explore these relationships, two parallel studies were designed. The aims of the first study were to determine if the CanMEDS Roles most often related to remediation, (Medical Expert and Professional) (J. Frank et al., 2015) are related to different implicit theories in the medical education community and determine whether individual implicit theories relate to remediation effort needed for each Role (J. Frank et al., 2015). The aim of the second study was to determine if remediation planning differs according to Role (J. Frank et al., 2015).

3.0 Chapter 2: Studies 1 and 2

3.1 Background:

In health professions education, trainee underperformance is typically managed with additional customized training, through a process generally referred to as remediation (Guerrasio, Garrity, et al., 2014). Remediation offers learning supports and increased observation and assessment, in order to encourage and document achievement in aspects of competency that have been identified as deficient (Zbieranowski et al., 2013). But remediation cannot work as “one size fits all”. Some have noted that certain aspects of physician competency are harder to remediate than others; professionalism issues compared to medical knowledge issues (Sullivan et al., 2011b).

Achievement goal orientation (S. Dweck, 1986) provides us with a theoretical framework that may explain differences in remediation planning according to CanMEDS Role (J. Frank et al., 2015). It has been applied to the study of assessment (Gaunt Anne et al., 2017) and feedback (Janssen & Prins, 2007) in medical education, but has not been studied in the context of remediation of underperforming residents. Gaining an understanding about remediation planning in the context of specific CanMEDS Roles (J. Frank et al., 2015) may help us apply more appropriate learning interventions.

3.1.1 Theoretical Framework:

Achievement goal orientation is a theory of motivation, described by Dweck in the 1980s (S. Dweck, 1986), that has been explored recently in medical education (Gaunt et al., 2017; Janssen & Prins, 2007). The theory explains how differences in behaviour patterns (mastery or helpless) are related to individual implicit theories of intelligence. One either believes that intelligence is incremental (amenable to change), leading to a learning-goal orientation and mastery behaviour pattern or intelligence is (fixed), leading to a performance-goal orientation and either a mastery, or helpless behaviour pattern, depending on their perceived level of ability. The mastery behaviour pattern is considered to be an adaptive one, consisting of challenge-seeking and persistence. However, the helpless behaviour pattern is considered to be maladaptive in most cases, with a focus on challenge-avoidance and demonstrating ability rather than the intention to develop one’s abilities (Dweck & Leggett, 1988; S. Dweck, 1986; Teunissen Pim W & Bok Harold G J, 2013). Individuals with a

performance-goal orientation activate a mastery behaviour pattern when they perceive their ability to be high, however in novel or complex situations, they activate the maladaptive helpless behaviour pattern. There has been interest in exploring how these motivational processes manifest in trainees in health professions education; how to measure them, and how to promote mastery learning.

Studies have shown that performance-goal orientation, is associated with the perception of assessment and feedback as having a high cost to one's ego (Gaunt et al., 2017), and it is thought to be related to the so-called 'assessment gaming phenomenon', where trainees actively seek-out positive assessment scores by being selective as to when they are assessed and by whom (Gaunt Anne et al., 2017). Performance-oriented trainees appear to primarily focus on demonstration of competence and avoiding demonstration of a lack of competence. These behaviours allude to a fixed theory of intelligence. On the other hand, learning-goal orientation has been found to associate with corrective feedback-seeking (Janssen & Prins, 2007) and a preference for formative assessment (*assessment-for-learning*) over summative (*assessment-of-learning*) methods (Dijksterhuis, Schuwirth, Braat, Teunissen, & Scheele, 2013). Learning-oriented individuals appear to exhibit behaviours associated with a malleable theory of intelligence.

While the above-cited studies have painted a clear picture regarding how one's achievement goals can influence their use of assessment (to develop or demonstrate competence) and feedback (seeking improvement-focused or reaffirming feedback) in the workplace, we do not know how these achievement goals influence the decisions that are made surrounding the management of underperforming trainees. Will those responsible for developing remediation plans use different strategies based on whether they believe ability is fixed or malleable? Furthermore, do those beliefs differ according to the Role in question (e.g., Professional vs. Medical Expert Role competencies) (J. Frank et al., 2015)?

3.1.2 Dimensionality in achievement goal orientation:

Thus far, the study of achievement goal orientation in medical education has focused on en-block measurements as opposed to domain specific measures (i.e., those addressing one

aspect of physician competence). Such approaches to the study of motivation in trainees are problematic because it is now known that achievement goal orientation is a multi-dimensional construct (Gunderson et al., 2017; Teunissen Pim W & Bok Harold G J, 2013) and that goals can vary even within individuals, according to competency/ability (Hughes, 2015). Therefore, it is more appropriate to describe learners as *both* learning and performance oriented, to varying degrees, and to recognize that achievement goals may differ according to the dimension of competence in question (Dweck et al., 1995).

The following two studies aim to determine whether one's implicit theories of intelligence (i.e., their beliefs regarding intelligence/ability are fixed or malleable) vary according to the dimension of physician competence, as outlined by the CanMEDS Framework (J. R. Frank & Danoff, 2007) and determine how those dimension-specific implicit theories correlate with remediation planning in those dimensions (i.e., CanMEDS Roles).

3.2 Study 1: “How do implicit theories of intelligence correlate with effort required for resident remediation?”

3.3 Study 1 Objectives:

The primary objective of this study was to **explore** whether teaching faculty and residents held different theories of intelligence related to the Professional and Medical Expert CanMEDS Roles (J. Frank et al., 2015). The secondary objective of this study was to determine whether faculty and residents selected varying levels of effort required to improve performance (remediate) according to Role.

3.4 Study 1 Research Questions:

1. *Will respondents' implicit theories vary according to CanMEDS Role? (Medical Expert and Professional)*
2. *Will participants indicate that remediation requires varying levels of effort depending on the Role being addressed?*

Commented [Office1]: I am wondering if we should include the pilot test aspect of Study 1 – you did get feedback on some aspects. As a pilot, it makes more sense that we just repeated much of the design in Study 2. But also we can downplay the whole ‘not powered’ to detect a difference bit. Or maybe a proof of concept study. Although the one comparison was not significant, the modified ITIS-S worked. And the correlations were in the right direction. Thoughts?

Commented [ET2R1]: I worry that this will look like I'm making excuses... what do you think? Meredith has already seen it phrased as the first of two studies, even though, yes it served as a pilot to demonstrate that people answered the questions regarding the two Roles differently... which they did. The correlations for those values i.e. (professional fixed vs. professional malleable) are in the right direction and are significant to 0.05 (same with med expert)

3. Will these responses relate to their implicit theories?

Medical Expert (Bhanji et al., 2015) and Professional (Snell et al., 2015) were selected for two reasons: first, the literature on resident remediation has repeatedly shown that deficits in the Medical Expert (Bhanji et al., 2015) and Professional Roles (Snell et al., 2015) are the most common reasons for residents to require formal remediation (M. Silverberg et al., 2015; Zbieranowski et al., 2013). Second, it was hypothesized that respondents would be most likely to hold an incremental theory of intelligence regarding the medical knowledge and an entity theory of intelligence regarding professionalism, based on the literature described in Chapter 1. These were selected as “goalposts”: two stimuli that were different enough to detect a signal, should a difference in implicit theories be present. It was thought to be extremely unlikely that knowledge would be perceived as a fixed trait, as that would invalidate the contemporary approach to education. However, this notion of professionalism as a fixed trait has been explored recently in the literature surrounding the teaching and assessment of professionalism (Huffmyer & Kirk, 2017; Hultman & Wagner, 2015; Irby & Hamstra, 2016), though consensus has not been reached regarding its ability to be taught. There are some that argue that professionalism is not a fixed trait, but a competency that is teachable and learnable (Roberts, Wilkinson, Norcini, Patterson, & Hodges, 2019).

Resident remediation was chosen as the context for this study of implicit theories of intelligence because during remediation, residents (or other trainees) must improve. Compared to formative assessment, which serves to foster learning and to document assessment, remediation is setting wherein the resident has demonstrated unacceptable levels of performance and the goal is to improve. Similar to the reasoning for choosing the Professional (Snell et al., 2015) and Medical Expert Roles (Bhanji et al., 2015), remediation serves as a goalpost by situating the study at the low-end extreme of the spectrum of resident performance. We expected to see statistical correlations that were consistent with achievement goal orientation theory. For example, if respondents reported a predominantly incremental theory of intelligence regarding a Role, they would report a lower amount of effort, as this would be reflective of a mastery behaviour pattern.

3.5 Study 1 Procedure:

Overview:

This study explored resident and faculty theories of intelligence regarding the CanMEDS Professional Role (Snell et al., 2015) and Medical Expert Role (Bhanji et al., 2015). Implicit theories of intelligence were measured using a modified scale (Cook, Gas, & Artino, 2018). Descriptive statistics, Pearson's r , Cronbach's alpha, Chi-Squared coefficients and Analysis of Variance were used to explore the integrity of the data as well as differences in implicit theories according to Role (J. Frank et al., 2015), differences in the amount of effort required to remediate poor performance in those Roles, and the relationship between implicit theories with remediation effort.

Study Population and Setting:

Participants were invited to participate via email from the Department of OB/GYN office. The email contained a link to the survey and the Letter of Information and Consent form was shown on the opening page of the survey. Consent was obtained electronically.

The study population included residents, and active teaching faculty, and education researchers in the Faculty of Medicine at McMaster University. A convenience sampling strategy was employed (Elfil & Negida, 2017). As we were interested in within-subject variability, any differences in culture between specialties, including for example, the interpretation of the CanMEDS Roles (J. Frank et al., 2015), were not considered relevant to this study.

Materials:

ITIS-S Questionnaire:

Several scales that explore motivation exist (Cook et al., 2018) and for this study, the choice was made to adapt the Implicit Theories of Intelligence Scale – Short (ITIS-S), making it domain-specific (i.e., related to Professional or Medical Expert) (Bhanji et al., 2015; Snell et al.,

2015), as opposed to using its global form as described by Cook and his colleagues in their 2018 study exploring the use of various motivational scales (Cook et al., 2018). This approach was supported by Dweck's recent work in motivational theory, which suggested using domain-specific, as opposed to global measures, when seeking to measure implicit theories in distinct domains or dimensions (Dweck, 2000). Other measures, including those of achievement goal orientation involve more globally-oriented language, therefore they are not amenable to dimension-specific measurement. We chose a self-reported scale because although the name would suggest otherwise, implicit theories of intelligence are not unconscious (Kaplan & Maehr, 2007). However, they are *implicit* because individuals may not be able to articulate *why* they hold a certain belief, despite being aware of those beliefs. People can identify whether they believe a characteristic is something that is fixed or something that can be learned (i.e., malleable) and there is no value judgement associated with believing a characteristic is fixed or can be learned. This is in contrast with other implicit theories, or biases, of which people may be unaware or unwilling to share, including gender and race-related biases. Therefore, respondents can be expected to have conscious access to their implicit beliefs and feel open to articulate them.

The modified (and original) version of the ITIS-S contained four items: 2 measuring an entity (fixed) and 2 measuring an incremental (malleable) theory of intelligence. The scale required respondents to indicate their level of agreement with the four statements regarding implicit theories of intelligence along a six-point scale (from "Strongly Disagree" to "Strongly Agree"). In our modified version, the items were reworded such that they asked the respondent about either the Professional Role (Snell et al., 2015) or Medical Expert (Bhanji et al., 2015), to achieve domain-specificity. The resultant scale included 8 items (4 measuring entity and incremental theories regarding the Professional and 4 measuring entity and incremental theories regarding the Medical Expert Roles).

Data Collection:

The study was hosted on an online survey platform (LimeSurvey) and included (1) a brief questionnaire which collected demographic information, including: age, gender, and

respondent type (resident or faculty), followed by (2) the modified Implicit Theories of Intelligence Scale – Short (ITIS-S) for the Professional Role (Snell et al., 2015) and for the Medical Expert Role (Bhanji et al., 2015), and finally (3) the two questions addressing the amount of effort required to remediate poor performance in the Professional and Medical Expert Roles.

Statistical Analysis:

Statistical analysis was performed using SPSS ver. 22 (IBM Corp.)

Internal Scale Structure: The reliability of the ITIS-S data was evaluated using Cronbach's alpha.

RQ1: *Will respondents' implicit theories vary according to CanMEDS Role?*

Repeated-measures ANOVAs were used to explore differences in mean entity sub-scale and mean incremental sub-scale scores regarding Professional (Snell et al., 2015) and Medical Expert (Bhanji et al., 2015). A repeated-measures ANOVA was used because it can measure within-subject differences, compared to, for example, an independent samples T-test which can only measure between-group differences. While implicit theories were expected to differ both within- and between-subjects, between-subject variance was expected to be greater than within-subject, which makes the repeated-measures ANOVA an appropriate test. Paired T-tests were used to explore interaction terms on the repeated-measures ANOVAs regarding within-subject factors, where applicable. The dependent variable was mean subscale score (entity or incremental). Within-subject factors included: CanMEDS Role (J. Frank et al., 2015) with 2 levels (Professional and Medical Expert) and Implicit theory with 2 levels (entity and incremental).

RQ2: *Will participants indicate that remediation requires varying levels of effort depending on the Role being addressed?*

A repeated measures ANOVA was used to explore within-subject differences between effort required to remediate deficits in the Professional and Medical Expert Roles (Bhanji et al., 2015; Snell et al., 2015).

RQ3: *Will levels of effort relate to their implicit theories?*

Pearson's correlation coefficient (r) was used to determine the extent to which mean ITIS-S sub-scale scores correlated with effort to remediate deficits in the Professional and Medical Expert Role (Bhanji et al., 2015; Snell et al., 2015).

Sample Size Calculation:

This was an exploratory study, making a sample size calculation difficult. However, for the primary outcome (to measure differences in implicit theories using ITIS-S scores) recent data from Cook et al. (Cook et al., 2018) informed the sample size calculation. To measure difference mean ITIS-S sub-scale scores of 1 (on a six-point scale, approximate $SD=1$) between Professional and Medical Expert (Bhanji et al., 2015; Snell et al., 2015) at an alpha of 0.05 and power of 0.8 a sample size of 16 participants in each was required. Since we the main effect was a within-subject analysis, as opposed to between-subjects, expected the resultant sample size requirement fell approximately between 16-32.

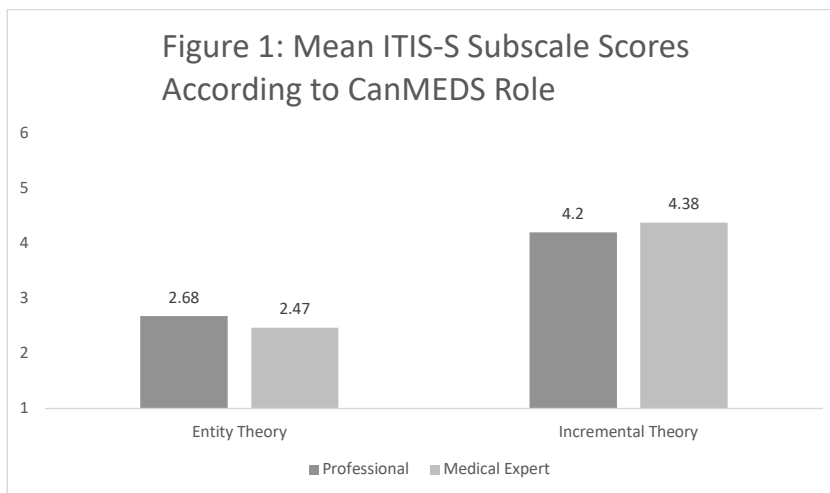
3.6 Study 1 Results:

Overview:

Study 1 was closed after 17 completed surveys. Of the 17 respondents, 5 were male (29%), with a median reported age range of 25-34 years. Respondents came from a diverse clinical background, with the most common being obstetrics and gynecology (35%). 7 were residents (41%) and the remainder were faculty members (see Table 2). Mean ITIS-S subscale scores were: 2.68 (SD 1.0) for Professional-entity, 4.2 (SD 0.9) for Professional-incremental, 2.47 (SD 1.1) for Medical Expert-entity, and 4.38 (SD 1.2) for Medical Expert-incremental (see Figure 1). Mean effort required for remediation of the Professional Role was 8.6 (SD 1.4) and 7.4 (SD 1.7) for the Medical Expert Role.

Table 2: Demographic characteristics of respondents		
		Number of respondents (%)
Gender	Male	5 (29.4)
	Female	12 (70.6)

Age	25-34	9 (52.9)
	35-44	3 (17.6)
	45-54	5 (29.4)
Clinical Background	Obstetrics and Gynaecology	6 (35.3)
	Other Medical Specialty	9 (52.9)
	Education Researcher	2 (11.8)



Internal Scale Structure:

Cronbach's alpha for each of the subdomains in the ITIS-S Professional and Medical Expert scales was acceptable: 0.93 for Professional-entity, 0.92 for Professional-incremental, 0.96 for Medical Expert-entity, and 0.93 for Medical Expert-incremental.

Will respondents' implicit theories vary according to CanMEDS Role?

Results from the repeated measures ANOVAs did not show a significant difference in implicit theories according to CanMEDS Role ($F = 0.395$, $df = 1$, $p = 0.539$). The observed power

within the sample was low (0.09), which suggests a high probability of type II error (i.e., a false negative).

Will participants indicate that remediation requires varying levels of effort depending on the Role being addressed?

The mean effort required for remediation of the Professional Role was 8.6 (SD = 1.41) and for the Medical Expert Role the mean effort was 7.4 (SD = 1.73), and the difference was statistically significant (SD = 1.95, $t = -2.61$, $df = 16$, $p = 0.019$).

Will levels of effort relate to their implicit theories?

Unfortunately, there were no significant correlations (at an alpha of 0.05) between mean ITIS-S subscale scores, according to Role and perceived effort required to remediate deficits in those Roles. (see Table 3).

Table 3: Correlations between implicit theories of intelligence and effort for remediation				
	Professional-Entity	Professional-Incremental	Medical Expert-Entity	Medical Expert-Incremental
Professional-Effort	0.155 ($p = 0.552$)	-0.176 ($p = 0.500$)	0.316 ($p = 0.217$)	-0.265 ($p = 0.305$)
Medical Expert-Effort	-0.204 ($p = 0.433$)	0.014 ($p = 0.957$)	0.286 ($p = 0.265$)	-0.379 ($p = 0.134$)

3.7 Study 1 Discussion:

The internal consistency of the ITIT-S scales was acceptable, with Cronbach's alpha >0.9 for each of the sub-scales. Therefore, the data support the use of this modified ITIS-S scale in exploring domain-specificity in implicit theories of intelligence.

Participants reported, on average, higher scores regarding an incremental theory of intelligence for both the Professional and Medical Expert Role (Bhanji et al., 2015; Snell et al.,

2015), compared to an entity theory. These findings mirrored those of previous studies that measured achievement goal orientation in medical trainees and practicing physicians (Babenko, Daniels, White, Oswald, & Ross, 2018; Gardner, Diesen, et al., 2016; Gaunt et al., 2017; Teunissen et al., 2009). For example, Babenko et al. found that respondents (medical students and practicing physicians) reported higher learning-oriented goals (which are predicated on an incremental theory of intelligence) as opposed to performance-oriented goals (which are predicated on an entity theory of intelligence). Most AGO researchers, including Teunissen and Bok, recognize that achievement goal orientation and implicit theories of intelligence are multidimensional constructs (Teunissen Pim W & Bok Harold G J, 2013) that describe individuals as both learning-oriented or performance-oriented (or as incremental and entity theorists). However, no studies had explored motivational dimensionality with respect to the various CanMEDS Roles (J. Frank et al., 2015). Although predicted based on the literature review, there was no significant difference between implicit theories of intelligence regarding the Professional and Medical Expert Role (Bhanji et al., 2015; Snell et al., 2015) were detected. The statistical power was limited due to a small sample size, and wider standard deviations than were predicted using Cook's findings (Cook, Castillo, Gas, & Artino, 2017).

The secondary objective of this study was to explore whether implicit theories of intelligence correlated with the amount of perceived effort required to remediate Professional and Medical Expert (Bhanji et al., 2015; Snell et al., 2015) deficits. Respondents believed a significantly larger amount of effort was required to remediate Professional deficits compared to Medical Expert. However, there was no association between implicit theories of intelligence and perceived effort for remediation of Professional and Medical Expert deficits; entity theories correlated positively with effort and incremental theories correlated negatively with effort, however these did not reach statistical significance.

In sum, the prediction that implicit theories of intelligence differ according to CanMEDS Role (J. Frank et al., 2015) was not supported. However, these findings mirrored the results of previous studies exploring motivation in the context of medical trainees and practicing physicians (Babenko, Daniels, et al., 2018). Respondents endorsed higher beliefs in incremental theories compared to entity theories regarding both Roles. Yet, these theories failed to

correlate significantly with differences in the amount of remediation required to remediate Professional and Medical Expert Role (Bhanji et al., 2015; Snell et al., 2015) deficits. This study was limited, primarily, by a small sample size. It is possible that the nuances regarding dimensionality in implicit theories of intelligence that we were not able to account for, resulting in an inappropriately small calculated sample size. The inability to detect differences related to Role (J. Frank et al., 2015) were either due to a true lack of dimensionality with respect of physician competency; that the Professional and Medical Expert Roles are thought of equally from a motivational perspective, or a type II error related to the small sample size (n=17). Less likely is the possibility that the scale was not measuring the constructs as intended, that the Role-specific ITIS-S scales were measuring two distinct yet undefined construct unbeknownst to us. It is arguably more likely that this is a sample size issue as opposed to a theoretical issue (that motivational dimensionality regarding Role does not exist). Recruitment was the most significant hurdle and this issue was addressed with Study 2.

3.8 Study 2: “Do differences in implicit theories of intelligence according to CanMEDS Role correlate with remediation planning in that Role?”

3.9 Study 2 Objectives:

The objectives of this study were similar to those of Study 1: to determine whether implicit theories of intelligence differed according to CanMEDS Role (J. Frank et al., 2015). This study also used a case-based approach to explore the relationship between implicit theories of intelligence and remediation. The aim was to determine if respondents’ recommendations for remediation planning (related to the duration, consequence of failure, and likelihood of success and “relapse”) differed according to the CanMEDS Role being remediated.

3.10 Study 2 Research Questions:

1. *Will respondents’ implicit theories vary according to CanMEDS Role?* (Medical Expert and Professional)

2. *Will respondents' remediation plans vary according to CanMEDS Role?*

3. *Will remediation plans relate to their implicit theories?*

3.11 Study 2 Procedure:

Overview:

As in Study 1, Study 2 explored resident and faculty theories of intelligence regarding the CanMEDS Professional and Medical Expert Roles (Bhanji et al., 2015; Snell et al., 2015). Fictitious case vignettes of residents with significant deficits in the Professional and Medical Expert Roles were developed and presented to respondents. Using multiple choice options, participants were asked to provide recommendations regarding the duration of remediation, consequences of unsuccessful remediation, the likelihood of success in the remediation program, and likelihood of future issues in the same Role (J. Frank et al., 2015) requiring remediation. After the cases, theories of intelligence were measured directly, using the same scale as Study 1. Statistical analyses explored differences in implicit theories of intelligence according to Role, whether recommendations for remediation differed according to Role, and whether respondents' recommendations for remediation correlated with their implicit theories of intelligence. For example, if respondents reported a predominantly incremental theory of intelligence regarding a Role, we expected that they would plan a remediation program that reflected a mastery-associated behaviour pattern (e.g., persistence).

Study Population and Setting:

The study population included residents and active teaching faculty in the Department of OB/GYN at the University of Toronto. The University of Toronto OB/GYN residency is a five-year Royal College-accredited training program and all residents from each of the five years of training as well as all faculty were invited to participate. There were approximately 70 residents and 150 active teaching faculty in the Department.

The study included (a) a brief questionnaire which collected demographic information, including: age, gender, and respondent type (resident, fellow, or faculty), followed by (b) the Role specific case vignettes, remediation questions, and the modified ITIS-S for each Role.

Materials:

Case Vignettes

Case vignettes were written to highlight deficits in either the Medical Expert knowledge or Professional Roles (Bhanji et al., 2015; Snell et al., 2015). The cases were developed based on Dr. Tannenbaum's experiences sitting on the Postgraduate MD-Board of Examiners and through consultation with Postgraduate MD staff who have experience with resident remediation. Specific deficits in Professional (e.g., record-keeping, truth-telling) and Medical Expert (e.g., gathering a history) were included from the Remediation Resource Inventory from Postgraduate Medical Education (PGME). These documents describe the types of deficits that are commonly found amongst trainees at the University of Toronto. Within this study, we assumed that such deficits were representative of all medical school residency programs in Canada.

The cases were novel to the participants and did not intentionally represent real resident cases brought to the Board, though they reflect the types of deficits commonly encountered in the Professional and Medical Expert Role (Bhanji et al., 2015; Snell et al., 2015). Prior to the study, the cases were shared with several Department of Family and Community Medicine faculty teachers and residents at the University of Toronto to ensure face validity; that they represented believable cases. Another goal was to help to explore response-process validity in the questions surrounding recommendations for remediation with narrative comments and written feedback. Prior to piloting the cases were reviewed with PGME staff, and in December 2018, the resident's clinical specialty was changed in one of the cases due to similarities with a historical case that was presented to the Board, of which Dr. Tannenbaum was not aware. The final study included 3 case vignettes demonstrating lapses in professionalism and 3 case vignettes demonstrating lapses in medical knowledge/skill (see Appendix 2 for cases and remediation questions).

Data Collection:

Data collection was facilitated using a Microsoft Form (Microsoft Office 365, Microsoft Corp.). Participants were invited to participate via email from the Department of OB/GYN office. Consent was obtained electronically using the Form. The Form contained the demographic questionnaire, followed by the case vignettes and remediation questions, and the modified ITIS-S scales. Data was downloaded into a Microsoft Excel file (Microsoft Corp.), cleaned, and prepared for analysis. We converted responses to numerical scales and averaged the sub-scale scores, where appropriate.

Statistical Analysis:

Statistical analysis was performed using SPSS ver. 22 (IBM Corp.)

Internal Scale Structure: The reliability of the ITIS-S data was evaluated using Cronbach's alpha.

RQ1: *Will respondents' implicit theories vary according to CanMEDS Role? (Medical Expert and Professional)*

As in Study 1, a repeated-measures ANOVA was used to explore differences in mean entity and incremental sub-scale scores between the Professional and Medical Expert Roles (Bhanji et al., 2015; Snell et al., 2015).

Dependent variable = subscale mean score. Within-subject factor = CanMEDS Role with 2 levels (Professional and Medical Expert), implicit theory with 2 levels (entity and incremental)

RQ2: *Will respondents' remediation plans vary according to CanMEDS Role?*

A repeated-measures ANOVA was performed for questions 1&2 separately from questions 3&4 because they employed different scales and measured distinct constructs.

For question 1 and question 2: Dependent variable = question response score. Within-subject factor = CanMEDS Role deficit with 2 levels (Professional and Medical Expert), case with 3 levels (case 1, 2, 3)

For question 3/4: Dependent variable = question response score. Within-subject factor = CanMEDS Role deficit with 2 levels (Professional and Medical Expert), case with 3 levels (case 1, 2, 3), question with 2 levels (question 3, question 4)

Will remediation plans relate to their implicit theories?

Pearson's r coefficient was calculated to explore the relationship between implicit theories and responses to questions about remediation, according to Role (J. Frank et al., 2015).

Sample Size Calculation:

Data from Study 1 was used to inform the sample size calculation. Since the observed difference was smaller than expected, the power calculation was adjusted to measure a mean difference ITIS-S sub-scale scores of 0.75 (on a six-point scale, approximate SD = 1.05) between Professional and Medical Expert (Bhanji et al., 2015; Snell et al., 2015) at an alpha of 0.05 and power of 0.8. The resultant sample size requirement was 31 participants per group, therefore the expected sample size requirement for within-subject analyses fell between 31-62 participants.

3.12 Study 2 Results:

Overview:

Study 2 was closed after 55 completed forms were submitted. Of the 55 responses collected, 23 (41.8%) were from residents, 4 (7.3%) from fellows, and 28 (50.1%) from faculty teachers. 41 (74.5%) respondents were women and 14 (25.6%) were men. The median age range of respondents was 35-44 years (see Table 4). Mean ITIS-subscale scores were 2.89 (SD 1.01) for Professional-entity theory, 3.73 (SD 1.17) for Professional-incremental theory, 2.41 (SD 0.90) for Medical Expert-entity theory, and 4.15 (SD 0.98) for Medical Expert-incremental theory. Regarding remediation planning, the mean response score for question 1 (duration of remediation) of the three Professional cases was 1.66 (SD 0.53), and for the three Medical Expert cases was 2.46 (SD 0.93). For question 2 (consequence of unsuccessful remediation), the mean response score of the Professional cases was 2.12 (SD 0.49) and of the Medical Expert

cases was 1.74 (SD 0.61). For question 3 (likelihood of success in remediation), the mean response score of the Professional cases was 3.78 (SD 0.76) and of the Medical Expert cases was 4.10 (SD 0.70). For question 4 (likelihood of presenting in the future with deficits in the same Role), the mean response score of the Professional cases was 3.88 (SD 0.88), and for the Medical Expert Cases was 3.64 (SD 0.81).

Table 4: Demographic characteristics of respondents		
		Number of respondents (%)
Stage of Training	Resident	23 (41.8)
	Fellow	4 (7.3)
	Faculty Teacher	28 (50.1)
Gender	Male	14 (25.6)
	Female	41 (74.5)
Age	18-24	1 (1.8)
	25-34	25 (45.5)
	35-44	11 (20.0)
	45-54	8 (14.5)
	55-64	6 (10.9)
	65+	4 (7.3)

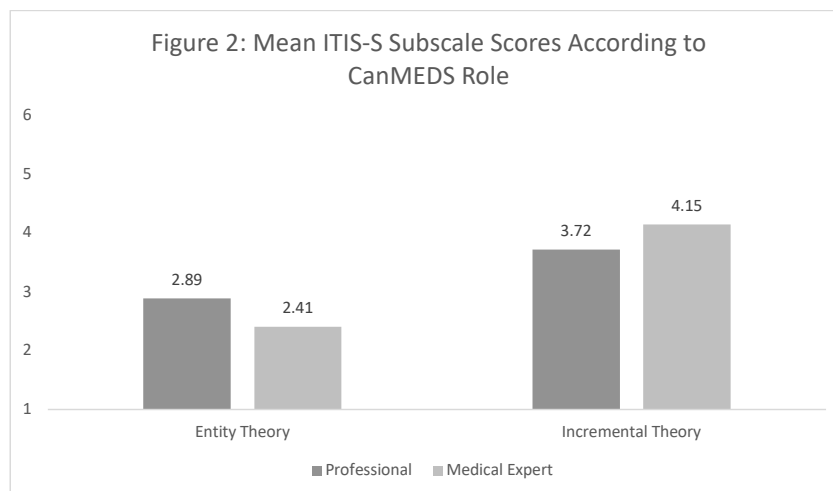
Internal Scale Structure:

Cronbach's alpha for each of the subdomains in the ITIS-S Professional and Medical Expert scales was acceptable: 0.93 for Professional-entity, 0.85 for Professional-incremental, 0.96 for Medical Expert-entity, and 0.84 for Medical Expert-incremental.

Will respondents' implicit theories vary according to CanMEDS Role? (Medical Expert and Professional)

The repeated-measures ANOVA revealed a significant interaction term for CanMEDS Role*Implicit theory ($F = 8.79$, $df = 1/54$, $p = 0.005$, partial eta-squared = 0.14) (see Figure 2).

Paired T-tests comparing mean subscale scores between the Professional and Medical Expert Roles showed a significant difference between implicit theories. The mean difference between entity theory subscale scores for Professional and Medical Expert was 0.48 (SD 1.19, $t = 3.00$, $df = 54$, $p = 0.004$). The mean difference between incremental subscale scores for Professional and Medical Expert was -0.42 (SD 1.18, $t = -2.63$, $df = 54$, $p = 0.011$). These analyses support the proposal that implicit theories of intelligence differ according to domain of competency, as outlined by the CanMEDS Framework. Respondents endorsed higher incremental theories, compared to entity theories regarding both Roles. However, the Professional Role was viewed as “more fixed” (i.e., higher entity score) than the Medical Expert Role, which was viewed as “more malleable” (i.e., higher incremental score).

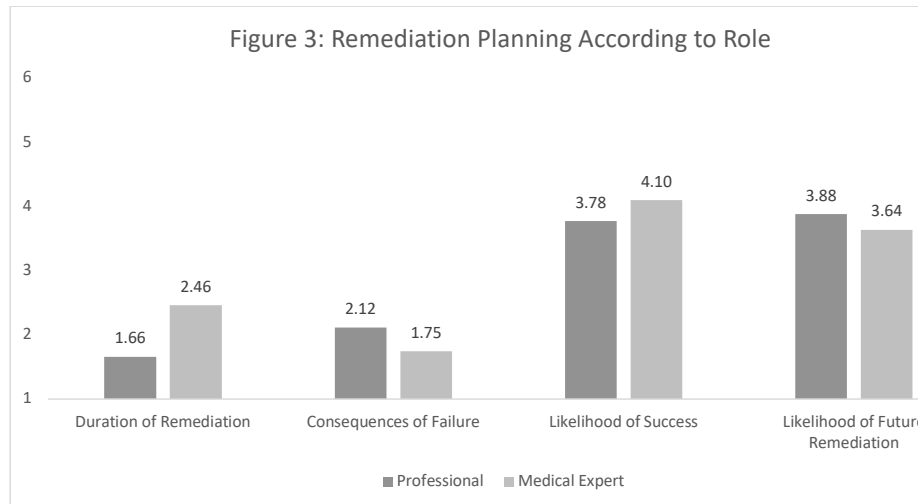


Will respondents' remediation plans vary according to CanMEDS Role?

Remediation planning differed significantly according to Role (see Figure 3). Regarding question 1, respondents planned a shorter duration of remediation for cases involving deficits in the Professional Role, compared to the Medical Expert Role (mean response scores of 1.66 and 2.46). The repeated-measures ANOVA showed a significant within-subject effect of CanMEDS Role ($F = 48.16$, $df = 1$, $p < 0.001$, partial eta squared = 0.471). Regarding question 2,

respondents recommended stricter consequences following a failure of the remediation plan in cases that described residents with deficits in the Professional, compared to the Medical Expert Roles (mean response scores of 2.12 and 1.75, respectively). The repeated-measures ANOVA showed a significant within-subject effect of CanMEDS Role ($F = 26.6$, $df = 1$, $p < 0.001$, partial eta squared = 0.330). Regarding question 3 and 4, respondents were less confident in the resident's ability to be successful in remediation of deficits in the Professional, compared to the Medical Expert Role (mean response scores of 3.78 and 4.10, respectively), and were more confident that they would return for remediation of Professional compared to Medical Expert deficits (mean response scores of 3.88 and 3.64, respectively). The repeated measures ANOVA showed a significant interaction between CanMEDS Role*Question ($F = 13.11$, $df = 1$, $p = 0.002$, partial eta squared = 0.162). Paired T-tests showed a significant difference in response scores regarding question 3 ($t = -4.125$, $df = 54$, $p < 0.001$) and question 4 ($t = 2.051$, $df = 54$, $p = 0.045$).

In summary, patterns of remediation differed according to the CanMEDS Role being remediated by the resident. Respondents recommended shorter duration of remediation and stricter consequences for unsuccessful remediation for cases involving Professional Role deficits. They also reported a lower likelihood of success and higher likelihood of repeated issues within the same Role in the future in cases where residents had deficits in the Professional, compared to the Medical Expert Roles.



Will remediation plans relate to their implicit theories?

There was a moderate ($0.3 < r < 0.7$) correlation between entity theory subscale scores in the Professional Role and higher consequences for failure of remediation (i.e., positive correlation with question 2) and higher likelihood of return for remediation of the Professional Role in the future (i.e., positive correlation with question 4). Incremental theory subscale scores in the Professional role showed a moderate positive correlation with higher likelihood of success in remediation (i.e., positive correlation with question 3) and a lower likelihood of returning for remediation of the Professional Role in the future (i.e., negative correlation with question 4). A moderate correlation was also evident between entity subscale scores in the Medical Expert Role and higher likelihood of returning for remediation of the Medical Expert role in the future (i.e., positive correlation with question 4). Conversely, there was a moderate correlation between incremental subscale scores in the Medical Expert Role and a higher likelihood of success in remediation (i.e., positive correlation with question 3).

Moderate Role-discordant correlations (i.e., between ITIS-S subscale scores in the Professional Role correlating with responses to questions regarding Medical Expert deficits) were also noted. While they were Role-discordant, they were concordant with the implicit

theory of intelligence. For example, there was a moderate correlation ($r = 0.482$) between Medical Expert-incremental subscale scores and likelihood of success in remediation in cases detailing a resident with deficits in the Professional Role (related to question 3). All other correlations were non-significant, though most were in keeping with the motivational construct. For example, there was a weakly negative correlation between entity subscale scores in the Professional Role and the perceived likelihood of success in the Professional Role remediation plan (related to question 3). Correlations are summarized in Table 5.

Table 5: Correlations between implicit theories of intelligence and questions regarding remediation planning					
		Professional- Entity	Professional- Incremental	Medical Expert- Entity	Medical Expert- Incremental
Mean score from Professional cases	Question 1	-0.062	0.256	0.206	0.067
	Question 2	0.374*	-0.194	0.073	0.030
	Question 3	-0.185	0.538*	-0.058	0.482*
	Question 4	0.524*	-0.331*	0.193	0.017
Mean score from Medical Expert Cases	Question 1	-0.042	0.207	-0.053	0.136
	Question 2	0.210	-0.152	0.104	-0.051
	Question 3	-0.105	0.457*	-0.118	0.453*
	Question 4	0.358*	-0.122	0.493*	-0.118
*Boded values represent statistical significance at a level of $\alpha = 0.05$.					

This pattern of correlation was largely in keeping with the proposal that patterns of remediation should correlate with implicit theories of intelligence. An entity theory appeared to be associated with a lower confidence in the resident's ability to improve, as reflected in the responses to questions 2-4. Conversely, an entity theory was associated with higher confidence in the resident's ability to improve.

3.13 Study 2 Discussion:

This study provided support for the proposal that implicit theories of intelligence differed according to CanMEDS Role (J. Frank et al., 2015). The Professional Role (Snell et al., 2015) was associated with higher entity scores and lower incremental scores, compared to the Medical Expert Role (Bhanji et al., 2015). Professional appears to be more “fixed” than the Medical Expert Role. Furthermore, patterns of remediation planning differed according to Role. Compared to the Medical Expert Role, the Professional Role was associated with stricter consequences for failure of remediation, a lower perceived likelihood of success in remediation, and a higher perceived likelihood of returning for remediation in the future for deficits in the Professional Role. Remediation planning correlated with implicit theories of intelligence, which indicates that the differences in planning may be accounted for, in part, by one’s implicit theories.

These results offer insight into how individuals make decisions surrounding remediation. Respondents who endorsed an entity theory, the belief that intelligence and ability are fixed, offered stricter consequences following failure of the remediation plan (e.g., remediation with probation, versus further remediation). They were also less confident in the resident’s ability to improve and were more likely to believe the resident would present for remediation in the same Role (J. Frank et al., 2015) in the future. Therefore, from the respondents’ perspective, the remediation period may serve more as an opportunity for the resident to prove that they lack a fundamental ability to perform, rather than an opportunity to improve over time. This focus on “demonstration” is more aligned with a performance-goal orientation than a learning-goal orientation. Conversely, respondents who endorsed an incremental theory, the belief that intelligence and ability are malleable and can change with practice, offered less strict consequences, with a higher perceived likelihood of success as well as a lower perceived likelihood of presenting for remediation again in that Role in the future. In this case, from the respondents’ perspective, remediation may serve as an opportunity to develop competence, rather than an opportunity to demonstrate a fundamental lack of ability.

Regarding question 1 (duration of remediation), respondents were more likely to assign a longer duration for Medical Expert (Bhanji et al., 2015) cases compared to Professional (Snell et al., 2015) cases, which may seem counterintuitive. One might think that if capacity within one Role (J. Frank et al., 2015) is relatively more malleable than another, less time would be required to overcome the “inertia” of the lack of ability. That is, if a competency is more fixed, more time would be required to facilitate change. However, the opposite was noted, and the rationale was explained clearly during the pilot phase, where for case 2 (Professional), one respondent wrote:

“if the resident knowingly committed this error, then I’m not sure what kind of remediation would help, which is why I chose 3 months” – Male resident

These sentiments were in keeping with the remainder of the remediation planning patterns that were noted in questions 2-4, where stricter consequences, lower likelihood of success, and higher likelihood of similar issues in the future were reported. It may be that when remediation is viewed as more of an opportunity to confirm the resident’s lack of ability and provide rationale for, perhaps, dismissal from the program in the future. That is, why expose patients to a resident with a fundamental lack of ability that is unlikely to improve for more time than is necessary to confirm that assumption? Another possibility is that the shorter duration of remediation may be a manifestation of the helpless behaviour pattern that is associated with a performance-goal orientation, a product of an entity theory of intelligence (S. Dweck, 1986). The thought may be that there is little chance of success, therefore less time should be invested in that possibility. This is representative of challenge-avoidance and low persistence, which are characteristics of a helpless behaviour pattern.

These data, which demonstrate the presence of dimensionality in implicit theories related to various domains of physician competency, support what has been previously alluded to in other studies. For example, in their study of Emergency Medicine Program Directors’ perceptions of professionalism, Sullivan et al. found that respondents believed “that unprofessional behavior often stems from a resident’s underlying personality or character and, as a result, is less amenable to meaningful, long-term behavioral change.” (Sullivan et al., 2011.

Commented [Office3]: At this point, I think we need some acknowledgement of the remediation process that typically involves review of the ‘facts’. Such as whether or not the trainees committed the troubling acts knowing it was wrong or not.

Commented [ET4R3]: I’m not sure this is really supported in real life or in the literature. There typically is no consideration around their intent. Decisions are made based on observed behaviour. The intent part can kind of be a part of that but how can you ever really know? If someone stole something, they obviously did it on purpose... or so you would think. But there are always outlandish excuses about how they thought they were doing the right thing....

p.S101) Importantly, these results provide empiric evidence that physicians and trainees do not simply have an entity or incremental theory of intelligence (Ramani, Könings, Ginsburg, & Vleuten, 2018), rather elements of both, to varying degrees, according to the dimension of physician competency (e.g., Medical Expert or Professional). We know from previous work that a performance-goal orientation, which is based on an entity theory of intelligence can be beneficial in some situations, in terms of job performance and learning outcomes (Kaplan & Maehr, 2007). Therefore, focusing on the “growth mindset” (Ramani et al., 2018; Ricotta, Huang, Hale, Freed, & Smith, 2019) may cause us to ignore some of the beneficial aspects of one’s entity theory (or “fixed mindset”), which can include a desire to perform at a high level. Such a desire would prove beneficial, when the consequences of underperformance can be life-threatening for patients.

Creating the dichotomy between fixed and growth mindsets, performance- and learning-goal orientation, and entity and incremental theories of intelligence may be inappropriate. Instead of trying to shift trainees and practitioners towards a growth mindset, more work is needed to deepen our understanding of how these dimensions of motivation influence behaviour in the workplace, including teaching, learning, assessment, and remediation of trainees. They may in fact be two sides of the same coin, rather than two different coins altogether. Nevertheless, small differences in implicit theories appear to produce significant differences in the way underperformance is managed. Consequently, residents who are sent for remediation may be subject to the “luck of the draw” with respect to who is planning their remediation and what those individuals’ implicit theories may be regarding the type of deficit the resident has demonstrated. The most significant limitation of this study was the lack of qualitative data to support or enhance our findings. This is important because we recognize that implicit theories of intelligence are *implicit*, and a qualitative methodology may have provided insight as to *why* respondents’ theories differed according to Role (J. Frank et al., 2015) and why remediation planning differed. While motivational theory appears to correlate with some of the variability in planning, according to Role, there is much more that goes into these decisions. Future research may include qualitative methodology to

Commented [Office5]: Perhaps this is the a place to acknowledge the potential influence of the review process to determine intent to do wrong.

Commented [ET6R5]: Again, not sure how to deal with this idea of intent....

MSc. Thesis – E. Tannenbaum; McMaster University – Health Science Education

explore *how* these plans are developed and the roles that implicit theories of intelligence play in that process.

4.0 Chapter 3: Discussion and Conclusions

4.1 Discussion:

4.2 Dimensionality in physician competence

Where previous studies have focused on global measurement of motivation (Babenko, Daniels, et al., 2018; Babenko, Szafran, Koppula, & Au, 2018) and its correlation with assessment behaviours (Gaunt et al., 2017) or feedback seeking (Janssen & Prins, 2007), they have disregarded the possibility that motivation may differ according to the domain of physician competency in question. Yet we know that physician competency is complex and is comprised of a diverse set of sub-competencies, as outlined in the CanMEDS framework (J. Frank et al., 2015). Learning how to perform hysteroscopy is different from learning how to break the unexpected news of a new cancer diagnosis to a patient. While both are physician competencies, they are comprised of different sub-competencies, such as hand-eye coordination and empathy. These different competencies draw on different dimensions of a person's intelligence/ability. Our studies have shown that there are differences in the way that trainees and teachers perceive these distinct dimensions of competencies as constructs that are amenable to change with practice or are fixed character traits.

Leaving motivational dimensionality unexplored is problematic because of what is known regarding "missing data". Missing data refers to the observation that the assessment and feedback tends to focus more on the Medical Expert Role, compared to the Intrinsic Roles (McConnell, Sherbino, & Chan, 2016; Sherbino, Kulasegaram, Worster, & Norman, 2013). Some have argued that the Intrinsic Roles are interrelated (Kuper et al., 2017), making them difficult for raters to code performance accurately (Sherbino et al., 2013). While this is a possible explanation, missing data has not been explored through the lens of motivational processes. It is possible that some raters choose to forgo formative assessment of Roles for which they hold an entity theory of intelligence because they see little value in providing feedback on a Role (J. Frank et al., 2015) that is relatively "fixed". Instead, they may focus on providing feedback regarding other Roles for which they hold an incremental theory of intelligence in order to

guide learner growth. The same may be true for trainees. They may preferentially ask for assessment of Roles about which they hold an incremental theory of intelligence.

Similarly, regarding remediation of these Roles (J. Frank et al., 2015), some may view remediation as an opportunity to facilitate growth, while others may view it as an opportunity to document a fundamental lack of ability and build a case for dismissal. These motivations appear to differ according to one's implicit theories of intelligence regarding each CanMEDS Role (J. Frank et al., 2015). This is important because all Roles are *supposed* to be equally amenable to change within the competency by design (CBD) framework. However, if this is not the case, or if individuals do not believe it to be true, they may approach remediation inappropriately, using it as an opportunity to document failure, rather than foster growth.

4.2 Remediation planning and its association with implicit theories of intelligence

While Study 1 failed to show a significant difference in ITI according to CanMEDS Role (J. Frank et al., 2015), it did show that respondents believed more effort was required to remediate Professional Role (Snell et al., 2015) deficits, compared to Medical Expert (Bhanji et al., 2015). Study 2, on the other hand, with its larger sample size, was able to detect subtle, yet significant differences in ITI related to the Professional and Medical Expert Roles (Bhanji et al., 2015; Snell et al., 2015). While respondents reported higher incremental theories (i.e., intelligence/ability as malleable), compared to entity theories (i.e., intelligence/ability as fixed) regarding both Roles, Professional (Snell et al., 2015) was felt to be relatively more fixed and less malleable than Medical Expert (Bhanji et al., 2015). In addition, the use of a case-based approach to remediation planning allowed for a more detailed understanding of how respondents planned for remediation differently, according to Role. Compared to cases with Medical Expert Role (Bhanji et al., 2015) deficits, cases with Professional Role (Snell et al., 2015) deficits were assigned a shorter duration of remediation, stricter consequences of failure, and respondents were less confident in the resident's ability to successfully remediate their deficits and believed they were more likely to return in the future for remediation in the Professional

Role (Snell et al., 2015). These differences in remediation planning correlated, to a certain extent, with the respondent's implicit theories.

There is an apparent paradox between the findings of Study 1 and Study 2 in that respondents believed more effort was required to remediate Professional Role (Snell et al., 2015) deficits, yet there was less time dedicated to remediation efforts for Professional Role deficits. However, using achievement goal orientation theory, the paradox can be dispelled. The amount of effort required for remediation can be thought of as a diagnostic question: *"how difficult of an issue is this to overcome?"*, and remediation planning as a management question: *"given the difficulty in overcoming such an issue, how would you approach the management of this struggling learner?"* The responses showed that the Professional Role (Snell et al., 2015) was thought of as more fixed than the Medical Expert Role (Bhanji et al., 2015), and the remediation planning was consistent with helpless behaviour patterns. In fact, because more effort was thought to be required to remediate Professional Role (Snell et al., 2015) deficits, we would predict that remediation planning would appear more performance-oriented (i.e., associated with helpless behaviour patterns). This type of apparent mismatch is common in medical education research. A similar difference between what learners say they believe and what they do is observed in some studies of self-assessment, where high-performers over-estimate their ability and high-performers underestimate it (Blanch-Hartigan, 2011).

From a theoretical perspective, these results show that there is dimensionality with respect to ITI, when considering the construct of physician competence. This mirrors what was found by others in different education contexts, where ITI differed according to domain of competency/skill (Costa & Faria, 2018; Hughes, 2015). Furthermore, these differences in ITI correlate with how trainees and faculty approach remediation of the struggling learner, which is in keeping with AGO theory, where an entity theory is associated with a helpless behaviour pattern and an incremental theory with a mastery pattern. These findings have implications on the approach to teaching and learning, as well as decision making surrounding achievement in a competency-based training paradigm.

4.2 Can achievement goal orientation explain why we can or cannot rely on workplace-based assessment to detect underperformers:

With the focus on frequent low-stakes assessment of performance, competency-based medical education (CBME) is purported to make up for the shortcomings of traditional residency training paradigms through: 1) documentation of adequate achievement in the competencies that comprise a clinical specialty and 2) providing learners with appropriate observation and feedback to support growth (J. R. Frank et al., 2010). In theory, frequent low-stakes assessment of performance should help identify areas of strength and weakness at an early stage and provide trainees with the guidance necessary to meet their training objectives. However, research in workplace-based assessment (WBA) has shown that faculty's and trainees' engagement with, and perception of this type of assessment is nuanced. For example, faculty's judgement of performance and subsequent scoring of WBAs can be subject to error variance that is unrelated to the task-at-hand (Gauthier, St-Onge, & Tavares, 2016; Gingerich et al., 2011). These can include social factors such as the faculty-trainee relationship, previous experience with the trainee, and the trainee's previous assessment scores (Gingerich et al., 2018). While the cognitive and social components of the assessment process are being explored from a rater (faculty) perspective, there is comparatively less research in this process from the trainee perspective, and neither have taken motivational dimensionality into account.

Research in undergraduate and postgraduate medical education has shown that trainees engage with WBAs variably (Dijksterhuis et al., 2013), where some view low-stakes assessment as an opportunity to learn and improve and others view all assessment, regardless of its explicitly stated purpose, as summative (Nesbitt, Baird, Canning, Griffin, & Sturrock, 2013). This belief can lead some trainees to "game" assessment systems by choosing when and by whom they will be assessed (Gaunt Anne et al., 2017). Assessment gaming can lead to an accumulation of assessment data that reflects an inaccurate representation of actual performance, based on preferential recording of positive results. In essence, since trainees are largely in charge of determining when assessment takes place (Massie & Ali, 2016), they can compile assessment data in such a way as to appear more competent than they really are,

which threatens the generalizability and validity of the assessment data. Furthermore, such behaviours are predictable, based on our understanding of motivational theory.

Specifically, Dweck's theory of achievement goal orientation (S. Dweck, 1986) details how individuals can have one of two mindsets: a fixed mindset (or entity theory of intelligence), which describes individuals who believe intelligence/ability is fixed, and a growth mindset (or incremental theory of intelligence), which describes individuals who believe intelligence/ability are malleable. In part, due to predictable behaviour patterns, according to achievement goal orientation theory, residents can accumulate a body of assessment data that may not reflect an accurate picture of their performance. This makes the reliance on assessment data in the identification of underperforming residents in need of remediation difficult. Perhaps even more-so than in previous paradigms, where residents were not in control of when assessment takes place.

Once remediation has been initiated, these findings suggest that the same motivational theories that lead to variability in the use of assessment contribute to differences in the way remediation is planned. An entity (fixed) theory of intelligence was associated with a remediation plan that appeared more like an opportunity to demonstrate a fundamental lack of ability and an incremental (malleable) theory of intelligence was associated with a plan that appeared like an opportunity to develop competence. These distinct patterns of remediation are in keeping with Dweck's initial theorization, making the link between implicit theories of intelligence, achievement goals, and their associated behaviour patterns (S. Dweck, 1986). These research findings add to our theoretical understanding of motivation, as they demonstrate that one's own theories can influence how they manage other people's learning. Additionally, these findings show that implicit theories of intelligence differ according to the dimension of physician competency, as outlined in the CanMEDS Framework (J. Frank et al., 2015).

4.4 While undergoing remediation, can we expect WBA to function as a teaching tool:

As discussed earlier, CBME will employ WBA as a method of teaching and assessment. From a teaching perspective, WBA is meant to provide learners with details of their performance, measured against pre-determined expectations, coupled with actionable feedback. One of the key assumptions implicit in this strategy is that residents will view assessment as an opportunity for growth, rather than simply a measure of performance at a point in time. Residents, in essence, are being asked to adopt a growth mindset irrespective of both their own implicit theories of intelligence (trait-goal orientation) and the effect of the learning environment (state-goal orientation). Based on the findings of Study 2, we can begin to question the feasibility of such an approach. For example, respondents reported higher a higher entity ITI and lower incremental ITI regarding the Professional Role (Snell et al., 2015), compared to the Medical Expert Role (Bhanji et al., 2015). Consequently, respondents recommended stricter remediation plans for residents with Professional Role deficits, compared to the Medical Expert Role. If we extrapolate these findings to WBA as a teaching tool, residents and faculty are unlikely to use WBA to teach and learn professionalism. We must consider the consequences of combining multiple Roles (J. Frank et al., 2015) into assessment of meta-competencies. We can hypothesize that learners (and faculty) are more likely to use WBA as a means of documenting a fundamental ability (or lack thereof) to behave professionally. That is, if a resident believes they are “professional”, then they may choose to use WBA as an opportunity to be directly observed behaving professionally and then have that documented, to prove that they are professional. Conversely, regarding the Medical Expert Role (Bhanji et al., 2015), the higher incremental ITI may, in fact, lead to the use of WBA for learning. However, in CBME, domains of competency are not assessed one-by-one, they are assessed as constituents of a given EPA.

As explored in Chapter 1, state-goal orientation (i.e., the environmental context) can have a profound effect on feedback-seeking behaviours and academic outcomes (Payne et al., 2007). In CBME, the progress in training is determined by demonstrating ability and we know that demonstration of competence, as opposed to development of competence is associated with a fixed mindset. This creates a problem because trainees are being told that it is *okay* to be deemed occasionally ‘untrustable’ because it is part of the learning process, yet in order to

progress in their programs they must demonstrate competence. This is especially true while undergoing remediation, where sub-competent performances may affect the trainee's ability to continue in their program. Therefore, assessment serves as a means of documenting competence. Whether or not the purpose of assessment is explicitly stated as formative (i.e., assessment-for-learning), when such assessment scores are used to make high-stakes entrustment decisions, as they are effectively high-stakes, assessments-of-learning, and learners have picked up on this (Massie & Ali, 2016; Nesbitt et al., 2013). How then, when we know that the assessment data is being used for high-stakes decision-making (i.e., for progression in training or completing a remediation plan), can we expect trainees to engage in assessment as a means to foster growth?

From the faculty perspective, if a teacher has a predominantly entity theory of intelligence regarding the Professional Role (Snell et al., 2015), we can hypothesize that they are more likely to view WBA as a high-stakes activity, with the goal of identifying those that are unprofessional, rather than a low-stakes activity, aimed at providing feedback to help residents develop competency in professionalism. The same can be said regarding surgical skill or any other domain of competency. Will those with predominantly entity theories of intelligence be more likely to document underperformance as a means of "catching" those trainees that they believe are fundamentally lacking in ability, instead of using WBA to foster growth? That is, will measurement come at the expense of learning, especially when multiple Roles are assessed at once? Future research may shed light on how motivational dimensionality affect faculty (and trainee) engagement with WBA and how assessment data is aggregated by competence committees. For residents undergoing remediation, should we preferentially select faculty supervisors who believe competence can be developed (i.e., hold a predominantly malleable theory of intelligence)?

4.5 Implications for Competence Committees and Assessment Portfolios:

In CBME, low-stakes WBA data will be aggregated and analyzed by competence committees, which will determine whether a resident has achieved competence in a given EPA

or set EPAs. Based on the findings of Study 1 and Study 2, we can hypothesize that based on one's ITI regarding the various CanMEDS Roles (J. Frank et al., 2015), individual committee members may have differing opinions about whether a resident is competent or not. For example, those with predominantly incremental ITIs may view untrustable performances as steps in the direction of achieving competence. If the trainee demonstrates they are improving over time, with an adequate number of entrustable observed performances, they may be deemed competent. However, another member with predominantly entity theories may view that same collection of assessment data differently. As was found in Study 2, they may focus underperformance as a red-flag, indicative of a fundamental lack of ability that is less likely to improve with further opportunities.

Therefore, from the trainee's perspective, there may be no clear advantage to collecting a portfolio of assessment that includes documentation of untrustable performances. One of the risks of placing the responsibility for ensuring assessment takes place in the hands of trainees is that they can be selective and choose to generate a portfolio of assessment that contains the documentation of good performances over relatively poorer ones. This threatens to reduce the chance that the struggling learner will be identified. First, assessors may be susceptible to contrast effects (Gingerich et al., 2018), where a portfolio of previously highly-scored assessments may bias the assessor to inflate grades. Second, competence committees may overlook those individuals, as they may lack evidence of underperformance in the portfolio of assessment and the committee members may not have any reason to believe the trainee is struggling (e.g., having personally supervised them).

When assessment data that is meant to be formative is used for high-stakes decision making, it effectively becomes summative assessment and this phenomenon has been documented in the literature (Nesbitt et al., 2013). Based on our understanding of achievement goal orientation, we can hypothesize that the use of formative assessment data (reliant on a growth mindset) for summative decision-making (a performance-oriented task) can be viewed as an environmental contextual factor that may induce a performance-orientation (Payne et al., 2007) and its associated maladaptive behaviours (e.g., challenge-avoidance, low persistence) in trainees. Therefore, not only is assessment gaming (Gaunt Anne et al., 2017) predictable, it may

in fact be a consequence of a curricular innovation that was meant to achieve the opposite effect. One of the main issues is the misalignment of the motivational goals of trainees, faculty, and programmes of assessment.

4.6 Motivational Misalignment:

As discussed earlier, contemporary research in motivation had demonstrated that the environmental context has a significant mediating effect on one's goal orientation and can have a significant effect on future learning and job performance outcomes (Gardner, Jabbour, et al., 2016; Kaplan & Maehr, 2007; Payne et al., 2007). Alignment of trait and state goal orientation appears to correspond with engagement in WBA (Dijksterhuis et al., 2013). Therefore, considering the curriculum as a contextual factor in the educational environment, we can see how the purpose of CBME is at odds with the use of assessment as a teaching tool. With its use of direct observation and feedback, and focus on outcomes, staged-progression, and mastery-learning, CBME can be considered learning-oriented. However, when direct observation and feedback as teaching tools are paired with the concurrent documentation of performance through WBA, there is a misalignment motivationally, because when the WBA data is used to make summative decisions, it becomes high-stakes and WBA. It can then be thought of as an opportunity to demonstrate competence or a lack of competence, which is characteristic of a performance-orientation.

Similar issues can arise regarding residents and faculty. Medical trainees are accustomed to a performance-oriented educational environment, characterized by grade-point average and medical college admissions test (MCAT) cut-offs and the competitiveness of undergraduate medical trainees (Lempp & Seale, 2004). This competitiveness and need to demonstrate intelligence and ability is heightened at the end of medical school, when trying to secure a residency spot, especially today, given the increasing numbers of unmatched medical students (S. L. Silverberg & Purdy, 2018). It is understandable, then, that some trainees would be skeptical of using assessment as a learning tool. Rather than outlining a path along the trajectory to entrustability, those untrustworthy data-points can be viewed as marks against

them during the next chapter in the medical education continuum: securing a job. For some in surgical specialties, such as neurosurgery, these job opportunities can be few and far between (Vogel, 2011). Therefore, even those who are learning-oriented may be forced to circumvent assessment as a teaching tool because it is motivationally misaligned, and focus on obtaining valuable learning opportunities and feedback outside of the documented assessment program (Gaunt et al., 2017).

This “grey market” curricular engagement is reflective of motivational dimensionality in ITI. As observed in Study 1 and 2, respondents reported *both* entity and incremental ITI, though these differed according to Role (J. Frank et al., 2015). Obtaining feedback outside of structured WBA (Gaunt et al., 2017) and selecting to have successful attempts at EPAs (or other clinical activities) assessed preferably over unsuccessful attempts satisfies an incremental and entity implicit theory, respectively. The desire to achieve competence can be achieved through feedback-seeking outside of documented assessments and the desire to avoid negative judgements and maximize positive judgements can be achieved through careful selection of assessors and cases to be assessed. It is important to recognize that while trainees are *primarily* responsible for ensuring WBA takes place, they are not *solely* responsible.

As alluded to previously, if a faculty has a predominantly entity theory of intelligence regarding a certain competency or domain of competency, they may elect to complete an assessment form following observation of a poor performance without being asked and without providing feedback to the resident. They may use assessment to build a case of incompetence. This assessment-of-learning approach is not in keeping with intended uses of WBA in CBME but is nevertheless a real possibility that can be predictable, based on our understanding of ITI. We must question how those involved in the assessment and remediation process view competence as either something that can change or something that is fixed because this can have significant consequences for the reliability and accuracy of assessment data and the motivations behind remediation (i.e., to foster growth or to document lack of ability).

5.0 Conclusion:

The motivation to develop or demonstrate competence differs according to the domain of physician competency in question and those differences manifest in the way health professionals manage underperformance. Qualitative work, exploring the dimensionality of ITI related to the various CanMEDS Roles (J. Frank et al., 2015) will be needed in order to better understand how motivational dimensionality affects trainee and faculty behaviours in the workplace, especially when multiple Roles are assessed or remediated. Part of this work should focus on addressing some of the assumptions related to CBME that have yet to be proven with empiric studies, such as randomized controlled trials or other population-based observational methods. For example, the notion that assessment drives learning (J. R. Frank et al., 2010) is popular, but as an intervention, the evidence for the use of assessment as a teaching tool is lacking. Many studies aim to answer this question using WBAs that serve the dual purpose of providing learners with feedback and measurement of performance (Norcini & Burch, 2007), therefore feedback may serve as a confounding factor that jeopardizes our ability to explore the effect of measurement on learning. We have yet to explore the effect of measurement on the accuracy/reliability of judgements of trainee performance. By employing a theoretical framework, such as achievement goal orientation theory, research in assessment can be situated within a body of existing work, follow defensible methodology, and contribute both to the assessment literature, as well as the literature relevant to the theoretical framework.

Finally, curricular innovation is necessary and documentation of performance using new and innovative methods is important moving forward, in order to ensure responsible self-governance and accountability to the public. No longer is an ITER completed every six weeks (or less frequently) considered adequate documentation of physician-in-training competence. Nevertheless, the competency-based approach to training brings with it a set of assumptions that unless tested in a methodologically-sound manner, threaten to undermine the goal of training and remediating compassionate, competent physicians in Canada.

6.0 References:

- Alrakaf, S., Anderson, C., Coulman, S. A., John, D. N., Tordoff, J., Sainsbury, E., ... Smith, L. (2015). An International Comparison Study of Pharmacy Students' Achievement Goals and their Relationship to Assessment Type and Scores. *American Journal of Pharmaceutical Education*, 79(3). <https://doi.org/10.5688/ajpe79335>
- Alvand, A., Auplish, S., Gill, H., & Rees, J. (2011). Innate Arthroscopic Skills in Medical Students and Variation in Learning Curves: *The Journal of Bone and Joint Surgery-American Volume*, 93(19), e115(1)-e115(9). <https://doi.org/10.2106/JBJS.K.00199>
- Babenko, O., Daniels, L. M., White, J., Oswald, A., & Ross, S. (2018). Achievement goals of medical students and physicians. *Educational Research and Reviews*, 13(2), 74–80. <https://doi.org/10.5897/ERR2017.3392>
- Babenko, O., Szafran, O., Koppula, S., & Au, L. (2018). Motivations for learning of family medicine residents trained in competency-based education. *Education for Primary Care*, 29(2), 86–93. <https://doi.org/10.1080/14739879.2017.1362666>
- Baird, J., & Vanstone, M. (2017). Professionalism's contextual nature: A call for compassionate, constructive responses. *Medical Education*, 51(7), 678–679. <https://doi.org/10.1111/medu.13354>
- Barrett, A., Galvin, R., Steinert, Y., Scherpbier, A., O'Shaughnessy, A., Horgan, M., & Horsley, T. (2016). A BEME (Best Evidence in Medical Education) review of the use of workplace-based assessment in identifying and remediating underperformance among postgraduate medical trainees: BEME Guide No. 43. *Medical Teacher*, 38(12), 1188–1198. <https://doi.org/10.1080/0142159X.2016.1215413>
- Bennett, K. G., Ingraham, J. M., Schneider, L. F., Saadeh, P. B., & Vercler, C. J. (2017). The Teaching of Ethics and Professionalism in Plastic Surgery Residency: A Cross-Sectional Survey. *Annals of Plastic Surgery*, 78(5), 552–556. <https://doi.org/10.1097/SAP.0000000000000919>
- Bhanji, F., Lawrence, K., Goldszmidt, M., Walton, M., Harris, K., Creery, D., ... Stang, A. (2015). Medical Expert. In *CanMEDS 2015 Physician Competency Framework*. Ottawa: Royal College of Physicians and Surgeons of Canada.
- Blanch-Hartigan, D. (2011). Medical students' self-assessment of performance: Results from three meta-analyses. *Patient Education and Counseling*, 84(1), 3–9. <https://doi.org/10.1016/j.pec.2010.06.037>

- Cook, D. A., Castillo, R. M., Gas, B., & Artino, A. R. (2017). Measuring achievement goal motivation, mindsets and cognitive load: Validation of three instruments' scores. *Medical Education*, 51(10), 1061–1074. <https://doi.org/10.1111/medu.13405>
- Cook, D. A., Gas, B. L., & Artino, A. R. J. (2018). Measuring Mindsets and Achievement Goal Motivation: A Validation Study of Three Instruments. *Academic Medicine, Publish Ahead of Print*. <https://doi.org/10.1097/ACM.0000000000002290>
- Costa, A., & Faria, L. (2018). Implicit Theories of Intelligence and Academic Achievement: A Meta-Analytic Review. *Frontiers in Psychology*, 9. <https://doi.org/10.3389/fpsyg.2018.00829>
- Dijksterhuis, M. G. K., Schuwirth, L. W. T., Braat, D. D. M., Teunissen, P. W., & Scheele, F. (2013). A qualitative study on trainees' and supervisors' perceptions of assessment for learning in postgraduate medical education. *Medical Teacher*, 35(8), e1396–e1402. <https://doi.org/10.3109/0142159X.2012.756576>
- Dweck, C. S. (2000). *Self-theories: Their Role in Motivation, Personality, and Development*. Psychology Press.
- Dweck, C. S., Chiu, C., & Hong, Y. (1995). Implicit Theories: Elaboration and Extension of the Model. *Psychological Inquiry*, 6(4), 322–333. https://doi.org/10.1207/s15327965pli0604_12
- Dweck, C. S., & Leggett, E. L. (1988). A Social-Cognitive Approach to Motivation and Personality. *MOTIVATION AND PERSONALITY*, 18.
- Eckles, R. E., Meslin, E. M., Gaffney, M., & Helft, P. R. (2005). Medical Ethics Education: Where Are We? Where Should We Be Going? A Review: *Academic Medicine*, 80(12), 1143–1152. <https://doi.org/10.1097/00001888-200512000-00020>
- Elfil, M., & Negida, A. (2017). Sampling methods in Clinical Research; an Educational Review. *Emergency*, 5(1). Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5325924/>
- Fokkema, J. P. I., Teunissen, P. W., Westerman, M., Lee, N. van der, Vleuten, C. P. M. van der, Scherpier, A. J. J. A., ... Scheele, F. (2013). Exploration of perceived effects of innovations in postgraduate medical education. *Medical Education*, 47(3), 271–281. <https://doi.org/10.1111/medu.12081>
- Frank, J. R., & Danoff, D. (2007). The CanMEDS initiative: Implementing an outcomes-based framework of physician competencies. *Medical Teacher*, 29(7), 642–647. <https://doi.org/10.1080/01421590701746983>

- Frank, J. R., Snell, L. S., Cate, O. T., Holmboe, E. S., Carraccio, C., Swing, S. R., ... Harris, K. A. (2010). Competency-based medical education: Theory to practice. *Medical Teacher*, 32(8), 638–645. <https://doi.org/10.3109/0142159X.2010.501190>
- Frank, J., Snell, L., & Sherbino, J. (2015). *CanMEDS 2015 Physician Competency Framework*. Ottawa: Royal College of Physicians and Surgeons of Canada.
- Gardner, A. K., Diesen, D. L., Hogg, D., & Huerta, S. (2016). The impact of goal setting and goal orientation on performance during a clerkship surgical skills training program. *The American Journal of Surgery*, 211(2), 321–325. <https://doi.org/10.1016/j.amjsurg.2015.07.028>
- Gardner, A. K., Jabbour, I. J., Williams, B. H., & Huerta, S. (2016). Different Goals, Different Pathways: The Role of Metacognition and Task Engagement in Surgical Skill Acquisition. *Journal of Surgical Education*, 73(1), 61–65. <https://doi.org/10.1016/j.jsurg.2015.08.007>
- Gaunt, A., Patel, A., Fallis, S., Rusius, V., Mylvaganam, S., Royle, T. J., ... Pawlikowska, T. R. B. (2017). Surgical Trainee Feedback-Seeking Behavior in the Context of Workplace-Based Assessment in Clinical Settings. *Academic Medicine: Journal of the Association of American Medical Colleges*, 92(6), 827–834. <https://doi.org/10.1097/ACM.0000000000001523>
- Gaunt Anne, Patel Abhilasha, Rusius Victoria, Royle T James, Markham Deborah H, & Pawlikowska Teresa. (2017). 'Playing the game': How do surgical trainees seek feedback using workplace-based assessment? *Medical Education*, 51(9), 953–962. <https://doi.org/10.1111/medu.13380>
- Gauthier, G., St-Onge, C., & Tavares, W. (2016). Rater cognition: Review and integration of research findings. *Medical Education*, 50(5), 511–522. <https://doi.org/10.1111/medu.12973>
- Gingerich, A., Regehr, G., & Eva, K. W. (2011). Rater-Based Assessments as Social Judgments: Rethinking the Etiology of Rater Errors. *Academic Medicine*, 86(10). <https://doi.org/10.1097/ACM.0b013e31822a6cf8>
- Gingerich, A., Schokking, E., & Yeates, P. (2018). Comparatively salient: Examining the influence of preceding performances on assessors' focus and interpretations in written assessment comments. *Advances in Health Sciences Education*, 23(5), 937–959. <https://doi.org/10.1007/s10459-018-9841-2>
- Grantcharov, T. P., & Funch-Jensen, P. (2009). Can everyone achieve proficiency with the laparoscopic technique? Learning curve patterns in technical skills acquisition. *The American Journal of Surgery*, 197(4), 447–449. <https://doi.org/10.1016/j.amjsurg.2008.01.024>

- Guerrasio, J., & Aagaard, E. M. (2014). Methods and Outcomes for the Remediation of Clinical Reasoning. *Journal of General Internal Medicine*, 29(12), 1607–1614.
<https://doi.org/10.1007/s11606-014-2955-1>
- Guerrasio, J., Furfari, K. A., Rosenthal, L. D., Nogar, C. L., Wray, K. W., & Aagaard, E. M. (2014). Failure to fail: The institutional perspective. *Medical Teacher*, 36(9), 799–803.
<https://doi.org/10.3109/0142159X.2014.910295>
- Guerrasio, J., Garrity, M. J., & Aagaard, E. M. (2014). Learner Deficits and Academic Outcomes of Medical Students, Residents, Fellows, and Attending Physicians Referred to a Remediation Program, 2006–2012: *Academic Medicine*, 89(2), 352–358.
<https://doi.org/10.1097/ACM.0000000000000122>
- Gunderson, E. A., Hamdan, N., Sorhagen, N. S., & D’Esterre, A. P. (2017). Who needs innate ability to succeed in math and literacy? Academic-domain-specific theories of intelligence about peers versus adults. *Developmental Psychology*, 53(6), 1188–1205.
<https://doi.org/10.1037/dev0000282>
- Holmboe, E. S., Sherbino, J., Long, D. M., Swing, S. R., Frank, J. R., & for the International CBME Collaborators. (2010). The role of assessment in competency-based medical education. *Medical Teacher*, 32(8), 676–682. <https://doi.org/10.3109/0142159X.2010.500704>
- Huffmyer, J. L., & Kirk, S. E. (2017). Professionalism: The “Forgotten” Core Competency. *Anesthesia & Analgesia*, 125(2), 378–379. <https://doi.org/10.1213/ANE.00000000000002269>
- Hughes, J. S. (2015). Support for the domain specificity of implicit beliefs about persons, intelligence, and morality. *Personality and Individual Differences*, 86, 195–203.
<https://doi.org/10.1016/j.paid.2015.05.042>
- Hultman, C. S., & Wagner, I. J. (2015). Professionalism in Plastic Surgery: Attitudes, Knowledge, and Behaviors in Medical Students Compared to Surgeons in Training and Practice—One, But Not The Same. *Annals of Plastic Surgery*, 74, S247–S254.
<https://doi.org/10.1097/SAP.0000000000000450>
- Irby, D. M., & Hamstra, S. J. (2016). Parting the Clouds: Three Professionalism Frameworks in Medical Education. *Academic Medicine*, 91(12), 1606–1611.
<https://doi.org/10.1097/ACM.00000000000001190>
- Janssen, O., & Prins, J. (2007). Goal orientations and the seeking of different types of feedback information. *Journal of Occupational and Organizational Psychology*, 80(2), 235–249.
<https://doi.org/10.1348/096317906X103410>

- Kaplan, A., & Maehr, M. L. (2007). The Contributions and Prospects of Goal Orientation Theory. *Educational Psychology Review*, 19(2), 141–184.
- Kelly, A. M., Gruppen, L. D., & Mullan, P. B. (2017). Teaching and Assessing Professionalism in Radiology Resident Education. *Academic Radiology*, 24(5), 563–573.
<https://doi.org/10.1016/j.acra.2017.02.004>
- Kozlowski, S. W. J., Gully, S. M., Brown, K. G., Salas, E., Smith, E. M., & Nason, E. R. (2001). Effects of Training Goals and Goal Orientation Traits on Multidimensional Training Outcomes and Performance Adaptability. *Organizational Behavior and Human Decision Processes*, 85(1), 1–31.
<https://doi.org/10.1006/obhd.2000.2930>
- Kuper, A., Veinot, P., Leavitt, J., Levitt, S., Li, A., Goguen, J., ... Whitehead, C. R. (2017). Epistemology, culture, justice and power: Non-bioscientific knowledge for medical training. *Medical Education*, 51(2), 158–173. <https://doi.org/10.1111/medu.13115>
- Lacasse, M., Audétat, M.-C., Boileau, É., Fon, N. C., Dufour, M.-H., Laferrière, M.-C., ... Théorêt, J. (2019). Interventions for undergraduate and postgraduate medical learners with academic difficulties: A BEME systematic review: BEME guide no. 56. *Medical Teacher*, 0(0), 1–21.
<https://doi.org/10.1080/0142159X.2019.1596239>
- Leffel, G. M., Oakes Mueller, R. A., Curlin, F. A., & Yoon, J. D. (2015). Relevance of the rationalist–intuitionist debate for ethics and professionalism in medical education. *Advances in Health Sciences Education*, 20(5), 1371–1383. <https://doi.org/10.1007/s10459-014-9563-z>
- Lempp, H., & Seale, C. (2004). The hidden curriculum in undergraduate medical education: Qualitative study of medical students' perceptions of teaching. *BMJ*, 329(7469), 770–773.
<https://doi.org/10.1136/bmj.329.7469.770>
- Leslie, S.-J., Cimpian, A., Meyer, M., & Freeland, E. (2015). Expectations of brilliance underlie gender distributions across academic disciplines. *Science*, 347(6219), 262–265.
<https://doi.org/10.1126/science.1261375>
- Licht, B. G., & Dweck, C. S. (1984). Determinants of academic achievement: The interaction of children's achievement orientations with skill area. *Developmental Psychology*, 20(4), 628–636.
<https://doi.org/10.1037/0012-1649.20.4.628>
- Louridas, M., Szasz, P., de Montbrun, S., Harris, K. A., & Grantcharov, T. P. (2016). Can We Predict Technical Aptitude?: A Systematic Review. *Annals of Surgery*, 263(4), 673–691.
<https://doi.org/10.1097/SLA.0000000000001283>

- Mascret, N., Falconetti, J.-L., & Cury, F. (2016). Implicit measures of beliefs about sport ability in swimming and basketball. *European Journal of Sport Science*, 16(3), 358–364.
<https://doi.org/10.1080/17461391.2015.1080304>
- Massie, J., & Ali, J. M. (2016). Workplace-based assessment: A review of user perceptions and strategies to address the identified shortcomings. *Advances in Health Sciences Education*, 21(2), 455–473.
<https://doi.org/10.1007/s10459-015-9614-0>
- McConnell, M., Sherbino, J., & Chan, T. M. (2016). Mind the Gap: The Prospects of Missing Data. *Journal of Graduate Medical Education*, 8(5), 708–712. <https://doi.org/10.4300/JGME-D-16-00142.1>
- Nesbitt, A., Baird, F., Canning, B., Griffin, A., & Sturrock, A. (2013). Student perception of workplace-based assessment. *The Clinical Teacher*, 10(6), 399–404. <https://doi.org/10.1111/tct.12057>
- Neville, A., Weston, W., Martin, D., Samson, L., Feldman, P., Wallace, G., ... Dojeiji, S. (2015). Communicator. In *CanMEDS 2015 Physician Competency Framework*. Ottawa: Royal College of Physicians and Surgeons of Canada.
- Norcini, J., & Burch, V. (2007). Workplace-based assessment as an educational tool: AMEE Guide No. 31. *Medical Teacher*, 29(9–10), 855–871.
- Papadakis, M. A., Teherani, A., Banach, M. A., Knettler, T. R., Rattner, S. L., Stern, D. T., ... Hodgson, C. S. (2005). Disciplinary Action by Medical Boards and Prior Behavior in Medical School. *New England Journal of Medicine*, 353(25), 2673–2682. <https://doi.org/10.1056/NEJMs052596>
- Payne, S. C., Youngcourt, S. S., & Beaubien, J. M. (2007). A meta-analytic examination of the goal orientation nomological net. *Journal of Applied Psychology*, 92(1), 128–150.
<https://doi.org/10.1037/0021-9010.92.1.128>
- Ramani, S., Könings, K. D., Ginsburg, S., & Vleuten, C. P. M. van der. (2018). Twelve tips to promote a feedback culture with a growth mind-set: Swinging the feedback pendulum from recipes to relationships. *Medical Teacher*, 0(0), 1–7. <https://doi.org/10.1080/0142159X.2018.1432850>
- Resnick, A. S., Mullen, J. L., Kaiser, L. R., & Morris, J. B. (2006). Patterns and Predictions of Resident Misbehavior—A 10-Year Retrospective Look. *Current Surgery*, 63(6), 418–425.
<https://doi.org/10.1016/j.cursur.2006.05.004>
- Ricotta, D. N., Huang, G. C., Hale, A. J., Freed, J. A., & Smith, C. C. (2019). Mindset theory in medical education. *The Clinical Teacher*, 16(2), 159–161. <https://doi.org/10.1111/tct.12765>
- Roberts, C., Wilkinson, T. J., Norcini, J., Patterson, F., & Hodges, B. D. (2019). The intersection of assessment, selection and professionalism in the service of patient care. *Medical Teacher*, 1–6.
<https://doi.org/10.1080/0142159X.2018.1554898>

- Rumack, C. M., Guerrasio, J., Christensen, A., & Aagaard, E. M. (2017). Academic Remediation. *Academic Radiology*, 24(6), 730–733. <https://doi.org/10.1016/j.acra.2016.12.022>
- S. Dweck, C. (1986). Motivational Processes Affecting Learning. *American Psychologist*, 41, 1040–1048. <https://doi.org/10.1037/0003-066X.41.10.1040>
- Sadideen, H., Alvand, A., Saadeddin, M., & Kneebone, R. (2013). Surgical experts: Born or made? *International Journal of Surgery*, 11(9), 773–778. <https://doi.org/10.1016/j.ijsu.2013.07.001>
- Sherbino, J., Kulasegaram, K., Worster, A., & Norman, G. R. (2013). The reliability of encounter cards to assess the CanMEDS roles. *Advances in Health Sciences Education: Theory and Practice*, 18(5), 987–996. <https://doi.org/10.1007/s10459-012-9440-6>
- Silverberg, M., Weizberg, M., Murano, T., Smith, J. L., Burkhardt, J. C., & Santen, S. A. (2015). What is the Prevalence and Success of Remediation of Emergency Medicine Residents? *Western Journal of Emergency Medicine*, 16(6), 839–844. <https://doi.org/10.5811/westjem.2015.9.27357>
- Silverberg, S. L., & Purdy, K. M. H. (2018). Unmatched Canadian medical graduates. *CMAJ*, 190(4), E118–E118. <https://doi.org/10.1503/cmaj.68737>
- Simzar, R. M., Martinez, M., Rutherford, T., Domina, T., & Conley, A. M. (2015). Raising the stakes: How students' motivation for mathematics associates with high- and low-stakes test achievement. *Learning and Individual Differences*, 39, 49–63. <https://doi.org/10.1016/j.lindif.2015.03.002>
- Siska, V. B., Ann, L., Gunter, D. W., Bart, N., Willy, L., Marlies, S., & Marc, M. (2015). Surgical Skill: Trick or Trait? *Journal of Surgical Education*, 72(6), 1247–1253. <https://doi.org/10.1016/j.jsurg.2015.05.004>
- Snell, L., Flynn, L., Pauls, M., Kearney, R., Warren, A., Sternszus, R., ... Wright, J. (2015). Professional. In *CanMEDS 2015 Physician Competency Framework*. Ottawa: Royal College of Physicians and Surgeons of Canada.
- Sullivan, C., Murano, T., Comes, J., Smith, J. L., & Katz, E. D. (2011a). Emergency Medicine Directors' Perceptions on Professionalism: A Council of Emergency Medicine Residency Directors Survey. *Academic Emergency Medicine*, 18(s2), S97–S103. <https://doi.org/10.1111/j.1553-2712.2011.01186.x>
- Sullivan, C., Murano, T., Comes, J., Smith, J. L., & Katz, E. D. (2011b). Emergency Medicine Directors' Perceptions on Professionalism: A Council of Emergency Medicine Residency Directors Survey. *Academic Emergency Medicine*, 18(s2), S97–S103. <https://doi.org/10.1111/j.1553-2712.2011.01186.x>

- Tempelaar, D. T., Rienties, B., Giesbers, B., & Gijsselaers, W. H. (2015). The Pivotal Role of Effort Beliefs in Mediating Implicit Theories of Intelligence and Achievement Goals and Academic Motivations. *Social Psychology of Education, 18*(1), 101–120. <https://doi.org/10.1007/s11218-014-9281-7>
- ten Cate, O., Gruppen, L. D., Kogan, J. R., Lingard, L. A., & Teunissen, P. W. (2018). Time-Variable Training in Medicine: Theoretical Considerations. *Academic Medicine, 93*(3S), S6. <https://doi.org/10.1097/ACM.0000000000002065>
- Teunissen, P. W., Stapel, D. A., van der Vleuten, C., Scherpbier, A., Boor, K., & Scheele, F. (2009). Who Wants Feedback? An Investigation of the Variables Influencing Residents' Feedback-Seeking Behavior in Relation to Night Shifts. *Academic Medicine, 84*(7), 910. <https://doi.org/10.1097/ACM.0b013e3181a858ad>
- Teunissen Pim W, & Bok Harold G J. (2013). Believing is seeing: How people's beliefs influence goals, emotions and behaviour. *Medical Education, 47*(11), 1064–1072. <https://doi.org/10.1111/medu.12228>
- Turner, J. A., Fitzsimons, M. G., Pardo, M. C. J., Hawkins, J. L., Huang, Y. M., Rudolph, M. D. D., ... Steadman, R. H. (2016). Effect of Performance Deficiencies on Graduation and Board Certification Rates: A 10-yr Multicenter Study of Anesthesiology Residents. *Anesthesiology, 125*(1), 221–229. <https://doi.org/10.1097/ALN.0000000000001142>
- Vandewalle, D. (1997). Development and Validation of a Work Domain Goal Orientation Instrument: *Educational and Psychological Measurement, 57*(6), 995–1015. <https://doi.org/10.1177/0013164497057006009>
- Viney, R., Rich, A., Needleman, S., Griffin, A., & Woolf, K. (2017). The validity of the Annual Review of Competence Progression: A qualitative interview study of the perceptions of junior doctors and their trainers. *Journal of the Royal Society of Medicine, 110*(3), 110–117. <https://doi.org/10.1177/0141076817690713>
- Vogel, L. (2011). Specialty training out-of-sync with job market. *CMAJ, 183*(13), E1016–E1016. <https://doi.org/10.1503/cmaj.109-3985>
- Wang, Y., Wang, W., Wang, L., Wang, J., & Tang, J. (2011). Ultrasound-guided high-intensity focused ultrasound treatment for abdominal wall endometriosis: Preliminary results. *European Journal of Radiology, 79*(1), 56–59. <https://doi.org/10.1016/j.ejrad.2009.12.034>
- Watson, A. M., Foster Thompson, L., Rudolph, J. V., Whelan, T. J., Behrend, T. S., & Gissel, A. L. (2013). When big brother is watching: Goal orientation shapes reactions to electronic monitoring during

MSc. Thesis – E. Tannenbaum; McMaster University – Health Science Education

online training. *Journal of Applied Psychology*, 98(4), 642–657.

<https://doi.org/10.1037/a0032002>

Zbieranowski, I., Takahashi, S. G., Verma, S., & Spadafora, S. M. (2013). Remediation of Residents in Difficulty: A Retrospective 10-Year Review of the Experience of a Postgraduate Board of Examiners. *Academic Medicine*, 88(1), 111–116.

<https://doi.org/10.1097/ACM.0b013e3182764cb6>

7.0 Appendices:

7.1 Appendix 1: Study 1 Materials (including modified ITIS-S)

Demographics

Age: [free-text]

Gender: [male/female/other]

Specialty: [free-text]

Section 1: Professional Role

Regarding your perception of the CanMEDS Professional Role, indicate your level of agreement with the following statements: [1 = strongly disagree – 6 = strongly agree]

1. You have a certain amount of professionalism, and you can't really do much to change it
2. Your professionalism is something about you that you can't change very much
3. No matter how much professionalism you have, you can always change it quite a bit
4. You can change even your basic professionalism level considerably

Section 2: Medical Expert Role

Regarding your perception of the CanMEDS Medical Expert Role, indicate your level of agreement with the following statements: [1 = strongly disagree – 6 = strongly agree]

1. You have a certain amount of intelligence/ability, and you can't really do much to change it
2. Your intelligence/ability is something about you that you can't change very much

3. No matter how much intelligence/ability you have, you can always change it quite a bit
4. You can change even your basic intelligence/ability level considerably

Section 3: Remediation

Remediation is the process whereby residents undergo additional training for deficits that are noted in their performance. Common reasons for resident remediation include: critical incidents that highlight significant deficits in one or more CanMEDS Role or failing a clinical rotation due to deficits noted in one or more CanMEDS Roles.

In your opinion, how much effort is required to remediate the following: [10-point scale, minimal effort to significant effort]

- A. A resident's deficits in the Professional Role
- B. A resident's deficits in the Medical Expert Role

7.2 Study 2 Materials

Demographics

Age: [free-text]

Gender: [male/female/other]

Respondent type: [resident/faculty]

Remediation Case Vignettes

Map of Educational needs by case (*was not included in the survey*):

Educational needs mapping by case		
Case	Professionalism educational needs	Medical Expert educational needs
1	- Reliability, accountability - Truth telling - Integrity (lying, cheating)	
2	- Integrity (lying, cheating) - Record keeping	
3	- Accepting feedback - Punctuality - Attendance - Reliability, accountability	
4		- Acquisition of medical knowledge (clinical) - Procedural competency

5		- Acquisition of medical knowledge (clinical and basic science) - Development and implementation of management and treatment plans
6		- Acquisition of medical knowledge (clinical) - Application of medical knowledge to patient care situations - Case synthesis - Development and implementation of management and treatment plans

Instructions to Participants:

Remediation is the process whereby residents undergo additional training for significant deficits that are noted in their performance. Common reasons for resident remediation include: critical incidents that highlight significant deficits in one or more CanMEDS Role or failing a clinical rotation due to deficits noted in one or more CanMEDS Roles.

Residents undergo formal remediation by being placed on clinical rotations relevant to their deficits (where applicable) with learning supports and increased supervision. Formal remediation includes coaching from the postgraduate medical education office, a dedicated non-evaluative mentor, and increased clinical assessment requirements to ensure clinical performance is frequently observed and assessed, as well as to document any continuing performance issues.

Cases:

Case 1 – Professionalism

“Resident A.Y. is a PGY-3 internal medicine resident-in-difficulty. They performed well in PGY-1, with all ITER scores in the 3-4 range and positive comments from their supervisors. However, with the added responsibility of acting as senior resident in late PGY-2 and PGY-3 they began struggling and exhibited several disruptive behaviours. For instance, they failed to answer numerous pages, requiring the supervising staff physician to leave clinic in order to attend to the issues. On another occasion, they failed to follow-up on a critical diagnostic test result, leading to a ‘near-miss’. The resident claimed they were never informed of the result and the issue was brought up with the patient’s nurse who reported that she communicated the critical result to the resident. The nurse’s recount was corroborated by the clinical record. The resident received an ITER score of 1 for Professional on this rotation and after this incident, the resident was brought to the attention of the site’s Resident Coordinator and the Residency Program Director. The decision was made for the resident to undergo formal remediation to address the deficits in the CanMEDS Professional Role (reliability, truth telling, integrity).

No underlying neuro-psychiatric or wellness issues are present.”

Case 2 – Professionalism

“Resident B.T. is a PGY-1 family medicine resident-in-difficulty. They were brought to the attention of the site’s Residency Coordinator and Program Director after they were found to have fabricated data for their required quality improvement/patient safety research project. This was discovered by the research supervisor after he noted that the data collection phase of the study appeared to be quite short in duration. Upon questioning the resident, the supervisor learned that the resident had duplicated responses to their survey in order to increase the sample size. They did not appear to recognize the gravity of their research misconduct and thought that duplication of surveys “would help make the stats easier”. They explained that most of the survey responses were “similar anyway”, so they didn’t think duplication was inappropriate. The resident received an ITER score of 1 for Professional and the decision was made for the resident to undergo formal remediation for their deficits in the CanMEDS Professional Role (integrity, record keeping).

No underlying neuro-psychiatric or wellness issues are present.”

Case 3 – Professionalism

“Resident J.R. is a PGY-3 radiology resident-in-difficulty. They previously struggled keeping up with the fast-pace of certain off-service rotations in PGY-1, such as OB/GYN, where they were noted to take longer than expected in conducting in-patient consultations but overall, they received average assessment scores and positive feedback from supervisors. In PGY-2, they were noted to have a strong knowledge base and received ITER scores of 3-5 in their rotations. Comments were made regarding some issues surrounding tardiness and responsibility. For example, the resident was often late for academic half-day and was reluctant to stay late to participate in interesting cases. In PGY-3 these deficits became more pronounced. They showed up late to several shifts on their neuroradiology rotation and in one instance failed to show up for work at all. They only notified their faculty supervisor one-hour prior to the start of the shift. The Residency Coordinator explored any wellness issues that may have been present, noted these deficits at the mid-rotation ITER interview, and reviewed the expectations surrounding communicating with supervisors about requesting time off. Unfortunately, the resident continued to have problems with absences. They missed three academic half-days in a row and failed to show up for an overnight call shift without any prior communication with the faculty supervisor. The resident received an ITER score of 2 for Professional and these lapses were brought to the attention of the Residency Program Director. The decision was made for the resident to undergo formal remediation for their deficits in the CanMEDS Professional Role (accepting feedback, punctuality, attendance, reliability, accountability).

No underlying neuro-psychiatric or wellness issues are present.”

Case 4 – Procedural Skill/Knowledge

“Resident P.R. is a PGY-4 general surgery resident-in-difficulty. They performed quite well in their first two years of training, however, in the middle of the PGY-3 year they had difficulty with complex laparoscopic surgical procedures. It was felt that the resident would benefit from additional practice in laparoscopy, so their schedule was adjusted to allow for more surgical exposure at a community site with a mix of minor and major laparoscopic procedures. The resident did not improve as expected. Feedback from their two most recent surgical blocks highlighted problems using both hands in laparoscopy and difficulty in locating their instruments in the abdomen. In addition, the resident’s supervisors noted that they lacked confidence in the operating room and often seemed like they did not know the steps of common surgical procedures. They also had poor problem-solving abilities when

complexities arose, often requiring the supervising surgeon to take over. They subsequently failed their formative OSCE, with deficits noted in the diagnosis and management of complex surgical presentations. Comments indicated that the resident's knowledge base was below expectations for a PGY-4. The resident received an ITER score of 2 in the Medical Expert Role and the decision was made for the resident to undergo formal remediation for their deficits in the CanMEDS Medical Expert Role (acquisition of medical knowledge, surgical proficiency).

No underlying neuro-psychiatric or wellness issues are present."

Case 5 – Knowledge

"Resident T.C. is a PGY-2 psychiatry resident-in-difficulty. They performed well in PGY-1 with ITER scores ranging from 3-5 and no significant deficits were noted. They were commended for their collegiality and patient-centred interviewing skills. At the beginning of PGY-2 the resident failed their simulated OSCE with significant deficits in medical knowledge noted. In addition, they received an ITER score of 2 in Medical Expert on their last clinical rotation in adult in-patient psychiatry. The narrative feedback comments on the ITER highlighted significant knowledge deficits with respect to pharmacology. The supervisor noted several instances where the resident was unable to formulate appropriate management plans, which was considered to be a skill that the resident should have developed in PGY-1. The comments also noted knowledge deficits in the form of incomplete histories, lacking pertinent details related to medical comorbidities and a salient psychiatric history. Although motivated, the resident was felt to be performing significantly lower than expected in PGY-2 and the decision was made for the resident to undergo formal remediation for their deficits in the CanMEDS Medical Expert Role (acquisition of medical knowledge, development and implementation of management and treatment plans).

No underlying neuro-psychiatric or wellness issues are present."

Case 6 – Knowledge

"Resident M.L. is a PGY-2 otolaryngology head and neck surgery (OHNS) resident-in-difficulty. They performed well in PGY-1 and were noted to be a responsible, driven resident, though some comments on their ITERs noted a lack of knowledge surrounding diagnosis and management of common ear

conditions. In PGY-2 these knowledge deficits became more pronounced. For example, on their formative OSCE at the start of PGY-2, they were the only resident in the cohort to fail the tinnitus station, which was felt to be a relatively simple station. The resident received borderline passing scores on the other stations. Narrative feedback comments noted that the resident struggled to take a relevant history and outline a coherent management plan. They had difficulty in the Ear Clinic, where it was noted that they were slower than their peers in obtaining a history and conducting relevant physical examinations. The faculty supervisor reported that the resident's histories were often incomplete and case presentations were missing essential aspects from the history and physical, leading to missed diagnoses. Senior residents and faculty supervisors repeatedly had to redo clinical assessments to ensure that patients received adequate care. The resident received an ITER score of 2 in Medical Expert. The resident was subsequently brought to the attention of the program director. These deficits were corroborated by the resident's other faculty supervisors and were felt to be significant enough to represent a critical lack of knowledge, warranting formal remediation of their deficits in the Medical Expert Role (acquisition of medical knowledge, application of medical knowledge to patient care situations, case synthesis development, and implementation of management and treatment plans.)

No underlying neuro-psychiatric or wellness issues are present."

Case questions (to follow each case):

You are being asked to give your opinion regarding this resident's remediation plan. Please answer the following questions regarding this resident's remediation:

1. In your opinion, what duration of remediation, in months (blocks) is required to address these deficits?
[3 months / 6 months / 9 months / 12 months]
2. In your opinion, what should the consequence be if the resident is unsuccessful at remediating their deficits by the end of the remediation period?
[further remediation / remediation with probation (i.e., dismissal if unsuccessful) / dismissal from residency program]
3. In your opinion, how likely is this resident to succeed in the remediation of their deficits [6-point scale from very unlikely – very likely]

4. How likely is it that the resident will present for remediation of the same deficit again in the future?
[6-point scale from very unlikely – very likely]
5. Please provide the rationale for the answers you provided:
[free-text comment]

ITIS-S: Professional Role

Regarding your perception of the CanMEDS Professional Role, indicate your level of agreement with the following statements: [1 = strongly disagree – 6 = strongly agree]

5. You have a certain amount of professionalism, and you can't really do much to change it
6. Your professionalism is something about you that you can't change very much
7. No matter how much professionalism you have, you can always change it quite a bit
8. You can change even your basic professionalism level considerably

ITIS-S: Medical Expert Role

Regarding your perception of the CanMEDS Medical Expert Role, indicate your level of agreement with the following statements: [1 = strongly disagree – 6 = strongly agree]

5. You have a certain amount of intelligence/ability, and you can't really do much to change it
6. Your intelligence/ability is something about you that you can't change very much
7. No matter how much intelligence/ability you have, you can always change it quite a bit
8. You can change even your basic intelligence/ability level considerably