FEEDBACK LITERACY

EXPLORING FEEDBACK LITERACY IN THE UNDERGRADUATE MEDICAL EDUCATION CONTEXT

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LAY ABSTRACT

Feedback from educators to students is considered an important element of effective learning. Despite the importance of feedback in medical education, this phenomenon has not been completely understood. To bring more answers to this complex phenomenon, this thesis explores the concept of feedback literacy. Different research approaches were used to provide a more complete understanding of feedback literacy in the undergraduate medical education context, and identify factors and learning strategies that can improve students' feedback literacy. Results support students' empowerment in the feedback process and help them to overcome the challenges they still face during this process to improve their learning experience in medical school.

ABSTRACT

Feedback has long been used and studied in medical education. To acknowledge the complexity of the feedback process, the term *feedback literacy* has been introduced into the medical education literature. This thesis attempted to explore feedback literacy in the undergraduate medical education context by aggregating a comprehensive body of evidence and using different research methodologies. It focused on providing a more complete understanding of feedback literacy, identifying factors and learning strategies that could improve medical students' feedback literacy skills, and direct further research on this topic. Results showed that little is known on how to teach feedback literacy and educational interventions to increase students' feedback literacy skills are still not well established. When exploring factors that could improve students' feedback literacy skills, this thesis' results identified that being more intrinsically goal oriented, having strong self-regulated learning traits, and seeking help when needed were positively associated to having better feedback literacy skills. Strategies that students could use to improve their own feedback literacy included self-reflection about the feedback received and how to be more proactive in the feedback process, take small steps when applying the feedback received, and actively discuss the feedback with the giver. Additionally, self-reflections on ones' motivational beliefs and interests, combined with actions such as creating and implementing strategies to manage motivations, could help students to adjust their learning goal orientation and, consequently, improve their feedback literacy skills. Students should encourage themselves to regulate their learning in the areas of planning, monitoring, and making adjustments in learning strategies to adapt to new situations whenever needed. Lastly, students should seek assistance from others by bringing

concerns up, asking questions, and asking clarifications about the feedback received. Taken together, the findings of this thesis support students' empowerment in the feedback process to help them to make the most of their feedback opportunities in medical school.

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LIST OF ABBREVIATIONS

AAPOR: American Association for Public Opinion Research

ANOVA: Analysis of variance

CROSS: Consensus-Based Checklist for Reporting of Survey Studies

ID: Identify Document

JBI: Joanna Briggs Institute

MSLQ: Motivated Strategies for Learning Questionnaire

NRB: Nonresponse Bias

PBL: Problem-Based Learning

PRC: Protocol Review Committee

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

REB: Research Ethics Board

RR: Response Rate

SD: Standard Deviation

SRL: Self-regulated Learning

UGME: Undergraduate Medical Education

DECLARATION OF ACADEMIC ACHIEVEMENT

I, Ligia Cordovani, declare this thesis to be my own work. I was responsible for identifying the topic of this thesis and the research questions, developing all the protocols and study designs, collecting and analysing all the data, interpreting the results, and writing the manuscripts. The members of my supervisory committee (Dr. Sandra Monteiro, Dr. Susan M Jack, and Dr. Anne Wong) have provided feedback on this work, guidance, and support at all stages of this project. To the best of my knowledge, the content of this document does not infringe on anyone's copyright. This thesis is considered a 'sandwich' thesis. The first study described on Chapter Two was accepted for publication in a peer-reviewed journal. The second study described on Chapter Three is currently under-review for publication. The third study described on Chapter Four is currently being edited to be submitted to publication.

CHAPTER ONE
INTRODUCTION

Background

Feedback has had a long history of use and study in medical education.[1–3] It can be broadly defined as a complex exchange of information between an educator and a student that allows the student to understand how they are performing, and to develop a plan for improvement.[1,3,4] Earlier studies have focused on the processes of giving feedback, particularly on guiding educators on how to provide the feedback (e.g., what the feedback content should be, the best time to give the feedback, and ways to deliver the message).[1,5,6] However, this emphasis on the delivery of feedback ignores the influence of other factors involved in the feedback process, such as the learning context and the students' perceptions. Therefore, work within this field now acknowledges that the feedback process depends on the educator, the student, and the information exchanged between them, and that this whole process is shaped by the learning environment culture where feedback occurs.[7–9] Research on the role that the learning environment plays has highlighted the negative influence of power asymmetry between students and educators in the medical learning environment, and the influence of the learning culture that dictates the expectations and rules for the feedback interactions.[10,11] Research examining students' perceptions have focused on how medical students perceive the feedback received, how they react to it, and how they decode and appraise the information.[12–15] Critical factors include students' emotional reactions, educators' credibility, students' self-assessment, and previous feedback experiences. [16–18]

To acknowledge the complexity of the feedback process, the term "feedback literacy" has been introduced into the medical education literature.[19,20] Feedback literacy is the process in which a student receives, comprehends, accepts, and makes use of the feedback.[4,20,21] Feedback literacy goes beyond receptiveness to feedback because it involves taking actions. Some studies outlined how to teach feedback literacy to students,[4,22] whereas others identified feedback literacy activities that could be part of the curriculum in the early years of a medical educational program.[23,24] The overall intention of the feedback literacy concept is to help students to make the most of feedback opportunities, without diminishing the importance of educators and institutions to provide them with support and encouraging students to be more active in the feedback process. By improving students' feedback literacy skills, educators and students would share responsibilities in the feedback process, and students could feel more in charge of their own learning to overcome challenges such as the variation in the feedback givers' training[25,26] and in the institutions' feedback culture;[27,28] therefore, enhancing the positive impact of feedback in learning.

The problem

Taken together, the literature mentioned above indicates that, in despite of the importance of feedback in the medical education context, this phenomenon has not been completely understood. One of the reasons for that is the existence of a complex number of factors that influence how students receive, interpret, and make use of feedback. These factors have only partially been explored, and previous studies suggested that they might be related to some students' characteristics, abilities for students' self-assessment,

students' emotional reactions to feedback, and students' learning maturity.[16,18,19,29] Exploring those factors could bring more answers to the complex phenomenon of feedback in medical education. It could improve students' feedback literacy skills, give students more power in the feedback process, and help them to overcome the barriers they still face during the feedback process; consequently, it could enhance students' learning experience in medical schools.

Objectives

The overall objective of this thesis was to explore feedback literacy in the undergraduate medical education context by aggregating a comprehensive body of evidence and using different research methodologies. More specifically, I aimed to: (1) provide a more complete understanding of feedback literacy in the undergraduate medical education context, (2) identify factors that could improve students' feedback literacy skills, (3) identify strategies to enhance students' feedback literacy skills, (4) and direct further research on this topic.

Thesis organization

This thesis is divided into five chapters. Chapter One is a general introduction to the topic, and it includes a brief background, the overall purpose and significance of this thesis, an explanation about the context of the medical school program in this study, the author's reflexive piece, and the philosophical foundations that underpin the studies described in Chapter Three and Four. Chapter Two is a scoping review of undergraduate

students' receptiveness to feedback and feedback literacy in medical schools.[19] This scoping review mapped the current literature in medical students' receptiveness to feedback and feedback literacy, provided an overview of factors related to it, identified the kind of research conducted in this field, and identified gaps in the existing literature to guide future research. The literature gaps identified in the scoping review served as a guide to define the phenomena of study and to design the studies described in Chapters Three and Four. I identified an area needing further investigation as the influence of self-regulation theories and students' learning maturity on feedback literacy. Based on that, I decided to look at students' learning motivations and strategies in different academic years in medical school, and then, whether these would influence feedback literacy. Chapter Three is a cross-sectional survey that aimed at describing and analyzing differences in undergraduate medical students' motivational orientations and learning strategies in their first and last year of medical school, using the Motivated Strategies for Learning Questionnaire (MSLQ). The idea of this study was to construct a portrait of medical students' motivational orientations and learning strategies, analyze whether students' learning maturity changes as they advance year by year through their medical education, and later, explore if some elements of students' motivational orientations and learning strategies could influence feedback literacy. No statistically significant differences were found between students in their first and last year of medical school, but the MSLQ showed to be a reliable instrument to measure motivational orientations and learning strategies in the study's sample, and the results represented the beliefs of a cohort of medical students in the study's institution. Therefore, the results of the survey were further explored as part of an explanatory mixed methods sequential study (Chapter

Four). The preliminary quantitative survey results were used to identify and purposefully select the best participants for the qualitative (interviews) phase of this mixed methods study, and to serve as a guide to more deeply explore the medical students' perspectives during the qualitative phase. The overall purpose of this mixed methods study was to measure students' motivational orientations for learning and learning strategies in medical school, and then, explain its influences in students' feedback literacy at a Canadian university. At the end, I have identified some factors related to motivational orientations for learning and learning strategies that might influence feedback literacy, and, based on that, I suggested strategies that students could use to enhance their own feedback literacy skills. Lastly, Chapter Five provides a general conclusion of this thesis, a summary of important findings and applications, overall limitations, and recommendations for future research.

Context

The work summarized in this thesis focuses on the population of undergraduate medical students enrolled in medical schools. I used the terms undergraduate students in medical school, undergraduate medical students, and medical students interchangeably to refer to students enrolled in a medical school program to pursue a medical degree. Undergraduate medical education is a unique context because it represents one of the medical trainee's first experiences in the medical field. The underlying values that shape how feedback is positioned within medicine's learning culture might be unique and different compared to the later postgraduate years of medical education. The studies described in Chapters Three and Four of this thesis were conducted with a sample of

students attending one medical school in Canada. In Canada, after completion of a bachelor's degree (or in some circumstances, a minimum of three years of undergraduate university degree-level work), students are eligible to apply for admission into an undergraduate program in medical education, working towards the degree of medicine. The program takes three to four years in length, and it is followed by postgraduate medical education, also referred to as residency. In the Canadian university where this study took place, the three-year undergraduate medical education program uses the Problem-Based Learning (PBL) approach to teaching. PBL is an instructional method characterized by the use of patient problems as a base for students to learn problem-solving skills to understand the basics of clinical sciences.[30] The idea is that students are actively involved in their learning, find information to solve the problems, and acquire the medical knowledge needed to complete their unit of study. With a learning context where the pedagogical approach of PBL is applied, the primary faculty role is to facilitate this process, support, and guide students. During the 15-month pre-clinical curriculum, students learn in small group tutorials (6-8 students) that are facilitated by a faculty member acting as the tutor for the group. Tutorials take place twice each week, for about 3 hours each time. Between tutorials, large group teaching sessions with expert faculty employ active learning pedagogy to consolidate and review concepts introduced in tutorials. A 63-week clinical curriculum, also known as clerkship, follows the pre-clinical phase. It consists of clinical rotations in medicine, general surgery, orthopedic surgery, family medicine, anesthesia, psychiatry, pediatrics, obstetrics and gynecology, and emergency medicine. The influence of this unique context on the results of this thesis will be discussed in the following chapters.

Reflexivity

As I previously explained, there is a qualitative study in Chapter Four included as a component of the broader mixed methods study. In qualitative research, ongoing engagement in a reflexive process is essential for the development and completion of a study where the findings can be assessed to be trustworthy.[31] Some authors argue that reflexivity should also be incorporated in quantitative research approaches because it encourages a more thoughtful engagement with the research and endorses a more transparent research process.[32] Reflexivity can be broadly defined as an ongoing process of self-awareness of our subjectivity towards the entire research process.[33,34] In general, reflexivity provides an opportunity for a researcher to identify, reflect on, and critically examine how their position, experiences, beliefs, and perceptions of the phenomenon under study influence both the research process and research findings. Researchers should reflect on their personal values, assumptions and expectations about the topic of their research, their relationship with participants, their design and methodological choices, their disciplinary location and standpoint.[35] The qualitative researcher does not intend to remove their subjectivity, but to think about their subjectivity to consider how that affects their approach to research and their interpretation of findings. Critical and reflexive practice can add value to the qualitative study because it improves the trustworthiness of the research study.[34]

As an anesthesiologist and lived experience as a medical student, reflexivity about my previous feedback experiences in medical school was important throughout the development of this thesis. I completed my undergraduate medical training in Brazil in

December 2003. In Brazil, in contrast to medical education in Canada, students are eligible to apply for admission into a medical undergraduate program after completing their secondary school (high school) program. The undergraduate medical program is six years in length (four years of a pre-clinical program, and two years of clinical rotations). After completing the six-year program, students earn their Doctor of Medicine degree. The undergraduate medical program that I went, have a traditional (not PBL) teaching approach, with large-group teaching sessions during the pre-clinical program, and small groups of students doing their clinical rotations together. I remember the huge variation in the feedback givers' training, the informality of the process in my medical school, the lack of standardization, and my initial negative reactions to critical feedback. I can't remember discussions about feedback receptiveness, feedback literacy, or feedback culture. In my mind, feedback was a one-way process that was always initiated by the tutor or teacher, the person "giving" the feedback. In reflection, the lack of discussion or exchange between the two actors as I experienced was one of the reasons prompting my interest in the topic of feedback literacy. As a medical student, I felt I had no control over the feedback process. When I read about feedback literacy and the possibility of encouraging students to be more active in the feedback process, I wished I were offered this opportunity. Additionally, as an educator, who teaches medical students, I realized the power of feedback (as in what the feedback giver says to the students), and how much it could affect students in positive and negative ways. I also recognize the power asymmetry between students and teachers, and the fears (of getting poor evaluations) that students might have when they actively engage in the feedback process. Lastly, as an anesthesiologist, who used to teach medical students in the operating room, I recognize

the challenging of giving feedback to students in a clinical environment. I believe that most medical doctors working in an academic setting is willing to give feedback to students. However, the need of providing feedback while taking care of the patient, often in unpredictable situations and a constricted period of time, may affect the quality of the feedback given. All these experiences and reflections further triggered my interest in listening to their experiences and comments, and in researching the topic in a way that could help them. Moreover, when I was interviewing medical students (during the qualitative part of this thesis) about their learning motivations and strategies, I reflected on my own learning motivations and strategies, during my medical school and now, as a lifelong learner. I reflected on how they changed as I transitioned to more senior years, especially from an extrinsic to a more intrinsic motivation to learn. Although I appreciated my experiences in medical school, I tried to be aware of my own experiences to allow me to pay more attention to the students' perspectives.

During the whole process of this thesis, and especially during the qualitative part of it, I was aware of my subjectivity because of my close relationship to the topic, and due to the fact that participants and I shared the feedback experience while medical students. Reflexivity particularly helped me to mitigate my own influences in the questions to participants during the interviews, to manage excessive involvement, and to try to avoid transferring my experiences onto what students are expressing.

Philosophical Foundations

In mixed methods studies, researchers must consider the philosophical assumptions that provided the foundations for their work because these assumptions

shape the way the research is conducted. The purpose of this section is to identify and articulate the assumptions that underpin the mixed methods study described in the Chapter Four of this thesis.

The philosophical assumptions compose the worldview that researchers would bring to their studies, and that would influence all the steps of the research process.[36] The philosophical assumptions that provided a study's foundation could be disclosed in all research approaches, but it is an imperative methodological component in qualitative and mixed methods designs.[36] The following elements of the worldviews help us to make distinctions between them: ontology, epistemology, axiology, methodology, and rhetoric. Ontology is the nature of the reality, or what is considered real in the world; epistemology is the relationship between the researcher and the research, or how researchers gain the knowledge needed for the study; axiology is the role that the researchers' values play in the research process; methodology is the research design, all the steps in the research process; and rhetoric is the way the research is written, or the language style.[36]

Some worldviews are more typically associated with certain research approaches. For example, post positivism is based on beliefs that there is a single reality that can be measured and collected objectively, and it is commonly used in quantitative studies.[36,37] The common assumptions of constructivism include the existence of multiple realities that researchers try to construct along with the participants, and it is usually used to build on qualitative studies.[38] In the mixed methods approach, authors in the field have been debating whether multiple worldviews or one single worldview should be used.[36,39–41] The main argument against multiple worldviews is that they can be contradictory because

worldviews are underpinned under different ontological and epistemological assumptions.[39] Authors in favour of a single worldview approach have suggested that the pragmatist and the transformative worldviews would be the best fit for mixed methods.[36,41,42] In the pragmatist worldview, reality is seen as singular or multiple, the epistemology position is practicality, researchers articulate bias and unbiased perspectives, the methodology is design to answer the overarching question (it could be deductive and/or inductive, quantitative and/or qualitative), and the rhetoric could be informal and/or formal. Overall, the pragmatist worldview suggests using approaches and types of knowledge that would work to study the topic of interest, highlights the importance of the research design and the choices the researcher makes as a link between the knowledge obtained and the actions taken to find that knowledge, and indicates a more practical way of seeing the research process.[36,40] The main problem is that it is often difficult to know what works before the study is finished; therefore, researchers could not justify the choice of the mixed methods design in advance.[39] The transformative worldview focuses on social injustices, the empowerment of communities to overcome discrimination and inequality, and on designing research that could make individual and societal changes.[42] Its ontology is based on different social and cultural positions, collaboration between researchers and participants is the base of transformative epistemology, the role of values is to advocate for social injustices and human rights, participants are involved in all steps of the research design, and the rhetoric is activist-oriented.[36] In this case, the main issue is that this worldview is limited to studies focusing on social and advocacy research.[39]

While some authors believe that one single worldview should be used in mixed methods, others suggest that multiple worldviews may be used because, even if some worldview's elements might seem contradictories, different assumptions could lead to new and different insights, enhancing the research contribution.[36,39,40] Multiple worldviews could be complementary,[43] combined,[44] or chosen depending on the study context and type of mixed methods design.[36] The mixed methods study described in the Chapter Four of this thesis was built using an explanatory mixed methods sequential design informed by Creswell and Clark.[36] Therefore, the multiple worldviews stance embraced by them was used to underpin that study. These authors believe that multiple worldviews should be used in mixed methods, and that they should be chosen depending on the type of mixed methods design. In explanatory mixed methods sequential design, they encourage researchers to use a postpositvist worldview for the quantitative first phase, and a constructivist worldview for the qualitative second phase. In the final interpretation, when results are integrated, Creswell and Clark [36] leave the worldview choice decision to the discretion of the researcher, who could use one single worldview or both. In my mixed methods study, the postpositivist worldview was used in the first quantitative phase, and the constructivist worldview was used in the second qualitative phase. A constructivist worldview was used in the final results interpretation because priority was placed on the second qualitative phase to focus on a qualitative examination of the phenomenon.

The postpositivist worldview sees nature as a single reality.[36,37] Its epistemology assumes that researchers should be impartial because the knowledge gained can be objective and quantifiable. However, this knowledge is not conclusive, and it can be

changed in light of future investigations.[37] Still, postpositivists pursue a true belief, but assume that this true belief could change in a different point in time. The axiology position is unbiased, although postpositivists believe that researchers have their own values, but these values should not influence their research. Moreover, the postpositivist methodology is deductive, and its rhetoric is formal. The postpositivist worldview provided the foundation for the first quantitative phase of my mixed methods study. The MSLQ was used to objectively measure medical students' motivational orientations and learning strategies based on predetermined scores, illustrating the epistemology postpositivist position that researchers objectively collect data on instruments. The deductive approach to test the hypothesis that medical students would score differently exemplifies the postpositivist ontology (single reality that is tested by hypothesis) and the methodology position (research test an a priori hypothesis). Lastly, the use of checks to avoid bias (sources of evidence validity framework) and the formal style of writing, based on survey constructs definitions and variables, demonstrate how the postpositivist axiology and rhetoric were presented in this phase of the study.

The constructivist worldview provided the foundation for the second qualitative phase of my mixed methods study. The goal of that phase was to rely as much as possible on the participants' views of the phenomenon being studied. Common assumptions in the constructivist worldview support the existence of multiple realities constructed by the individuals as they engage with the world.[36,38,45] Its ontology position relies on the relativism (reality is subjective and varies from person to person), and its epistemology position is based on the subjectivism (individuals' subjective awareness of the phenomenon and the contribution the researcher plays in the research process). In the

second qualitative phase of this study, realities were co-constructed along with the participants, through semi-structured individual interviews with medical students and in-depth data collection. Quotes to illustrate participants' perceptions exemplify how the constructivist ontology was presented in this phase of the study. The inductive approach (a constructivist methodology) was used during the qualitative data analysis process to build patterns based on medical students' views about feedback literacy. Moreover, instead of using checks to avoid bias, a journal and a reflexive piece was written to support the constructivist axiology to actively think and write about the researchers preconceived opinions and interpretations. Lastly, the constructivist rhetoric was presented through a narrative writing style when describing the participants' perspectives, and using words and terms appropriated for the qualitative language (e.g., understanding, meaning, phenomenon). The constructivist worldview was also used in the final results interpretation because the quantitative phase was used to identify the best participants for the next phase, while the qualitative data was used to provide further explanations. Therefore, the final results interpretation was mainly based on the qualitative results that explained how medical students' learning motivations and strategies could influence feedback literacy and helped to build on practical recommendations.

Importance of this thesis

While the delivery of feedback has long been studied, the literature on feedback literacy is new, especially within the medical undergraduate education field.[3,19] Although feedback literacy could enhance the positive impact of feedback in learning enabling students to feel more in charge of their own learning, there is little discussion on

strategies to improve students' feedback literacy skills. Therefore, this thesis expands the knowledge around this topic by providing a more complete understanding of feedback literacy in the undergraduate medical education context, identifying factors related to it, and suggesting strategies to enhance students' feedback literacy skills. The final and foremost importance of this thesis is to contribute to students' empowerment in the feedback process and help them to overcome the challenges they still face during this process to improve their learning experience in medical school.

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CHAPTER TWO
SCOPING REVIEW

Title: Undergraduate learners' receptiveness to feedback in medical schools: a scoping review.

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Abstract

Feedback from educators to learners is considered an important element of effective learning in medical school. While early studies were focused on the processes of providing feedback, recent work has showed that factors related to how learners receive feedback seems to be equally important. Considering that the literature on this topic is new in medical education, and studies are diverse and methodologically variable, we sought to conduct a scoping review to map the articles on receptiveness to feedback, to provide an overview of its related factors, to identify the types of research conducted in this area, and to document knowledge gaps in the existing literature. Using the Joanna Briggs Institute scoping review methodology, we searched four databases (CINAHL, Ovid, PubMed, and Web of Science) and screened 9120 abstracts, resulting in 98 articles for our final analysis. In this sample, 80% of studies on the feedback receiver were published in the last 10 years, and there is a vast variation in the studies' methodologies. The main factors that affect medical students' receptiveness to feedback are students' characteristics, feedback content, educators' credibility, and the learning environment. Feedback literacy is a very recent and rarely used term in medical education; therefore, an important area for further investigation. Lastly, we identified some gaps in the literature that might guide future research, such as studying receptiveness to feedback based on academic seniority and feedback literacy's long-term impacts on learning.

Funding

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Conflicts of interest

There is no conflict of interest in this project.

Ethics approval and consent to participate

Not applicable for scoping review methodology.

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Key Words

Feedback, medical education, medical school, scoping review, receptiveness to feedback, feedback literacy.

Introduction

Feedback, broadly defined as the information provided to make adjustments in performance, has been extensively studied and long been used in different fields (i.e. education, engineering, music, medicine).[1–4] In education, feedback seems to have an impact on improving students' learning; however, the magnitude of this impact cannot be understood uniformly across different fields due to the heterogeneity of types of feedback, effects, and the settings where it occurs.[3,4] Within medical education, feedback from educators to learners is considered an important and essential element of effective learning in clinical settings.[5,6] Early studies were focused on the processes of providing feedback (i.e. guiding supervisors on ways to best deliver feedback to learners).[3,7–9] Recently, work within this field has expanded to include a focus on the process of receiving feedback, given the recognition that feedback is a complex exchange of information that goes beyond the delivery process.[10,11] While the process of delivering feedback is essential, receiving feedback, and the context and the culture where the feedback occurs seems to be equally important to optimize the learners' use of feedback. The learners who receive the feedback must respond to it, and the environment in which the feedback occurs also plays an important role in learning effectiveness.[12–15] Therefore, some current authors have incorporated learners' receptiveness to feedback into the concept of feedback, and there has been an increase in studies exploring the factors related to it, such as the influences of emotional reactions, educators' credibility, learners' self-assessment, learners' self-esteem, and previous feedback experiences.[3,5,16–18]

The term "feedback literacy" has been used to describe the process in which a learner receives, comprehends, accepts, and makes use of feedback, and is increasingly being adopted within the medical education research field.[19–21] Learners achieve feedback literacy in different ways, depending on the context, curricula, previous feedback experiences, and their own personal characteristics.[19] Some studies outline how to teach feedback literacy to students,[19,20] whereas others identify that activities necessary to support the development of students' feedback literacy should be part of the curriculum in the early years of a medical educational program.[12,21]

Another current discussion in this field is regarding important elements related to receptiveness to feedback and to the environment where feedback occurs. It is common for medical students to perceive feedback as a top-down process, even when they might have some social power in the clinical learning.[22] While some authors suggest that power asymmetry between learners and instructors can impact feedback,[14] others have identified that there are contexts where medical students describe having some social power in the clinical learning environment, and view themselves as active negotiators during the process to improve their clinical learning.[22] These are important observations as it demonstrates, depending on context, that it is possible for medical students to actively engage in and assume ownership of, at least, part of their learning, even in a training environment that is hierarchically organized. Moreover, some studies highlighted how the learning culture influences the receptiveness to feedback by defining the expectations for educators and learners, by establishing rules, and by directing attention toward certain parts of the professional performance.[13,18,23,24] Even when the educator is able to deliver the feedback, and the learner is able to engage with it, the learning culture might impact

the result of this interaction. Thus, it is essential to understand how the learning culture in each specific professional context influences the processes of feedback delivery and receipt.

In conclusion, previous studies indicated that it is important to understand the learners' feedback experiences in each specific learning context, in order to adequately deliver and receive feedback. The learners who receive the feedback must respond to it. Thus, it is important to empower them with skills that help them to take charge of their own learning in order to adapt to the different quality of feedback received. Medical school is a unique context representing one of the medical trainee's first experiences in the medical field and in the community of practice. The underlying values that shape how feedback is positioned within medicine's learning culture might be unique and different compared to the later postgraduate years of medical education (i.e. medical residency). Although the delivery of feedback has long been studied, the literature on receptiveness to feedback is new, especially within the medical undergraduate education field. Articles on this topic are diverse and methodologically variable. Moreover, we could not find a scoping review about receptiveness to feedback after a preliminary search on CINAHL and Ovid Databases, even with no restriction regarding geographic location, original language, and date of publication. Therefore, our scoping review intends to map the current literature in medical students' receptiveness to feedback, to provide an overview of its related factors, to identify the kind of research conducted in this field, and to find gaps in the existing literature to guide future research

Research questions

Our scoping review was guided by the primary research question: What is known about undergraduate students' receptiveness to feedback in medical schools? The sub questions were:

1. How do undergraduate students perceive the feedback received in medical schools?
2. What are the factors related to undergraduate students' receptiveness to feedback while in medical school?
3. How has feedback literacy been defined and taught in medical schools?
4. What are the gaps in our knowledge and understanding about undergraduate students' receptiveness to feedback in medical schools?

Participants

In this scoping review, we will be focusing on undergraduate medical students enrolled in medical school to best answer our research questions. We used the terms undergraduate students in medical school, undergraduate medical students, and medical students interchangeably to refer to students enrolled in a medical school program to pursue a medical degree. The terms learners and students were also used interchangeably in this article. Prior research indicates that maturity plays an important role in receiving feedback.[25,26] Junior students (i.e. medical students), when compared to seniors (i.e. medical residents), may have a lower capacity to evaluate and change their learning behaviours; therefore affecting their ability to receive, accept, and make use of the

feedback received. We therefore chose to focus on undergraduate medical students in order to minimize the maturity gap between learners enrolled in medical school and medical residents, to avoid the differences in pedagogy in other health professions education, and to best understand what is known about the topic specifically in the medical school's context. If the study included medical students, as well as medical residents or other health professions, it was deemed to meet the inclusion criteria. Studies were excluded if exclusively reporting on a non-medicine trainee population or medical residents.

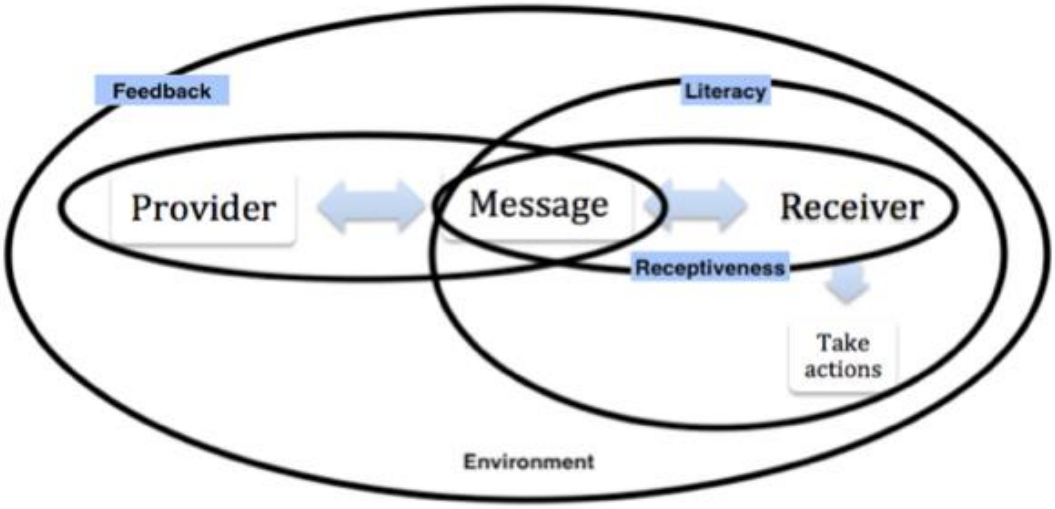
Concepts

Three core concepts (feedback, receptiveness to feedback, and feedback literacy) were identified and defined to guide us in the extension and breadth of this review. We defined feedback as a complex exchange of information between an educator and a learner that allows the learner to understand how they are performing, and to empower them to develop a plan for improvements.[4,19,27] This interaction depends on the educator (the feedback provider), the learner (the feedback receiver), and the information exchanged (the message); and this whole process is shaped by the learning environment culture where feedback occurs (i.e. medical schools).[18,23] The feedback delivered by physician educators was chosen to minimize the influences in receptiveness to feedback due to the variation in feedback givers' training, and the differences in pedagogy and clinical supervision in other health professions. Therefore, studies exploring feedback delivered exclusively by other students, residents, patients, or other health professionals were not included in this review.

We defined receptiveness to feedback as how medical students perceive the feedback received, how they react to it (i.e. emotionally), and how they decode and appraise the information.[6,19] We did not consider a student's receptivity to feedback and the learning environment as two separate components; instead, the learning environment was considered part of one of the factors affecting receptivity. Therefore, studies exploring the feedback learning culture were considered in this review when associated with receptiveness to feedback.

Lastly, we defined feedback literacy as the process which learners receive, comprehend, accept, and make use of feedback.[20,21] In our view, feedback literacy goes beyond receptiveness to feedback because it involves taking actions. Therefore, feedback literacy is a broader and more recent term in the field of medical education that includes 'receptiveness to feedback'. After consultation with the health science librarian involved in this project, we concluded that we should include both concepts (receptiveness to feedback and feedback literacy) so we would not exclude articles published before the term feedback literacy has been defined in medical education, nor we would exclude articles that use the term feedback literacy as a way to discuss receptiveness to feedback. The Figure 1 illustrates our three main concepts and the interactions among the educator (the feedback provider), the learner (the feedback receiver), the information exchanged (the message), and the learning environment.

Figure 1 - Representation of our three main concepts: feedback, receptiveness to feedback, and feedback literacy



Context

We included studies that recruited participants from or were conducted within the context of a medical school, including different learning contexts such as classrooms, laboratories, and clinical settings. The environment where learning occurs influences the receptiveness to feedback, and that a unique learning culture exists that is inherent to medical education. [10,18] Therefore, we decided to exclude studies that exclusively reported on another setting than the medical schools, so we could focus on the medical learning context.

Following recommendations of the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis, there was no restriction regarding geographic location and original language to avoid limitations in answering our research questions.[28]

Types of Sources

As recommended by the JBI Manual for Evidence Synthesis,[28] our scoping review considered all studies designs among peer-reviewed publications, including systematic reviews, meta-analysis, quantitative, qualitative, and mixed methods approach, letters and opinions. We followed JBI recommendation to not restrict the type of source because the literature on receptiveness to feedback is new within the medical undergraduate education field, so we believe it was important to map all the evidence.

Methods

This scoping review was conducted in accordance with the JBI methodology for scoping reviews.[28] As part of the process for developing the review protocol, consultations were completed with all the authors of this article, and the protocol items were discussed before starting the search for sources of information.

Scoping review rationale

The JBI Manual for Evidence Synthesis recommends that scoping reviews should be used to examine the extension or breadth of a topic in the literature, to map and summarize research findings, and to identify gaps that could be used to inform future research.[28] Therefore, scoping reviews are especially useful for examining emerging topics and less specific questions. In contrast to systematic reviews for example, scoping reviews do not aim at assessing the quality of the evidence; thus, an appraisal of studies methodological limitations or risk of bias is, usually, not performed.

Considering the broad nature of our main research question and that the literature on receptiveness to feedback is new within the medical undergraduate education field, a scoping review is the most suitable methodology to achieve the study objectives. We aim at examining the extension of this topic, to map and summarize our findings following our research sub questions, and to identify gaps in the literature to inform future researches in the medical education field.

Search Strategy

We followed the three-step strategy described by the JBI methodology.[28] We aimed at being as comprehensive as possible by locating both published and unpublished studies. In consultation with a health science librarian at McMaster University (Canada), we defined concepts and chose keywords for searching the articles. See Appendix I – Concepts and Keywords. Next, we defined the databases (CINAHL and Ovid Databases) for the initial search based on the librarian suggestions and a limited search using our concepts and keywords. We also looked at the text words contained in the title and abstracts of relevant articles to ensure the concepts and keywords where in alignment with the objectives of our scoping review. Based on the results of this initial search, we decided to expand the full search using two other databases (PubMed and Web of Science). Lastly, we checked the reference lists of the articles selected from full-text to include additional sources. We did not limit our search by language or dates to minimize limitations in answering our research questions. Our search was conducted between September and December 2021.

Source of evidence screening and selection

We used Covidence, a web-based software review tool that facilitates the process of screening, selection, and data extraction. First, a pilot process was conducted with five reviewers (LC, CT, DW, AR, AH). Fifty abstracts were randomly selected using the concepts and keywords defined. The reviewers were asked to screen the titles and abstracts. We had 4 conflicts (8%), which was considered acceptable. Next, we searched the initial databases (CINAHL and Ovid Databases) for titles and abstracts using the concepts and keywords. After removing the duplicates, we found 3074 abstracts to be screened. Then, we searched the two other databases (PubMed and Web of Science), and we added 1754 abstracts, after removing the duplicates. Therefore, a total of 4828 abstracts were selected for the screening process. The first author (LC) and one independent reviewer (CT, DV, AR, or AH) screened all of the abstracts using the inclusion and exclusion criteria described above. We try to resolve the conflicts through discussions among the reviewers. If the conflict was not resolved, the vote of a third reviewer was taken into consideration. One hundred thirty-four full-texts were selected and assessed for eligibility by the first author (LC) and one independent reviewer (CT, DV, AR, or AH) using the inclusion and exclusion criteria. We had eight conflicts that were resolved by a third reviewer. At the end, 98 full articles were included for data extraction. The reasons for exclusion were: different concepts other than the ones defined for this study, different population or setting, and duplicates. There were no full texts for three of the abstracts because they were published only as abstracts (i.e. research forum). See Appendix II for the complete list of sources excluded following full-text review with primary reasons for exclusion.

The results of the search and the study inclusion process is presented in a Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for scoping review.[29] See Appendix III.

Data extraction

The first author (LC) and three volunteer students (CT, DV, and AR) extracted the data from the articles included in this scoping review using the Covidence web-based software. We developed a data extraction template that was discussed with the volunteer students and all the authors of this scoping review before starting the extraction process. The template was not modified after the process of extracting data started. The data extracted included specific details about the characteristics of the studies (i.e. country where the study was conducted, year, type of article, methodology, aim of the study, population, context, data collection method, study intervention), definition of the concepts being considered in this study (i.e. feedback, receptiveness to feedback, culture of feedback), the feedback provider, the type of feedback (i.e. written, oral, computer), the focus of the feedback (i.e. communication skills, procedure skills), how the impact of the feedback was evaluated (i.e. learners' reaction, difference in learning), the medical students' overall perceptions about the feedback received (i.e. positive, negative, neutral), the factors that influence the receptiveness to feedback and the learning culture of the receptiveness to feedback, the definition of feedback literacy, how feedback literacy has been taught in medical schools, and the gaps in the topic that were suggested by the authors of the included articles. Data were extracted directly from the articles using

passages quoted from the text. See Appendix IV - Data extraction instrument template. Conflicts were all resolved through discussions among the reviewers.

Data Analysis and Presentation

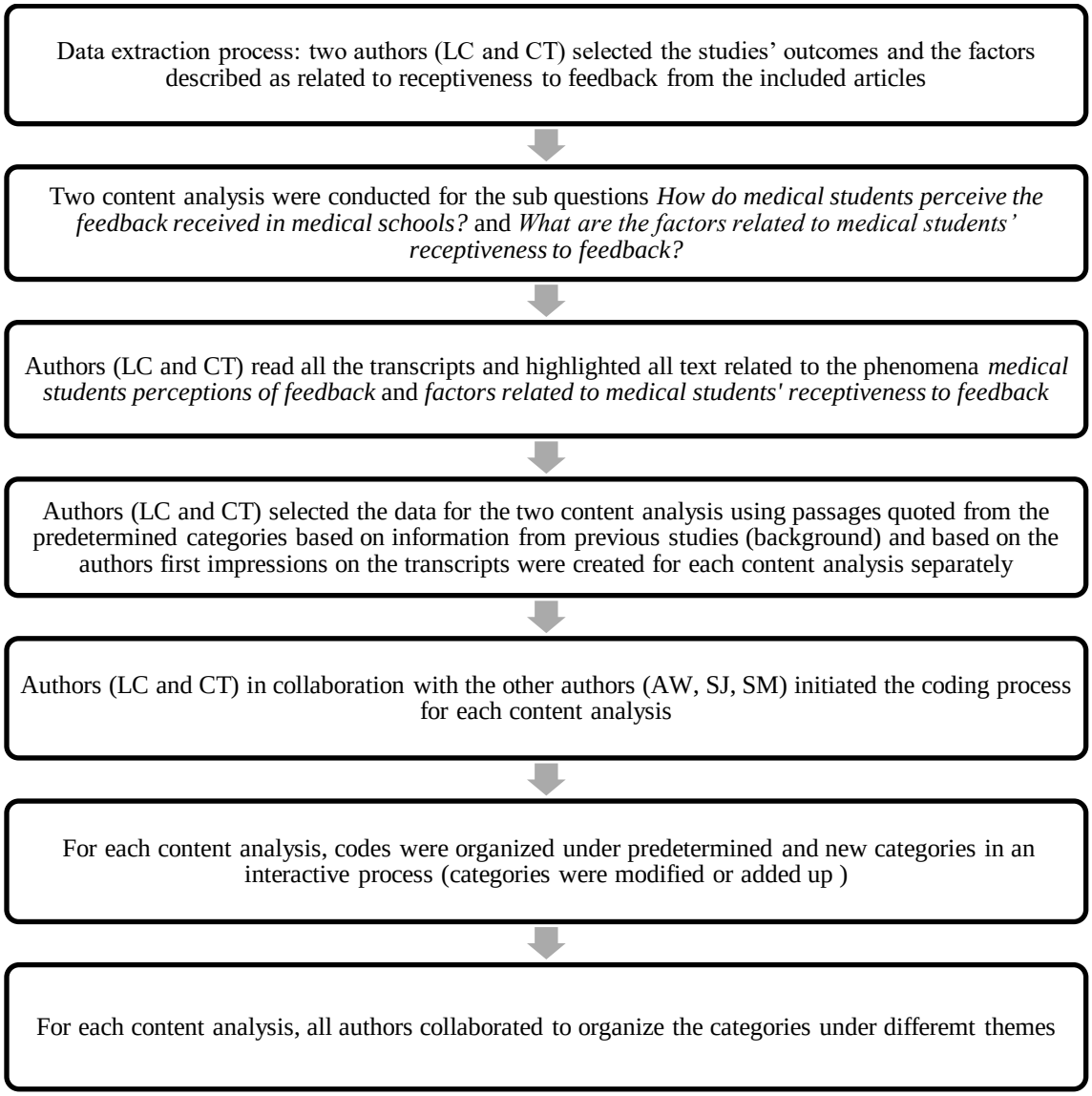
Results were classified under main conceptual categories: how medical students see feedback, factors related to receptiveness to feedback, how feedback literacy has been defined and taught in the medical undergraduate program, and the gaps in the literature. Moreover, since this is a new topic in the literature, we presented the number of sources of evidence published in each year, and we mapped the type of studies and methodologies used and the countries where studies were conducted. For each category reported, a clear explanation was provided. A descriptive summary accompanied the charted results to describe how the results are related to the review objectives and research question.

We conducted two separate directed content analysis [30] of the studies included in this scoping review in order to better answer our two sub questions *1. How do medical students perceive the feedback received in medical schools? 2. What are the factors related to medical students' receptiveness to feedback?* We chose the directed content analysis approach because we used prior knowledge and research about the phenomenon to make predictions about our variables of interest. We based our analysis on previous studies that explored: the type (i.e. constructive, specific), the structure (i.e. oral, written), and the timing of feedback; some factors related to receptiveness to feedback (i.e. emotional reactions, educators' credibility, learners' self-assessment, learners' self-

esteem); and the influence of the context and the culture where the feedback occurs.[6,7,19,26,27,31]

Using only the texts selected in the data extraction phase, two of the authors (LC and CT) highlighted and extracted all text related to the phenomena (*medical students perceptions of feedback* and *factors related to medical students' receptiveness to feedback*) for each of the sub questions separately. The data for the content analysis was extracted using passages quoted from the texts. For example, the quote *"We conclude that the positively framed feedback group was more satisfied (…) than the group in the negatively framed condition"* was extracted from the article by van de Ridder et al [32] to answer the sub question *What are the factors related to medical students' receptiveness to feedback?* Then, the authors (LC and CT) in collaboration with the other authors (AW, SJ, SM) initiated the coding process for each content analysis. Next, we defined the predetermined categories for each sub question. The predetermined categories were based on information from previous studies (background) and our first impressions on the transcript. The pre-categories will be described below in the *Results* section. We used an unconstrained matrix of analysis, meaning that the predetermined categories were modified or added up as the interactive process of coding continued.[33] For each content analysis, codes were organized under predetermined and new categories. Lastly, we analyzed the results of the coding process, and organized all the categories in different themes in order to express underlying meanings found in two or more categories. See Figure 2 for Directed content analysis approach diagram and Appendix V for examples of data analysis from text quotes to codes.

Figure 2 - Directed content analysis approach diagram. Based on Hsieh, H.F., & Shannon, S.E.[30]

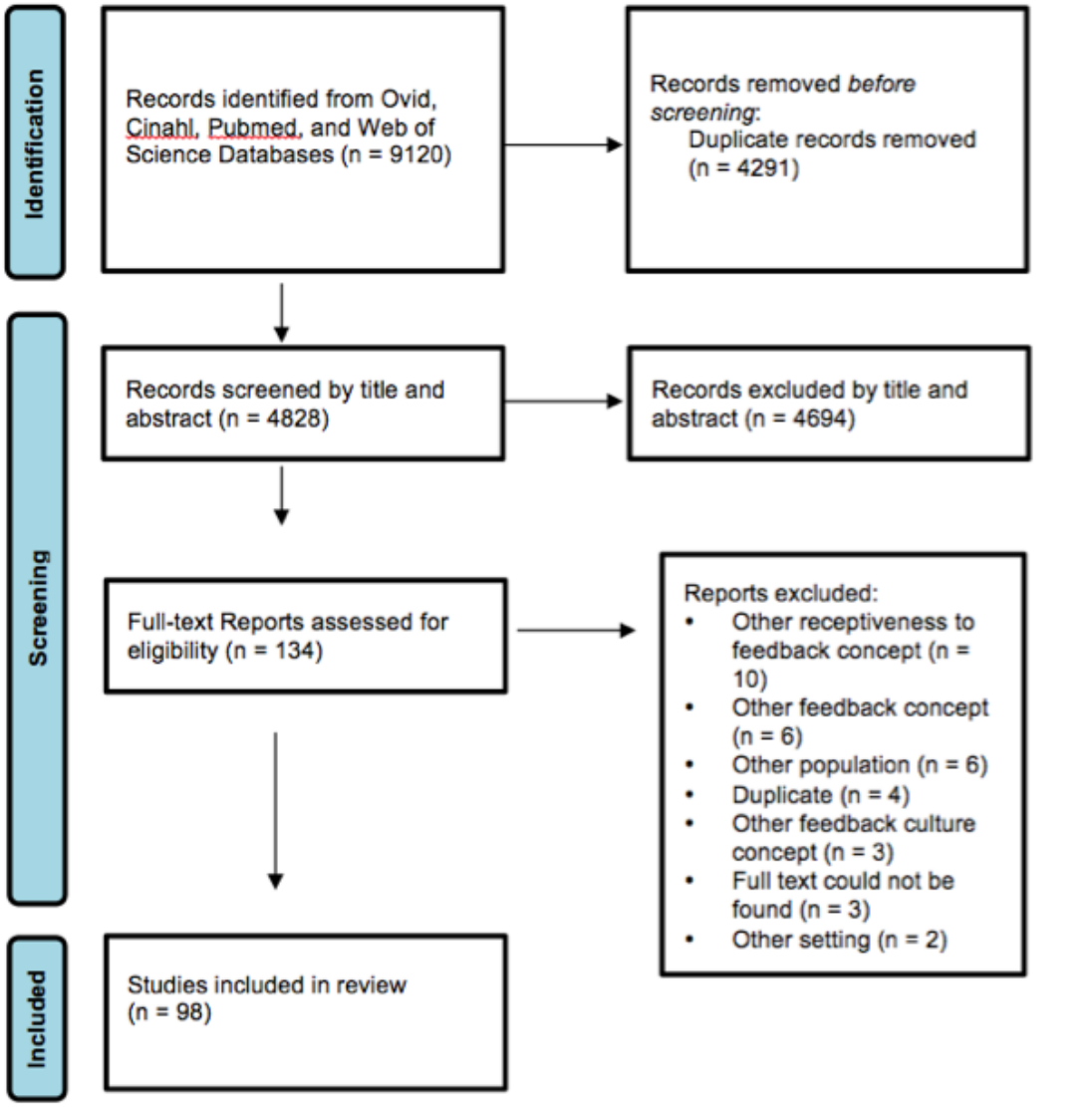


Trustworthiness of the findings was enhanced by providing a detailed description of the analysis process, close supervision of the whole process by all the authors, and engagement of a panel of experts that supported category production and coding issues.[34,35]

Results

A total of 98 articles were included in the scoping review, after excluding 36 articles that did not meet our inclusion criteria, were duplicates, or unobtainable. See Figure 3 – PRISMA flow diagram. A complete list of included articles can be found in the Appendix VI.

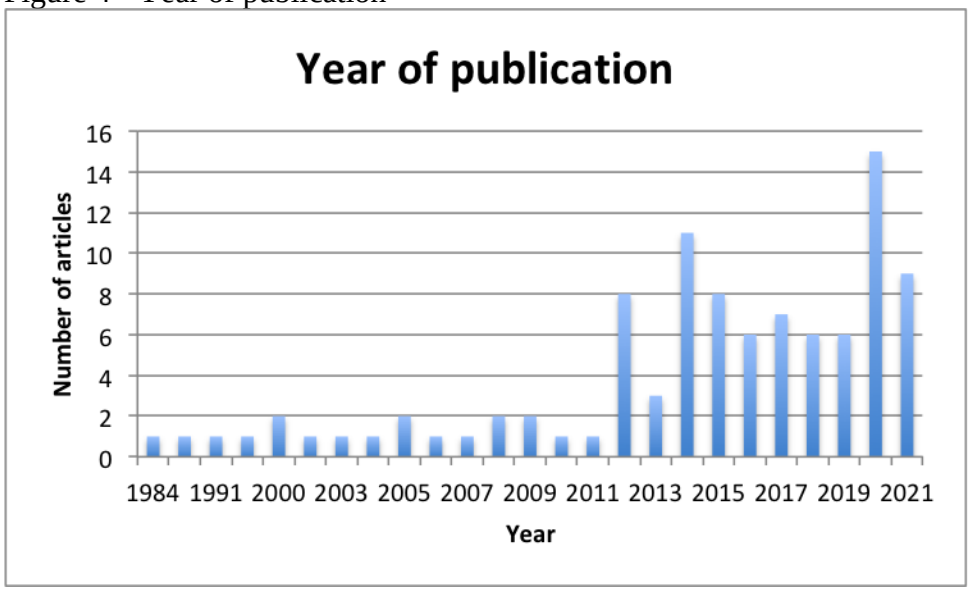
Figure 3- PRISMA flow diagram



Characteristics of the articles

Publication on the topic of receptiveness to feedback in medical school has increased in the last 10 years. See Figure 4 – Year of Publication. These results reinforce our initial findings that current authors have incorporated learners' receptiveness to feedback into the concept of feedback, and there has been an increase in studies exploring the factors related to it.

Figure 4 - Year of publication



In alignment with our inclusion criteria for participants (medical students) and setting (medical schools), we found that most articles were published in journals focused on health sciences education, and more specifically, medical education.

When looking at the country in which the study was conducted, most studies were completed with samples of participants from: United States (30 articles), followed by Canada (17 articles), and then England (11 articles). Most studies were conducted in North America (47 articles), followed by Europe (25 articles), and then Asia (17 articles).

Only a small number of additional studies were conducted in Oceania, [12,20,36–39] Africa,[40,41] and South America.[42]All studies but one were conducted and published in English; the exception [43] was published in Korean but translated to English by one of the reviewers (LC).

There was a vast variation in study methodologies. Most articles were original articles (79 articles), followed by review articles (12 articles), letters and opinions (5 articles), and commentaries (2 articles). Forty-two studies included some kind of intervention, such as feedback training/workshops for learners, a different feedback format (encounter cards, video records), or specific tasks (peg transfer in surgery box, surgical knot). With respect to design, of those articles that included an evaluation or research component, designs included cross-sectional studies (23 articles), different approaches for qualitative studies (24 articles), or review articles (12 articles).[44] Two studies were classified as unknown methodologies because neither we could identify the methodology used nor the authors of the study mentioned it. It is out of the scope of this review to assess the quality of the studies. The data collection of choice was mostly survey (33 articles) used in cross-sectional and mixed-method approaches, followed by individual interviews (11 articles) and focus group (8 articles) used in qualitative studies. See Table 1 – Studies' Map

Table 1 - Studies' map

Journal of Publication	Number of articles
Medical Education	16
Medical Teacher	13
Academic Medicine	7
Advances in Health Sciences Education	7
Others	48
Origin of Studies (by Continent)	Number of articles
North America	47
Europe	25
Asia	17
Oceania	6
Africa	2
South America	1
Methodology	Number of articles
Quantitative Studies - Observational	26
Cross-sectional	23
Cohort	3
Qualitative Studies	24
Qualitative study (design not specified)	11
Grounded Theory	10
Exploratory Qualitative	1
Interpretive Description	1
Qualitative Description	1
Reviews	12
Review (design type not specified)	8
Scoping review	2
Thematic review	1
Narrative review	1
Mixed Methods	9
Quantitative Studies - Experimental	9
Randomized controlled trial	7
Time-series repeated-measures	1
Experimental (not specified)	1
Quantitative Studies - Quasi-experimental	8
Quasi-experimental (not specified)	7
Static-group comparison design	1
Letters/Commentary	7
Unknown	2

Study's methodology classified according to the Centre for Evidence-Based Medicine University of Oxford's directions

Population and context

The population of most studies was medical students exclusively, without including other type of learners (80 articles). There was a large variation in the number of participants across studies (from 7 to 520 participants). This was expected due to the variation in methodologies. Most studies were situated in medical schools, exclusively (83 articles). Other populations and contexts included, in addition to medical school and students, were: midwifery, veterinary, and nursing programs, medical residents, and practicing physicians.

Feedback mapping

In most studies, the feedback was provided exclusively by a physician (71 articles). When looking at the type of feedback that has been studied, most articles explored written and oral feedback combined (20 articles), followed by exclusively oral (20 articles) or written (15 articles) feedback. The type of feedback provided was not specified in 33 articles. Most studies focused on analysing the feedback given regarding clinical skills (i.e. history and physical examination, diagnosis, and treatment), or a combination of clinical skills and communication skills (i.e. communication with patients). Only five studies focused on analysing the feedback given in classrooms. Lastly, the impact on learners of the feedback received was mostly analysed through learners' perceptions (e.g. whether the feedback received motivated them to improve their skills). See Table 2 – Feedback Mapping.

Table 2 - Feedback mapping

Feedback Provider	Number of Articles
Exclusively Physician	71
Physician and Self-reflection	6
Physician and Residents/Student	9
Educators (not specified)	3
Combination (physicians, residents, students, self-reflection, and/or other health professionals)	9
Type of Feedback	**Number of Articles**
Not specified	33
Written and Oral	26
Oral	20
Written	15
Combination of the types above	4
Focus of the feedback	**Number of Articles**
Clinical skills	32
Not specified	29
Communication and Clinical skills	10
Communication skills, Procedural skills, and Clinical skills	8
Communication skills	5
Procedural skills	5
Assessments	4
Others*	5
Feedback Evaluation	**Number of Articles**
Learners' perceptions	59
Not specified	16
Learners' reactions combined with Difference in learning (pre-post tests) and/or Changes in behaviour (pre-post perceptions)	23

Others: biochemistry, case presentations, and Problem-Based Learning (PBL) sessions.

Factors related to medical students' receptiveness to feedback

Our content analysis resulted in eight pre-determinated categories (i.e. emotional reactions, maturity, feedback content, timing, ways to deliver, type of feedback, credibility, and environment) that were modified or added up as the interactive process of coding continued. We started with eight pre-determinated categories: emotional reactions (e.g. distress, fear, relief), maturity, feedback content (e.g. constructive, detailed, positive,

focused), timing (e.g. immediate, timely, during), ways to deliver (e.g. one-on-one, triangulation, standardize), type of feedback (e.g. oral, written), credibility, and environment (e.g. supportive, comfortable, safe). *Students' characteristics* was added to include codes related to students' characteristics related to learning motivation that could affect receptiveness to feedback (e.g., autonomy, confidence, engagement, mindset, initiative). *Abilities for students' self-assessment* was considered a separate category due to the number of codes related to students' abilities to evaluate themselves (e.g., self-awareness, self-efficacy, self-perception, self-reflection). *Impact of the feedback* means areas where the feedback would have an impact, for example impact on students' overall performance, non-technical skills only, changes in behaviour, or learning in general. *Students' perceptions of the feedback* include codes representing whether students perceive the feedback, the way it was given to them, as important for their learning (e.g. feedback recognition, feedback expectations). *Credibility* was one of the pre-determinated categories split in two: *feedback credibility* (e.g. feedback based on direct observation, number of observations), and *the feedback giver's credibility* (e.g. educator-student relationship, tutors engagement, trustworthiness, and whether feedback was given by a physician, medical student, or other health professional). *Environment* was another category split in two: *learning environment* (e.g. supportive, safe, healthy) and the *culture of the country* (e.g. social hierarchy, gender barrier). Lastly, we decided to add two categories related more specifically to the term feedback literacy: *decoding feedback messages* (e.g. feedback awareness, feedback language, being able to recognize the feedback) and *seeking feedback* (e.g. requesting feedback, student empowerment). At the end, we developed 376 codes that were grouped into 16 categories. The categories were

then organized into five themes. Our themes were based on our core concepts of receptiveness to feedback and feedback literacy, and focused on the receiver (i.e. learner), the message (i.e. feedback information), and the feedback environment. See Table 3 - Factors related to medical students' receptiveness to feedback.

Table 3 - Factors related to medical students' receptiveness to feedback

THEMES and CATEGORIES
1. Factors related to the students themselves
a) Students' characteristics (10.1%) b) Abilities for students' self-assessment (7%) c) Students' emotional reactions to feedback (3.7%) d) Students' maturity (2.1%)
2. Factors related to the feedback
a) Feedback content (23.4%) b) Impact of the feedback (5.9%) c) Feedback credibility (5.6%) d) Timing of feedback (5.2%) e) Way feedback is delivered (5%) f) Type of feedback (4%) g) Students' perceptions of the feedback (2.1%)
3. Students' perceptions of the feedback giver
a) Feedback giver's credibility (12.5%)
4. Factors related to the environment where feedback occurs
a) Learning environment (4.2%) b) Culture of the country (2.4%)
5. Factors related to feedback literacy
a) Decoding feedback messages (3.7%) b) Seeking feedback (3%)

The number in parenthesis refers to the percentage of codes for each category.

Our content analysis results support past findings that experiences of receiving feedback are influenced by multiple factors acting at multiple different levels from individual to environmental. [6,12,15,16] The category *Factors related to the feedback content* received the greatest number of codes. According to our content analysis results, students receive feedback better when it is constructive, detailed, specific, and with

suggestions for improvement. Inherent to our findings, the feedback giver's credibility plays an important role in feedback receptivity. Feedback giver's credibility was associated with a sense of trust, caring, and long-term relationship with students. Additionally, credibility was related to the quality of feedback (i.e. feedback was reassuring, and based on multiple and directed observations,). Moreover, under the category *Students' characteristics,* we found that confidence, engagement, mindset, and self-motivation were elements frequently mentioned.

When looking at the codes associated to *the environment where feedback occurs*, we noticed that some of them referred to the learning environment (i.e. supportive, comfortable, and safe), and others were related to the culture of the country. We considered the culture of the country where the feedback occurs as a separate factor because we found some studies addressing the fact that the country cultural aspects *per se* may influence how feedback is perceived.[45–47] For example, it seems that in countries with larger power distance and lower individualism (i.e. Indonesia), feedback initiated by the supervisor (instead of the student) seems to be more acceptable than in countries with lower power distance and higher individualism culture (i.e. Netherlands).[45] Other examples of culture differences between countries that could influence receptivity to feedback are the uncertainty avoidance (how the society deals with unpredictable situations), masculinity (gender role divisions), and long-term orientation (whether people focus efforts on the present or future).[45,46] Lastly, following the recent literature in feedback literacy, our content analysis identified factors related to *Decoding feedback messages*, such as recognizing the feedback and the feedback language, and participating

in feedback literacy workshops. Additionally, being able to *seek for feedback* and feel empowered also seems to improve students' receptivity to feedback.

Medical students' perceptions of feedback in medical school

Most studies reported that the learners have a positive perception of the feedback received (61 articles). Only five studies reported that the learners have a negative perception. However, we have to take into consideration that the students' perceptions were mostly influenced by the studies' interventions that improved receptivity to feedback (e.g. workshops, lessons, technology tools). Our directed content analysis resulted in 6 pre-determinated categories (i.e. positive, negative, neutral, credible, useful, and helpful) that were modified or added up as the interactive process of coding continued. We eliminated four pre-determinated categories (neutral, credible, useful, and helpful). The pre-determine category *positive perceptions* was divided in three categories: *positive feelings* (e.g., encouraging, helpful, useful), *positive content* (e.g., constructive, effective, instructive), and *positive timing* (e.g., frequent, regular, timely). *Negative perceptions* was also divided in three categories: *negative feelings* (e.g. uncomfortable, intimidated, insulting), *negative content* (e.g. unspecific, undetailed, unclear), and *negative timing* (e.g. irregular, limited, scarce). We added two new categories based on students' overall perception of the *quality* (e.g. positive, negative, varied) and the *process* (e.g. one-way, monologue, passive) of the feedback. At the end, we developed 126 codes that were grouped into 8 categories. The categories were then organized into three themes to reflect the medical students' perceptions of feedback in medical schools. Perceptions

of feedback are related to our core concept of receptiveness to feedback. See Table 4 - Medical students' perceptions of feedback in medical school.

Table 4 - Medical students' perceptions of feedback in medical school

THEMES and CATEGORIES
1. Students' Positive Perceptions
a) Positive Feelings (25.4%) b) Positive Content (15.8%) c) Positive Timing (12%)
2. Students' Negative Perceptions
a) Negative Content (14.2%) b) Negative Timing (7.1%) c) Negative Feelings (4.8%)
3. Overall Perception
a) Quality (15%) b) Process (5.5%)

The number in parenthesis refers to percentage of codes for each category.

The category with the most number of codes was *Students' positive feelings* towards the feedback received. These codes showed that learners perceive feedback as positive when they feel encouraged, helped, and they feel that the feedback is useful. On the other hand, the *Negative feelings* category shows that the learners perceive feedback as negative when they feel uncomfortable, intimidated, or insulted. Students also have a positive perception of the feedback depending on its content and whether it is constructive, effective, and instructive (*Positive content* category), as opposed to feedback that is unspecific, undetailed, and unclear (*Negative content* category). Moreover, the timing when feedback is given seems to influence students' perceptions. Our codes showed that feedback that is frequent, regular, and timely was associated with positive perceptions (*Positive timing* category), while feedback that is irregular, limited, and infrequent was related to negative perceptions (*Negative timing* category). Lastly, our results included the categories *Quality* and *Process.* Our codes showed that the *quality* of

the feedback received is an important factor in students' perceptions about it, but we couldn't identify how the quality would influence the medical student's perceptions (i.e. positively, negatively) because the studies either provided different specifications for the term *quality* or they did not specified it at all. Moreover, most studies described feedback as a one-way process, and this way of process seems to influence negatively students' perceptions of the feedback received, reinforcing previous findings in the literature.[16,48,49]

Feedback literacy

Only four studies defined feedback literacy, and they were all articles published within 2017 and 2020,[20,25,50,51] reinforcing our findings that feedback literacy is a very recent term in medical education. We found four studies that described how feedback literacy has been taught in medical schools.[20,25,52,53] They were all pilot studies in which the interventions included workshops from educators to students (one of them combined to reflective logs), or longitudinal coaching. However, two of these studies did not provide a definition for the term feedback literacy, although the interventions were done to help students to receive and make use of feedback.[52,53] Overall, students that participated in these programs seemed more engaged in seeking and receiving feedback, were more aware of the feedback received, and had an increase in self- perceived confidence and skill in accepting and acting on feedback.

Gaps described in the literature

When looking at the data by year of publication, we noticed that more gaps were identified after 2010. This was not a surprise, considering the increase in publication

about receptiveness to feedback in the last 10 years. Moreover, before 2010, articles focused their recommendations on investigating feedback provider characteristics or feedback content to improve feedback effectiveness. After 2010, authors started to suggest further research to study the feedback receiver characteristics, the students' actions due to the feedback received, the relationship between educator and learner, and the context or culture influences. This change in gaps in the reviewed literature suggests a shift of research focus from providing feedback to receiving feedback and the role of the environment in learning effectiveness. However, most gaps are focused on one element of the feedback concept (i.e. provider, or the message, or the receiver, or the feedback actions, or the environment). Only more recently, some authors started to suggest that further investigations should focus on the relationships between provider, receiver, and environment at the same time in order to get a more complete understanding of the feedback process. Some authors identified gaps in methods and methodologies. They suggested a need for more rigorous methodologies, more qualitative methods of data collection and analysis (i.e. focus group, interviews, content analysis), and more quantitative studies that are not observational ones (e.g. randomized educational trials). These needs were supported by our results since we identified that most studies were cross-sectional ones, and little was described about the qualitative studies designs and reviews' approaches. For an overall view of our results, we summarized the gaps in the literature according to the elements described in our core concept of feedback (i.e. provider, the message, receiver, actions taken, and environment). See table 5 – Summarized gaps by feedback concept elements.

Table 5 - Summarized gaps by feedback concept elements

Provider	Message	Receiver	Actions	Environment
Follow-up studies on faculty development Feedback content when giving feedback Comparison with performance standards Tutors practices based on gender, attendance of faculty development workshops, academic qualifications, and perceptions of the value of feedback.	Positive versus negative messages Technology useful for giving and receiving feedback easily Efficient methods of written feedback Effectiveness of written summary of the feedback discussion To investigate the content of feedback and its relation with the perceived instructiveness of feedback	Different year groups Student's perception Emotional responses Self-Regulation Theory, and differences in the receipt and use of feedback. Feedback-seeking behaviors of students Difference by medical specialty and professions Recognition of the feedback provided Feedback negative impact on students Students' perceptions of feedback providers characteristics related to feedback acceptance Credibility of feedback Influences in trainees' response Feedback and self-esteem Interventions for receptivity to feedback	Making use of feedback Decision to develop from the feedback The impact of goal setting and other aspects of self-regulated learning Feedback and trainees' future performance Long-term efficacy and effects of feedback Impact of the feedback Guidance on how to utilize the feedback Using feedback episodes in their future learning Moving from novice to expert: responsibility for learning Supporting their use of feedback.	Changes in the learning culture and effect on the quality of feedback Workplaces and their influence on feedback Cultural factors and hierarchical system of medical education Assessment and improvement of culture of feedback in an organization Elements of effective feedback in different cultures Elements of open and safe interaction in the feedback conversation Effects of context on feedback incorporation Influences of culture in implementing feedback processes in different countries Influence of culture on the process and acceptance of feedback

Relationship provider-receiver-environment
Tutors/students perspectives at the same time
Feedback from students to faculty to understand feedback conversation
A need for better and complete understanding of the process of giving, receiving, interpreting, and using feedback as a basis for real progress toward entrustment decisions
Educational alliances
Relationship (educator and learner) and the conditions that facilitate effective and meaningful evaluation

Discussion

Our results highlighted that research focusing on the feedback receiver is very recent in the medical education field. In a scoping review on feedback in general, Bing-You et al.[54] analysed data from 1980 to 2015, and they found that 52% of the articles were published between 2010 and 2015. Their scoping review was different from ours, since it included a broader topic, population, and setting, different search terms and search years, and they excluded non-English articles and the grey literature. Still, our results not only reinforced that publication in this topic has increased in the last ten years, but also supported their findings in feedback mapping and studies' methodology. We found a vast variation in studies' methodologies, an abundance of observational descriptive studies (e.g. survey, qualitative), and a lack of experimental studies. Therefore, most studies gave us an overall picture of what is happening within our phenomenon of study (e.g. medical students' perceptions of the feedback received) and provided associations, but not causal relationships (e.g. the factors associated to medical students' receptiveness to feedback). It was out of the scope of our review to assess the quality of the studies, and it was not our intention to dismiss any methodology based on

quality of evidence. However, it seems that many articles did not follow a rigorous methodology, since many studies did not specify the approach used or only mentioned the analysis method of choice (e.g. content analysis, review). Among the 12 review articles, only two described a rigorous process of data searching and study methodology.[54,55] Long et al.[55] looked at factors that could affect the credibility of assessment and assessment-generated feedback, and Bing-You et al. [54] conducted a scoping review about feedback for learners in general. Moreover, even though we did not restrict our search by geographic location and language, our results showed that most studies were done in North America. As some of these studies pointed out, the culture of a country seems to affect how medical students receive feedback; therefore, further analysis of studies from outside North America could give us new perspectives on how to manage this phenomenon.[45,47,49]

Thinking of the factors that affect medical student's receptiveness to feedback, our content analysis showed that students' characteristics (e.g., confidence and mindset), feedback content (e.g. constructive, detailed), and feedback provider's credibility seems to be important. Exploring the students' characteristics to successfully use feedback, Garino [56] found that students with strong self-regulated learning traits and a growth mindset have more adaptive learning behaviours, and are better able to understand what needs to be done, creates a learning plan, and implemented it; therefore, making better use of the feedback received. Regarding feedback content, some authors showed medical students prefer positive messages and value compliments.[57,58] However, it seems that student satisfaction is not an accurate measure of quality of feedback; therefore, skills improvements might be more related to constructive feedback. Moreover, student

seniority in the programme appears to play a role in students' perceptions of the purpose of feedback.[59] Thus, junior students value positive and written feedback, while senior students value specific and constructively critical feedback. Looking at our codes related to credibility, as a factor that influences medical students' receptiveness to feedback, our data supported previous results that feedback is perceived as credible when it involves a certain number of direct observations, and when it is delivered by a credible person (i.e. long term and engaged educator).[31,60] Bakke et al. [25] discussed how longitudinal coaching relationships could enhance the feedback provider and feedback's credibility by promoting frequent and regular interactions, more direct observations, and more interactive discussions. Moreover, in a scoping review about factors affecting credibility of assessment-generated feedback in medical education, Long et al. [55] also suggested that students value feedback given by a trusting and long-term supervisor, as well as, a standardized process with clear purpose. Lastly, our content analysis also highlighted the importance of the culture of the environment where feedback occurs, as discussed in previous researched.[10,23,31] Under the category of *Learning environment*, we found codes such as safe, non-critical, and supportive, endorsing Ramani et al. [23,61] strategies to improve the learning culture that included establishing a safe and just learning environment. We were also able to find codes related to the *Culture of the country*. As suggested by Suhoyo et al., [45] cultural aspects may influence receptiveness to feedback; therefore, one model of feedback does not necessarily translate to another country.

Regarding the medical students' perceptions of feedback in medical school, our content analysis of the articles revealed that students have a positive perception expressed by positive feelings towards the feedback received (e.g. reassuring, encouraging), and

when feedback was given through positive messages (e.g. constructive, instructive) in a timely manner. Moreover, the students overall perception of the quality of the feedback was positive. However, these students' perceptions were mostly related to the studies' results, which usually included an intervention to improve receptivity to feedback. Still, as described by Duijn et al., [62] students feel that feedback is meaningful when it is instructive, provided immediately after the observed activity, and based on multiple observations from the same supervisor. In a previous study, Greenberg [63] also described that medical students rated the amount and quality of feedback received as high, with most students reporting that the feedback was timely, reinforcing and corrective, and few students reporting it as demeaning and abusive. Additionally, our results showed that negative perceptions were related to an unclear, unspecific, limited, and insufficient feedback, as well as an uncomfortable and intimidated feeling.

Our search for the term feedback literacy in medical schools indicated that this is a very recent and rarely used term in the medical education field. In 2018, Carless & Boud [19] developed a consistent definition of this term, given it was increasingly being introduced into medical education articles.[19,20,25,51] Carless & Boud defined student feedback literacy as 'the understandings, capacities and dispositions needed to make sense of information and use it to enhance work or learning strategies'. [19 p.1316] They proposed a framework to underpin students' feedback literacy that involved appreciating feedback, making judgments, managing affect, and taking actions. In our scoping review, we found four articles that used the term feedback literacy as defined by Carless & Boud, and three studies that proposed programs to promote feedback-literate medical students.[12,20,25] Bakke et al.[25] used Carless & Boud definition to support their findings

about the positive effects of longitudinal coaches on how medical students conceptualize and engage in feedback discussions. Noble et al.[20] discussed the benefits of their feedback literacy programs for health students using Carless & Boud's framework. Moreover, McGinness et al.[12] suggested an interactive one-off feedback workshop that helped students to have a more active role in the feedback process based on some of Carless & Boud's concepts. These studies reported that it is possible to develop programs that could enhance learners' appreciation to feedback, increase learners' productive participation in the feedback process and the frequency of feedback seeking by students, and help students to be more aware of possible strategies to acting on feedback.

Perhaps the most helpful contribution from our scoping review to the literature around this topic is the gaps we were able to identify. This is important to guide future researches and move the ongoing feedback discussion forward. Our results endorsed the shifting in the focus of the studies, from processes with respect to provide feedback to receiving the feedback and the role of the environment. This is a valuable finding because it shows that medical education researchers have started moving away from the limited definition of feedback that focus mostly on the feedback provider and the way the message is delivered. However, receptivity to feedback is still a very recent area of study in medical education; therefore, it seems that there is still room to explore further the students' perceptions of feedback, their reactions to it, how they decode and appraise the information, and the actions they take. More specifically, when thinking about feedback from the receiver's perspective, our content analysis results showed that receptiveness to feedback could be studied depending on the learners' academic years (junior and senior years), medical specialties, different feedback providers (i.e. health professionals,

residents, peers, and patients), and feedback characteristics (i.e. content and type). Moreover, feedback literacy is indeed a new concept in medical education, and a better understanding of how students recognize and use the feedback provided, and the impact of this feedback in future performances might help us to develop programs to guide medical students in achieving feedback literacy. Many questions about how the learning environment and culture influence the receptiveness to feedback in medical schools are still not answered, especially aspects related to feedback acceptance, feedback seeking, and how the environment could be a barrier for students to take control of their own learning. Lastly, there is a call for more rigorous and well-designed studies in medical education assessing the various aspects of feedback, particularly non-observational quantitative studies and qualitative approaches.

Limitations

Our scoping review has some limitations inherent in this type of methodology. Usually, scoping reviews are not designed to assess studies' methodological limitations, risk of bias, or the studies' quality; therefore, our scoping review is not intended to provide clinical guidelines or policy-making recommendations. Instead, we aimed at providing an overview of the topic, examining how research has been conducted on the medical education field, and to identify some knowledge gaps. Additionally, scoping reviews can omit relevant sources of information because it relies on a screening process and on the information being available. For example, our scoping review did not include books, even though we haven't considered it an exclusion criterion, and we might have left out some relevant articles in the topic because they did not meet our inclusion

criteria. We also excluded articles in which feedback was exclusively provided by non-physicians, potentially having some impact on our conclusions. Moreover, our content analysis showed that students' perceptions towards the feedback received were mostly positive. However, the analysis was mainly related to the studies' results, and usually these studies included an intervention to improve receptivity to feedback. Lastly, although we have not limited our search based on language or country of origin, all our articles, but one, were in English, and most of them from North America due to the databases we chose to use for this review.

Conclusion

The findings of our scoping review add to the literature by mapping the studies in medical students' receptiveness to feedback, endorsing some existing knowledge, and providing gaps to guide future research. Our results showed that research focusing on the feedback receiver is very recent in the medical education field, there is a vast variation in studies' methodologies, and most studies were conducted in North America and Europe. Looking at the factors that affect medical student's receptiveness to feedback, it seems that students' characteristics, feedback content, feedback giver's credibility, the learning environment, and the culture of the country are important elements that should be considered in research about this phenomenon. Regarding medical students' perceptions of feedback in medical school, we found that most learners had a positive perception expressed by positive feelings and positive messages. Additionally, our search showed that feedback literacy is a very recent and rarely used term in the medical education field;

therefore an important area for further investigations. Lastly, we were able to identify many gaps in the literature that will be very helpful to guide future researches, such as studying receptiveness to feedback based on academic seniority, the influence of the workplaces, multisite trials, and feedback literacy long-term impacts on learning.

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Appendix I - Keys and concepts

Search Strategy	**Concept 1**	**Concept 2a**	**Concept 3**	**Concept 4**	**Concept 4**
Natural Language	Feedback	Medical Students	Receptiveness	Culture	Medical school
Subject Heading	Feedback	Students, medical	Receptiveness	Culture	Medical school
Keyword	Feedback or feed back	Medical student* or undergraduate medical student*	Receiv* or recept* or accept* or engage* or experience* or perception*	Culture	Medical school or medicine

Appendix II - List of excluded articles

	Title	Authors	Published Year
1.	Educating Medical Students in Receiving Feedback: The Importance of Self-Reflection	Oliveira, D; Tulloch, E; Xu, NN	2020
2.	Improving feedback for medical students in a family medicine clerkship.	White, DG; Tiberus, R; Talbot, Y; Schiralli, V; Rickett, M	1991
3.	Emotions as student feedback.	Belch, Karin; Law, Susan	2018
4.	Improving medical student feedback with a clinical encounter card.	Ozuah, Philip O; Reznik, Marina; Greenberg, Larrie	2007
5.	Feedback in clinical education: untying the Gordian knot.	Weinstein, Debra F	2015
6.	Receiving feedback from peers: medical students' perceptions.	Burgess, Annette; Mellis, Craig	2015
7.	Twelve tips for making the best use of feedback.	van der Leeuw, Renee M; Slootweg, Irene A	2013
8.	Finessing Feedback: Recommendations for Effective Feedback in the Emergency Department.	Buckley, Catherine; Natesan, Sreeja; Breslin, Adam; Gottlieb, Michael	2020
9.	Which factors, personal or external, most influence students' generation of learning goals?.	Eva, Kevin W; Munoz, Juan; Hanson, Mark D; Walsh, Allyn; Wakefield, Jacqueline	2010
10.	The Feedback Tango: An Integrative Review and Analysis of the Content of the Teacher-Learner Feedback Exchange.	Bing-You, Robert; Varaklis, Kalli; Hayes, Victoria; Trowbridge, Robert; Kemp, Heather; McKelvy, Dina	2018
11.	Teaching feedback to first-year medical students: long-term skill retention and accuracy of student self-assessment.	Kruidering-Hall, Marieke; O'Sullivan, Patricia S; Chou, Calvin L	2009
12.	A Broader Theoretical Model for Feedback in Ambulatory Care.	Smith, C. Scott; Francovich, Chris; Gieselman, Janet; Servis, Mark	1998
13.	Motivation and emotion predict medical students' attention to computer-based feedback.	Naismith, Laura M; Lajoie, Susanne P	2018
14.	An Extended Validity Argument for Assessing Feedback Culture.	Rougas, Steven; Clyne, Brian; Cianciolo, Anna T; Chan, Teresa M; Sherbino, Jonathan; Yarris, Lalena M	2015
15.	Barriers to effective feedback in undergraduate medical education: Case study from Saudi Arabia.	Alrebish, Saleh Ali	2018
16.	Feedback: the complexity of self-perception and the transition from 'transmit' to 'received and understood'.	Murdoch-Eaton, Deborah	2012
17.	[About the feedback between medicine and culture].	Danek, K	1999
18.	A workshop in feedback improves learning and changes the teaching culture.	Dubi, Aweke Y.; Becker, Deborah; Tekian, Ara	2015
19.	Feedback mapping - The curricular cornerstone of an "educational alliance"	Murdoch-Eaton, D; Bowen, L	2017
20.	Feedback as a spectrum: The evolving conceptualisation of feedback for learning	Govender, I; Archer, E	2021
21.	Medical student strategies for actively negotiating hierarchy in the clinical environment.	Vanstone, Meredith; Grierson, Lawrence	2019
22.	A Proposed Conceptual Framework and Investigation of Upward Feedback Receptivity in Medical Education.	Kost, Amanda; Combs, Heidi; Smith, Sherilyn; Klein, Eileen; Kritek, Patricia; Robins, Lynne; Cianciolo, Anna T; Butani, Lavjay; Gigante, Joseph; Ramani, Subha	2015
23.	Holistic feedback approach with video and peer discussion under teacher supervision.	Hunukumbure, Agra Dilshani; Smith, Susan F; Das, Saroj	2017
24.	Feedback sandwiches affect perceptions but not performance.	Parkes, Jay; Abercrombie, Sara; McCarty, Teresita	2013
25.	Evaluating Core Clerkships: Lessons Learned From Implementing a Student-Driven Feedback System for Clinical Curricula.	Russel, Sarah M; Geraghty, Joseph R; Kobayashi, Kenji R; Patel, Savan; Stringham, Richard; Hyderi, Abbas; Curry, Raymond H	2021
26.	Music lessons: revealing medicine's learning culture through a comparison with that of music.	Watling, Christopher; Driessen, Erik; van der Vleuten, Cees P M; Vanstone, Meredith; Lingard, Lorelei	2013
27.	General practitioners' and students' experiences with feedback during a six-week clerkship in general practice: a qualitative study.	Gran, Sarah Frandsen; Braend, Anja Maria; Lindbaek, Morten; Frich, Jan C	2016
28.	Understanding constructive feedback: a commitment between teachers and students for academic and professional development.	Hamid, Yasir; Mahmood, Sajid	2010
29.	Going beyond 'received and understood' as a way of conceptualising feedback.	Ajjawi, Rola	2012
30.	Providing and Receiving Feedback: It Takes Two to Tango!	Deitte, Lori A.; Swanson, Jonathan O.; Gunderman, Richard B.; Shenoy-Bhangle, Anuradha S.	2019

31. Giving feedback to learners in the practice.	Moorhead, Robert; Maguire, Peter; Thoo, Siew Lee	2004
32. Tutor training, evaluation criteria and teaching environment influence students' ratings of tutor feedback in problem-based learning.	Baroffio, Anne; Nendaz, Mathieu R; Perrier, Arnaud; Vu, Nu V	2007
33. Undergraduate medical students: who seeks formative feedback?.	Sinclair, Hazel K; Cleland, Jennifer A	2007
34. Feedback as Key Element of a New Culture of Teaching and Learning Part I: Theoretical Background	Brunner, A; Armstrong, E	2010
35. Interns' perceptions of performance feedback.	Ibrahim, Joseph; MacPhail, Aleece; Chadwick, Liam; Jeffcott, Shelly	2014
36. Perceived Retaliatory Evaluations of Faculty by Learners and Their Effect on the Culture of Feedback.	Vora, S.; Williams, S.; De Boer, K.; Monrad, S.; Kamin, C.; Harris, I.	2015

Appendix III - PRISMA-ScR checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	23
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	24
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	26-29
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	26-29
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	Done. Access by contacting first author through email.
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	29-33
Information sources	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	29-33
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Done. Access by contacting first author through email.
Selection of sources of evidence	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	34-35
Data charting process	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	35-36
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	NA
Critical appraisal of individual sources of evidence	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	NA
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	41-60
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	34 and Appendix V
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Appendix V
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	NA
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Done. Access by contacting first author through email.
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	41-60
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	55-60
Limitations	20	Discuss the limitations of the scoping review process.	60-61

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	61
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	No source of funding

Appendix IV - Data extraction instrument template

Article	**Options**
Study ID	
Title	
First author (Last, First names)	
Year of publication	
Journal	
Country	Canada, US, Australia, England, other (specify)
Type of article	Original, Review, Letters or opinions, other (specify)
Study methodology	Qualitative Description, Interpretive Description, Grounded Theory, Phenomenology, Focused Ethnography, Case Study (qualitative), Mixed Methods, RCT, Cohort, Case-control, Cross-sectional, Meta-analysis, Scoping Review, Narrative Review, Other (specify)
Aim of the study	
Population	Pre-clerk, Clerk, Medical students (not specified), Other (specify)
Context	Medical school, Other than medical school (specify)
Total number of participants	
Data collection method	Survey, Individual interviews, Focus group, Observation, Documents/Chart, Videotapes, Other (specify)
Intervention	
Intervention outcome	
Definition of feedback	
Feedback provider	Teacher/Instructor, Peer, Patient, Self-reflection, Other (specify)
Type of feedback	Written, Oral, Video, Cards, Computer, Other (specify)
Focus of feedback	Communication, Procedural, Teaching, Clinical, Other (specify)
Evaluation of the impact of the feedback	Learners' reaction, Difference in learning before/after, Changes in behaviour, Chart review, Other (specify)
Medical students' perceptions of the feedback received	Positive, Negative, Neutral
Definition of receptiveness to feedback	
Factors related to receptiveness to feedback (influencing factors, barriers)	
Factors described as related to the feedback culture in the medical school	
Factors described as related to the culture of receptiveness to feedback in the medical school	
Definition of feedback literacy	
How feedback literacy has been taught	Workshops from students to students, Workshops from students to teachers, Workshops from teachers to teachers, Workshops from teachers to students, Other (specify)
Gaps suggested in the article	

Appendix V - Examples of data analysis from text to codes

Factors related to medical students' receptiveness to feedback		
Article **First author / Year**	**Text (quotes)**	**Codes**
Watling, C. 2014	"To win a learners' attention and become influential, feedback must survive a critical judgement of its credibility."	Feedback credibility
Kim, J. 2014	"Most of all, students hoped for systematic feedback and timely feedback."	Systematic feedback Timely feedback
Suhoyo, Y. 2014	"Students perceived feedback from specialists and residents as more instructive than feedback from nursing and paramedical"	Instructive by specialists Instructive by residents
Brouwers, M. 2019	"The reception of feedback is influenced by the students' emotional reaction, the time interval within the feedback is given, or the perceived credibility of the feedback provider"	Students' emotional reaction Timing of feedback Provider's credibility
Ramani, S. 2019	"Self-factors that could influence feedback seeking and acceptance include: mind-set, goal-orientation, self-aware-ness, self-efficacy, and autonomy."	Mind-set Goal-orientation Self-awareness Self-efficacy Autonomy
Saeed, M. 2020	"Many socio-cultural factors influence students' satisfaction with feedback."	Socio-cultural factors
Matthews, A. 2021	"As students progress through medical school, their engagement with feedback improves due to factors such as their increasing clinical skills and knowledge"	Student maturity
Medical students' perceptions of feedback in medical school		
White, D. 1991	"Frequency of feedback was strongly correlated with the students' perception of the usefulness of feedback to their learning"	Frequency Useful
Murdoch-Eaton, D. 2012	"They reported the most useful feedback as being constructively critical and providing specific information on ways to improve"	Constructive Critical Specific
Robertson, A. 2017	"Students within all focus groups perceived timely feedback as an opportunity for improvement."	Timely
Ansari, T. 2018	"67.8% of student reported frustration because of limited feedback."	Frustration Limited feedback
Rassos, J. 2019	"Despite the universal perception that feedback is scarce, interviews revealed that feedback does occur"	Not scarce
Kiger, M. 2020	"The overall student perceptions of the feedback they received were positive"	Positive
Areemit, R. 2021	"Students viewed positive feedback as feedback that was specific and guided learning, regardless of the positivity or negativity of the tone."	Specific Guided

Appendix VI - Included articles

Title	Authors	Published Year	Journal
1. OSCE Feedback: A Randomized Trial of Effectiveness, Cost-Effectiveness and Student Satisfaction	Taylor, Celia A; Green, Kathryn E	2013	Creative Education
2. Why medical educators may be failing at feedback.	Bing-You RG; Trowbridge RL	2009	JAMA
3. Framing of feedback impacts student's satisfaction, self-efficacy and performance.	van de Ridder JM; Peters CM; Stokking KM; de Ru JA; Ten Cate OT	2015	Adv Health Sci Educ Theory Pract
4. Providing feedback to students on clinical skills by using the Objective Structured Clinical Examination.	Black NM; Harden RM	1986	Med Educ
5. Learning/feedback activities and high-quality teaching: perceptions of third-year medical students during an inpatient rotation.	Torre, Dario M; Simpson, Deborah; Sebastian, James L; Elnicki, D Michael	2005	Academic medicine: journal of the Association of American Medical Colleges
6. Guidelines: the do's, don'ts and don't knows of feedback for clinical education.	Lefroy, Janet; Watling, Chris; Teunissen, Pim W; Brand, Paul	2015	Perspectives on medical education
7. "It's yours to take": generating learner feedback literacy in the workplace.	Noble C; Billett S; Armit L; Collier L; Hilder J; Sly C; Molloy E	2020	Adv Health Sci Educ Theory Pract
8. Feedback: a key feature of medical training.	Wood BP	2000	Radiology
9. Twelve tips to promote a feedback culture with a growth mind-set: Swinging the feedback pendulum from recipes to relationships.	Ramani S; KÃ¶nings KD; Ginsburg S; van der Vleuten CPM	2019	Med Teach
10. Cognition, culture, and credibility: deconstructing feedback in medical education.	Watling C	2014	Perspect Med Educ
11. Factors influencing responsiveness to feedback: on the interplay between fear, confidence, and reasoning processes.	Eva KW; Armson H; Holmboe E; Lockyer J; Loney E; Mann K; Sargeant J	2012	Adv Health Sci Educ Theory Pract
12. The teacher-student partnership: exploring the giving and receiving of feedback.	Rodriguez, Teresa; Liu, Yi A; Veerapen, Kiran	2015	Medical education
13. Feedback for Learners in Medical Education: What Is Known? A Scoping Review	Bing-You, R; Hayes, V; Varaklis, K; Trowbridge, R; Kemp, H; McKelvy, D	2017	ACADEMIC MEDICINE
14. Impact of tailored feedback in assessment of communication skills for medical students.	Uhm, Seilin; Lee, Gui H; Jin, Jeong K; Bak, Yong I; Jeoung, Yeon O; Kim, Chan W	2015	Medical education online
15. Evaluating the performance of the Minute Feedback System: A web-based feedback tool for medical students.	Georgoff, Patrick E; Shaughness, Gabrielle; Leininger, Lisa; Nikolian, Vahagn C; Sandhu, Gurjit; Reddy, Rishindra; Hughes, David T	2018	American journal of surgery
16. Tensions in post-examination feedback: information for learning versus potential for harm.	Ryan, Anna; McColl, Geoffrey J; O'Brien, Richard; Chiavaroli, Neville; Judd, Terry; Finch, Sue; Swanson, David	2017	Medical education
17. Introduction of Feedback for Better Learning	Bajaj, JK; Kaur, K; Arora, R; Singh, SJ	2018	JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH
18. Third-year medical students' and clinical teachers' perceptions of formative assessment feedback in the simulated clinical setting	Abraham, RM; Singaram, VS	2016	AFRICAN JOURNAL OF HEALTH PROFESSIONS EDUCATION
19. Training Undergraduates Skills in Breaking Bad News: How Students Value Educators' Feedback.	Brouwers, Marianne; van Weel, Chris; Laan, Roland; van Weel-Baumgarten, Evelyn	2019	Journal of cancer education : the official journal of the American Association for Cancer Education

20. Challenging feedback myths: Values, learner involvement and promoting effects beyond the immediate task.	Molloy, Elizabeth; Ajjawi, Rola; Bearman, Margaret; Noble, Christy; Rudland, Joy; Ryan, Anna	2020	Medical education
21. An investigation of medical student reactions to feedback: a randomised controlled trial.	Boehler, Margaret L; Rogers, David A; Schwind, Cathy J; Mayforth, Ruth; Quin, Jacquelyn; Williams, Reed G; Dunnington, Gary	2006	Medical education
22. Effective Feedback, An Essential Component of All Stages in Medical Education	Ludeke, AK; Olaya, JFG	2020	UNIVERSITAS MEDICA
23. Have you had your feedback today?	Kogan, J R; Bellini, L M; Shea, J A	2000	Academic medicine : journal of the Association of American Medical Colleges
24. Formative feedback to students: the mismatch between faculty perceptions and student expectations.	Perera, Jennifer; Lee, Nagarajah; Win, Khin; Perera, Joachim; Wijesuriya, Lionel	2008	Medical teacher
25. Barriers to feedback in undergraduate medical education. Male students' perspective in Central Saudi Arabia.	Al-Haqwi, Ali I; Al-Wahbi, Abdullah M; Abdulghani, Hamza M; van der Molen, Henk T	2012	Saudi medical journal
26. Engaging medical students in the feedback process.	Rogers, David A; Boehler, Margaret L; Schwind, Cathy J; Meier, Andreas H; Wall, Jarrod C H; Brenner, Michael J	2012	American journal of surgery
27. An encounter card system for increasing feedback to students.	Paukert, Judy L; Richards, Melanie L; Olney, Cynthia	2002	American journal of surgery
28. What kind of feedback do medical students want?	Kim, Jong-Yeup; Na, Baeg Ju; Yun, Jungmin; Kang, Jaegu; Han, Seungyeon; Hwang, Wonmin; Hur, Yera	2014	Korean journal of medical education
29. Report from an Effort to Optimize Feedback in Undergraduate Psychiatry Training.	Nasir, Stefan; Oster, Caisa; Ramklint, Mia	2020	Academic psychiatry : the journal of the American Association of Directors of Psychiatric Residency Training and the Association for Academic Psychiatry
30. Introduction of Structured Feedback to Medical Undergraduate Students in the First Professional	Gupta, K; Badyal, D; Mahajan, R; Singla, G; Goyal, R; Kaur, H; Singla, B; Ahi, RS	2021	INTERNATIONAL JOURNAL OF APPLIED AND BASIC MEDICAL RESEARCH
31. The Art (and Artifice) of Seeking Feedback: Clerkship Students' Approaches to Asking for Feedback	Bing-You, R; Hayes, V; Palka, T; Ford, M; Trowbridge, R	2018	ACADEMIC MEDICINE
32. Potential of feedback during objective structured clinical examination to evoke an emotional response in medical students in Canada.	Karol, Dalia Limor; Pugh, Debra	2020	Journal of educational evaluation for health professions
33. Students' Feedback about Feedback; Have our PBL tutors started the shift towards a dialogic ask-tell-ask approach?	Saeed, Majda; Isnani, Arthur C; Khan, Samina A; Khamis, Nehal	2020	Pakistan journal of medical sciences
34. Response to: An educational intervention to increase student engagement in feedback. McGinness HT, Caldwell PHY, Gunasekera H, et al. Med Teach. 2020.	Ali, Georgina; Shah, Shahini; Soni, Nikita	2021	Medical Teacher
35. Implementing feedback cards in core clerkships.	Kogan, Jennifer R; Shea, Judy A	2008	Medical education
36. Integrating students' reflection-in-learning and examination performance as a method for providing educational feedback.	Devi, V; Mandal, T; Kodidela, S; Pallath, V	2012	Journal of postgraduate medicine
37. Making sense of feedback experiences: a multi-school study of medical students' narratives.	Urquhart, Lynn M; Rees, Charlotte E; Ker, Jean S	2014	Medical education
38. Perceptions of medical school faculty members and students on clinical clerkship feedback.	Gil, D H; Heins, M; Jones, P B	1984	Journal of medical education

39. Medical Student Perceptions of Learner-Initiated Feedback Using a Mobile Web Application.	Robertson, Amy C; Fowler, Leslie C	2017	Journal of medical education and curricular development
40. Assessment, feedback and the alchemy of learning.	Watling, Christopher J; Ginsburg, Shiphra	2019	Medical education
41. Integrating 360Â° behavior-orientated feedback in communication skills training for medical undergraduates: concept, acceptance and students' self-ratings of communication competence.	Engerer C; Berberat PO; Dinkel A; Rudolph B; Sattel H; Wuensch A	2016	BMC Med Educ
42. Importance of incorporating teaching of feedback skills into medical curricula Reply	Burgess, A; Mellis, C	2016	ADVANCES IN MEDICAL EDUCATION AND PRACTICE
43. Triangulation of written assessments from patients, teachers and students: useful for students and teachers?	Gran, Sarah Frandsen; Braend, Anja Maria; Lindbaek, Morten	2010	Medical teacher
44. Improving Feedback for Medical Students in a Family Medicine Clerkship: Evaluating medical student performance using frequent feedback.	White, D G; Tiberius, R; Talbot, Y; Schiralli, V; Rickett, M	1991	Canadian family physician Medecin de famille canadien
45. Simple feedback notes enhance specificity of feedback to learners.	Schum, Timothy R; Krippendorf, Robert L; Biernat, Kathy A	2003	Ambulatory pediatrics : the official journal of the Ambulatory Pediatric Association
46. Instructiveness of feedback during clerkships: influence of supervisor, observation and student initiative.	Van Hell, Elisabeth A; Kuks, Jan B M; Raat, A N Janet; Van Lohuizen, Mirjam T; Cohen-Schotanus, Janke	2009	Medical teacher
47. Am I ready for it? Students' perceptions of meaningful feedback on entrustable professional activities	Duijn, CCMA; Welink, LS; Mandoki, M; ten Cate, OTJ; Kremer, WDJ; Bok, HGJ	2017	PERSPECTIVES ON MEDICAL EDUCATION
48. Barriers to the uptake and use of feedback in the context of summative assessment.	Harrison, Christopher J; Konings, Karen D; Schuwirth, Lambert; Wass, Valerie; van der Vleuten, Cees	2015	Advances in health sciences education : theory and practice
49. The "educational alliance" as a framework for reconceptualizing feedback in medical education.	Telio, Summer; Ajjawi, Rola; Regehr, Glenn	2015	Academic medicine : journal of the Association of American Medical Colleges
50. Exploring cultural differences in feedback processes and perceived instructiveness during clerkships: replicating a Dutch study in Indonesia.	Suhoyo, Yoyo; van Hell, Elisabeth A; Prihatiningsih, Titi S; Kuks, Jan B M; Cohen-Schotanus, Janke	2014	Medical teacher
51. Educating Medical Students in Receiving Feedback: The Importance of Self-Reflection [Response to Letter].	Matthews, Andrew; William, Jeffrey H	2021	Advances in medical education and practice
52. Feedback using an ePortfolio for medicine long cases: quality not quantity.	Bleasel, Jane; Burgess, Annette; Weeks, Ruth; Haq, Inam	2016	BMC medical education
53. An educational intervention to increase student engagement in feedback.	McGinness, Hannah T; Caldwell, Patrina H Y; Gunasekera, Hasantha; Scott, Karen M	2020	Medical teacher
54. Online assessment: what influences students to engage with feedback?	Stone, Alan	2014	The clinical teacher
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92. Unfulfilled promise, untapped potential: feedback at the crossroads.	Watling, Christopher J	2014	Medical teacher
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CHAPTER THREE

SURVEY STUDY

Title: Surveying undergraduate medical students' motivational orientations and learning strategies in the first and last year of medical school

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Transitional summary

In Chapter Two, I conducted a scoping review to map the current literature in medical students' receptiveness to feedback and feedback literacy, provide an overview of factors related to it, and identify gaps for future research. Some of the factors that I found were related to the students themselves (i.e., students' characteristics, students' self-assessment, students' emotional reaction, and students' maturity). Some of the areas that were identified as needing further investigation were the influence of self-regulation theories, students' confidence, and students' learning maturity on feedback literacy. Based on that, I decided to conduct a study to identify which specific learning factors related to the students could influence feedback literacy, so we could act on those factors to facilitate students' feedback literacy skills. To do that, first, I had to assess what were the learning characteristics and abilities in my population, in my sample. Thus, I looked at different instruments that could assess students learning characteristics and abilities. The Motivated Strategies for Learning Questionnaire (MSLQ) showed to be an appropriate instrument to portrait the students' learning characteristics and abilities in my sample by assessing the constructs motivational orientations and learning strategies. I also decided to look at students' learning motivations and strategies in different academic years in medical school because previous studies showed that students enhance their metacognitive skills as they advance in their academic years. Therefore, Chapter Three is a cross-sectional survey that aimed at describing and analyzing differences in undergraduate medical students' motivational orientations and learning strategies in their first and last year of medical school, using the MSLQ. The results of this study enriched my knowledge about the participants and the context

of this thesis, and they were used to select participants for the qualitative phase of the mixed methods study described in Chapter Four.

Abstract

Motivation to learn has been linked to learning outcomes, academic performance, learner well-being and choice of medical specialty. Previous studies showed successful educational interventions to optimize students' levels of motivation and learning strategies. The purposes of this study are: (1) to describe undergraduate medical students' motivational orientations and learning strategies in the first and last year at a Canadian university, (2) to analyze possible differences between undergraduate medical students' motivational orientations and learning strategies in those two academic years. An online cross-sectional survey was conducted using the Motivated Strategies for Learning Questionnaire (MSLQ). The survey was sent to a total of 207 first-year and 203 third-year students. We received a total of 58 surveys, with an adjusted response rate of 14.4%. The internal consistency for all the scales varied from 0.61 to 0.904. The overall score for the survey was 4.97 on a 7-point scale for all students. The total scores did not differ by students' academic year ($p=0.764$), except for the effort regulation scale in which first year students scored higher ($p=0.01$). Our results showed a sample of students that are highly motivated, mostly driven by intrinsic goals, and are confident that they will master the tasks given to them. They rely more on elaboration strategies building connections between new and prior information, and less in rehearsal strategies used for simple tasks and memorization. The MSLQ showed to be a reliable instrument in our sample, and it could be use as an instrument to identify students' adaptive changes to enhance students' motivation to learn. A portrayal of medical students' attitudes in learning could guide educators to develop instructional programs that would help students to optimize their own learning.

Funding

There are no sources of funding for this survey.

Conflicts of interest

There is no conflict of interest in this project.

Ethics approval and consent to participate

The Hamilton Integrated Research Ethics Board (HiREB) has reviewed and approved this study (project ID 16097).

Key Words

Survey, medical education, medical school, motivational orientations, learning strategies.

Introduction

Studies have extensively examined the role of motivation in learning.[1,2] In medical education, the interest in motivation in learning has increased in the last two decades.[3–8] Motivation to learn can be defined as the process to initiate and achieve a goal-directed activity, and definitions often included associated terms, such as goal orientation, interest, attribution, self-competence, and self-efficacy.[1,9] Theoretical foundations have been developed to explain how motivation might influence learning behaviour and academic performance, and how learner motivation may be influenced by educational curriculum, teachers, and students' age, gender and previous learning experiences.[1,3] Contemporary theories about motivation to learn commonly include the following concepts: self-efficacy, task value, goal, mastery goal mindset, performance goal mindset, intrinsic motivation, and cause of action.[1] Additionally, these theories tend to be socio-cognitive, meaning that motivation is not an individual phenomenon, but a process that involves interactions between the individual and their social context.[1] Moreover, previous theories suggested that, when the goal is to increase students' motivation to learn, the quantity of motivation (e.g., questionnaires' scores) and the quality of motivation (e.g., types of motivation, types of goal orientation, different beliefs) should be evaluate.[4] Although motivation to learn and learning strategies can be assessed as different constructs, these terms intersect because students' levels of motivation may influence learning strategies, and learning strategies could be changed in order to increase motivation to learn.[3,10]

Strategies to improve motivation to learn is specially important in medical education since it seems to be related not only to academic performance, but also learner well-being, and

satisfaction; all essential elements for medical proficiency, and life-long learning.[3,5,6,8] Additionally, motivation seems to influence the choice of medical specialty and it is related to students' intentions to continue medical studies.[3] Strategies to enhance students' motivation to learn may include regulate their learning in four areas: cognition, motivation, behaviour, and context.[7] Specifically within the motivation area, students could regulate their learning by setting criterion for comparison, self-monitoring their motivation, using feedback to monitor effectiveness, and selecting strategies for managing motivation and affect. Therefore, self-regulated students show motivational orientations and learning strategies that are goal-directed and informed by metacognition from self and others. Students' motivation to learn may also be affected by students' learning experience.[10,11] Novice learners, individuals less mature in approaches to learning either due to less exposure to the field of training or due to younger age, have poorly developed metacognitive skills and less capacity to assess their own learning goals when compared to senior learners; therefore, affecting their learning regulation and motivation.

Other factors that could affect students' motivation in medical school include teacher support, type of curriculum, students' self-efficacy, perceived task value, and early patient contact.[3] In contrast, the degree or presence of motivation may also affect academic success and performance, and learning and study behaviours.[3] Particularly looking at the influence of the medical education curriculum in students' motivation, it seems that the Problem-Based Learning (PBL) model [12–14] improves students' motivation to learn, especially by stimulating intrinsic motivation among medical students, and by increasing student's autonomy and satisfaction.[4,5,14] While it is important to understand the influence of motivation in medical education, it is, perhaps, more important to know that there are several studies showing successful educational interventions to optimize students' levels of motivation.[4,8,15–17] Sandars and Timothy [8]

highlighted the importance of training students to become more strategic thinkers, but also, being able to make adjustments to their learning strategies when needed, as a way to keep students motivated to learn. They suggested that students should be taught to shift their forethought goals from processes (when they are first learning a task) to outcome (after they mastered the task), select a strategy to achieve these goals, and make adaptive changes based on internal and external feedback. Sandars [15] described a successful intervention using the self-reporting Motivated Strategies for Learning Questionnaire (MSLQ) as a guide during students' tutorial sessions. The idea was to enhance students' motivation to learn through discussion and self-reflection on task strategies (time management, study techniques, environmental management) and self-motivational beliefs (self- efficacy, intrinsic interest). Moreover, some authors suggested that medical curriculum should be designed to enhance students' intrinsic motivation to learn adopting strategies such as enhancing students' autonomy in learning, supporting their need for competence, and stimulating their capacity to be related to others through work [4]. Additionally, it seems that some curriculum models (i.e., PBL, integrated curriculum, and experienced-based learning) facilitate students' motivation to learn.[4,5,12,14]

Together these findings suggest that students' levels of motivation may influence learning behaviours, academic achievements, performance success, professional accomplishments, and life-long learning. More importantly, students can benefit from programs that maximize their learning motivations and strategies, and medical curriculum can take into account the effects of motivation to learn to support students' short and long-term learning.

The purposes of this study are: (1) to describe undergraduate medical students' motivational orientations and learning strategies in the first and last year at a Canadian university, (2) to analyze possible differences between undergraduate medical students'

motivational orientations and learning strategies in those two academic years. We aimed at answering the overarching research question: *What are the motivational orientations and learning strategies among students enrolled in their first and last years of undergraduate medical education at a Canadian university*? We hypothesized that last-year medical students would score higher than first-year medical students on all scales because previous studies suggested that students increase learning motivation and improve strategies to learn as they advance in school.[3,7,8,10,11]

Methods

A cross-sectional survey was conducted following Phillips et al [18] survey methods design. This design was chosen because it is a concise, practical, and straightforward approach, it was written by authors from the health science domain, and it focuses on health professional audiences. Additionally, the Consensus-Based Checklist for Reporting of Survey Studies (CROSS)[19] was used as a guide to increase the quality in the reporting of this survey study. See Appendix I – CROSS checklist.

Instrument

We used the Motivated Strategies for Learning Questionnaire (MSLQ) to survey medical students at a Canadian university and identify students' motivational orientation and learning strategies. See Appendix II - Motivated Strategies for Learning Questionnaire (MSLQ). The MSLQ has been widely used as an instrument to assess students' motivational orientations and their use of different learning strategies.[20–23] We intended to measure the students' attitudes and

beliefs towards the constructs: students' motivation to learn and students' learning strategies. Each of these constructs can be broken down in different aspects that can be separately assessed: goal orientation, task value, learning believes, self-efficacy, test anxiety, rehearsal, elaboration, organization, critical thinking, self-regulation, time and study environment, effort regulation, peer learning, and help seeking. See Table 1 – Description of MSLQ scales.

Table 1 - Description of MSLQ scales. Based on Pintrich PR., de Groot E V.[21]

Scales	Description
Motivation	
Value component	
Intrinsic goal orientation	Student perceives oneself to be participating in a task for reasons such as challenge, curiosity, and mastery. It indicates that the student's participation in the task is an end all to itself.
Extrinsic goal orientation	Student perceives oneself to be participating in a task for reasons such as grades, rewards, performance, evaluation by others, and competition. It indicates that the student's participation in the task is the means to an end.
Task value	Refers to how interesting, how important, and how useful the talk is for the student.
Expectancy component	
Control of learning beliefs	Students believe that their efforts to learn will result in positive outcomes and it will make a difference in their learning.
Self-efficacy	Self-efficacy includes judgments about one's ability to accomplish a task as well as one's confidence in one's skills to perform that task.
Affective component	
Test Anxiety	Students' negative thoughts that disrupt performance, cognitive concern and preoccupation with performance.
Learning strategies	
Cognitive and metacognitive strategies	
Rehearsal	Rehearsal strategies involve reciting or naming items from a list to be learned, and they are best used for simple tasks and activation of information in working memory.
Elaboration	Paraphrasing, summarizing, creating analogies, and generative note taking. It helps students to store information into long-term memory by building internal connections between items to be learned.
Organization	Clustering, outlining, and selecting the main idea in reading passages.
Critical thinking	Refers to the degree to which students report applying previous knowledge to new situations in order to solve problems, reach decisions, or make critical evaluations with respect to standards of excellence.
Self-regulation	Refers to the awareness, knowledge, and control of cognition through planning, monitoring, and regulating. Regulating activities are assumed to improve performance by assisting learners in checking and correcting their behaviour as they

	proceed on a task.
Resources management	
Time and study environment	Time management and setting where the student studies.
Effort regulation	Students' ability to control their effort and attention in the face of distractions and uninteresting tasks.
Peer learning	Collaboration with one's peers.
Help seeking	Seeking support of others.

The MSLQ has 15 scales that have been designed to be modular, so they can be used together or singly (to assess each of the different aspects listed above). The questionnaire total score is calculated by taking the mean of all the items that make up the scales. The total score is a measure of the student' motivation to learn and learning strategies. We used 13 scales with a total of 67 items. We did not use the *Task Value* scale and the *Time and Study Environment scale* because, after a panel of expert review and pilot study, we decided that these aspects were not relevant for our study and context. The motivation section consists of 25 items and the learning strategy section includes 42 items. The items have the closed-ended response Likert-type format (from 1 – Not at all true for me, to 7 – Very true for me). The last survey section included a demographic section to analyse: age (18-24, 25-34, >35 years old), medical school academic year (1st, 3rd, other), and previous undergraduate education (open-ended question).

Instrument pretesting

An expert panel, consisting of three experts in survey designs and health science education, reviewed the questionnaire. We created a rating scale for each of the constructs being assessed. Each expert rated the clarity and relevance of each item within the constructs and commented about the survey as a whole indicating any important characteristic that was inadequately represented in the survey. We made minor revisions on some of the items' wording in order to fit the questionnaire to our institution context and to make it clearer. Then, we piloted

the questionnaire with five undergraduate medical students to assess clarity, relevance, and reliability. Based on their comments, we made minor modifications, such as adding terms that were more familiar to them and adding an open-ended question at the end. We used the IBM SPSS Statistics software Version 28.0.1.1.[24] to calculate the scores (means), standard deviations (SDs), and Cronbach's alphas (for internal consistency across items reliability) for each scale and for the survey as a whole. The removal of the scales extrinsic goal orientation and rehearsal increased the whole survey reliability for this sample (Cronbach alpha from 0.404 to 0.773). We hypothesized that those results could be due to our sample characteristics or small sample size. The internal consistency reliabilities for each scale, separately, were considered acceptable, as measured by Cronbach alpha above 0.65. Although some authors suggested a value of alpha >0.7 to be considered acceptable [18] we based our decision comparing the results from other studies [21,23] and the fact that we had a small pilot sample size. Overall, we considered the final survey version clear, relevant, and reliable for the constructs measured and the pilot population. See Appendix III – Survey final version.

Participants

Participants in our study were medical students at a three-year curriculum program that uses the Problem-Based Learning (PBL) pedagogical approach.[25] We included medical students in their first and third (last) years of medical school because we wanted to compare novice and senior students. Exclusion criterion included medical students in their second year of medical school. There was a total of 207 first- year and 203 third- year students. The literature indicates that for α=0.05 and power of 0.80 we can use a close approximation to the exact formula: Sample Size = 16 x s2/d2 (s is standard deviation and d is the expected group difference).

Relying on prior work by Artino et al. [6] exploring the use of the MSLQ, we proposed an average standard deviation of 0.66 across all domains in the survey. The study by Artino et al. [6] recruited medical students in 2nd year only. Therefore, we proposed an estimated, yet conservative difference of 0.4 between students in first year and those in third year. This resulted in an estimated sample size of 43 to allow sufficient power to detect a group difference. We have rounded this estimate up to 50, ideally 25 first- year students and 25 third- year students.[6,26]

Context

The Undergraduate Medical Education (UGME) program is a three-year curriculum program that uses the PBL approach to learning.[25] The PBL is an instructional method characterized by the use of patient problems as a base for students to learn problem-solving skills to understand the basics and clinical sciences.[13] During the 15-month pre-clinical curriculum, students learn in small groups (6-8 students) of tutorials that are facilitated by a faculty member acting as the tutor for the group. Tutorials take place twice each week, for about 3 hours each time. Between tutorials, large group teaching sessions with expert faculty employ active learning pedagogy to consolidate and review concepts introduced in tutorials. A 63-week clinical curriculum, also known as clerkship, follows the pre-clinical phase. It consists of clinical rotations in medicine, general surgery, orthopedic surgery, family medicine, anesthesia, psychiatry, pediatrics, obstetrics and gynecology, and emergency medicine.

Survey delivery

An online version of the survey was delivered to the students by the UGME program, after the Research Ethics Board (REB) approval. We used LimeSurvey, an online survey system

offered to faculty and students.[27] Participation was anonymous and voluntary, and we used implied consent. No financial incentives were offered. The survey was open for students' access from December 2022 to February 2023, with one reminder in January 2023. Each member of the students' population had an equal chance to participate in the study. To avoid multiple participation of participants, the online platform was preset to allow only one response per browser or email invitation. One participant voluntarily shared our survey link on his social media medical school class webpage.

Data analysis

All statistical analysis was performed using the IBM SPSS Statistics software Version 28.0.1.1.[24] For data analysis purposes, we did not include the partially completed surveys because there were missing necessary information when considering the constructs being measured. Then, for the MSLQ 13 scales, scores were constructed by taking the mean of the items that make up the scale. The student's individual scores for each scale, for each section of the questionnaire, and for the questionnaire as a whole was reported, according to the MSLQ manual.[21] Next, we analyzed our data according to the following types of measures: ordinal (i.e., academic year and age range) and interval (i.e., survey scores). We described demographics and contextual information (age, medical school year, and previous education). Additionally, response rate and nonresponse bias analysis were calculated (*see Results for more details*). Lastly, internal consistency reliability across items was calculated for each scale and for the whole questionnaire using the Cronbach's alpha index.

Results were reported as mean and standard deviations for interval data, and count and percent (%) for nominal and ordinal data. The General Linear Model (ANOVA) was used to

compare the survey scores (means) and the survey scales scores (means) between students in different academic years. Differences were considered statistically significant when p-value was less than 0.05.

Results

Respondents, Response rate, and Nonresponse bias

We received a total of 58 surveys, including 32 completed surveys and 26 partially completed. Among the 32 completed surveys, 12 (37.5%) were from first- and 20 (62.5%) were from last- year undergraduate medical students; 18 (56.3%) students were between 18-24 years old, and 14 (43%) students were between 25-34 years old. Moreover, the majority of students (27 students) reported previous undergraduate education in science (including 2 students in nursing), 3 students reported previous undergraduate education in arts, and 2 in engineering.

Response rate (RR) of 14.14% was calculated and adjusted using the American Association for Public Opinion Research (AAPOR) definition number 6, as suggested by Phillips et al. [18] survey design. The Nonresponse bias (NRB) was calculated using the Proxy Nonrespondent model. We compared the survey scores among the 16 first respondents and 16 last respondents (proxy to nonrespondents) related to the intrinsic goal scale (NRB coefficient= 0.19), the self-regulation scale (NRB coefficient= 0.20), and the survey as a whole (NRB coefficient= 0.10). Therefore, the differences seen in the last respondents on a 7-point scale were 2.7%, 2.8%, and 1.4% respectively, unlikely to have practical significance.

Validity and Reliability

We used The Four Inferences (Kane's) Validity Framework[28] to define the evidence needed for our study. We chose this framework because it includes relevant and contemporary concepts, and it helped us to develop evidence to support our assumptions related to the survey scoring, the combination of various scales, the study's context and generalization, and the implication of our results. See Table 2 – Validity framework.

Table 2 - Validity framework. Based on Kane MT.[28]

Validity Inference	Meaning	Evidence
Scoring	Do the survey scores capture key aspects of students' motivational and learning strategies?	Use of previous instrument Expert panel review Pilot test
Generalization	Does the combination of scales reflect the results across the main constructs been measured?	Internal consistency across items
Extrapolation	Is the study data an accurate representation of the entire scope of the domain been measured?	Description of the context Comparison with other studies measuring the same constructs Comparison with other studies using the same instrument (MSLQ)
Implications	Do students' motivational and learning strategies constitute a rational basis for meaningful decisions and actions?	Impact on learning (encouragement to adjust learning strategies) Impact on teachers (potential improvement in teaching by knowing the students' motivations and learning strategies)

The internal consistency for all the scales, as measured by Cronbach alpha, was considered acceptable, with alpha varying between 0.601 and 0.904. See Table 3 – Scales and survey reliability. When we looked at the Item-Total Statistics for the whole survey, we decided to use 9 (out of 13) scales to compute total students' scores in the survey, in order to increase reliability (from alpha= 0.577 to alpha= 0.770)

Table 3 - Scales and survey reliability

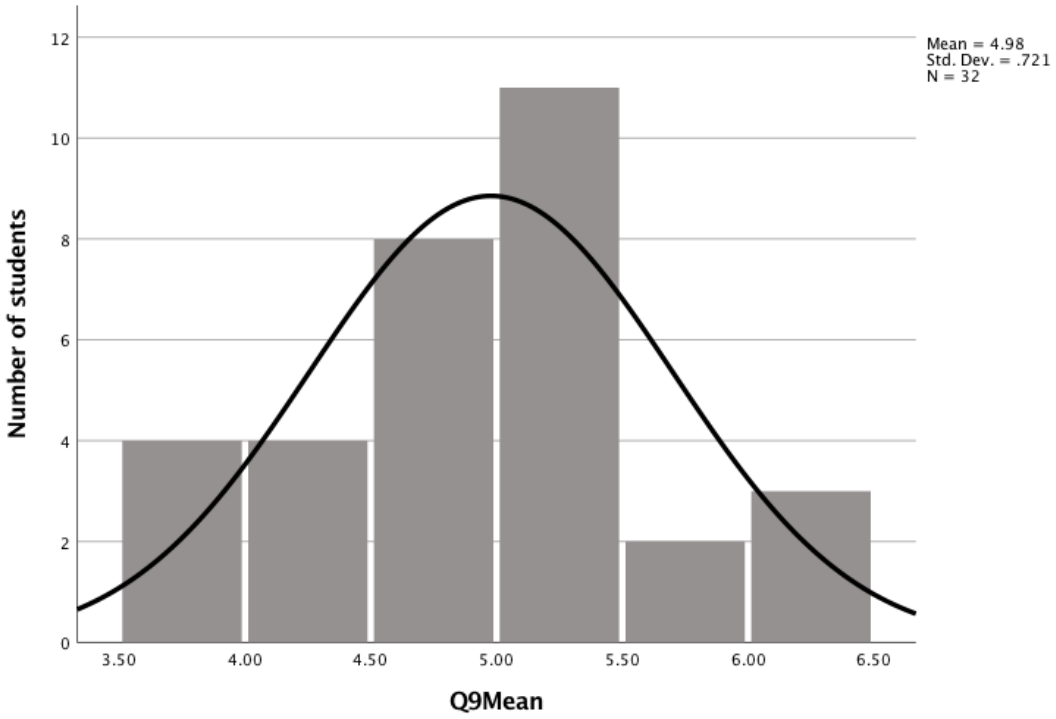
	Number of Items	Cronbach's alpha
Survey		
13 Scales*	67	0.577
9 Scales**	50	0.770
Survey sections		
Motivation	25	0.753
Learning strategies	31	0.659
Scales		
Intrinsic goal	4	0.601
Extrinsic goal	4	0.796
Learning beliefs	4	0.858
Self-efficacy	8	0.863
Test anxiety	5	0.904
Rehearsal	4	0.773
Elaboration	6	0.787
Organization	4	0.834
Critical thinking	5	0.892
Self-regulation	12	0.728
Effort regulation	4	0.761
Peer learning	3	0.873
Help seeking	4	0.614

*Scales: Intrinsic Goal, Extrinsic Goal, Control of learning beliefs, Self-efficacy, Anxiety, Rehearsal, Elaboration, Organization, Critical Thinking, Self-regulation, Effort regulation, Peer Learning, Help Seeking.
**Scales: Intrinsic Goal, Self-efficacy, Elaboration, Organization, Critical Thinking, Self-regulation, Effort regulation, Peer Learning, Help Seeking.

Descriptive analysis

The overall score (mean) for the survey was 4.98, on a 7-point scale, among all the students. See *Picture 1 – Overall survey scores histogram.* For the motivation section the mean was 4.96, and for the learning strategies section the mean was 4.78.

Picture 1 – Overall survey scores histogram



Highest scores were obtained for: elaboration (mean 5.68) and learning beliefs (mean 5.64), with the lowest scores obtained for rehearsal (3.82) and test anxiety (3.94). The largest differences between our study and selected studies [16,21] were found for peer learning (difference of 1.23 and -1.18) and extrinsic goal (difference of -0.96 and -1.29). See 4 - Descriptive statistics and results from comparable studies.

Table 4 - Descriptive statistics and results from comparable studies

Scale	Score Mean	Standard deviation	Score Mean in previous study[21]	Score Mean in previous study[16]
Intrinsic Goal	5.36	.87	5.03	5.48
Extrinsic Goal	4.07	1.54	5.03	5.36
Learning and Beliefs	5.64	1.17	5.74	5.59
Self-efficacy	5.50	.82	5.47	4.89
Anxiety	3.94	1.63	3.63	4.76
Rehearsal	3.82	1.40	4.53	5.08
Elaboration	5.68	.88	4.91	5.53
Organization	4.98	1.43	4.14	5.34
Critical Thinking	4.62	1.36	4.16	5.06
Self-regulation	4.73	.82	4.54	4.96
Effort regulation	5.19	1.13	5.25	5.03
Peer Learning	4.12	1.93	2.89	5.30
Help Seeking	4.59	1.18	3.84	4.85
Motivation section	4.96	0.57	4.98	5.21
Learning strategies section	4.78	0.68	4.28	5.14
Survey*	4.98	0.72	4.55	5.25

*Considering 9 scales: Intrinsic Goal, Self-efficacy, Elaboration, Organization, Critical Thinking, Self-regulation, Effort regulation, Peer Learning, Help Seeking.

[21]Study used to first validate MSLQ. Participants were four-year university and community college students (N=380).

[16]Participants were first and second year medical students in a 5 year undergraduate program (N= 240).

Descriptive analysis by academic year

The overall survey, motivation section, and learning strategies section scores (means) among first- and last (third)- year medical students were, respectively: 5.02 and 4.94, 4.90 and 5.0, 4.84 and 4.74. See Table 5 - Descriptive by academic year.

Table 5 - Descriptive by academic year

Scale	Medical school year	Score Mean	Standard deviation
Intrinsic goal	1st year	5.37	0.82
	3rd year	5.36	0.91
Extrinsic Goal	1st year	3.95	1.35
	3rd year	4.15	1.68
Learning Beliefs	1st year	5.70	0.93
	3rd year	5.61	1.31
Self-efficacy	1st year	5.46	0.78
	3rd year	5.51	0.87
Anxiety	1st year	3.72	1.63
	3rd year	4.0	1.65
Rehearsal	1st year	3.75	1.12
	3rd year	3.86	1.58
Elaboration	1st year	5.81	0.49
	3rd year	5.60	1.05
Organization	1st year	5.14	1.68
	3rd year	4.88	1.30
Critical Thinking	1st year	4.46	1.54
	3rd year	4.72	1.26
Self-regulation	1st year	4.78	0.77
	3rd year	4.70	0.87
Effort regulation	1st year	5.81	0.73
	3rd year	4.82	1.17
Peer Learning	1st year	3.80	1.69
	3rd year	4.31	2.08
Help Seeking	1st year	4.58	1.17
	3rd year	4.59	1.22
Motivation section	1st year	4.90	0.57
	3rd year	5.00	0.58
Learning strategies section	1st year	4.84	0.51
	3rd year	4.74	0.78
Survey*	1st year	5.02	0.56
	3rd year	4.94	0.81

*Considering 9 scales: Intrinsic Goal, Self-efficacy, Elaboration, Organization, Critical Thinking, Self-regulation, Effort regulation, Peer Learning, Help Seeking.

Highest scores for first-year medical students were obtained for: elaboration (mean 5.81), effort regulation (mean 5.80), and learning beliefs (mean 5.70); with lowest scores for: test anxiety (mean 3.72), rehearsal (mean 3.75), and extrinsic goal (mean 3.95). Highest scores for last-year medical students were obtained for: learning beliefs (mean 5.61), elaboration (mean 5.60), and self-efficacy (mean 5.51); with lowest scores

for: rehearsal (mean 3.86), test anxiety (mean 4.08), and extrinsic goal (mean 4.15). The largest differences between first- and last-year medical students were found in effort regulation, where first-years scored higher (difference of 0.99), followed by peer learning (difference of -0.51), then test anxiety (-0.36).

Associations

Total scores (mean) did not differ by students' academic year (p=0.764), age group (p=0.910), or previous undergraduate education (p= 0.639). Scale scores (means) also did not reveal differences due to academic year (p > 0.05). There was one exception for the effort regulation (p=0.01), as first-year students scored higher (mean= 5.81, SD= 0.73) than last- year students (mean= 4.82, SD= 1.17). See Table 6- General Linear Model results. The effect size for the difference seen in effort regulation is 0.8 (Mean first-year – Mean last-year/SD), which is considered large according to Cohen's classification;[29] therefore, the difference might be considered relevant.

Table 6 - General Linear Model results expressed in p-value

	Academic year
Survey	0.764
Motivation section	0.660
Learning strategies section	0.711
Scales	
Intrinsic goal	0.969
Extrinsic goal	0.740
Learning beliefs	0.827
Self-efficacy	0.872
Test anxiety	0.564
Rehearsal	0.841
Elaboration	0.511
Organization	0.630
Critical thinking	0.618
Self-regulation	0.791
Effort regulation	0.014
Peer learning	0.479
Help seeking	0.978

Discussion

The aim of our study was to describe and analyze the students' motivational orientations and learning strategies in the first and last years of medical school at a Canadian university using the self-reporting MSLQ questionnaire.

The overall mean score among first- and last-year medical students was 4.98. This score is similar to the scores of other students who participated in studies also conducted in the context of medical schools,[16,30–32] and higher than the results found by Pintrich et al [21] when the first version of the MSLQ was published to evaluate undergraduate students across five different disciplines. This was expected, considering that medical students are the result of a highly competitive academic selective process; therefore, medical students are, in general, high achieving learners able to show motivational orientations and learning strategies that are goal-directed and informed by metacognition. The teaching and learning context at our university, where PBL is a primary pedagogical strategy, also seems to contribute to a high motivation for learning by stimulating intrinsic motivation, a student's autonomy, and satisfaction.[5,14] When looking at the scales' scores, our results showed that, among the motivation component, self-efficacy and intrinsic goal were higher scored, while extrinsic goal was lower scored, reinforcing the idea that medical students who are engaged in PBL are motivated to learn for the sake of learning, and that they perceive greater control over their own learning.[4,5,14] Among the learning strategies used by our students, elaboration seems to be the main one, while rehearsal and peer learning were the lowest scored. Elaboration helps students to create deep connections and analogies, while rehearsal involves memorization and activation of working memory.

Pintrich et al [21] found a greater difference between elaboration and rehearsal scores in their non-medical students sample, while Lee et al [16] found much closer numbers in their medical students population. We speculate that our result might be due again to the PBL approach to teaching and learning, or the fact that medical students use this learning strategy (elaboration) to increase their metacognitive and motivational dimensions of learning in order to cope with the complexity of the medical curriculum and clinical cases.[3,7,8] Regarding the low score on peer learning (collaboration with one's peers), we noticed that it is still a higher score than the one found by Pintrich et al,[21] but lower than scores found by other studies assessing medical students.[16,18] We hypothesize that peer learning is one of the learning strategies least scored by our sample probably due to the PBL context. The PBL curriculum is structured in small groups of tutorial sessions, and students seem to have a high level of autonomy and control over their own learning.[12,13,33] The students may collaborate to each other during the PBL tutorial sessions, but the PBL approach may also create a sense of independence that could result in less peer collaboration and more individual strategies for learning outside of small group tutorial sessions.

When looking at our sample based on students' academic year, we expected that last year medical students would score higher than first years in all scales because previous studies suggested that students improve their strategies to learn as they advance in school. We were not able to confirm our hypothesis. Additionally, we found that first year medical students scored statistically higher than last years on effort regulation, the opposite of what we have predicted. The finding that there was no statistical difference between the two groups in their overall score and the other scales might be due to our

small sample size. We had calculated an estimated sample size of 43 participants to allow sufficient power to detect a group difference. Although we received 58 surveys back, only 32 were fully completed and considered for analysis. Nevertheless, the difference seen in effort regulation is probably not fully explained by a small sample size. This scale measures the student's ability to control their attention in face of distraction or uninteresting tasks, and we would argue that students' interests and learning skills increase as they advance in medical school, not the opposite. We speculate that our findings might be a result of scale items that are not ideally measuring this construct in our sample (despite of Cronbach's alpha 0.76), or because last year medical students are more focused on the medical specialty of their interest than in learning medicine in general, increasing the amount of uninteresting tasks for them.

Limitations

There are important limitations of our study. Data collection took place in one institution—a medical school in southern Ontario that offers a three year PBL undergraduate medical education program—the unique context of this medical school may limit generalization. Also, despite multiple recruitment strategies to increase participation, we were not able to achieve our desired sample size, which limited our ability to detect significant differences. The low response rate suggests that respondents might not be representative of our student population. Moreover, the analysis of the missing values showed that items at the end of the survey were more likely to be missing than earlier items. It suggested that participants dropped out of the survey before completing it, most likely due to its long length. We couldn't identify missing values

differences between first and last years because the missing values and the demographic section were both at the end of the survey; therefore, we didn't have the academic year information to relate it to the missing values. Lastly, even though we followed a rigorous survey design methodology, self-reported measures might not fully represent participants' beliefs because students might select answers that will show a positive image of themselves. Additionally, socially desirability bias may be higher in first year students.

Future research

We suggest that further research should focus on exploring medical students' motivational orientations and learning strategies across more than one institution, with a larger number of students, using qualitative approaches to explore medical students' motivational orientations to learn, as well as how the medical education curriculum (i.e., different pedagogies) influences or explains students' motivation and learning strategies. Moreover, future research should explore instructional programs that could enhance students' motivational orientations and learning strategies, such as training students to strategically think about their forethought goals processes and outcomes, and discuss adaptive changes based on feedback. The MSLQ could be use as an instrument of students' self-reflection to identify areas where students could change to enhance their motivation to learn. A more complete portrayal of medical students' attitudes in learning could guide educators to develop instructional programs that would help students to optimize their own learning.

Conclusion

Motivational orientations and learning strategies help students to control their learning behaviour, affection, and to improve cognitive strategies to learn. Our results showed a sample of medical students that are highly motivated, especially driven by intrinsic goals, and are confident that they will master the tasks given to them. These students rely more on elaboration strategies to build deep connections between new information and prior knowledge, and less in rehearsal strategies that are best used for simple tasks and memorization. We are unable to confirm whether these results are a representation of medical students in general and the PBL context, or merely a portrayal of our sample. Still, the MSLQ showed to be a reliable instrument to measure motivational orientations and learning strategies in our sample, and our results represent the beliefs of a cohort of medical students in our institution. These results could be further explored in order to optimize students' learning through intervention programs that enhance students' motivation to learn.

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Appendix VII - CROSS checklist

Section/topic	Item	Item description	Reported on page #
Title and abstract			
Title and abstract	1a	State the word "survey" along with a commonly used term in title or abstract to introduce the study's design.	85
	1b	Provide an informative summary in the abstract, covering background, objectives, methods, findings/results, interpretation/discussion, and conclusions.	86
Introduction			
Background	2	Provide a background about the rationale of study, what has been previously done, and why this survey is needed.	88-89
Purpose/aim	3	Identify specific purposes, aims, goals, or objectives of the study.	90-91
Methods			
Study design	4	Specify the study design in the methods section with a commonly used term (e.g., cross-sectional or longitudinal).	91
	5a	Describe the questionnaire (e.g., number of sections, number of questions, number and names of instruments used).	91-93
Data collection methods	5b	Describe all questionnaire instruments that were used in the survey to measure particular concepts. Report target population, reported validity and reliability information, scoring/classification procedure, and reference links (if any).	91-93
	5c	Provide information on pretesting of the questionnaire, if performed (in the article or in an online supplement). Report the method of pretesting, number of times questionnaire was pre-tested, number and demographics of participants used for pretesting, and the level of similarity of demographics between pre-testing participants and sample population.	93-94
	5d	Questionnaire if possible, should be fully provided (in the article, or as appendices or as an online supplement).	Appendix III
Sample characteristics	6a	Describe the study population (i.e., background, locations, eligibility criteria for participant inclusion in survey, exclusion criteria).	94-95
	6b	Describe the sampling techniques used (e.g., single stage or multistage sampling, simple random sampling, stratified sampling, cluster sampling, convenience sampling). Specify the locations of sample participants whenever clustered sampling was applied.	94
	6c	Provide information on sample size, along with details of sample size calculation.	94
	6d	Describe how representative the sample is of the study population (or target population if possible), particularly for population-based surveys.	94
Survey administration	7a	Provide information on modes of questionnaire administration, including the type and number of contacts, the location where the survey was conducted (e.g., outpatient room or by use of online tools, such as SurveyMonkey).	95-96
	7b	Provide information of survey's time frame, such as periods of recruitment, exposure, and follow-up days.	95-96
	7c	Provide information on the entry process: –>For non-web-based surveys, provide approaches to minimize human error in data entry. –>For web-based surveys, provide approaches to prevent "multiple participation" of participants.	95-96
Study preparation	8	Describe any preparation process before conducting the survey (e.g., interviewers' training process, advertising the survey).	93-94
Ethical considerations	9a	Provide information on ethical approval for the survey if obtained, including informed consent, institutional review board [IRB] approval, Helsinki declaration, and good clinical practice [GCP] declaration (as appropriate).	87 and 95
	9b	Provide information about survey anonymity and confidentiality and describe what mechanisms were used to protect unauthorized access.	95
Statistical analysis	10a	Describe statistical methods and analytical approach. Report the statistical software that was used for data analysis.	95-96
	10b	Report any modification of variables used in the analysis, along with reference (if available).	n/a

	10c	Report details about how missing data was handled. Include rate of missing items, missing data mechanism (i.e., missing completely at random [MCAR], missing at random [MAR] or missing not at random [MNAR]) and methods used to deal with missing data (e.g., multiple imputation).	95 and 106
	10d	State how non-response error was addressed.	97
	10e	For longitudinal surveys, state how loss to follow-up was addressed.	n/a
	10f	Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for non-representativeness of the sample.	n/a
	10g	Describe any sensitivity analysis conducted.	n/a
Results			
Respondent characteristics	11a	Report numbers of individuals at each stage of the study. Consider using a flow diagram, if possible.	97
	11b	Provide reasons for non-participation at each stage, if possible.	106
	11c	Report response rate, present the definition of response rate or the formula used to calculate response rate.	97
	11d	Provide information to define how unique visitors are determined. Report number of unique visitors along with relevant proportions (e.g., view proportion, participation proportion, completion proportion).	n/a
Descriptive results	12	Provide characteristics of study participants, as well as information on potential confounders and assessed outcomes.	97
Main findings	13a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates along with 95% confidence intervals and p-values.	tables
	13b	For multivariable analysis, provide information on the model building process, model fit statistics, and model assumptions (as appropriate).	n/a
	13c	Provide details about any sensitivity analysis performed. If there are considerable amount of missing data, report sensitivity analyses comparing the results of complete cases with that of the imputed dataset (if possible).	n/a
Discussion			
Limitations	14	Discuss the limitations of the study, considering sources of potential biases and imprecisions, such as non-representativeness of sample, study design, important uncontrolled confounders.	97
Interpretations	15	Give a cautious overall interpretation of results, based on potential biases and imprecisions and suggest areas for future research.	95-97
Generalizability	16	Discuss the external validity of the results.	97
Other sections			
Role of funding source	17	State whether any funding organization has had any roles in the survey's design, implementation, and analysis.	87
Conflict of interest	18	Declare any potential conflict of interest.	87
Acknowledgements	19	Provide names of organizations/persons that are acknowledged along with their contribution to the research.	85

Appendix VIII - Motivated Strategies for Learning Questionnaire

Motivated Strategies for Learning Questionnaire (MSLQ)
Participants responded on a scale of 1 = not at all true of me to 7 = very true of me.
Item content
Part I: MOTIVATION SCALES
1. Intrinsic Goal Orientation
In a class like this, I prefer material that really challenges me so I can learn new things.
In a class like this, I prefer material that arouses my curiosity, even if it is difficult to learn.
The most satisfying thing for me in this class is trying to understand the content as thoroughly as possible.
When I have the opportunity in this class, I choose assignments that I can learn from even if they don't guarantee a good grade.
2. Extrinsic Goal Orientation
Getting a good grade in this class is the most satisfying thing for me right now.
The most important thing for me right now is improving my overall grade point average, so my main concerns in this course is getting a good grade.
If I can, I want to get better grades in this class than most of the other students.
I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.
3. Task Value
I think I will be able to use what I learn in this course in other courses.
It is important for me to learn the material in this class.
I am very interested in the content area of this course.
I think the material in this class is useful for me to learn.
I like the subject matter of this course.
Understanding the subject matter of this course is very important to me.
4. Control of Learning Believes
If I study in appropriate ways, then I will be able to learn the material in this course.
It is my own fault if I don't learn the material in this course.
If I try hard enough, then I will understand the course material.
If I don't understand the course material, it is because I didn't try hard enough.
5. Self-efficacy for Learning and Performance
I believe I will receive an excellent grade in this class.
I'm certain I can understand the most difficult material presented in the readings for this course.
I'm confident I can understand the basic concepts taught in this course.
I'm confident I can understand the most complex material presented by the instructor in this course.
I'm confident I can do an excellent job on the assignments and tests in this course.
I expect to do well in this class.
I'm certain I can master the skills being taught in this course.
Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this course.
6. Test Anxiety
When I take a test I think about how poorly I am doing compared with other students.
When I take a test I think about items on other parts of the test I can't answer.
When I take tests I think of the consequences of failing.
I have an uneasy, upset feeling when I take an exam.
I feel my heart beating fast when I take an exam
Part II: LEARNING STRATEGIES SCALES
1. Cognitive and Metacognitive strategies: Rehearsal
When I study for this course, I practice saying the material to myself over and over.
When studying for this course, I read my notes and the course readings over and over again.
I memorize key words to remind me of important concepts in this course.
I make lists of important terms for this course and memorize the lists
2. Cognitive and Metacognitive strategies: Elaboration
When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions.
I try to relate ideas in this subject to those in other courses whenever possible.
When reading for this class, I try to relate the material to what I already know.
When I study for this course, I write brief summaries of the main ideas from the readings and the concepts from the lectures.
I try to understand the material in this course by making connections between the readings and the concepts from the lectures.
I try to apply ideas from course readings in other class activities such as lecture and discussion
3. Cognitive and Metacognitive strategies: Organization

When I study the readings for this course, I outline the material to help me organize my thoughts.
When I study for this course, I go through the readings and my class notes and try to find the most important ideas.
I make simple charts, diagrams, or tables to help me organize course material.
When I study for this course, I go over my class notes and make an outline of important concepts.
4. Cognitive and Metacognitive strategies: Critical Thinking
I often find myself questioning things I hear or read in this course to decide if I find them convincing.
When a theory, interpretation, or conclusion is presented in a class or in the readings, I try to decide if there is good supporting evidence.
I treat the course material as a starting point and try to develop my own ideas about it.
I try to play around with ideas of my own related to what I am learning in this course.
Whenever I read or hear an assertion or conclusion in this class, I think about possible alternatives.
5. Cognitive and Metacognitive strategies: Self-regulation
During class, I often miss important points because I'm thinking of other things. (REVERSED)
When reading for this course, I make up questions to help focus my reading.
When I become confused about something I'm reading for this class, I go back and try to figure it out.
If course materials are difficult to understand, I change the way I read the material.
Before I study new course material thoroughly, I often skim it to see how it is organized.
I ask myself questions to make sure I understand the material I have been studying in this class.
I try to change the way I study in order to fit the course requirements and instructor's teaching style.
I often find that I have been reading for the class but don't know what it was all about. (REVERSED)
I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.
When studying for this course I try to determine which concepts I don't understand well.
When I study for this class, I set goals for myself in order to direct my activities in each study period.
If I get confused taking notes in class, I make sure I sort it out afterwards.
6. Time and Study Environment
I usually study in a place where I can concentrate on my course work.
I make good use of my study time for this course.
I find it hard to stick to a study schedule. (REVERSED)
I have a regular place set aside for studying.
I make sure I keep up with the weekly readings and assignments for this course.
I attend class regularly.
I often find that I don't spend very much time on this course because of other activities. (REVERSED)
I rarely find time to review my notes or readings before an exam. (REVERSED)
7. Effort Regulation
I often feel so lazy or bored when I study for this class that I quit before I finish what I planned to do. (REVERSED)
I work hard to do well in this class even if I don't like what we are doing.
When course work is difficult, I give up or only study the easy parts. (REVERSED)
Even when course materials are dull and uninteresting, I manage to keep working until I finish.
8. Peer Learning
When studying for this course, I often try to explain the material to a classmate peer or a friend.
I try to work with other students from this class to complete the course assignments.
When studying for this course, I often set aside time to discuss the course material with a group of students from the class.
9. Help Seeking
Even if I have trouble learning the material in this class, I try to do the work on my own, without help from anyone. (REVERSED)
I ask the instructor to clarify concepts I don't understand well.
When I can't understand the material in this course, I ask another student in this class for help.
I try to identify students in this class whom I can ask for help if necessary.

Appendix IX - Survey

Survey
Participants responded on a scale of 1 = not at all true of me to 7 = very true of me.
Part I: MOTIVATION SCALES
1. Intrinsic Goal Orientation
In a course like this, I prefer material that really challenges me so I can learn new things.
In a course like this, I prefer material that arouses my curiosity, even if it is difficult to learn.
The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.
In this course, I am more interested in understanding the material than getting a good grade or pass the course
2. Extrinsic Goal Orientation
Getting a good grade or pass in this course is the most satisfying thing for me right now.
The most important thing for me right now is improving my overall grade point average or receiving a good evaluation, so my main concerns in this course is getting a good grade or pass the course.
If I can, I want to get better grades and evaluations in this course than most of the other students.
I want to do well in this course because it is important to show my ability to my family, friends, employer, or others.
3. Control of Learning Believes
If I study in appropriate ways, then I will be able to learn the material in this course.
It is my own fault if I don't learn the material in this course.
If I try hard enough, then I will understand the course material.
If I don't understand the course material, it is because I didn't try hard enough.
4. Self-efficacy for Learning and Performance
I believe I will receive an excellent grade or evaluation in this course.
I'm certain I can understand the most difficult material presented in this course.
I'm confident I can understand the basic concepts taught in this course.
I'm confident I can understand the most complex material presented in this course.
I'm confident I can do an excellent job on the evaluations, assignments and/or tests in this course.
I expect to do well in this course.
I'm certain I can master the skills being taught in this course.
Considering the difficulty of this course, the instructor and my skills, I think I will do well in this course.
5. Test Anxiety
When I am evaluated (e.g. take a test) I think about how poorly I am doing compared with other students.
When I am evaluated (e.g. take a test) I think about items on other parts of the test I can't answer.
When I am evaluated (e.g. take a test) I think of the consequences of failing.
I have an uneasy, upset feeling when I take an exam.
I feel my heart beating fast when I take an exam
Part II: LEARNING STRATEGIES SCALES
1. Cognitive and Metacognitive strategies: Rehearsal
When I study for this course, I practice saying the material to myself over and over.
When studying for this course, I read my notes and the course material over and over again.
I memorize key words to remind me of important concepts in this course.
I make lists of important terms for this course and memorize the lists
2. Cognitive and Metacognitive strategies: Elaboration
When I study for this course, I pull together information from different sources, such as lectures, readings, discussions, and internet resources.
I try to relate ideas in this subject to those in other courses whenever possible.
When reading for this course, I try to relate the material to what I already know.
When I study for this course, I write brief summaries of the main ideas from the readings and the concepts.
I try to understand the material in this course by making connections between the readings and the concepts.
I try to apply ideas from course material in other activities such as lecture and discussion
3. Cognitive and Metacognitive strategies: Organization
When I study the readings for this course, I outline the material to help me organize my thoughts.
When I study for this course, I go through the readings and notes and try to find the most important ideas.
I make simple charts, diagrams, or tables to help me organize course material.
When I study for this course, I go over my ~~class~~ notes and make an outline of important concepts.
4. Cognitive and Metacognitive strategies: Critical Thinking
I often find myself questioning things I hear or read in this course to decide if I find them convincing.
When a theory, interpretation, or conclusion is presented in a course, I try to decide if there is good supporting evidence.

I treat the course material as a starting point and try to develop my own ideas about it.
I try to play around with ideas of my own related to what I am learning in this course.
Whenever I read or hear an assertion or conclusion in this course, I think about possible alternatives.
5. Cognitive and Metacognitive strategies: Self-regulation
During class/lecture/tutorial time/clinical activities, I often miss important points because I'm thinking of other things. (REVERSED)
When reading for this course, I make up questions to help focus my reading.
When I become confused about something I'm reading for this course, I go back and try to figure it out.
If course materials are difficult to understand, I change the way I read the material.
Before I study new course material thoroughly, I often skim it to see how it is organized.
I ask myself questions to make sure I understand the material I have been studying in this course.
I try to change the way I study in order to fit the course requirements.
I often find that I have been reading for the course but don't know what it was all about. (REVERSED)
I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.
When studying for this course I try to determine which concepts I don't understand well.
When I study for this course, I set goals for myself in order to direct my activities in each study period.
If I get confused taking notes or practicing in this course, I make sure I sort it out afterwards.
6. Effort Regulation
I often feel so lazy or bored when I study for this course that I quit before I finish what I planned to do. (REVERSED)
I work hard to do well in this course even if I don't like what we are doing.
When course work is difficult, I give up or only study the easy parts. (REVERSED)
Even when course materials are dull and uninteresting, I manage to keep working until I finish.
7. Peer Learning
When studying for this course, I often try to explain the material/clinical activities to a peer or a friend.
I try to work with other students from this course to complete the course assignments/benchmarks.
When studying for this course, I often set aside time to discuss the course material/clinical activities with a group of students from the course.
8. Help Seeking
Even if I have trouble learning the material/clinical activities in this course, I try to do the work on my own, without help from anyone. (REVERSED)
I ask the instructor/preceptor to clarify concepts I don't understand well.
When I can't understand the material/clinical activities in this course, I ask another student in this course for help.
I try to identify students in this course whom I can ask for help if necessary.
PARTIII: DEMOGRAPHICS
How would you describe your gender?
What is your age?
What year of medical school you are in?
Which course/rotation/PBL unit were you referring to in your answers?
Please, list your previous undergraduate education.
This research can benefit you directly by providing you an individual narrative feedback about your scores. If you wish to receive an individual narrative feedback, please provide us with your email address.

CHAPTER FOUR
MIXED METHODS STUDY

Motivation strategies for learning and their influences in students' feedback literacy during undergraduate medical school:

An explanatory sequential mixed methods study

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Transitional summary

In Chapter Three I conducted a cross-sectional survey study using the MSLQ questionnaire to construct a portrait of medical students' motivational orientations and learning strategies, and to analyze whether students' learning maturity changes as they advance year by year through their medical education. The findings showed that there were no statistically significant differences between students in their first and last year of medical school. However, the MSLQ showed to be a reliable instrument to measure motivational orientations and learning strategies in the study's sample, and the results represented the beliefs of a cohort of medical students in the study's institution. Therefore, I decided to further explore the results of the survey in the explanatory mixed methods sequential study described in Chapter Four. Part of the survey results was used to identify and purposefully select the best participants for the qualitative (interviews) phase of this mixed methods study, and to build part of the interview guide. The overall purpose of this mixed methods study was to measure students' motivational orientations for learning and learning strategies in medical school, and then, explain its influences in students' feedback literacy at a Canadian university. At the end, I have identified some factors related to motivational orientations for learning and learning strategies that might influence feedback literacy, and, based on that, I suggested strategies that students could use to enhance their own feedback literacy skills.

Background

Feedback, broadly defined as the information provided to adjust performance, has been extensively used and evaluated within medical education.[1–3] Feedback from educators to students is considered an important and essential element of effective learning.[2,4,5] Feedback is typically described as a complex phenomenon that involves communication of information between a deliverer and a receiver, that is influenced by a range of contextual elements that have the potential to cause interference within this process.[2,3,6,7] The deliverer must transmit a message, and the receiver, (in this case, students who receive the feedback), must decode, interpret and respond to the message. Therefore, different factors can influence this process, and impact students' learning. Some of these factors are related to the deliverer, such as how the educator encodes one's ideas, feelings, and interactions into a message.[3,8,9] Other factors are related to the message itself.[5,8–10] For example, whether the feedback is focused on procedural or communication skills, or whether it is a positive or negative message. There are factors related to the environment where feedback occurs, such as the feedback culture in the institution or professional environment.[11–13] Further factors are associated with the attributes of the receiver (i.e., students), including how they receive the feedback (i.e., students' emotional reaction to feedback, perceptions of educators' credibility, and the impact of the feedback in improving future performances).[8,10,14] Therefore, authors within this field have incorporated students' receptiveness to feedback into the concept of feedback, and some frameworks extend the idea of receptiveness to endorse the term "feedback literacy", that include the processes in which a student receives, comprehends, accepts, and makes use of feedback.[6,8,14]

Motivation theories have been used to explain how students' individual characteristics and attitudes (e.g., self-awareness, confidence, motivation, and mindset) can influence feedback literacy.[10,15,16] Motivation in education has been well studied.[17–19] It can be defined as the process to initiate and achieve a goal-directed activity, and it includes different terms, such as goal orientation, interest, attribution, self-competence, and self-efficacy.[17,20] Several theories have been created and discussed with the purpose of explaining how motivation might influence learning behaviour and academic performance, and how motivation could be influenced by educational curriculum, teachers, and students' age, gender and previous learning experiences.[17,21] In medical education, the interest in motivation in learning has increased in the last two decades.[21–26] Strategies to improve motivation for learning is especially important in medical education since it seems to be related to deep learning, good academic performance, student well-being, and satisfaction; all essential elements for medical proficiency, life-long learning, and professional attainment.[21–23,27,28] Additionally, motivation seems to influence the choice of medical specialty and it is related to students' intention to continue medical studies.[21] More importantly, students can benefit from programs that maximize their motivation to learn strategies, and medical curriculum can consider the effects of motivation in learning to support students short- and long-term learning outcomes.[22,23,25,26,29]

Literature Review

Cook & Artino Jr[17] summarized five contemporary "motivation to learn" theories that were considered important to advance research in the medical education field (i.e., expectancy-value, attribution, social-cognitive, self-determination, and goal theory). All these theories include the following concepts: self-efficacy (expectancy of success/competence), task value (outcome expectation), goal (objective, aim, and purpose), mastery goal mindset (learning goal, task goal), performance goal mindset (ego goal, ability goal), intrinsic motivation (intrinsic interest or value), and locus (internal or external cause of action). Additionally, all these theories are socio-cognitive, meaning that motivation is not an individual phenomenon, but a process that involves interactions between the individual and their social context. In another review, Kusurkar et al[22] summarized the concepts of nine motivation theories to analyze how they have been driving curriculum development in medical education (i.e., need to achieve theory, drive theory, theory of hierarchy of needs, scoring achievement motivation, expectancy-value, attribution, social-cognitive, self-determination, and goal theory). The authors highlighted how the theories' foci have shifted from the quantity of motivation (i.e., scores) to quality of motivation (e.g., types of motivation, types of goal orientation, different beliefs); therefore, we should enhance both quantity and quality of motivation if we want to increase students' motivation in learning. Cho et al[25] conducted a scoping review to explore what is known about self-regulated learning by medical students during their rotations in the clinical environment. The authors defined self-regulated learning (SRL) as 'the process where one is metacognitively, motivationally, and behaviourally proactive in the learning process'.[25(p.1)] They argued that students could regulate their learning in four areas: cognition, motivation, behaviour, and context. Specifically, within

the motivation area, students could regulate their learning by setting criteria for comparison, self-monitoring their motivation, using feedback to monitor effectiveness, and selecting strategies for managing motivation and affect. Therefore, self-regulated students show motivated strategies for learning that are goal-directed and informed by metacognition from self and others. The authors also found that higher levels of SRL are associated to higher academic and clinical skills achievement, and that some factors can affect SRL of medical students (i.e., student's experience, medical school curriculum, and learning autonomy).

When considering factors that might affect students' motivation, some authors found that novice learners (individuals less mature in approaches to learning either due to less exposure to the field of training or due to younger age) have poorly developed metacognitive skills and less capacity to assess their own learning goals when compared to senior learners; therefore, decreasing their SRL.[30] Kusurkar et al[21] demonstrated that other factors with the potential to influence a student's motivation in medical school include academic year, teacher support, type of curriculum, self-efficacy, perceived task value, and early patient contact. In comparison, motivation could affect academic success and performance, and learning and study behaviour. In particular, when considering the influence of the medical education curriculum in students' motivation, it seems that the Problem-Based Learning (PBL) model[31,32] improves students' motivation for learning, especially by stimulating intrinsic motivation among medical students (i.e., interest in learning medicine for the sake of learning), and by increasing student's autonomy and satisfaction.[22,23,33] These results in the medical education context were supported by other studies in general education.[18,34–36] For instance, Zimmerman & Martinez-Pons[35] showed that students used their self-regulated strategies to learn (i.e., self-evaluation, organization, goal settings, planning, seeking information, rehearsing, and reviewing) more efficiently as they

advanced in school, that skilled students not only used greater self-regulated strategies, but also increased their strategies earlier in school life, and that some instructional procedures to reduce social comparison and focus in task mastery may optimize students' motivation in learning.

Moreover, studies have showed that learning behaviours and strategies associated with motivation may also influence feedback literacy.[10,15,16] For instance, some authors explored the consequences for the students of receiving negative and positive feedback experiences, based on the regulatory focus theory (how one brings oneself into alignment with one's goals).[37] Positive feedback would increase motivation and performance under promotion focus (things we want to do), but attenuate motivation and performance under prevention focus (things we have to do). On the other hand, negative feedback would be motivating under prevention focus, but attenuate under promotion focus. The authors concluded that the regulatory focus theory cannot predict how students will react to feedback in medical education settings, but it can be used to assist educators on how to thoughtfully frame their feedback to try to enhance feedback receptiveness. In another study, Curtis and O'Sullivan[15] brought up social cognitive theories to discuss how students could self-monitor their confidence during feedback experiences. The authors indicate that the monitoring of confidence could influence students' receptivity to feedback and their ability to develop meaningful goals. Students' confidence is powerfully supported by experience; therefore, it seems that self-confidence increases over the years in medical school. A confident student could better accept feedback because the feedback is seen as information to enhance performance, and not as a personal criticism. Eva et al[30] used two classes of influences described as ''hot cognition'' and ''cold cognition'' to explain how one's perception of oneself can impact the way one interprets feedback. The authors described that hot cognitions (e.g., emotions) could explain why some students attribute failures of performance to situational

factors and their successes to their own ability. On the other hand, cold cognitions (e.g., attention, memory) could trigger a confirmation bias, and the students would tend to find evidence in the feedback received that support their own preconceptions. Moreover, Murdoch-Eaton and Sargeant[38] suggested that students perceive and use feedback differently depending upon their seniority in the programme. Maturity influences students' perceptions of the purpose of feedback, students' recognition of feedback, and students' perceptions regarding the credibility of the feedback providers. In this study, junior students perceived feedback as being a passive and summative activity and valued positive and written feedback. On the other hand, senior students perceived feedback as being generally formative, and they valued specific and constructively critical feedback. Garino[16] explained the differences in feedback's use based on the Self-regulated Learning, Achievement Goal, and Mindset theories. The author concluded that students with strong self-regulated learning traits, a mastery-approach goal orientation, and a growth mindset have more adaptive learning behaviours, and are better able to understand what needs to be done, create a learning plan, and implement it; therefore, making better use of the feedback received.

In conclusion, feedback from educators to students is considered an important and essential element of effective learning in medical education. Medical school is a unique context representing one of the medical trainee's first experiences in the medical field and in the broader health care community of practice. The underlying mechanisms that shape how feedback is positioned within the undergraduate medical learning might be unique and different from other health professionals and the postgraduate years of medical education (i.e., medical residency). Despite the importance of feedback in this context, this phenomenon has not been completely understood. One of the reasons for that is the existence of a complex number of factors that

influence how students receive, interpret, and make use of feedback. Factors affecting medical students' receptiveness to feedback related to the medical students themselves include students' characteristics *(*confidence, engagement, mindset, and self-motivation), abilities for students' self-assessment, students' emotional reactions to feedback, and students' maturity. Some studies highlighted that motivation theories could help us to better understand how these factors can influence feedback literacy. Other studies showed that these theories could also explain how professional maturity has a positive relationship with receptiveness to feedback, and the impact of this as they progress through the years of undergraduate medical school. However, past research in medical education has only partially explored this topic, and studies are fragmented by exploring specific factors, only students' learning behaviours, or the influence of maturity in perceptions to feedback. There is thus a need to comprehensively and holistically study these concepts and the relationships between them. Therefore, with the intention to provide a more complete and unique understanding of this phenomenon, a mixed methods study was conducted, which included the measurement of the different students' motivational orientations and strategies towards learning, how these orientations and strategies are related to students' feedback literacy, and how this relationship changes as these students progress through the years of undergraduate medical school.

Purpose Statement

The purpose of this study was to measure students' motivational orientations for learning and learning strategies in medical school, and then, explain how students' motivational orientations for learning and learning strategies influence students' feedback literacy as they progress through the years of undergraduate medical school. An explanatory mixed methods sequential design was conducted to achieve this purpose. A brief description of the steps I took during this mixed methods study is provided in Appendix I. In the first quantitative phase of this study, a cross-sectional survey was administered to first- and third-year medical students at a Canadian university to measure students' motivational orientations for learning and learning strategies in medical school. Using the quantitative results to develop a sampling strategy for the second phase, individuals with different motivational orientations and learning strategies were identified in the first- and third-year of medical school based on their questionnaires' scores. This purposeful sample was then invited to participate in the second explanatory phase of this study, where a qualitative description approach was applied to the sampling, data generation and analysis.[39] I conducted semi-structured interviews with students, divided into two groups: those who through the measurement of 4.62 or below by the Motivated Strategies for Learning Questionnaire (MSLQ) were identified as having a low motivational orientation for learning, and those who through the measurement of 5.34 or above by the MSLQ were identified as having a high motivational orientation for learning. This stratification of the purposeful sample was done to both compare and explain how aspects of their learning attitudes might influence how they perceive, accept, and use the feedback received. Therefore, the quantitative phase provided a general overview of the different motivational orientations for learning and learning strategies at

a Canadian university undergraduate medical school. Following the analysis of the data, these findings were then used to inform the purposeful sampling strategy for the second phase of the study. Then in the second phase, a descriptive qualitative study, participants' views were explored and synthesized, with the intent for these findings to further explain how medical students' learning motivations and strategies might influence feedback literacy.

Research questions

In the first phase of this mixed methods study, the following quantitative research question was answered:

What are the motivational orientations and learning strategies among students enrolled in their first and third years of undergraduate medical education at a Canadian university?

Following analysis of this quantitative data, and the identification of a purposeful sample of students, the second component of this mixed methods study was conducted to answer the question:

What can we learn about feedback literacy from medical students with different motivational orientations and learning strategies at a Canadian university?

Finally, to purposefully link the findings from the two study components, the following mixed methods research question was answered:

In what ways do the interview data reporting the views of medical students about feedback literacy explain how medical students' learning motivations and strategies reported in the survey might influence feedback literacy at a Canadian university?

Theoretical foundations

This study was based on the four foundational principles that underpin contemporary motivation theories, as suggested by Cook and Artino.[17] The four principles are: competence beliefs (i.e., perceive ability to master and achieve), value beliefs (i.e., personal importance, intrinsic interest), attribution (i.e., internal or external causal explanations for the results), and social-cognitive interactions (i.e., learning results from interactions among personal, behavioural, and environmental factors). More specifically, this study was based on the general cognitive view of motivation and learning strategies' framework by McKeachie, Pintrich, Lin, & Smith.[36,40] These authors believe that students' characteristics (i.e., intelligence and personality), students' cognition (i.e., knowledge structure, learning strategies, and thinking and problem solving), and students' motivation are intimately conjoined in student learning, and they should be taken into consideration when teaching students more effective skills for learning and thinking. Two other theories served as a theoretical foundation for this study: the Achievement Goal Theory by Zimmerman[18] and the Mindset theory by Dweck et al.[41,42] The Achievement Goal Theory strives to explain motivation and why individuals expend effort to learn. The Achievement Goal Theory holds that individuals are either mastery- or performance-oriented and each type has a positive or negative approach to learning. It seems that mastery-oriented students are more likely to seek and accept constructive feedback that helps them grow, when compared

to performance-oriented students. The Mindset theory suggests that individuals hold certain beliefs about intelligence: a fixed mind-set (one is either born with talent and cannot become any smarter) or a growth mind-set (they can continue to learn and become more intelligent). It is believed that a growth mind-set would allow students to engage in feedback seeking, be more receptive to constructive feedback, and incorporate feedback into daily performance. Additionally, our study took into consideration previous research suggesting that students become more metacognitively, motivationally, and behaviourally effective in learning as they advance in school years.[21,26,38]

Methods

Mixed Methods Design

An explanatory mixed methods design that starts with a quantitative phase followed by a qualitative study was used.[43] More specifically, the preliminary quantitative input design explanatory variant was used.[43,44] This design is used when priority is placed on the second qualitative phase to focus on a qualitative examination of the phenomenon, but the initial quantitative results are needed to identify and purposefully select the best participants. Constructs from the survey were then used to develop the questions for the first part of the interview guide. The purpose of the interviews was to elicit students' reflections on their own learning motivations and strategies, and students' perspectives on how these factors might influence feedback literacy.

In the mixed methods explanatory sequential design, integration (when the quantitative and qualitative research intersect) happens in more than one point of the study.[43] In this study,

integration first happened when I used some of the quantitative results to purposefully select participants to the qualitative phase. Then, integration happened during the qualitative data analysis and findings, when I paid attention to similarities and differences in perspectives between the two groups of participants with different motivational orientations and learning strategies. Lastly, integration happened during discussion when I combined the two types of data to reflect about the implications of learning motivations and strategies in feedback literacy. I used narrative and joint displays (visual displays that combine quantitative and qualitative results) to represent and interpret the integrations.

Ethical Considerations

Each phase of this mixed methods study was separately submitted to and approved by the Hamilton Integrated Research Ethics Board (HiREB) and by the Undergraduate Medical Education Program Protocol Review Committee (PRC). Additional procedures were taken to minimize participants' risks and discomfort during the interviews. During data collection, course activities in the university were not interrupted, and interviews were scheduled according to participants' preferences. The interviews were conducted on the video conferencing Zoom platform, but only audio, and not video, recordings were made, unless participants had wanted to leave their camera on. To ensure confidentiality, participants' names were not collected, and all data obtained were de-identified after the interview was transcribed and stored in a private password-protected desktop. During the final report, quotes were completely de-contextualized to preserve anonymity.

Context

This study took place at a Canadian university undergraduate medical education (UGME) program.[45] In Canada, UGME programs are either three or four years long, and students are eligible to apply after completion of a bachelor's degree. The program, where this study was conducted, is a three-year UGME curriculum program that uses the PBL approach to learning, and it is organized in sequential blocks with early exposure to patients and case management. The 15-month pre-clinical curriculum is divided into five foundation units, clinical skills, and anatomy. There is also a longitudinal Professional Competencies curriculum that runs during the entire pre-clinical program. During this time, students learn in small groups (6-8 students) of tutorials that are facilitated by a faculty member acting as the tutor for the group. Tutorials take place twice each week, for about 3 hours each time. Between tutorials, large group teaching sessions with expert faculty employ active learning pedagogy to consolidate and review concepts introduced in tutorials. A 63-week clinical curriculum follows the pre-clinical phase. It consists of clinical rotations in medicine, general surgery, orthopedic surgery, family medicine, anesthesia, psychiatry, pediatrics, obstetrics and gynecology, and emergency medicine.

Participants

Participants in this study were undergraduate medical students. I included medical students in their first and third (last) years of medical school because I wanted to compare novice and senior students. Exclusion criterion included medical students in their second year of medical school. In the academic year when this study was conducted (2022-23), there was a total of 207 first- year and 203 third- year students enrolled in the medical school.

Quantitative phase

I followed the self-administered survey methods to quantitative research suggested by Phillips et al.[46] The MSLQ instrument was used to measure first- and third-year medical students' learning motivations and strategies. A detailed explanation of the survey methods and results are described in Chapter Three. In Chapter Four, I focused on the qualitative phase of the mixed methods study, and I explained the quantitative findings needed to select the participants for the qualitative phase of this mixed methods study, and the findings needed for the integration process.

Qualitative phase

In the qualitative phase of this study, I explored medical students' perceptions of feedback literacy and their attitudes towards learning in medical school by asking them to (1) explain their answers in the Motivated Strategies for Learning Questionnaire (MSLQ), (2) describe their experiences in receiving feedback during medical school, (3) discuss their understanding of the concept of feedback literacy and the factors related to it, (4) and share their thoughts about how their learning motivations and strategies could be related to feedback literacy.

Qualitative design rationale

The principles of qualitative description informed all the methodological decisions in this phase.[39] This approach is useful in generating descriptions of individuals' experiences of the

phenomenon under study within a specific context. It suits the purpose of this study because qualitative description intends to explore the phenomenon of interest (i.e., feedback literacy) in a particular situation (i.e., undergraduate medical education at a Canadian university) with the research question related to the meaning of the experience (i.e., medical students' perspectives).

Qualitative phase: selection of participants

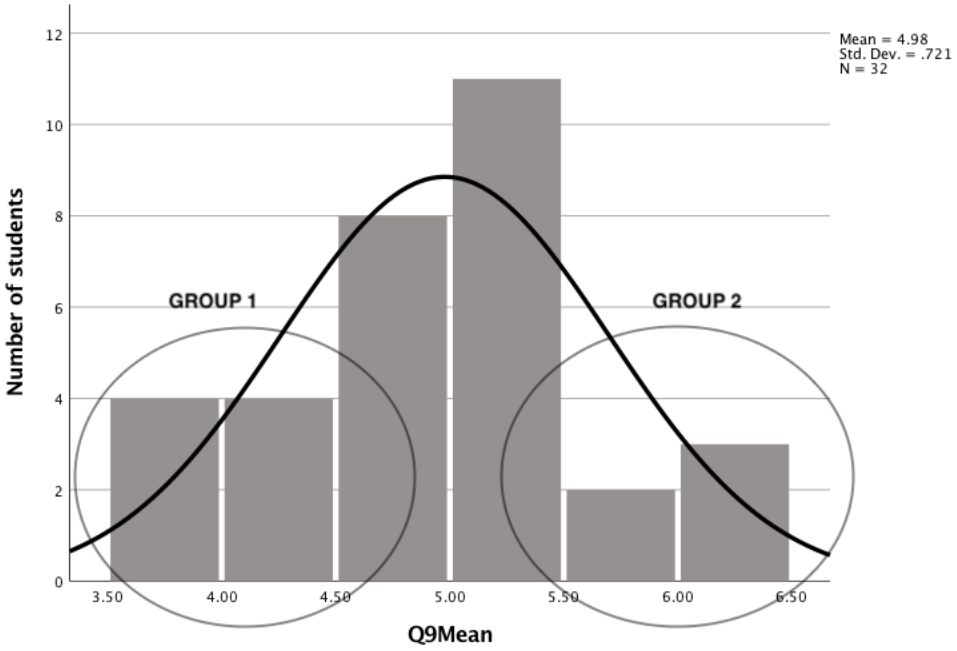
The first instance of integration of quantitative and qualitative methods occurred when the quantitative results informed the qualitative sampling strategy to purposefully select participants for the qualitative phase.

During the quantitative phase, I found that the survey overall score (mean) and individual scale scores did not differ by students' academic year (p 0.764), age group (p 0.910), or previous undergraduate education (p 0.639). There was one exception, effort regulation (p 0.01), as first year students scored higher on effort (mean 5.89, SD 0.74) than third year students (mean 4.82, SD 1.18). Therefore, I decided that I would not separate participants per academic year when selecting them to the qualitative phase of this study. I would base my decision only on their survey overall scores. This was an important decision since I had hypothesized that third-year medical students would score higher than first-year medical students because previous studies suggested that students improve their self-regulated strategies to learn as they advance in school.[21,26,38] Nevertheless, I decided to pay attention to students' academic years when conducting the interviews in case similarities or differences were detected during the qualitative phase.

To select participants for the qualitative phase, students were divided into two groups based on their overall survey score: Group 1 – students that scored 0.5 below the standard

deviation for the study mean (survey score <4.62); Group 2 - students that scored 0.5 above the standard deviation for the study mean (survey score >5.34). I used 0.5 as a cut-off because, after looking at the distribution of our data, I decided that 0.5 would allow me to invite enough participants with distinct motivational orientations and learning strategies that would represent different groups. Figure 1 is a histogram showing the survey score frequency distribution among all participants; the frequency distribution in Groups 1 and 2 is highlighted by the circles.

Figure 1 - Groups of participants according to survey total score



Therefore, I used purposive sampling by inviting students that scored, at least, 0.5 standard deviation above or below the study's mean in the MSLQ for the interview. This purposeful sample was drawn from the original convenience sample of students who provided me with their email addresses during the quantitative phase of this study. In March 2023, I invited, by email, all 15 students who met the study inclusion criteria. I sent two reminders two weeks apart. Participation was voluntary, and I used written digital consent. I offered an online store gift card for those who accepted being interviewed. I recruited 7 students in total (4 students that scored 0.5 below the standard deviation for the study mean, and 3 students that scored 0.5 above the standard deviation for the study mean).

Qualitative phase: data collection

Data were collected using semi-structured individual interviews with the students. The semi-structured interview guide (Appendix II) was piloted for feasibility and acceptability with two medical students who were not part of the study sample. Their input informed minor modifications to question order and clarity. Interviews were done through the Zoom platform. At the beginning of the interview, I showed the students their MSLQ scores, and provided them with a brief explanation of the meaning of each scale and their results. While the interviews were conducted on Zoom, only audio, and not video, recordings were made. To provide choice regarding their level of comfort, participants were given the option therefore to leave their camera on or off. I conducted all the interviews and checked all the transcripts that were automatically recorded through the Zoom platform. All responses remained confidential, and transcripts were not linked

to participants' names, only to their MSLQ scores and year in medical school. During the final report, quotes were completely de-contextualized in order to preserve anonymity.

Qualitative phase: data analysis

The study data were analyzed following the six-step process of reflexive thematic analysis approach.[51,52] This approach is useful to summarize key characteristics of a large body of data, and highlight similarities and differences across datasets, making it suitable to this study aims.[51]

During the whole data analysis process, I attended to core assumptions outlined in Braun and Clarke's[51,52] approach to reflexive thematic analysis, namely: (1) researcher subjectivity is considered a resource to generate knowledge, (2) analysis and interpretation of data should be insightful, thoughtful, and rich, (3) data analysis processes involve immersion for engagement and distancing for reflection, (4) a single coder and group collaboration (as opposed to consensus) are recommended, (5) codes and themes are analytic outputs, interpretations resulting from a deep and prolonged engagement with the data, (6) themes are patterns of meanings that share an idea, (7) themes are not discovered, they are produced by the researcher through a systematic analytic engagement with data and reflection (8) data analysis is always underpinned by theoretical assumptions, (9) reflexivity is essential to good quality analysis, and (10) data analysis is a creative process within a framework of rigor based on methodological, theoretical, and philosophical underpinnings; therefore, multiple analyses are possible and the researcher needs to decide which one works best for their project.

Lastly, before starting the data analysis, I reflected on some additional elements suggested by Braun and Clarke.[51,52] Braun and Clarke[51] suggested the term *predominantly* deductive or inductive approach because they assert that data analysis cannot be exclusively one or the other. I believed that a predominantly inductive approach was more appropriate to this study because I was driven by the data, without trying to fit into pre-existing coding frames, but not completely free from my theoretical foundations. However, a small degree of deductive analysis was employed when I directed my analysis to answer the research question. Moreover, I adopted the semantic level of thematic analysis, meaning that I progressed from description of data to interpretation of the significance and meanings of the patterns to better answer the research question. Additionally, I used the themes and peer debriefing as a strategy to promote credibility and data dependability during the data analysis process. The themes were based on their importance in addressing the research question, and, although I paid some attention to the prevalence of codes within a theme, code occurrence *per se* was not a reason to determine the themes. Table 1 shows the data analysis process step-by-step, including some examples to illustrate and specify what was done.

Table 1 - Step-by-step of reflexive thematic analysis. Adapted from Braun and Clarke[52] and Campbell et al.[53]

Phase	Description	Examples
1. Data familiarization	Checking the data transcript with the audio Immersing oneself in the data Note/Ideas taking	While reading and re-reading the whole transcript, I took some notes. E.g., I noticed that all students agreed with their scores in the MSLQ, and that students with backgrounds other than science (i.e., arts, engineering) highlighted some positive and negative aspects of this during their answers.
2. Generating initial coding	Labelling and organizing data items into meaningful groups (possible themes)	While paying attention on the overall MSLQ students' scores, I took notes about my first impressions, and sorted them out into groups. E.g., goal orientation, maturity, PBL influences, feedback in medical school, students' power. Then, these "possible themes" were presented to and discussed with the other researchers in our group.
3. Generating themes	Sorting codes into initial themes Using notes and tables Writing themes characteristics	I divided meaningful sentences into smaller parts, then smaller parts into codes. I sorted the codes out among the themes, always paying attention on whether that code came from a student that scored higher or lower in the MSLQ. E.g., from the sentence *I was motivated by having enough knowledge to pass*, I coded *knowledge to pass*, then labeled it as *extrinsic goal orientation* under the theme *Reasons to learn.* I added a note that that code came from a student that scored lower.
4. Reviewing themes	Checking if the themes are supported by the original data and codes Re-working and refining codes and themes	After the whole process of coding, I re-read the transcripts, the highlighted sentences, and the codes to check whether themes were supported by the codes. I made some modifications, such as adding the subtheme *emotions involved in reasons to learn* because of the codes related to it.
5. Defining and naming themes	Ongoing analysis to refine themes, themes' characteristics and names	I discussed my results with the other researchers in our group.
6. Report	Selection of examples, illustrations, quotes Writing a concise and interesting account of the story told by the data, both within and across themes Presenting a scholarly report of the analysis	I took into account the considerations to write the report provided by Braun and Clarke. I compared findings to the literature when reporting the qualitative results. I discussed the final report with the other researchers in our group, incorporating their suggestions.

Qualitative phase: rigor

I followed the 15-point checklist of criteria for good thematic analysis proposed by Braun and Clarke.[51] This checklist was not designed to be applied in a rigid way, but to be used as a way for researchers to reflect on the quality and rigor of their work. Table 2 summarizes the study rigor checklist I used.

Table 2 - Study rigor checklist. Based on Braun and Clarke.[52]

Criteria
1. Data detailed transcribed and checked against the recording with accuracy.
2. Each data item has been given equal attention in the coding process.
3. Coding process was thorough, inclusive, and comprehensive.
4. All relevant extracts have been collated.
5. Themes have been checked against each other and data set.
6. Themes are coherent, consistent, and distinctive.
7. Data have been interpreted rather than just paraphrased.
8. Analysis and data match each other.
9. Analysis tells a well-organized story about the data and topic.
10. Good balance between narrative and illustration.
11. Enough time has been allocated to complete data analysis adequately.
12. The thematic analysis approach is clearly explicated.
13. What you claim you do is consistent with what you show you do.
14. The language and concepts are consistent with the epistemological position of the analysis.
15. The researcher is positioned as active in the research process.

Additionally, I considered some strategies to enhance rigor specifically proposed for the qualitative descriptive approach.[39,54] It included the credibility (engagement with the data, persistent observation of the data, collaboration among the authors), transferability (description of the data, illustrations using participants' quotes), dependability and confirmability (detailed description of the methods and peer collaboration during the whole research process), and reflexivity throughout the whole research process (journal).

Mixed methods validity threats

In addition to paying attention to validity and reliability during the quantitative phase, and study rigor during the qualitative phase, I took into consideration strategies to minimize validity threats specifically proposed to the mixed methods explanatory sequential design.[43] First, I identified important quantitative results that helped me to select participants for the qualitative phase of our study. Then, I connected my initial quantitative results with the qualitative follow up by purposefully selecting participants from the sample of quantitative participants. Lastly, I showed the questionnaire results to the participants in the interview to look for explanations, not only to the answers that they agree with, but also to contradictory results.

Results

Qualitative phase: results

In the qualitative results section, I followed Braun and Clarke's best practices to report the reflexive thematic analysis findings.[51] Their preferred approach includes the discussion of the qualitative findings contextualized in relation to previous research when reporting the themes in the *results section*. The *discussion section* of this chapter focused on elaborating on the integration of findings.

A purposeful sample of seven undergraduate medical students completed an in-depth interview as part of the qualitative study component. The average length of the interviews was 33 minutes (between 27 and 40 minutes each). Four participants were first-year students, and three participants were third-year students. Table 3 shows the

distribution of participants according to their medical school academic year and their group based on their overall survey score.

Table 3 - Qualitative phase participants

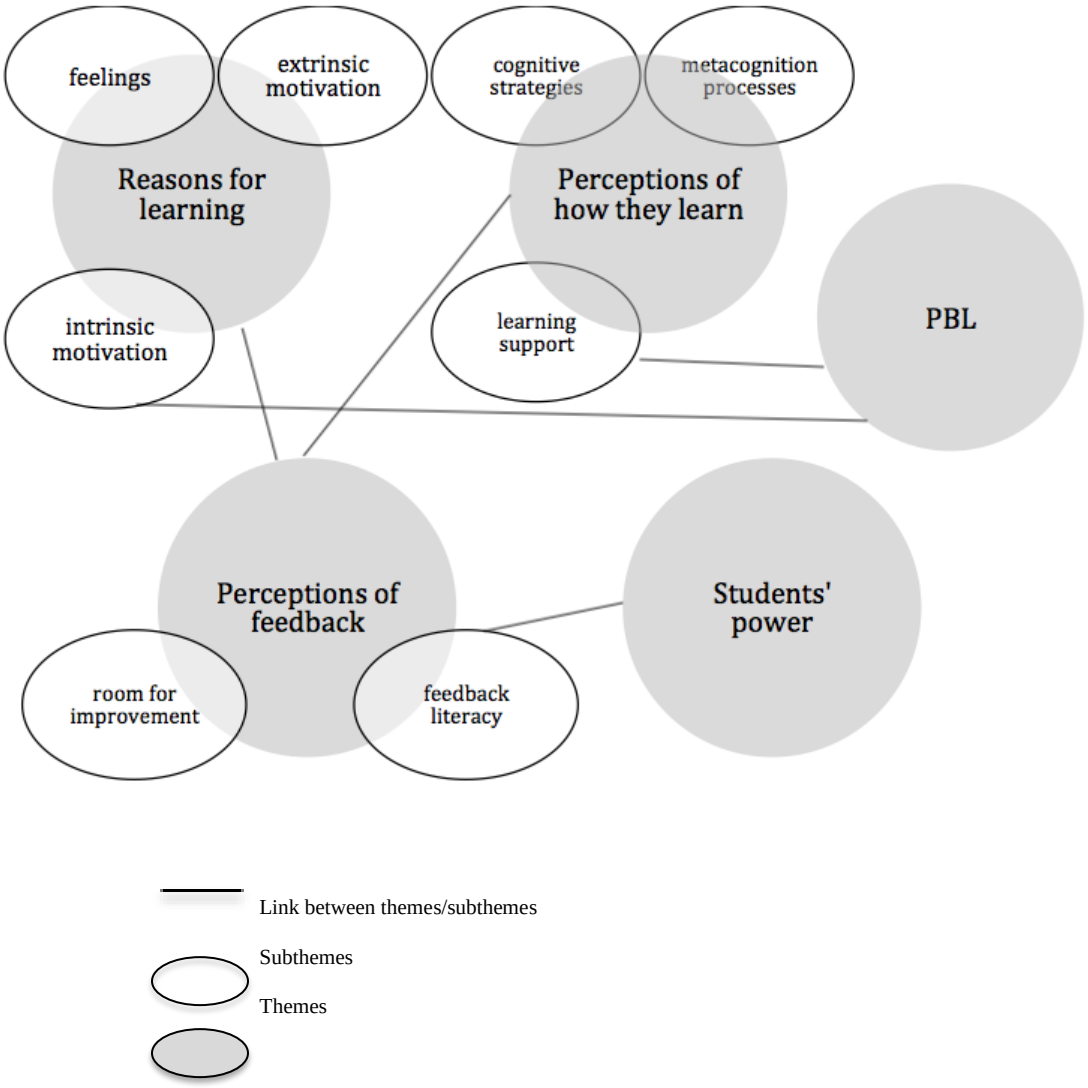
	Group 1 Score 0.5 below SD	**Group 2 Score 0.5 above SD**	**Total**
1st year	2	2	4
3rd year	2	1	3
Total	4	3	7

At the start of the interview, each participant received their MSLQ scores, and was provided with a brief explanation of the meaning of each scale and their results. Then, they were asked whether they agreed with their scores in each scale, and to elaborate more on it. Among the seven participants, five validated the accuracy of their overall and scales scores and acknowledged that the numeric value was a fair representation of their motivational orientations and learning strategies. The remaining two participants indicated discordance on two scales, but they validated the accuracy of the other scales and their overall score. One participant in Group 1 (ID4) thought one's scores in intrinsic goal orientation and critical thinking would be higher than the mean, instead of lower. Another participant in Group 2 (ID5) thought one's scores in organization and self-regulation would be lower than the mean, instead of higher. Still, when reflecting about their results, these participants' sense of surprise was explained by their own interpretations of the items in the survey and the course they were taking at the time they answered the survey.

In the analysis of medical students' different motivational orientations and learning strategies and their experiences of feedback literacy, five themes were developed to summarize the key findings: (1) Students' reasons for learning, (2) Students' perceptions of how they learn in medical school, (3) The Problem-Based Learning (PBL)

approach influences on students' learning motivations and strategies, (4) Students' perceptions of feedback in medical school, and (5) Students' own power during the feedback process. Figure 2 illustrates the thematic map showing the five themes, their subthemes, and the relationship among them.

Figure 2 - Qualitative results thematic map



The first two themes explain students' different motivational orientations and learning strategies in medical school, the two constructs measured in the quantitative survey. This is important because the overall objective of this mixed methods study was to explain how these constructs might influence feedback literacy; therefore a richer portrait of students' thoughts on this matter provided the basis to start answering the mixed methods question. The third theme highlighted the uniqueness of the PBL context and the relevance of this approach to learning motivations and strategies. The fourth and fifth themes illustrated students' opinions about feedback and feedback literacy; therefore it helped to complete the answer for the qualitative question, and then, to answer the mixed methods question after the final data integration.

During the analysis process, a constant comparative approach was used, which required paying attention to differences and similarities between the two groups of students with different motivational orientation and learning strategies. Table 4 summarizes the themes and exemplifies similarities and differences in students' thoughts according to students' group within each theme, as I noted when conducting the interviews and analysis.

Table 4 - Themes and students' thoughts according to students' group

Themes	Group 1	Group 2
1. Students' reasons for learning	Intrinsic and extrinsic goal orientations were reasons to learn Examples of intrinsic: to be a good doctor, to learn, to gain clinical knowledge. Examples of extrinsic: to get good evaluations, to pass the exams, to match the residency program, to get some autonomy. Feelings could influence reasons to learn	More intrinsic than extrinsic goal were reasons to learn Examples of extrinsic: curiosity, passion, being a good physician, to learn, to enjoy. Grades were important to get in Medical School. Feelings were not mentioned as influencing reasons to learn
2. Students' perceptions of how they learn	Elaboration and critical thinking are time consuming Rehearsal is a faster way to learn. It seems to be the most used strategy in this group. A lot to do with being overwhelming, too many things to learn. Planning seems to be important for them. Learning support Only when they really need it Usually rely on the internet sources Usually they don't study in groups	Elaboration and critical thinking are very important tools used in this group. Rehearsal was considered much easier, but not used as much. Time/amount of material influences learning style in this group. Strategies related to self-regulation seem to be most important. Having control of their own learning and self-effort is also very important Learning support Rely on peer learning as much as studying by themselves Ask for help
3. The PBL approach influences	Less pressure Less stressful	Learning for the sake of learning Peer learning in tutorials
4. Students' perceptions of feedback	Positive and negative Good frequency Not constructive, too subjective Feedback literacy was not effectively taught Maybe it is related to maturity/experience and/or personality It should be taught through workshops with examples and practice. Specifically before clerkship.	Positive and negative Good frequency Not always specific to content Feedback literacy was not effectively taught. Feedback literacy should be taught. Specifically before clerkship. Through practice sessions and examples.
5. Students' own power	Factors affecting receptiveness to feedback are mostly internal. Personal factors seem to have a bigger impact in this group. Other factors: having an extrinsic or intrinsic goal orientation, working hard, and having control of your own learning. There is much that students could	Factors affecting receptiveness to feedback are all internal, such as: personality, maturity, having an intrinsic goal orientation, and control of your own learning. There is much that students could do to help themselves in the feedback process: reflections and actions.

	do to help themselves in the feedback process: reflections and actions.	

Group 1– participants that scored <4.62 in the survey
Group 2 - participants that scored >5.34 in the survey

Students' reasons for learning

Participants' descriptions of their motivations to learn, and the factors influencing this process, contributed to the theme *students' reasons for learning.* These factors included motivations that were clustered as being intrinsically (e.g., learning for the sake of learning) or extrinsically (e.g., learning to be able to receive good evaluations) goal oriented. Additionally, because students recurrently described how some feelings could influence their reasons to learn (e.g., how fear and stress could make them less motivated to learn), factors related to it were also part of this theme. Therefore, within the theme *students' reasons for learning,* three subthemes (i.e., reasons influenced by intrinsic motivation to learn, extrinsic motivation to learn, and feelings) were generated.

Although both groups described intrinsic and extrinsic goal-oriented motivations, the balance between these two motivation types was different for each group. Students in Group 2 were more intrinsic goal-oriented, mentioning learning for the sake of learning, for curiosity, for passion, for enjoyment, and to be a "good" physician. When talking about learning, these students did not articulate negative feelings; on the contrary, they expressed appreciation for their learning journey. One medical student in Group 2 explained:

Maybe you should be doing well at something because you're passionate about it and you want to do it (…) you want to make the best out of that opportunity (ID7)

Overall, these students maintained their motivation to learn by finding interesting topics even in courses that they might not be so interested about at the beginning, a strategy to increase motivation previously suggested in the literature.[36,47] On the other hand, there were no consistent patterns among students in Group 1, with participants reflecting on elements related to either being intrinsic and extrinsic goal -oriented depending on the learning subunit or rotation, their preceptors or mentors, or whether they were preparing for an upcoming exam, as one students in Group 1 said:

I do have curiosity for things (…) but in order to stick with something for a long time, I need some extrinsic motivation (…) otherwise, I just get bored. (ID3)

Another characteristic of Group 1 is that there were many negative feelings involved when they talked about their reasons to learn in medical school. They often mentioned how overwhelming medical school is, and the fear and stress of realizing that there is so much to learn. The number of things to study and the positive or negative relationship with their preceptors seem to be related to their motivation orientation. One student in Group 1 stressed the negative emotional impact that teachers (i.e., preceptors) can have in students' motivations to learn:

I had such great preceptors (…) these were the most fun and enjoyable rotations even though they were really hard (…) and then, the opposite (...) they made me feel small and bullied me with my skills (…) it turned me off from the specialty (…) I wasn't learning, I was just trying to survive. (ID2)

In describing these experiences, the student ID2 emphasized how extrinsic factors can either negatively or positively impact learning motivations by influencing intrinsic motivations and learning choices, as suggested by previous studies.[21,56]

Moreover, students' descriptions of their mindset changes were dependent on the learning context. For Group 2, grades were a learning motivation to enable them to get into medical school, as one student in Group 2 explained:

In undergraduate [before medical school], I was extremely focused on my grades, and I would sacrifice other things in order to do better on a test. Since I got here [medical school], I realized that grades are not so important to me anymore (…) I just try to learn what I am curious about (ID6)

For participants in Group 1, grades and evaluations are still an important learning motivation; especially when the students do not like the topic or when a high stakes evaluation is upcoming. This aligns with the findings above, that these students shift between being intrinsic and extrinsic goal-oriented depending on external reasons. Participants in Group 1 were not able to abandon their study behaviours from before medical school, the habits that made them getting good grades in high school or to get into medical school, something that Group 2 was able to do. Why they seem to keep their old study habits could be related to maturity or experience in medical school,[26,38] but I was not able to notice a difference between first- and third-year students on this matter. It reinforces the idea that students' cognition and motivations are intimately conjoined;[36,40] therefore, students who are able to shift their learning mindsets might also be able to

change their motivation orientation.

These differences in findings between the groups is important because it supports our quantitative results that guided the distribution of participants in two groups, but also, because it explains some of the extrinsic, intrinsic, and emotional factors related to motivation to learn. If these factors influence feedback literacy, we could guide students to manage them through learning activities to improve students' feedback literacy skills.

Students' perceptions on how they learn

This theme builds on the previous theme (*students' reasons for learning)* by further explaining one of the constructs measured in the quantitative survey, students' learning strategies in medical school. The main concept of this theme is defined by the different strategies that students use to learn in medical school. It was built with patterns that clustered around three subthemes: cognitive strategies (i.e., elaboration, critical thinking, and rehearsal), metacognition processes (i.e., planning, monitoring, and regulating their studies), and learning support (i.e., peer support, help seeking, learning tools support).

Students consistently described learning strategies related to elaboration (e.g., summarizing, creating analogies, and generative note-taking), critical thinking (e.g., applying previous knowledge to new situations), and rehearsal (e.g., memorizing, reciting or naming items from a list). The recurrence of these ideas generated the subtheme *cognitive strategies*. However, when examining these ideas between the two groups of students, students in Group 2 put more emphasis on factors related to elaboration and critical thinking than rehearsal; while the opposite was noted in students in Group 1. The

reason for that might be because rehearsal (i.e., memorizing) is seen as a faster way to learn, even though the students agreed that elaboration and critical thinking are more effective tools. For students in Group 1, the amount of material and lack of time was identified as an important learning strategy determinant, and that is why they would use rehearsal more often. Therefore, rehearsal could be another study behaviour (like the extrinsic motivation to learn discussed above) that students bring with them from their study habits before medical school, but it is not necessarily the best approach to learn in medical school. One student in Group 1 illustrated that thought by sharing:

(Rehearsal)… I did this a lot [before medical school] (…) you know, I had 2 weeks to study before an exam (…) Okay, here are the big topics, the headers, the summary sheet (…) I feel like I was still doing that [in the beginning of medical school], even though it might not have been the best strategy. (ID2)

If those learning strategies are demonstrated to influence feedback literacy, changes in students' study behaviours might help to improve their feedback literacy skills, since the successful use of feedback requires implementation of effective learning strategies.[16]

Still within the concept of strategies that students use to learn in medical school, students within Group 2 recurrently described the use of metacognition processes. They put emphasis on self-regulation, self-effort, and having control of their own learning, as factors that would shape their learning experience. One student in Group 2 commented:

I do have control [of my learning] because I've noticed when I try, like new sort of study or tutorial preparation techniques, I really see like first hand, all my efforts to study have

made a difference in my learning. (ID6)

This example shows that the student ID6 has a growth mind-set, meaning that one can continue to learn because learning depends on one's own effort. This is interesting for the purpose of this study because it has been described that a growth mind-set would help students to develop better feedback literacy skills.[16,41] Metacognition processes were not seen as a pattern within this theme among the students in Group 1.

Participants also frequently reflected on whether students' learning support could help them to learn. This pattern of shared meanings created the subtheme *learning support.* Although students in both groups commented about the relevance of students' support for learning, the opinions between the two groups of students were very distinctive. Students in Group 2 said that they rely on studying with their peers as much as studying by themselves because, sometimes, peer learning can be distracting. Thus, whenever they feel that studying with their peers would not be effective, they would change their strategy, showing (again) how this group of students is able to shift their study habits to regulate their learning. They also would ask for help more often than the students in the other group because they perceived this improves their learning, as one of the students in Group 2 emphasized:

I think this is so important; you got to ask for help. Everyone is very actually helpful and they actually want to see you do the best actually… because if you don't ask for help, no one knows that you need help. (ID7)

In contrast, students in Group 1 prefer to study alone because studying with their

peers is more distracting, they not always study things that are important, can be less productive, and some peers seem too confident when giving wrong answers. These students rarely ask for help, relying on their own resources, including their notes and the Internet.

When analysing the findings in these two first themes, I noticed some alignment between the different learning strategies and learning support within each group. The students in Group 2 use more elaboration and critical thinking when studying, learning strategies that may benefit from peer learning and help seeking to enhance discussions and deep learning. Students in Group 1 use more rehearsal when studying, taking advantage of being alone to repeat and memorize things, and looking for their own resources, instead of seeking for other people help.

The joint display Table 5 below illustrates how the qualitative findings from the first two themes supported and added some explanations to the quantitative scale scores, as it was discussed above. This integration of data represents the first step to answer this study mixed methods question because it provided a richer portrait of the different students' learning motivations and strategies within this sample.

Table 5 - Integration of survey scales' scores and qualitative results

Scale	Group	Score Mean	Qualitative Results	Students' Quotes
Rehearsal	1	3.65	Rehearsal is a faster way to learn. It seems to be used more in Group 1.	I think it's just the volume and the lack of specialization and focus (…) kind of prohibit that critical thinking for me. I'll memorize it. It's just faster. (ID2 –Group 1)
	2	3.55		
Anxiety	1	4.36	Group 1 demonstrated many negative feelings when talking about their learning (overwhelming, a lot of things they don't know, stress).	A lot of times I just realize how little I know and how much there is to know (…) I know I should go back and re-read (…) I make a plan (…) but I just don't actually see it through. (ID3- Group 1)
	2	3.62		

Extrinsic goal orientation	1	4.00	Students in Group 1 seem to bounce between being intrinsically and extrinsically goal oriented.	It definitely depends on the subunit with regards if I am more intrinsic, more curious (…) and then, if I'm kind of bored, I would definitely be more extrinsic. (ID4- Group 1)
	2	3.90		
Intrinsic goal orientation	1	4.81	Students in the Group 2 seemed to be much more intrinsically goal oriented.	Maybe you should be doing well at something because you're passionate about it. (ID7- Group 2)
	2	5.77		
Elaboration	1	4.99	Students in Group 2 indicated that they use elaboration and critical thinking more than rehearsal.	I know elaboration is the most effective way to learn (…) to make sure I understood."(ID6- Group 2) I think that's what you should do all the time (critical thinking). (ID7- Group 2)
	2	6.41		
Critical Thinking	1	3.37		
	2	5.48		
Self-regulation	1	3.97	Students in Group 2 highlighted the importance of self-regulation, self-effort, and having control of their own learning.	I do believe if you put in the effort you will be good enough … the times when I don't succeed in something, it was never unexpected. (ID5- Group 2)
	2	5.48		
Effort-regulation	1	4.53		
	2	6.00		
Peer Learning	1	1.70	Students in Group 2 rely on studying with their peers more often than Group 1.	I think peer learning played a key role in my success in medical school. (ID7- Group 2)
	2	5.36		
Help Seeking	1	4.15	Students in Group 2 would ask for help more often than the students in the other group.	Every time I ask someone for help (…) (they have) been patient and answered my question. So I just keep doing it. (ID6- Group 2)
	2	5.25		
Survey	1	4.01	Students agreed with their overall MSLQ scores.	I feel like this is a pretty much fair score. (ID3- Group 1)
	2	5.75		

Group 1 – participants that scored <4.62 in the survey
Group 2 - participants that scored >5.34 in the survey

The PBL influences on students' learning motivations and strategies

Across interviews, most participants consistently discussed how the context in which they were learning, specifically their engagement with a PBL approach to pedagogy, was perceived to strongly influence their learning motivation, including reasons for learning and their process of learning. For both groups of students, PBL guided their learning because of the lack of high stakes exams and grades during their units of study, and the importance given to tutors' evaluations (formative assessments), as opposed to summative assessments. The students in Group 2 explained that the PBL

approach stimulates their intrinsic motivation to learn because they do not have to worry about high stake exams and grades, so they can study for the sake of learning or interest, as one student in Group 2 exemplified:

The PBL, how medical school is structured, at least here, it's like all pass or fail. I think the incentive is to know the stuff that would be applicable to whatever specialty that you are going to be pursuing in in the future, and knowing, just knowing the medicine, just to know the medicine, because you're interested in medicine. (ID7)

This effect of PBL on motivation to learn described by the student ID7 has been studied, and it seems that PBL increases students' level of situational interest and intrinsic motivation.[22,32,57] However, while previous authors explained that this effect is due to the encounter of situations (or problems) that students do not understand, triggering their desire to learn, the students within this sample explained that it is the structure of their evaluations that was responsible for increasing their intrinsic motivation to learn. Either way, the effect of PBL on motivation to learn could help to answer this study's mixed methods question because it enriched the portrait of students' thoughts on learning motivations. If intrinsic motivation influences feedback literacy, recommendations could be made in how small changes in medical schools' evaluations structure or students' reflections on how they handle their evaluations could enhance students' feedback skills.

Another cluster of ideas was seen around the influences on PBL on students' learning support. However, this pattern was only seen in Group 2. Students in Group 2 repeatedly commented on how the PBL approach might encourage peer learning because, in PBL, learning happens in small groups of students trying to discuss problems and

producing explanations for the problems. One student in Group 2 excitedly described this:

I think peer learning played a key role in my success in medical school (…) it is the best thing (…) [in PBL tutorials] explaining concepts to others, and then other people explaining concepts to you, and then, answering questions together (…) it is awesome. (ID7)

This quote explains more in detail how PBL might influence the peer learning strategy measured in the MSLQ. In describing this experience in tutorials, the student ID7 appeared to illustrate how tutorials could influence peer learning, and how peer learning could influence one's motivation to learn. If increased motivation to learn enhances students' engagement with the feedback received, as discussed previously in the literature,[6,16] then, strategies to encourage peer learning activities might as well increase students' feedback literacy skills. However, these strategies might work better for students that are pre-disposed to engage in peer learning activities (i.e., students in Group 2).

Students' perceptions of feedback

In the second part of the interview, participants were asked to talk about their feedback experiences in medical school, and their thoughts about feedback literacy. The students consistently linked their previous experiences in receiving feedback in medical school with comments on areas of improvement in the feedback process. Therefore, within the theme *students' perceptions of feedback,* I created two subthemes: *room for improvement and feedback literacy.* The last subtheme was greatly influenced by the way

the interview questionnaire was organized. One of the interview guide questions asked about their perceptions of feedback literacy in medical school. However, the students did not know the meaning of the term. Because talking about feedback literacy was essential to help answering this study's research questions, I provided them with a brief explanation of the term (i.e., the process in which a student receives, comprehends, accepts, and makes use of feedback). After that, students started elaborating on this idea.

Within the subtheme *room for improvement,* students in both groups shared similar experiences and comments. Overall, they described a good experience in receiving feedback in a good frequency. However, they consistently emphasized that, most of the times, the feedback is not constructive because it is too broad and expressed without specificity, as one student in Group 1exemplified:

I would say, is actually not regarding the positivity or the negativity of what the feedback they're giving to you…it is how they present it to you. So I think the people who say, you know… Good job! … You know…. Keep it up! (...) They don't really elaborate too much on that. (ID1)

The student ID1 identified that the most important aspect of the feedback for their learning is the content of the feedback (whether the feedback is helpful, constructive, specific, and appropriate). The same idea was shared by other students within this sample, as this other student in Group 1 illustrated:

I've definitely gotten feedback that Oh, you're really quiet, and you don't share enough…but that's part of my personality, for all the years I've lived that's been how I have been! (ID3)

In describing one's personality traits, the student ID3 not only reinforced the relevance of the feedback content, but also brought up concerns about how students' participation in classes (or tutorials) and communication skills have been evaluated in medical school.

The patterns within this subtheme showed that students receive enough feedback (in quantity) in medical school, but it lacks efficacy to help them to improve. This is an important finding because it indicates that, even though there is a culture of giving feedback in their medical school, there is an issue in the way the feedback is delivered, in despite of all the attention that researchers have been giving to the delivery part of the feedback process.[3,58] Therefore, efforts to teach and improve students' feedback literacy might help them to advocate for more effective feedback, to overcome the barriers they face during the feedback process, and to enable them to use the feedback that will help them to grow.

Within the subtheme *feedback literacy*, the students in both groups recurrently reported that feedback literacy has not been taught in medical school, or it was vaguely mentioned. The codes were clustered around ways to teach feedback literacy skills to students and the factors that could influence feedback literacy. Some students specifically made suggestions on how to best teach feedback literacy, as one student in Group 2 explained:

It [feedback literacy teaching] would be interesting, specifically, before clerkship starts. I think that's probably the best time, because that's when you, during clerkship, that's when you really grow as an individual through those clinical shifts. (ID7)

While the student above elaborated on the best timing to teach feedback literacy, other students within this sample shared that the best ways to teach feedback literacy would be through workshops, practice sessions (simulations), and examples; instead of lectures or articles discussions. On the other hand, students in Group 1 pointed out that there might be factors related to feedback literacy that could not be taught, such as students' maturity, clinical experience, and personality, as one student in Group 1 illustrated:

I think learning how to take feedback, I think, is an ongoing skill, that you learn as you have more experience. I also think that there's a lot of personality factors (…) or just based on their either personal disposition or background. (ID3)

The student ID3 put great emphasis on factors related to feedback literacy that would be harder to be changed, while students in Group 2 expressed that learning motivations and strategies (i.e., having an intrinsic goal orientation and a sense of controlling your own learning) also could influence the way students receive and make use of the feedback given to them. This pattern identified within this sample might show that students in Group 1 have a more fix mind-set, and less adaptive learning behaviours, which leads to a less effective use of the feedback received, as suggested by other authors.[16,41]

Students' own power during the feedback process

This theme is defined by the idea that students can have some control over the

feedback process, instead of relying only on the feedback giver's skills or the learning environment in the institution. It moves beyond the theme *students' perceptions of feedback* because the codes around this concept shared factors that students believe they actually could do to help themselves during the feedback process. These factors were later organized in self-reflections and actions, as described below in the text.

Both groups of students believe that there is so much they could do for themselves. They commented on their power on reflecting about what was said to them, and the choice that they have of accepting or not accepting the feedback, as one student in Group 2 explained:

Sometimes it can be hard to receive it (…) for example, the feedback is you would be great in psychiatry because you're like a good listener, or you have a nice and kind voice… it seems like positive feedback. [And I think] that's the feedback I got after learning about the gastrointestinal system? (…) Is this something I want to accept and implement? (ID6)

The student ID6 not only illustrated something they could reflect on, but also identified the big impact that feedback can have, not only on students' medical skills and performance, but also on their professional decisions and self-perceptions. Even with all the emphasis given in the past on how to effectively deliver feedback,[1,3,59] it is clear that students are not protected from negative experiences; therefore, they should, at least, know how to deal with this kind of feedback, and feedback literacy might help them with that. Within our sample, students suggested some actions that they could take to improve their feedback literacy, such as being more proactive, asking for clarifications, and

bringing concerns up, as the one student in Group 1 exemplified:

Ask the instructors to clarify it [the feedback] (…) bring up what specifically you are concerned about after your own self-reflection. (ID3)

I organized the students' ideas about strategies they could take in order to have more control over the feedback process into two groups: self-reflections and actions. These strategies are summarized in Table 6. In this table, and with respect to this theme, there were no discernable differences in participants' reflections between groups.

Table 6 - Strategies to improve feedback literacy suggested by the students

Self-reflection strategies	Actions strategies
Think about the feedback received	Take small steps
Think on how it can make you better	Take it
Think of it as an opportunity to grow	Use it/Apply it
Think whether you want to accept it	Ask questions
Think if and what you want to apply	Clarify it
Think if you trust the giver	Bring your concerns up
Think about the personal factors related to it	Discuss the feedback with the giver
Think about how you could be proactive in this process	Be proactive
Value the feedback received even if you do not agree with it	

Integration of findings

To find ways of how the quantitative and qualitative results could help to explain the influences of students' learning motivations and strategies in feedback literacy, overall results were integrated into a second joint display (Table 7). This table includes the three factors, among the MSLQ scales, that could be related to feedback literacy according to this study's qualitative findings: goal orientation, self-regulation, and help seeking. The qualitative results most relevant to these scales are summarized in the joint display, and some students' quotes are showed to support the findings.

Table 7 - MSLQ scales and qualitative results related to feedback literacy

MSLQ scales that might affect feedback literacy	Qualitative results	Students' quotes
Goal orientation	Group 1 expressed that either being intrinsically or extrinsically orientated facilitates feedback literacy. Group 2 expressed that being intrinsically orientated facilitates feedback literacy.	Learning for the sake of learning or to be a good doctor would motivate me to seek feedback (…) or to get good evaluations sort of depends on the fact that you are able to get feedback. (ID1- Group 1) I think being intrinsically goal oriented is so important (…) because if you present yourself out there as like I want to be the best doctor (…) I think that makes it better for feedback. (ID7- Group 2)
Self-regulation	Both groups expressed the importance of having the sense of controlling your own learning in order to improve the way you accept, use, and seek feedback.	I think when you are willing to work hard (…) it makes you more willing to get the feedback and not slack it off (…) if you have less effort you might not be willing to use the feedback. (ID4- Group 1) I want to be in control of your own learning (…) and I think that helps me be more open to feedback, because I really see it as decisions that may affect my learning. (ID7- Group 2)
Help seeking	Both groups commented on how students that seek out help might be more willing to seek out feedback; although this was a stronger remark in Group 2.	I think that the willingness to seek out feedback would be higher if you are more willing to seek out for help. (ID4 – Group 1) I always seek out for help and I always seek out for feedback (…) I think that's so important. (ID7- Group 2)

Group 1– participants that scored <4.62 in the survey
Group 2 - participants that scored >5.34 in the survey

Discussion

The purpose of this study was to measure students' motivational orientations for learning and learning strategies in medical school, and then, explain their influences in students' feedback literacy at a Canadian university. To do that, I have first provided a general picture of students' different learning motivations and strategies, and then, I refined this portrait by exploring students' views. The findings and joint displays illustrated how the integration of the two phases of this study helped me with that first purpose. I identified different motivational orientations and strategies for learning based on the MSLQ, and then, students provide me some explanations for the quantitative findings during the interviews. I could not identify differences in motivational orientations and strategies for learning between first- and third-year medical students in this sample, maybe due to its small sample size. However, I was able to identify two distinct groups with higher and lower scores in the MSLQ, and the qualitative analysis supported and added to the quantitative findings. Later, I integrated the results one more time to provide further explanations on how medical students' learning motivations and strategies might influence feedback literacy. I identified three factors, among the MSLQ scales, that could be related to feedback literacy (i.e., goal orientation, self-regulation, and help seeking) and two others that are not related to the MSLQ scales (personality traits and learning experience). I also identified some strategies to improve feedback literacy suggested by the students.

All those five factors that might be related to feedback literacy (i.e., goal orientation, self-regulation, help seeking, personality traits, and learning experience) were previously mentioned by other authors and by the general cognitive view of motivation and learning strategies' framework.[16,21,30,38,40] It is believed that those factors are

intimately conjoined in students learning and they should be taken into consideration when teaching students. Murdoch-Eaton and Sargeant[38] suggested that senior medical students perceive and use feedback differently from junior medical students. Although I was not able to detect this difference bewteen first- and third-year medcial students in this sample, the participants did express that learning experience could affect feedback literacy during the interview phase. Based on the Achievement Goal Theory,[18] I was expecting that goal orientation would be one of the factors that could affect feedback literacy. This theory holds that mastery-oriented students (intrinsically goal-oriented) are more likely to seek and accept feedback, when compared to performance-oriented students (extrinsically goal-oriented). Students in Group 2 were more intrinsically goal oriented, and they emphasized that being more intrinsically goal oriented is relating to having better feedback literacy skills, reinforcing the Achievement Goal Theory. However, students in Group 1, seemed to bounce between being intrinsically and extrinsically goal oriented, and they couldn't link one or another to feedback literacy. In fact, they expressed that having motivation to learn in general (independently on being intrinsically or extrinsically goal oriented) could enhance feedback literacy skills. The Achievement Goal Theory also endorsed the association between students' self-regulation and feedback literacy. It seems that students with strong self-regulated learning traits have more adaptive learning behaviours; therefore, they are better able to receive and use feedback. Interestingly, I noticed that students in Group 2, with higher scores in the self-regulation scale, seemed to be the ones that would shift their learning mindsets easier, adapting their learning strategies to a new context, thus, reinforcing the idea that strong self-regulated students might have better feedback literacy skills by adapting their

learning behaviours. Lastly, one of the foundational principles that underpin motivation theories are social-cognitive interactions, meaning that learning results from interactions among personal and environmental factors.[17] Students that more often seek for help might be better able to manage aspects of their learning environment by getting support from others, including getting feedback to facilitate their learning achievement. Therefore, students that score higher in the help seeking scale might have stronger feedback literacy skills, especially in seeking out feedback from others.

Limitations

There are some limitations inherent to the type of methodological approaches I have chosen. Self-reported measures (i.e., MSLQ) might not fully represent participants' beliefs because students might select answers that will show a positive image of themselves. Additionally, students' thoughts about their strategies to learn during the interview phase might have been influenced by the MSLQ structure. The students might have had the MSLQ scales in mind when talking about their perceptions on how they learn in medical school because patterns were seen around those strategies. In the qualitative phase of this study, I used the constructivist philosophical assumptions. Thus, realities were presented through the comments of medical students of this sample. Moreover, as in all qualitative approaches, the results of this study are not completely free of interpretation.

There are other limitations that are related to our sample. Despite my efforts to recruit participants, I was not able to achieve the desired quantitative sample size, which limited the ability to detect significant differences between first and third years medical

students. In qualitative studies, the size of the sample has been a topic of discussion among researchers.[1,7] I based my sample size using the concept of information power suggesting that the sample size should be guided by the aim of the study (broad or narrow), the sample specificity (demographics, context), the established theory, and the analysis strategy.[10,11] According to this concept, a small (less than 10 participants) data set could be used.[13] However, the small sample size might reflect a narrow range of responses and experiences described in the qualitative results. Given the limited response to participate in the interviews, I had limited opportunities to explore and then document if there are a broader range of experiences. It is also likely that students with negative experiences may not have wished to participate in this type of study because interviews are not anonymous. Lastly, the data collection took place in one institution, and the unique context of this medical school (i.e., PBL approach, three-year medical degree program) must be taken into consideration when expanding the conclusions of this study to other populations.

Future research to address these limitations should include a larger sample size (maybe offering more incentives to increase participants recruitment), data collection in different institutions, and the use of different research methodologies, such as longitudinal designs, to analyse same participants in different academic years.

Implications and recommendations

This study showed that the MSLQ is a reliable instrument to measure students' motivational orientations and learning strategies in this study's sample, adding to other studies that endorsed this same evidence.[19,27,60] The MSLQ could be used by other

institutions to describe their student population in order to optimize students' learning through intervention programs that would help them to better regulate their learning and make adjustments to their learning strategies when needed.[25,29]

Moreover, I have identified some factors that might be related to feedback literacy. Some of them cannot be manipulated, such as students' personality and maturity (learning experience). However, I propose that students could reflect on how such factors might impact their receptiveness to feedback, and their willingness to use it and to seek it out. For example, a student could better accept feedback when seeing it as information to enhance performance, and not as a personal criticism, or seeing it as an opportunity to reflect and make small steps to change if needed. Other factors that might be related to feedback literacy could be manipulated by learning interventions. Previous authors suggested that goal orientation to learn could be adjusted by self-reflecting on ones' motivational beliefs, specifying intrinsic and extrinsic interests, and then, creating and implementing strategies to manage motivations, such as using learning strategies that better fit the purposes of the course or the current reality of the student.[16,47] Institutions could use learning motivations questionnaires (such as the MSLQ) to help students to identify their own motivational beliefs. When looking at self-regulation in learning, students could regulate their learning in three different areas: planning (e.g., setting learning goals, setting tasks to be completed), monitoring (e.g., tracking own attention, self-testing, setting criterion to comparison), and regulating (e.g., making adjustments to adapt based on self-reflection, summative, and formative feedback, paying attention to effort their own effort to learn).[25,26,47] Institutions could help students by promoting programs that would allow them to critically discuss and reflect about these areas of self-

regulation, such as the Pause 2 learn sessions suggested by Sandars and Timothy.[29] Lastly, the results of this study showed that help seeking seems to facilitate feedback literacy because students would seek out feedback from others. Students should learn to manage their study environment to receive support from others by identifying study areas and people (peers or instructors) that could provide them some assistance, and reflect on ways to be more proactive in the feedback process. Participants in this study suggested that students could be more proactive by bringing their concerns up, asking questions, and asking for clarifications to the feedback giver. Institutions could help students by promoting a safe feedback environment. For example, faculty development activities could emphasize the need to move away from the concept of feedback as a top-down process, and show the importance of sharing the feedback process responsibility with students.[11,61] The Table 8 summarizes the recommendations discussed above.

Table 8 - Summary of recommendations

MSLQ scales that might affect feedback literacy	Students' strategies to improve learning motivations and strategies related to feedback literacy	Institutionals' strategies
Goal orientation	Identifying motivational beliefs through questionnaires Self-reflection on motivational beliefs Finding intrinsic and extrinsic interests Selecting strategies to manage motivation Creating a plan to implement strategies	Promote learning motivations questionnaires to help students to identify their own motivational beliefs.
Self-regulation	Planning Self-reflection on learning strategies Setting learning goals Setting tasks to be completed Monitoring Tracking attention to tasks Self-testing Setting criterion for comparison Regulating Making adjustments to adapt to new situations Effort control Time and environmental management Study strategies	Promote programs that would allow students to critically discuss and reflect about specific areas of self-regulation.
Help seeking	Identify people that could provide assistance Identify areas that would need assistance	Promote a safe feedback environment.

Conclusion

Feedback literacy is the processes in which a student receives, comprehends, accepts, and makes use of feedback. This study explored how learning motivation orientations and strategies could be related to feedback literacy. The results showed that five factors could be taken into consideration when improving students' feedback literacy skills: learning goal orientation, self-regulation, help seeking, personality traits, and learning experience. Based on those factors, I have identified some approaches that could allow the students to enhance their own feedback literacy. Feedback literacy could

empower students to have some control over the feedback process and help them to overcome the barriers they still face during the feedback process.

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Appendix I - Mixed methods steps

Phase	Procedures	Products
Quantitative data collection ⇓	Canadian university medical students first and third years. (N=32) Online cross-sectional survey: Motivated Strategies for Learning Questionnaire (MSLQ)	Numeric data
Quantitative data analysis ⇓	Variables based on MSLQ: goal orientation, learning believes, self-efficacy, test anxiety, rehearsal, elaboration, organization, critical thinking, self-regulation, effort regulation, peer learning, and help seeking. Demographic characteristics: age, previous education, medical school year, and current course. SPSS software General Linear Model Four Inferences Validity Cronbach alphas	Response rate Non-response bias Descriptive analysis Overall survey scores Survey scales scores Group 1 and Group 2 according to overall scores
Qualitative selection of participants ⇓	Purposive sampling: students that scored, at least, 0.5 standard deviation above or bellow the study's mean in the MSLQ Convenience sampling: students that provided us with their email addresses during the quantitative phase of this study	Participants (N=7)
Qualitative data collection ⇓	One-on-one semi-structured online interview (N=7) Interviews lasted between 27 and 40 minutes each (4 hours in total)	Interview transcripts Text data
Qualitative data analysis ⇓	Reflexive thematic analysis approach	Codes and themes Similar and different themes between groups
Discussion	Interpretation and explanation of the quantitative and qualitative results	Discussion Limitations Implications Future research

Appendix II- Semi-structured interview guide

Participant number: MSLQ score: Year in medical school:

Part1: exploring the MSLQ results

(1) A. Could you please review your answers to the MSLQ in the following sections: goal orientation, efforts to study, self-efficacy for learning, learning strategies, and help seeking?

B. How reflective are these factors to your approach to learning? Please explain/elaborate

Note: students will have their MSLQ results and feedback in front of them
Probe if needed: when answering the MSLQ was there a scale that caught your attention? Why?

(2) During medical school, how would you describe how you self regulate your learning? Please, elaborate if possible.

Probe if needed: some self-regulation skills include goal setting, self-monitoring emotional states, self-instruction, and good time management.

(3) One of the MSLQ scales measures the students' control of learning believes.
What factors, in general, do you believe could interfere with your academic performance?

Probe if needed: control of learning refers to students' beliefs that their efforts to learn will result in positive outcomes.

Part2: feedback and feedback literacy perceptions

(4) Now, could you please tell me about your experiences in receiving feedback during medical school?

(5) Could you give us some examples of positive and negative feedback experiences in medical school?

(6) For you, what does the term feedback literacy mean?

(7) Could you please tell us your thoughts about how your learning motivations and strategies could be related to the way you receive and make use of feedback?

Probe if needed: for example, some authors suggest that students that are able to self-monitor their confidences could better receive feedback; or that students who strive to master the task (mastery-approach goal orientation) are better able to understand, receive, and use the feedback.

(8) What do you think your role in obtaining feedback should be?

(9) Thinking about feedback literacy as the processes of receiving, comprehending, accepting, and making use of feedback, do you think this should be taught to you during medical school? How?

(10) Lastly, is there anything else that you would like to tell me?

Thank you very much for your interview.

CHAPTER FIVE
CONCLUSIONS

Overall conclusions

The general objective of this thesis was to explore feedback literacy in the undergraduate medical education context by aggregating a comprehensive body of evidence and using different research methodologies. The scoping review provided a more complete understanding of feedback literacy in the undergraduate medical education context. The results showed that this is indeed a new topic in the field, that publications on receptiveness to feedback in medical school has increased since 2012, and that the term feedback literacy has started to be used in undergraduate medical education publications in 2017. Little is known on how to teach feedback literacy, and educational interventions to increase students' feedback literacy skills are still not well established. When identifying factors that could improve students' feedback literacy skills, this thesis' results supported past findings that experiences in receiving feedback are influenced by multiple factors acting at multiple different levels from individual to environmental.[1–3] Factors acting at the individual level that were previously showed to influence feedback literacy the most are: students' confidence, learning mindset, and self-motivation. To investigate some of these factors, the Motivated Strategies for Learning Questionnaire (MSLQ) was used and proved to be a reliable instrument to measure medical students' learning motivations and strategies. During the qualitative study analysis, three factors, among the ones measured by the MSLQ, were identified as being

related to feedback literacy (i.e., goal orientation, self-regulation, and help seeking). Being more intrinsically goal oriented, having strong self-regulated learning traits, and seeking help when needed were positively associated to having better feedback literacy skills. These findings were endorsed by previous studies and theories,[4–6] and educational strategies targeting those factors might help students to improve their feedback literacy skills.

Important Findings and Recommendations

This thesis provided important and novel contributions to the understanding of feedback literacy in the undergraduate medical education context.

Medical education curriculum

The findings of this thesis supported previous evidences that the PBL approach to learning increases students' intrinsic motivation for learning and contributes to students' learning strategies choices.[7–9] It was found that this influence was a consequence of the lack of high stake exams and grades during the units of study, instead of a merely desire to learn due to the encounter of situations that students don't understand, as previously suggested.[8,9] Even though, motivational theories haven't traditionally driven medical education curriculum,[10] these findings show that small changes in the courses evaluations' structure might help to stimulate students' intrinsic motivation and their willingness to seek help as one of their learning strategies. Additionally, while tutorials in small groups of students might encourage peer collaboration and help seeking, the

importance put on students' participation during tutorials underestimate students that are more quiet or shy. Therefore, it is important to find other ways to evaluate students' participation in class taking into account different personality traits.

Students' role in fostering their own feedback literacy

Students believe that they can have some control over the feedback process, instead of relying only on the feedback giver's skills or the institution's learning environment. Strategies to improve feedback literacy identified by the students included self-reflection about the feedback received and how to be more proactive in the feedback process, and about the value of the feedback received even if they do not agree with the message. Students also suggested some actions they could take such as taking small steps when applying the feedback received, and actively discussing the feedback with the giver. Regarding the influences of students' learning motivations and strategies in feedback literacy, the findings of this thesis showed that self-reflections on ones' motivational beliefs and interests, combined with actions such as creating and implementing strategies to manage motivations, could help students to adjust their learning goal orientation and, consequently, improve their feedback literacy skills. Additionally, students should encourage themselves to regulate their learning in the areas of planning, monitoring, and making adjustments in learning strategies to adapt to new situations whenever needed. Students could use the MSLQ as a self-assessment tool to help them to identify their own motivational beliefs and learning strategies. Moreover, students should support their own learning by seeking assistance from others (e.g., faculty staff, peer); more specifically, by bringing concerns up, asking questions, and

asking clarifications about the feedback received. Lastly, group discussions could help students to critically reflect on the areas mentioned above, facilitating the setting of learning interests, goals, and purposeful tasks to be completed.

Educators and institution's roles in fostering students' feedback literacy

In addition to keep promoting best practices in providing feedback and encouraging a positive feedback culture, educators and institutions should implement learning strategies to support students' feedback literacy development. Faculty development activities could emphasize the importance of sharing the feedback process responsibility with students, instead of focusing exclusively on how to improve feedback delivery. Additionally, institutions should promote programs that would allow students to critically discuss and reflect about specific areas of learning goal orientation and self-regulation. Learning motivations and strategies questionnaires, such as the MSLQ, and an individualized feedback with respect to their scores should be available for students whishing to learn more about their own motivations and learning strategies.

Future research

This thesis added to the literature by mapping the studies in undergraduate medical students' receptiveness to feedback and feedback literacy, endorsing some existing knowledge, and providing gaps to guide future research. Types of reviews, that critically appraise studies' methodological limitations, risk of bias, and studies' quality, could expand the current findings in the field. Moreover, although there is a vast variation in studies' methodologies, most studies in feedback literacy are observational. The

literature could benefit from experimental approaches evaluating learning activities that could potentially enhance students' feedback literacy skills. Moreover, although the quantitative study did not show statistical difference between first- and last-year students in their MSLQ scores, the mixed methods study showed that academic maturity could be positively related to students' feedback literacy skills. Further research (involving a bigger sample and more than one institution) about the influence of student seniority in the programme on learning strategies and feedback literacy could help to target learning strategies specifically for each academic year in medical school.

Overall limitations

This thesis has some limitations that should be considered. First, the unique context of the undergraduate medical schools in Canada underlies the overall findings of this thesis and the beliefs shared by the students during the interviews. More specifically, the medical education curriculum of the institution where data collection took place, including a PBL approach to learning and a three-year medical degree program, must be taken into account when expanding the mixed methods study's findings to other populations. Second, the sample size of the studies in this thesis might reflect a narrow range of responses and experiences described by the students. A broader range of learning motivations, strategies, and experiences, and significant differences between first and last years medical students might be found in bigger samples. Third, there are some limitations inherent to the data collection methods chosen for the studies in this thesis. The MSLQ is a self-reported questionnaire, and it might not fully represent participants'

beliefs because students might seek to make a good impression of themselves. In the qualitative study, interviews were not anonymous; therefore, students with negative feedback experiences may not have wished to disclose them or to participate in the study. Fourth, the results of this thesis are not completely free of interpretation. In the qualitative study, realities were presented through the comments of medical students of that sample, and findings were constructed from my perspective along with the participants' point of view. In despite of the constant support and supervision from the members of my thesis committee, my novice researcher status might have influenced some of the qualitative findings and guided some of my methodological decisions throughout this thesis.

Lastly, in my eagerness to positively contribute to students' learning, I might have overlooked the negative impacts that the concept of feedback literacy could have on students. We still do not know what would be the negative impacts on students by suggesting them to share the feedback process responsibility with educators and institutions, and by introducing a new concept to the medical education literature. By asking students to have more control over the feedback process, we might be, in fact, increasing students' learning burden, instead of facilitating the learning experience for them. To address this limitation, future studies should explore feedback literacy learning activities and their impact on students' learning perceptions and outcomes.

Final conclusion

This thesis contribute to the knowledge around feedback literacy in undergraduate medical education by providing a more complete understanding of feedback literacy in that context, identifying factors related to it, and suggesting strategies to develop students' feedback literacy skills. Taken together, the findings of this thesis support students' empowerment in the feedback process and help them to overcome the challenges they still face during this process to improve their learning experience in medical school.

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