The Relationship between Kazakhstani Senior Student-Teacher College Practicum Experience and Teacher Self-Efficacy, Satisfaction with the Profession and Intention to Become a Teacher

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Submitted in partial fulfillment of the requirements for the degree of

Master of Sciences

in

Educational Leadership

Nazarbayev University Graduate School of Education

[April, 2023]

Word Count: [15,875]

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October 2022

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Yours sincerely,

Matthew Courtney

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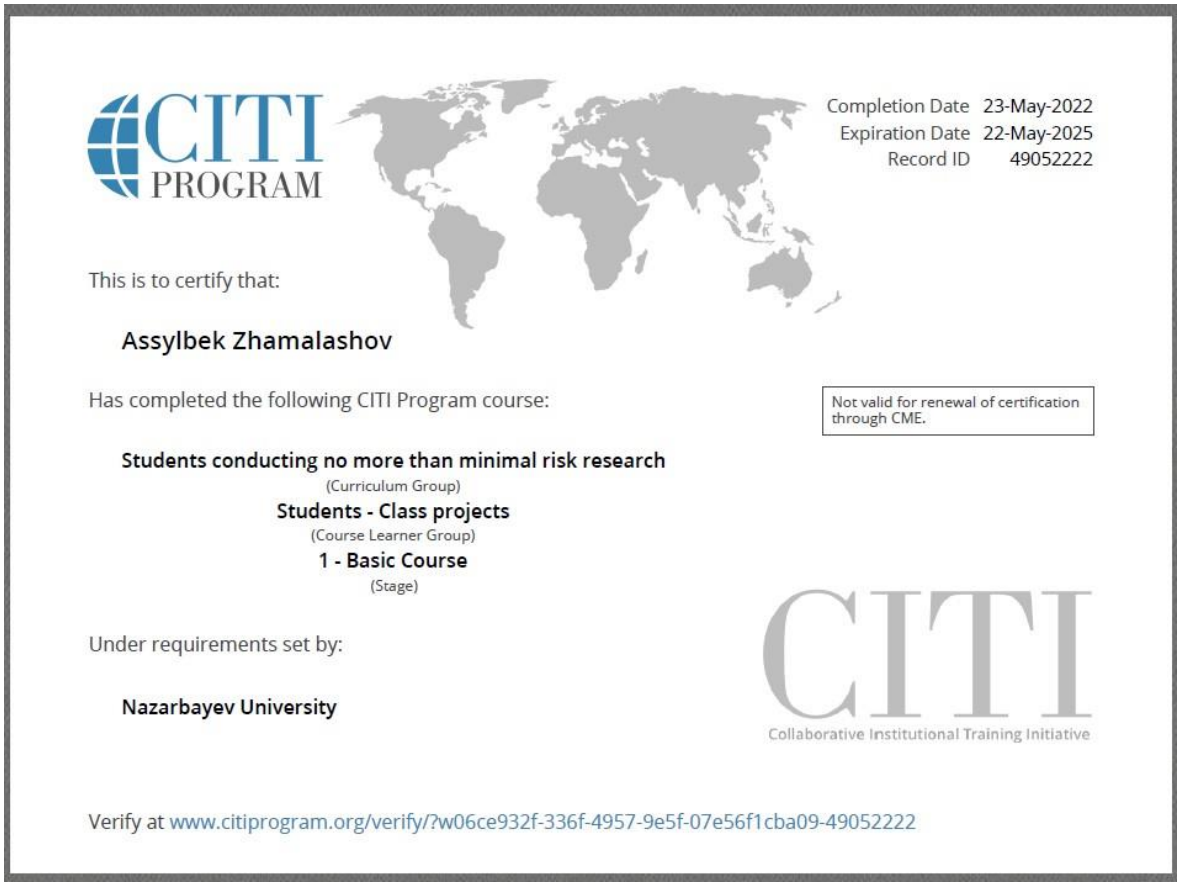

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ACKNOWLEDGMENT

I would like to express my sincere appreciation and gratitude to Dr. Matthew Courtney, my supervisor, for his guidance and support throughout the academic year in completing my thesis at an advanced level. His academic assistance, continuous support in using the R software, motivation, and positive attitude have been invaluable. His passion for educational statistics and programming languages has inspired and motivated me to learn more. I am also grateful to the faculty and staff of the Graduate School of Education at Nazarbayev University for their assistance and knowledge sharing that helped me achieve my goals.

Furthermore, I am extremely grateful to my family, especially my wife, for her unwavering support and encouragement throughout my online and offline journey. Their love and support were instrumental in making this achievement possible. Lastly, I would like to express my gratitude to my peers who have shared this journey with me and provided me with assistance and support along the way.

ABSTRACT

The Relationship between Kazakhstani Senior Student-Teacher College Practicum Experience and Teacher Self-Efficacy, Satisfaction with the Profession and Intention to Become a Teacher

The current study explored the practicum experiences of senior student-teachers of the pedagogical programs across Kazakhstan. The goal of this study is to look into the practicum experience of senior student-teachers from Kazakhstan's pedagogical universities and see how it relates to student-teachers' early levels of teacher self-efficacy (SE), satisfaction with the profession, and intention to become a teacher. The study adopts a mixed-method research design and makes use of descriptive statistics, confirmatory factor analysis (CFA), and structural equation modeling (SEM), and multilevel modeling (MLM). Undergraduates enrolled in practicum internships completed questionnaires about their overall practicum satisfaction, perceived supervising teacher competence, self-efficacy (related to classroom management, instruction, and student engagement), motivational questions, and intention to become a teacher. The questionnaire was administered to a sample of 213 senior student-teachers from 12 state and national universities and four private universities. A three factor 12-item measurement model was deemed a good presentation of the raw data consisting of (1) General Practicum Satisfaction (GPS), SE in Instruction and Student Engagement, and SE in Classroom Management. A multi-level SEM model was also specified, and the results reinforced and extended the findings from the single-level model. While GPS drove both forms of SE, belief that students would contribute to society, and intention to work in the field within institutions, collective GPS drove student-teachers collective perception of SE in Instruction and Student Engagement and their belief that they will able to contribute to society. Implications suggest that institutions should pay careful attention to improving the GPS for student-teachers as these have important long-term class- and system-level consequences. In

addition, semantic analysis of open-ended responses form student-teachers revealed that the quality of the practicum experience should be a priority for such programs, and they should provide student-teachers with authentic and meaningful teaching opportunities along with adequate feedback and support from experienced teachers. Furthermore, the practicum experience should be considered an essential factor in attracting and retaining individuals in the teaching profession, which can be achieved through marketing strategies that emphasize its positive aspects.

Аңдатпа

Қазақстандық университеттердің педагогикалық мамандықтардың жоғары курс студенттерінің практика тәжірибесі мен мұғалімнің өзіндік тиімділігі, мамандыққа қанағаттану және мұғалім болу ниеті арасындағы өзара байланыс

Ағымдағы зерттеу бүкіл Қазақстан бойынша педагогикалық бағдарламалардың жоғары курс студенттері-оқытушыларының практика тәжірибесін зерттеді. Бұл зерттеудің мақсаты-Қазақстанның педагогикалық университеттерінің жоғары курс студент-оқытушыларының практика тәжірибесін зерделеу және оның мұғалім-студенттердің өзіндік тиімділігінің ерте деңгейлерімен, мамандыққа қанағаттануымен және мұғалім болу ниетімен қалай салыстырылатынын көру. Зерттеу аралас зерттеу әдісін қолданады және факторлық талдауды (CFA), құрылымдық теңдеулерді модельдеуді (SEM) және көп деңгейлі модельдеуді (MLM) қолдайтын сипаттамалық статистиканы қолданады. Тәжірибеден өткен студенттер тәжірибеге жалпы қанағаттануы, мұғалімнің болжамды құзыреттілігі, өзін-өзі тиімділік (сыныпты басқарумен, оқумен және студенттердің қатысуымен байланысты), мотивациялық мәселелер және мұғалім болу ниеті туралы сауалнамалар толтырды. Сауалнама 12 мемлекеттік және Ұлттық университеттерден және төрт жеке университеттерден 213 жоғары курс студенттерінің үлгісіне жіберілді. 12 тармақты өлшеудің үш факторлы моделі (1) жалпы тәжірибеге қанағаттанудан, оқушылардың оқуы мен қатысуындағы өзіндік тиіміділік және сыныпты басқарудағы өзіндік тиімділіктен тұратын бастапқы деректердің жақсы көрінісі ретінде танылды. SEM көп деңгейлі моделі де нақтыланды және алынған нәтижелер бір деңгейлі модель негізінде жасалған қорытындыларды нығайтты және кеңейтті. Тәжірибеге қанағаттану өзіндік тиімділіктің екі түрін де анықтағанымен, студенттер қоғамға үлес қосады деген сенім және оқу орындарында

далада жұмыс істеу ниеті, ұжымдық тәжірибеге қанағаттану студенттерді оқыту және тарту процесінде оқытушы студенттердің se-ді ұжымдық қабылдауын және олардың қоғамға үлес қоса алатынына деген сенімін анықтады. Мұның салдары мекемелер оқушылар мен оқытушылардың өзара әрекеттесуін жақсартуға мұқият назар аударуы керек деп болжайды, өйткені бұл сынып пен жүйе деңгейінде маңызды ұзақ мерзімді салдарға әкеледі. Сонымен қатар, оқытушы студенттердің ашық жауаптарының семантикалық талдауы практикалық тәжірибенің сапасы мұндай бағдарламалар үшін басымдық болуы керек екенін көрсетті және олар оқытушы студенттерге барабар кері байланыс пен тәжірибелі оқытушылардың қолдауымен қатар шынайы және мағыналы оқу мүмкіндіктерін ұсынуы керек. Сонымен қатар, практикалық тәжірибе адамдарды оқытушылық мамандыққа тартудың және сақтаудың маңызды факторы ретінде қарастырылуы керек, оған оның жағымды жақтарын көрсететін маркетингтік стратегиялар арқылы қол жеткізуге болады.

Аннотация

Взаимосвязь между опытом практики студентов старших курсов казахстанских педагогических програм и самоэффективностью учителя, удовлетворенностью профессией и намерением стать учителем

В текущем исследовании изучался практический опыт студентов-преподавателей старших курсов педагогических программ по всему Казахстану. Цель этого исследования - изучить практический опыт студентов-преподавателей старших курсов педагогических университетов Казахстана и посмотреть, как это соотносится с ранними уровнями самоэффективности учителей-студентов, удовлетворенностью профессией и намерением стать учителем. В исследовании используется смешанный метод исследования и используются описательная статистика, подтверждающий факторный анализ (CFA), моделирование структурными уравнениями (SEM) и многоуровневое моделирование (MLM). Студенты, прошедшие практику, заполнили анкеты об их общей удовлетворенности практикой, предполагаемой компетентности учителя-супервайзера, самоэффективности (связанной с управлением классом, обучением и вовлеченностью студентов), мотивационных вопросах и намерении стать учителем. Анкета была разослана выборке из 213 студентов-преподавателей старших курсов из 12 государственных и национальных университетов и четырех частных университетов. Трехфакторная модель измерения из 12 пунктов была признана хорошим представлением исходных данных, состоящих из (1) общей удовлетворенности практикой, само-эффективность в обучении и вовлеченности учащихся и само-эффективность в управлении классом. Также была уточнена многоуровневая модель SEM, и полученные результаты укрепили и расширили выводы, сделанные на основе одноуровневой модели. В то время как удовлетворенность практикой определял обе формы само-эффективности, верю в то, что студенты внесут свой вклад в общество, и

намерение работать на местах в учебных заведениях, коллективная удовлетворенность практикой определяла коллективное восприятие само-эффективности студентами-преподавателями в процессе обучения и вовлечения студентов и их веру в то, что они смогут внести свой вклад в общество. Последствия предполагают, что учреждениям следует уделять пристальное внимание улучшению взаимодействия учащихся и преподавателей, поскольку это имеет важные долгосрочные последствия на уровне класса и системы. Кроме того, семантический анализ открытых ответов студентов-преподавателей показал, что качество практического опыта должно быть приоритетом для таких программ, и они должны предоставлять студентам-преподавателям аутентичные и значимые возможности обучения наряду с адекватной обратной связью и поддержкой со стороны опытных преподавателей. Кроме того, практический опыт следует рассматривать как важный фактор привлечения и удержания людей в профессии преподавателя, чего можно достичь с помощью маркетинговых стратегий, подчеркивающих его положительные аспекты.

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1. Introduction

In 2021, I embarked on a career as a lecturer of mathematics at Astana Pedagogical College. Currently, my responsibilities include giving lectures on the grade 11 and 12 Mathematics curricula to college freshmen. I also teach mathematical concepts in several courses at the same college. Since my students are future teachers, I often have a dialogue with them about the topic of pedagogy. One of our common topics of discussion is students' practicum experience in schools. Starting in 2021, our college moved to a new program where students receive their TAFE-Delivered Vocational Education and Training (TVET) degree in three years as opposed to the prior four-year program (Ministry of Justice of the Republic of Kazakhstan, 2018). Additionally, as part of the new program, students are required to complete their practicum in the 2nd and 3rd years of college. Consequently, students devote less actual time to the practicum itself while the theoretical and practical requirements of the program remain the same. Given these major changes, my goal is to investigate the relationship between students' practicum experience and their self-efficacy, satisfaction, and intention to become a teacher. Moreover, the intention of this study is to add to the current understanding of teacher training programs in general and to offer possible strategies for improving them. In order to gain a broader picture of the issue, this thesis surveys students from all pedagogical universities in Kazakhstan.

1.1 Background Information

In recent years, teacher preparation programs in Kazakhstan have come under criticism. The Ministry of Education and Science of the Republic of Kazakhstan (MoES) continues to monitor the countries' teacher preparation programs and has recently implemented some reforms. In an effort to recruit the most successful students, the main reform effort involved an increase in the educational stipend for those studying pedagogical degrees (Government of the Republic of Kazakhstan [RK], 2021). However, still, there have been no policy changes associated with the curricula and training programs themselves.

Additionally, the teacher practicum (TP), one of the most important elements of teacher preparation (Woullard & Coats, 2004), also still remains unchanged. The TP is of primary importance to the teacher education program as candidates who obtain more field experience and take advantage of quality mentorship opportunities are more prepared to deal with the complicated realities of today's schools, classrooms, and students (Spooner et al, 2010).

According to Uzakbaeva and Zholdasbekova (2015), student-teachers in Kazakhstan (i.e., those university- or TVET-based students studying to be school teachers) are required to complete a total of 40 months of study at a higher education facility. However, pedagogical practice typically only constitutes just eight weeks of this time period (approximately, five percent of study time). In addition, the proportion of time that student-teachers dedicate to practicum can vary. This is because, in Kazakhstan, the credit hours for a practicum vary according to the particular working curriculum of the university or college (Kulakhmetova et. al., 2014).

Practicums are classroom-based experiences that allow student-teachers to apply knowledge and expertise, derived from their courses, into practice without the responsibilities of being a practicing teacher (Koc, 2012). The main purpose of the practicum is for student-teachers to learn from and engage with experienced teachers while developing their own teaching styles and beliefs in order to become successful educators. It is important to understand the personal impressions and judgments of prospective teachers in terms of the usefulness of the practicum, the skills acquired, and the quality of mentorship. Therefore, an investigation into student-teachers' practicum experience and how this might contribute to their self-efficacy, level of professional satisfaction, and intention to enter the profession in Kazakhstan is worthy of investigation.

1.1.1 Self-Efficacy Beliefs

Belief in one's own ability to succeed at a task is one of the key concepts that Albert Bandura emphasizes as the basis for Social Learning Theory (Bandura, 1982). According to Bandura, the belief in one's own capacity for self-efficacy is connected to one's competence or the likelihood of successfully completing a task, or, described in another way, the level of belief that is necessary in order to overcome the challenges posed by the uncertainties.

A belief in one's own self-efficacy is not the same thing as simply being aware of what to do. The belief in one's own self-efficacy encompasses one's productive capacity, which can include social, cognitive, and behavioral abilities and must be organized to serve a variety of purposes. A person's perception of their own capabilities influences not only how hard they try but also how long they can persevere through challenges. If the individual is concerned about his or her ability to make it through challenging times, he or she has the option of not working as hard or giving up on the task altogether. On the other hand, a person who has complete faith in his or her abilities is more likely to put in extra effort when confronted with challenges, and this person is also more likely to find creative ways to overcome these challenges (Bandura, 1982). Importantly, a person with a high level of self-efficacy does not mean that they are talented; rather, it refers to the conviction that they have in their own capabilities and resources. If a person has a low sense of efficacy, they will not be able to use their abilities effectively even when they are confronted with major challenges. In addition, a person who has high efficacy beliefs is more likely to blame their failures on the choices they made regarding their methods and strategies than on their own shortcomings (Woodcock & Stuart, 2011). According to Yildirim and Ilhan (2010), having high self-efficacy leads to an increase in beliefs regarding personal development, success, a variety of skills, and well-being. According to Ozdemir (2008), teachers', including prospective teachers', self-efficacy belief in teaching is one of the most important factors that contribute to teachers' problem-solving and classroom

management; their planning, application, and assessment of the teaching process; and, their capacity to improve student success and self-efficacy belief.

1.1.2. Teacher's Attitude toward the Profession

Constituting the primary component of an educational system, it is the teachers that have the significant responsibility of ensuring that students acquire the knowledge and skills that they need to succeed (Ajzenman et al., 2021). Before beginning their professional careers, ideally teachers should have not only have attained a high level of domain-specific competency but also exhibited a positive *attitude* toward the teaching profession (Karadag, 2012). This provides some assurance that they will not only be able to fulfill their responsibilities but also contribute to and improve the overall quality of the educational system.

A teacher's attitude can be defined as a complex mental state that is generally exhibited by certain behaviors (Hussain et al., 2011). Teachers' "attitude toward the profession" can be broadly classified as their initial "intention to become a teacher" in addition to their general "attitude toward the profession" (Hussain et al., 2011). Prospective teachers' intention to enter the profession and their perspective on the profession itself is influenced by their level of conviction, passion for the work, awareness of the significance that their profession plays in the larger society, and capacity to continue to grow as individuals as a direct result of the demands of their jobs. The way in which prospective teachers feel about these issues, whether positively or negatively, can have a significant impact on their code of professional conduct. Because of this, the learning experiences that students have should be structured in such a way as to encourage them to have favorable attitudes toward the teaching profession (Coşkun, 2011).

Research suggests that as a teacher becomes more committed to their profession and exhibits a more positive attitude toward the teaching profession, their performance improves, and they are generally more productive (Hussain et al., 2011). In this context, prospective

teachers who are more devoted to the teaching profession have a positive attitude toward teaching and possess more positive values and perceptions, all of which can be seen as a determinant of success in their professional life (Karadag, 2012).

Ideally, prospective teachers should receive the necessary training to ensure that they exhibit optimal vocational behaviors in relation to their profession. The sentiments, information, and competencies that are taught to tertiary-level students in teacher training programs should be developed to assist teachers to be more effective in their vocational behaviors. Insofar as possible, tertiary teacher education should be aimed at developing teachers who have a positive attitude toward the teaching profession. Such positive and constructive attitudes are likely to foster more teacher motivation and success in the classroom. Moreover, a teacher that exhibits an improved attitude toward the profession may also inspire pupils to acquire the knowledge, skills, and values of their teachers and become teachers who are interested in becoming teachers themselves (Ustuner, 2006; Karadag, 2012).

1.2 Problem Statement

Teachers are an essential component in the attempt to enhance educational institutions and they are expected to respond to fast-changing policy changes and social expectations. Indeed, the teacher is regarded as the most significant force influencing the educational system (OECD, 2005). The teaching practicum is a vital aspect of teacher education because it affords pre-service teachers the opportunity to apply theoretical knowledge obtained in courses to real-world classroom settings (Allen & Wright, 2014). Overall, the teaching practicum is a complicated and dynamic process that, ideally, should have positive effects on pre-service teachers' professional development. In Kazakhstan, there exists a dearth of research related to how pre-service teachers' practicum experiences affect their self-efficacy, professional satisfaction, and intention to enter the teaching profession.

1.3 Purpose of the Study

The purpose of this study is to investigate the practicum experience of senior student-teachers from pedagogical universities in Kazakhstan and to identify how this experience might be associated with student-teachers' early level of teacher self-efficacy, satisfaction with the profession, and intention to become a teacher. Specifically, the study investigates the practicum experience of the student-teachers in terms of socio-emotional components (e.g., students feeling about their practicum classroom and their perceived fit with their cooperating teacher) and practicum satisfaction components (e.g., overall satisfaction, satisfaction with the tasks and outcomes, competencies acquired during the practicum). How these experiences might be associated with student-teacher self-efficacy, satisfaction, and intention to become a teacher is yet to be explored in Kazakhstan.

1.4 Significance of the Study

This research intends to provide new insights into the practical training provided by pedagogical universities and colleges in Kazakhstan. Understanding student-teachers' perceptions of their practicum placement and identifying the factors that may contribute to emerging teacher efficacy, satisfaction, and early career commitment may help guide undergraduate preservice teacher education programs to develop optimal practicum experiences and ultimately, more efficient, competent, and committed school teachers in the country.

1.5 Summary

The following chapter, the Theoretical Framework, provides a summary of the theories undergirding the current research. It will include and integrate two theoretical perspectives, namely Bandura's (2001) social cognitive theory, and Rotter's (1982) social learning theory, and describe how these theories have been employed to provide a framework for understanding practicum student experiences. Thereafter, the literature review provides a summary of the literature devoted to the topic to date. While there exists little research on teacher training in

Kazakhstan specifically, the review draws on research from various other contexts to provide an understanding of the importance of student-teacher practicum experiences and their role in developing the careers of teachers. Specifically, the chapter provides a review of the literature devoted to research into student-teacher practica, overall practicum satisfaction, role of the practicum, and sense of self-efficacy. Subsequently, the methodology provides information on the research design, participants, materials and instruments, procedures, data analysis tools, and limitations of the study at hand. At this juncture, the results section includes a description of the data collected and the results of the analysis. After the results a presented the discussion chapter provides an interpretation of the study's results. The discussion chapter also covers the limitations and suggestions for future studies and practical implications and applications of the findings. The final chapter is devoted to the conclusions and implications of this study.

2. Theoretical Framework

The theoretical framework serves as a basis and inspiration for exploring a subject matter of focus. In the case of investing practicum student experiences, there are various theoretical perspectives that can be applied, such as Bandura's (2001) social cognitive theory and Rotter's (1982) social learning theory. Each of these theories offers unique insights and a framework for comprehending the experiences of practicum students, as briefly described below.

2.1 Bandura's Social Cognitive Theory

Social Cognitive Theory has had a significant impact on the fields of psychology, education, and communication, and is widely used as a basis for studying teacher efficacy (Ross et. al., 1996; Tschannen-Moran et. al., 1998; Woodcock, 2011). Bandura's (2001) theory suggests that individuals are both products and producers of social systems. They develop their own interpretations of their environment and are influenced by society and those around them. Thus, while student-teachers might hold their own unique set of teaching beliefs prior to practicum, these beliefs will continue to evolve through their interactions with the practicum classroom environment and cooperating teachers.

The social cognitive theory emphasizes the importance of human agency, which encompasses four main elements: intentionality, forethought, self-reactiveness, and self-reflectiveness (Bandura, 2001). Intentionality requires individuals to take initiative and carry out specific actions, while forethought involves setting goals with a clear understanding of the likely outcomes. In the context of a practicum course, students must use intentionality and forethought to integrate course content and employ various teaching strategies, including behavior management techniques to ensure student learning. Self-reactiveness involves the motivation and self-regulation necessary to act with intention and forethought, and practicum students demonstrate this quality by adapting their interactions with children as needed.

Practicum students must also be self-reflective, regularly assessing their own actions and functioning. This can be accomplished through activities such as weekly journal entries, lesson plan reflections, and conversations with fellow student-teachers. Overall, the successful integration of intentionality, forethought, self-reactiveness, and self-reflectiveness are essential for practicum students to effectively apply what they have learned in the classroom to real-world teaching situations.

The concept of human agency encompasses an individual's ability to make choices and execute those choices within larger social contexts. This concept is rooted in self-efficacy, which is defined by Bandura (1997) as an individual's belief in their ability to successfully complete a task. It is crucial for individuals to believe that they can achieve a desired outcome in order to actually produce that outcome. Furthermore, an individual's level of self-efficacy can impact their overall way of thinking, such as whether they approach tasks with optimism or pessimism (Bandura, 2001). Bandura emphasizes that an individual's perceived self-efficacy is a significant factor in the productivity and overall functioning of society.

Drawing upon the foundational concept of human agency, the present research defines and assesses teacher efficacy as practicum students' belief in their general ability to effectively engage with students and facilitate learning outcomes among students.

2.2 Rotter's Social Learning Theory

The current study draws on social learning theory (Rooter, 1982) to inform its approach. This process-oriented theory emphasizes how individuals acquire their characteristic behaviors and attitudes through interactions with others and their environment (Rotter, 1982). This theory is highly relevant to the desired outcome of practicum experiences for students, as they acquire teaching skills by observing and interacting with cooperating (supervising) teachers and spending time in developmentally appropriate classrooms. Furthermore, early childhood

practicum settings provide students with a new environment to apply previously learned skills and develop new teaching strategies that they can implement after becoming teachers.

According to social learning theory, individuals have the ability to unlearn responses to situations and develop new ones as they gain experiences and learn from their interactions with others and the environment. For instance, a child who is initially afraid of a classroom pet due to lack of prior experience may develop a new response of interest in the pet after multiple interactions and observing others interact with it. Social learning theory has been studied and influenced by various scholars, including Alfred Adler, Kurt Lewin, Clark Hull, and Albert Bandura. However, for the purposes of this study, the works of Julian B. Rotter were used to comprehend social learning theory.

Social learning theory includes expectations, context, and reinforcement as its core assumptions and basic principles (Rotter, 1982). The theory proposes that people's expectations in a current situation are shaped by their experiences in that situation and by similar experiences that they have had in the past. For instance, a practicum student who has worked as a classroom assistant in an educational center may have certain expectations for their future practicum experiences based on their past experiences. People use their previous experiences to form perceptions that can help them understand new situations that share similarities with their past experiences. Furthermore, practicum students have individual characteristics, such as their temperament, family structure, and work experiences, which can affect their perception of the practicum experience.

Social learning theory stresses the significance of the situational context of learning. According to this theory, individuals' interactions and experiences with their surroundings impact their personality development in a cohesive manner (Rotter, 1982). In other words, individuals' personality becomes more stable as they gain more experience and acquire new

skills (Caspi & Shiner, 2006; Rotter, 1982). The more experiences individuals have that are similar, the more they can draw meaning from these experiences and apply it to larger concepts, such as teaching children. Throughout the practicum semester, students engage in various activities such as lesson planning, teacher-child interactions, and behavior management, which contribute to the development of their teaching efficacy. Furthermore, environmental factors play a significant role in shaping the practicum experiences. Practicum students' perceptions of their relationship with their cooperating teacher, for instance, can provide insights into potential implications, such as satisfaction levels, and highlight areas for improvement in the dynamic between the cooperating teacher and practicum student.

Rotter's social learning theory posits that reinforcement, whether positive or negative, can influence learned behavior. In the context of practicum students, the feedback they receive from their cooperating (supervising) teachers can impact their overall learning experience. Positive reinforcement, such as affirmations from their teacher can improve a student's perception of their teaching skills. On the other hand, negative reinforcement or the fear of negative feedback can lead to negative emotions that can hinder their learning and impact their self-efficacy as a teacher. The current study aims to understand how practicum students feel in the classroom and their satisfaction with their practicum experiences, including feedback, opportunities to practice skills, and their responsibilities. This information can help identify factors that can positively or negatively affect the overall experience of practicum students.

To summarize, the current study focuses on constructs of interest such as cooperating teacher fit, practicum satisfaction, and practicum students' teacher efficacy. These constructs are identified and conceptualized based on the underlying theoretical perspectives of Social Cognitive Theory and Social Learning Theory. Attention is now drawn to the empirical literature that highlights the links between student-teacher practica and self-efficacy.

3. Literature Review

3.1 Introduction

The purpose of the literature review is to provide a summary of the relevant research in the field pertaining to student-teacher practicum experience and its relationship with teacher self-efficacy, satisfaction with the profession, and intention to become a teacher. Boote and Beile (2005) suggest that a researcher must comprehend the existing literature in their field prior to conducting significant research. Hence, before commencing a literature review, it is crucial to establish a framework for exploring, summarizing, and presenting the literature to a specific area of interest. Cooper (1998) provides a useful way to organize the structure of a literature review in accordance with the following six characteristics: focus, goal, perspective, coverage, organization, and audience (Table 1).

Table 1
Cooper's Taxonomy of Literature Reviews

Characteristic	**Categories**
Focus	***Research outcomes*** Research methods Theories[a] ***Practices or applications***
Goal	Integration (a) Generalization (b) Conflict resolution (c) Linguistic bridge-building Criticism ***(d) Identification of central issues***
Perspective	***Neutral representation*** Espousal of position
Coverage	Exhaustive Exhaustive with selective citation Representative ***Central or pivotal***
Organization	Historical ***Conceptual*** Methodological
Audience	***Specialized scholars*** General scholars ***Practitioners or policy makers*** General public

Note. [a]Attention already afforded to establishing a theoretical framework; specific category chosen for teach characteristic is in bold and italics; reprinted from *"A Guide to Writing the Dissertation Literature Review," by J. Randolph, 2009, Practical Assessment,* Research and Evaluation, *14*(13). Copyright 2019.

For focus, the research reviewed herein will primarily be related to research outcomes and practices of applications, however, some attention has already been afforded to establishing an appropriate theoretical framework. “Research outcomes” was chosen for focus because the intention was to analyze and synthesize that focused on research outcomes in the field in order to draw conclusions. As for the goal of the literature review, “Identification of central issues” was chosen as the primary purpose was to critically analyze previous studies and identify relevant gaps in the field. “Neutral representation” was selected for perspective as the author aimed to represent the central quantitative-based literature in an unbiased manner. For coverage, “Central or pivotal” was chosen as priority was given to key articles and research findings. Meta-analyses and systematic reviews were also emphasized where possible, and articles from established journals with Q-rankings were given priority. For organization, “Conceptual” was selected since theories and conceptualizations were introduced systematically. Finally, the dissertation literature review was written for both general scholars interested in the theory and practitioners or policymakers who may apply the results in practice.

3.2 The Vital Role of the Teacher Practicum

Training future teachers through practicum is an essential component of the Initial Teacher Education (ITE) program (Perry 2004; Quick & Sieborger, 2005; Maphosa et. al., 2007). This is because practicum provides student-teachers with their first exposure to actual teaching practices (Ngidi & Sibaya, 2003). According to Tuli and File (2009), practicum enables student teachers to become aware of their own capabilities and creative potential, both of which will assist them in the teaching processes that they will eventually undertake. In addition, Tuli and File demonstrate that participating in a practicum enables student-teachers to gain a better understanding of the real world of teaching and provides them with information regarding the challenges and issues associated with the profession that they may encounter in the future. In the same sense, Smith and Lev-Ari (2005) pointed out that practicum helps

student-teachers to understand the environment of their pupils and to accept the pluralism and difference that exists among their students. In addition, these researchers found that participating in practicum may help student teachers cultivate positive attitudes toward both the teaching profession and the students that they will eventually teach.

The practicum also helps develop the student teachers' behaviors and practices in the classroom. It does this by (1) giving them a clear understanding of the school's context and educational best practices, (2) letting them know what students really need to learn, (3) bridging the gap between theory and practice, and (4) building their professional and personal skills (Smith & Lev-Ari, 2005). In addition, student-teachers are able to achieve integration between theoretical, practical, and empirical knowledge through their practicum experience.

3.3 Research into Student-Teacher Practica

Research on student-teacher learning during teacher practicum (TP) has covered a variety of topics, including the primary concerns of student teachers, the experiences of student teachers, what and how student-teachers learn, and how particular innovations implemented by particular universities contribute to teacher learning.

To begin, a number of studies have demonstrated that the majority of student teachers, when they first begin their careers, are initially more concerned with ensuring their own survival in the classroom and determining how best to maintain order among the students than with how best to facilitate their own students' educational growth (see, for example, Kagan, 1992; Numrich, 1996).

The need to appear humble and to want to seek support from experienced teachers in the spirit of "commitment to inquiry and willingness to learn from error" was also identified by Intrator (2006) as one of the most difficult challenges student-teachers faced during the TP. He saw that if this problem wasn't resolved, it could prevent aspiring educators from gaining

valuable experience. Previous studies have pointed to insufficient induction and socialization of student teachers in placement schools as a possible cause of such difficulties (Farrell, 2001).

The question of what, if anything, preservice teachers pick up on during their field experiences has also been investigated. Research has suggested that student-teachers often acquire and develop skills pertaining to planning (e.g., Dellicarpini, 2009) and pedagogical judgment (Johnson, 1992; Kohler et al., 2008). Despite this, these authors noted that the student-teachers in their studies lacked the ability to articulately justify the choices that they made in the classroom.

More recently, research related to student-teacher practicum experience has also investigated teacher efficacy, defined as "the confidence that the instructor has in his or her ability to plan out and carry out the steps that are necessary to successfully complete a particular activity within a particular setting" (Tsachannen-Moran et al., 1998, p. 233). Research by Liaw (2009) and Atay (2007) suggested that teacher efficacy, as defined above, increased during TPs in Taiwan and Turkey, respectively. However, this effect appeared to be especially evident when practicums were longer (around one year), well supported, and involved close collaboration among (1) student-teachers and their teacher supervisors, (2) fellow student-teachers, and (3) senior teacher educators.

3.4 Overall Practicum Satisfaction

An investigation into the experiences that student-teachers have while on practicum not only provides insight into the benefits that students may derive from the placement, but it also provides insight into the benefits that the practicum program itself provides. In addition, the research indicates that there may be a connection between the level of satisfaction felt by teachers and their perceived level of efficacy (Ciftci, 2011; Nias, 2012). Studies conducted on Norwegian educators already working in the classroom found that a successful student-teacher practicum is a good indicator of future job satisfaction (Skaalvik & Skaalvik, 2014). There

have been studies that have focused on student-teacher self-efficacy during practicum as an outcome variable (Ross, 1996; Woodcock & Stuart, 2011; Ozdemir, 2008). However, it could be argued such an outcome is likely very closely influenced by how satisfied student-teachers are with their participation in the practicum itself. Students' levels of satisfaction with their practicums may be also a reflection of the environments in which they were able to experiment with a variety of teaching strategies and further develop their teaching beliefs, both of which may be related to the student's sense of their own ability as teachers. Because of the potential impact that satisfaction may have on teaching and on beliefs held by teachers, it is extremely important to evaluate these constructs with practicum students who are just beginning their formal training to become teachers (Woolfolk-Hoy & Spero, 2005).

Different factors, such as confirmatory statements (for example, "I am satisfied with what I achieve at work") and a feeling of collaboration with coworkers, have been used to measure teachers' levels of job satisfaction (Caprara et. al., 2006; Guo et. al., 2011). For example, "I am satisfied with what I achieve at work". According to research (Ciftci et. al., 2011; Guo et al., 2011; Nias 2012,), teachers' perceptions of their own effectiveness are influenced by their level of job satisfaction. According to the findings of one study conducted in Turkey on undergraduate students enrolled in a teacher education program, the relationship between student teachers' needs, school adjustment (such as GPA), university experiences, perceived friendships, and student's teaching job satisfaction was mediated by teachers' perceptions of their own efficacy as educators (Ciftci et. al., 2011).

In the same vein, the perceptions of in-service teachers regarding the climate of the school and their interactions with colleagues have also been investigated in relation to teacher self-efficacy. The findings suggest that a feeling of collaboration with one's colleagues is associated with higher levels of teacher self-efficacy (Guo et al., 2011). One possible

explanation for this relationship is that when you have positive relationships with your colleagues and mentors, you are more likely to be satisfied and proficient as a teacher.

On the basis of the research above, regarding the connection between teacher collegiality and teacher efficacy, it seems reasonable to investigate the relationship between the same constructs for practicum students who are just starting their formal training to become teachers. Aspects such as pay and work hours are included in some of the measures of satisfaction for in-service teachers. However, these factors may be less applicable to practicum students. Measures of practicum students should instead incorporate relevant factors for the student-teachers themselves, such as the degree to which they (1) are comfortable in their role in the classroom, (2) receive feedback from cooperating teachers, and (3) are able to implementing various teaching strategies.

3.5 Sense of Self-Efficacy

Teacher self-efficacy is defined in this study as a teacher's perception of their own abilities to achieve teaching-related goals, as well as the impact that they believe they have on the development and learning of their students (Armor et al., 1976). Teachers who are highly effective, for example, have the mindset that the activities and discussions they have with their students in the classroom contribute to the student's development as learners and people (Tschannen-Moran & Woolfolk-Hoy, 2001). However, teachers who have low levels of teaching self-efficacy may believe that other contextual factors, such as the student's home environment, may have a greater influence on student learning than they do. As a consequence of this misconception, these teachers may be less likely to consistently work to improve relationships and teaching strategies with students (Fives et al., 2007, Woodcock 2011).

During the formative years of teacher preparation, it may be extremely important to investigate which aspects of the practicum experience may influence teachers' sense of their own efficacy. According to studies conducted in both the United States and Australia, there is

a correlation between higher levels of teacher efficacy and lower levels of teacher burnout (Woodcock, 2011; Woolfolk-Hoy & Spero, 2005).

Obviously, there is more to teacher self-efficacy than just how well students perform. It has been demonstrated that higher levels of teacher effectiveness are specifically linked to better academic outcomes and progress for students (Armor et al. 1976; Caprara et al. 2006). In an ideal world, student-teachers would use their practicum experiences to gain an understanding of how the lessons they teach affect the development and education of the pupils under their care (Tschannen-Moran & Woolfolk-Hoy 2001; Woolfolk-Hoy & Spero, 2005). Therefore, the research at hand focuses on the important question concerning the association between students' practicum experiences and the early levels of self-efficacy, professional satisfaction, and intention to become a teacher.

3.6 Summary

A review of the related research suggests that student-teachers practicum experience can shape their sense of competence as teaching professionals, their expectations and attitude toward the profession, and their intention to enter the profession. When assessing the effectiveness of practicum student teachers, it is important to take into account a variety of factors, including the teaching environment, whether or not the individual is motivated to become a teacher, and their self-efficacy beliefs.

According to the theory and empirical research reviewed, previous experiences of student-teachers provide a scaffold for how they interpret new situations. Consequently, the current study will investigate the role that teacher practica has on student-teachers' emergent teacher self-efficacy, satisfaction with the profession, and intention to become a teacher.

4. Methodology

4.1 Introduction

This section presents an explanation of the methodology selected for this research aimed to answer the overarching research question: What is the experience of senior student-teachers from pedagogical universities in Kazakhstan and what is the role of this experience on their teacher self-efficacy, satisfaction with the profession, and intention to become a teacher. This chapter includes the following subsections: research questions, research design, participants, methods of data collection, sampling approach, instrumentation, procedures, and data analysis.

4.2 Research Questions

Based on the rationale provided, the following three main research questions are posited:

RQ1: What measurement model best represents student-teacher practicum satisfaction, teacher self-efficacy, and student-teacher motivation?

RQ2: What structural model best represents the role of student teachers' practicum experience on their level of self-efficacy, motivation, and intention to become a teacher?

RQ3: (a) How do student-teachers feel about their practicum experience in Kazakhstani educational institutions and (b) how do they think that these experiences be improved?

4.3 Research Design

The purpose of this study is to investigate the extent to which student teaching practicum experience is associated with their self-efficacy beliefs, levels of job satisfaction, and motivation to enter the teaching profession. To achieve this goal, the current study surveys pedagogy student-teachers' students across all registered pedagogical universities in

Kazakhstan. To assess the outcome of the practicum experience, a mixed-methods approach with an embedded design was employed (Creswell, 2003). For this design, the second form of data (qualitative, for answering RQ3) augments the primary form of data (quantitative, for answering RQ1 and RQ2). By using both quantitative and qualitative methods, researchers can triangulate their findings, which means that they can cross-check the results from different sources to increase the validity and reliability of their research (Creswell & Plano Clark, 2018). This approach can help researchers to better understand the complexities of their research topic and to gain a more nuanced understanding of the data they collect.

Triangulation is a key feature of mixed-methods research designs, which are becoming increasingly popular in various fields, including education. Quantitative methods allow researchers to measure and analyze numerical data, while qualitative methods allow them to gather rich, detailed information about students, teachers, and other educational stakeholders' experiences and perspectives. Specifically, by using both methods, educational researchers can make use of the advantages of both methods leading to a more comprehensive understanding of the research topic.

In this study, both quantitative and qualitative methods were used to collect data. The quantitative data were collected through the close-ended questions in the survey, while the qualitative data were collected through open-ended questions in the same survey. The quantitative data were analyzed using statistical techniques to test hypotheses and make inferences about the studies phenomenon. The qualitative data were analyzed using thematic analysis to identify common themes and patterns in the data. Specifically, for each open-ended question, this involved reading through the available translated scripts and looking for patterns and meaning in the data to find themes. For this method, an active process of reflexivity was applied in which my subjective experience was at the center of making sense of the data. To ensure trustworthiness in the qualitative data analysis, the current study considered aspects of

credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). More credibility was afforded to the repeated opinions from student-teachers and field-notes concerning patterns in the data were also checked by a close colleague. Transferability was enhanced by way of selecting student-teachers form the multiple pedagogical institutions, and, insofar as possible, confirmability was ensured by way of repeated checking of patterns in the transcripts and the adoption of a clear coding scheme throughout the qualitative data analysis process.

Nevertheless, by triangulating the findings from both quantitative and qualitative data, the validity and reliability of the research findings were increased. It was thought that this approach would provide an improved understanding of the complexities of the research topic and generate a more nuanced understanding of the subject area.

In conclusion, using both quantitative and qualitative methods in research can lead to a more comprehensive understanding of the research topic. Triangulation of the findings from both methods can increase the validity and reliability of the research findings, and provide a more nuanced understanding of the data collected.

4.4 Participants

The participants in this study were senior student-teachers from 16 pedagogical universities/registered training collages in Kazakhstan. To participate in the study, student-teachers needed to meet the following criteria: (1) be aged 18 or above, (2) be in Year 2, 3, or 4 of their teacher training (or equivalent due to part-time status), and (3) have already completed at least one school practicum unite.

4.5 Methods of Data Collection

Firstly, to collect data, a self-report style questionnaire was designed according to the research objectives. The questionnaire includes five sections: the first pertained to respondent demographic; the second related to practicum satisfaction; the third to student-teacher self-

efficacy; and the fourth pertained to student-teacher motivation and intention to become a teacher. Finally, in the last part of the questionnaire, a series of open-ended questions were included for this study as part of the embedded mixed-method design. The questions probed the respondents' perceptions of their practicum experience.

4.6 Sampling Approach

For the present study, a web-based response-driven sampling approach (Wejnert & Heckathorn, 2008) was used to survey student-teachers in the country. This was done because initially responsive student-teachers (seed participants) are likely to know other eligible research participants. In this instance, such snowball-related sampling approaches are advantageous (Simkus, 2022). In order to identify an initial sample, a list of pedagogical universities and colleges providing recognized undergraduate and TVET teacher education programs was compiled in MS Excel. Thereafter, this author used relevant search terms (e.g., "Kazakh National Women's Teacher Training University") on popular social media platforms (namely, Facebook, Contact, and Instagram) to compile a list of potential contacts. Sampling itself was undertaken between November of 2022 and the January of 2023 as it was expected that student-teachers would have completed their practicum for that semester.

The invitation to participate in the survey was sent to a total 12 university student groups on Facebook, 10 student groups on Instagram, and sent to 23 university student organizations' email addresses.

A total 213 student-teachers completed the survey from a total 16 different pedagogical universities and colleges across the country.

4.7 Instruments

The questions in the survey were adapted from the following sources: the practicum satisfaction questionnaire (Chaw & Kopp, 2021); the teacher self-efficacy questionnaire (OECD, 2019); and the teacher motivational questionnaire (OECD, 2019). A description of the

questions in each of these four sections will now be provided (see Appendix A for the full list of questions).

The practicum satisfaction questionnaire was adapted from Chaw and Kopp (2021) and was comprised of 12 unique items designed to elicit the level of satisfaction that student-teachers derived from their practical experience. To ensure maximal variance, response options included a six-point positively packed agreement scale with the following anchors: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly agree, 4 = moderately agree, 5 = mostly agree, and 6 = strongly agree (Brown, 2004). Items pertained to the meaningfulness of tasks, availability of supervising teacher, and perceived improvement in professional competencies (Appendix A).

The teacher self-efficacy questionnaire was adapted from the OECD (2019). For these questions, student teachers are required to envisage themselves in front of a classroom and consider the extent to which they exhibit self-efficacy in classroom management (4 items), instruction (4 items), and student engagement (4 items). For these items, for the purpose of comparison with international studies, the response options remained the same as those presented by the OECD: 1 = not at all, 2 = to some extent, 3 = quite a bit, 4 = a lot (Appendix A).

The final battery of quantitative questions pertained to student motivation to become a teacher and intentions to enter the profession. Motivational questions were adapted from OECD (2019) and pertained to student-teachers' perceived level of personal (4 items) and social utility (3 items) of the teaching profession. Response options for these motivational questions were as follows: 1 = not important at all, 2 = of low importance, 3 = of moderate importance, and 4 = of high importance. Student-teacher intention to become a teacher was measured by way of the six Likert-style questions. For example, "The teaching profession was my priority and main

choice", or "I may change my teaching profession to another" (reversed) with response options, 1 = not at all, 2 = to some extent, 3 = quite a bit, and 4 = fully.

In addition, the following open-ended questions were designed to elicit qualitative-based responses about students' experience on practicum:

1. What did you find most challenging about the practicum?

2. Is there anything about the structure of the practicum that can be improved upon to support your learning?

3. What was your favorite part/activity/action during the practicum? Please explain.

4. What is one skill you know you need to improve upon as a future teacher?

5. How does the practicum support you in improving that skill? (Appendix A)

4.8 Procedures of the Study

The study was carried out in compliance with ethical principles and standards as set out by the Nazarbayev University Institutional Research Ethics Committee (IREC). Because the research includes individual participants and records their personal opinions, the researcher presented a description of the research processes to the Nazarbayev University review board (Cresswell, 2012). After receiving clearance from the NU IREC, the initial respondents for the sample responded to the questionnaire in December, 2022. Upon completing the questionnaire, the initial respondents were asked to forward the link to the survey to their eligible friends and colleagues. Further, those friends and colleagues of the initial students were also prompted to forward the survey to their eligible colleagues. Each participant received a link for the survey, which included an introduction letter and participant consent forms. Finally, for the qualitative component of the survey, participants were prompted to complete the five open ended questions.

4.9 Adherence to the Kazakhstani Code of Ethics

The study will be fully conducted according to ethical principles and standards which were mentioned in the Code of Ethics of Researchers of Education in Kazakhstan (KERA, 2020). The main priority is to protect participants' interests and to keep them from any further risks.

The participants of the investigation all participated voluntarily and all of them were introduced to the purpose and the nature of the investigation. The participants were informed about the duration of the research and what was required from them as participants of the study. Before starting, all of the participants received an introductory letter, an informed consent form, and a support letter from the supervisor of the investigation. The introductory letter and consent form consisted of information related to the purpose of the study, the nature of voluntary participation, and confidentiality. As it was a voluntary study, the participants were able to withdraw from the study at any time (though not beyond two weeks of completing the questionnaire as the data based on their responses had already been processed). All participants were able to skip any question that they did not want to answer. Any identifying information from the participants was kept confidential and on this author's password-protected computer. Further, in order to protect participants' anonymity and confidentiality, the researcher used pseudonyms. Also, participants of the study were guaranteed that the recorded information would be kept safe, and no one except the supervisor and researcher had access to the record of survey responses. Participants of the research were informed that their participation in this study would contribute to a better understanding and of the state of teacher education practical training in Kazakhstan.

4.10 Data Analysis

The data analysis for each of the four research questions will now be detailed.

RQ1 seeks to identify the measurement model that best represents student-teacher practicum satisfaction, teacher self-efficacy, and student-teacher motivation? To answer this question, an initial examination of the degree to which the related variables vary within- and between institutions will be undertaken by way of estimation of intra-class correlation coefficients (ICC). In accordance with the literature, ICCs above .10 can be considered substantive, and design effects above 2.00 can also be represent substantive between-institution effects. In accordance with the literature, de = 1 + ICC(c-1), where ICC = intra-class correlation, c = average number of students sampled per cluster. Thereafter, confirmatory factor analysis (CFA) (or multi-level CFA, dependent on the size of ICCs and de) will be performed on the observed data.

Model fit indices including chi-square/df ratio, CFI, RMSEA, SRMR, and gamma-hat will be assessed in accordance with Hu and Bentler (1999). The measurement and structural models in this study must satisfy four fit indices: SRMR, RMSEA, CFI, and gamma hat. It is generally recommended by Hu and Bentler (1999) that a model should meet at least three out of the four minimum requirements to be considered acceptable. This criterion is followed in the analysis of the thesis. For the models, discriminant validity will be examined by way of the following three criteria: (i) the existence of minimum item-factor loadings (with > .50, acceptable), (ii) the Cronbach's alpha reliability coefficients (Cronbach, 1951) for each factor (with > .70, acceptable), (iii) the heterotrait-monotrait criteria ($HTMT_{.85}$; Kline, 2011). All analysis will be undertaken with the assistance of the R lavaan package (Rosseel, 2012).

RQ2 seeks to identify the structural model that best represents the role of student-teachers practicum experience on their level of self-efficacy, motivation, and intention to

become a teacher. To answer this question, structural equation modeling will be employed with the assistance of the lavaan package (Rosseel, 2012).

RQ3 asks (a) how student-teachers feel about their practicum experience in Kazakhstani educational institutions and (b) how do they think that these experiences be improved. To answer this research question, sentiment analysis will be employed to identify the key themes and will be conducted with the assistance of the text-mining and word cloud-package called wordcloud (Fellows, 2018) using R.

5. Results

The results of the investigation are presented in this chapter. The aim of this study is to investigate the association between student-teacher practicum experience, teacher self-efficacy, satisfaction with the profession, and intention to become a teacher among senior students of Kazakhstani universities. The findings of this research are presented in accordance with the three research questions, in sequential order.

RQ1: What measurement model best represents student-teacher practicum satisfaction, teacher self-efficacy, and student-teacher motivation?

RQ2: What structural model best represents the role of student teachers' practicum experience on their level of self-efficacy, motivation, and intention to become a teacher?

RQ3: (a) How do student-teachers feel about their practicum experience in Kazakhstani educational institutions and (b) how do they think that these experiences be improved?

The initial section of the results chapter includes descriptive statistics and all the findings.

5.1 Descriptive Statistics

The descriptive statistics for this study are presented in this section. Descriptive statistics are provided for all 213 participants from the 16 universities in Kazakhstan. Also, descriptive statistics include background information regarding the age, gender, language of survey ethnicity, major (specialization), whether the student has his/her own children, and previous working experience with preschool, primary, and secondary school students.

A total four universities out of 16 were private universities, and other 12 were public state or national universities of Kazakhstan. The language of the survey was chosen to be

English by eight participants (3.51%), whilst the Kazakh language was chosen by 72 participants (31.58%), and the Russian was chosen by 148 participants (64.91%).

In terms of age, 98 participants were 18 years old (42.98%), 35 participants were 19 years old (15.35%), 55 participants were 20 years old (24.12%), 22 participants were 21 years old (9.65%), 7 participants were 22 years old (3.07%), 7 participants were 23 years old (3.07%), 3 participants were 24 years old (1.32%) and 1 participant was 31 years old (0.44%).

In terms of gender, 182 (79,82%) were females while 46 (20,18%) were male respondents. In terms of ethnicity, the majority of respondents were Kazakh at,183 participants (80.26%), while there were also 36 Russians (15.79%), three Tatars (1.32%), two Uzbeks (0.88%), one Ukrainian and one Belarusian (0.44%) each, and one participant assigned himself as mixed-ethnicity (0.44%).

Only seven participants (3.1%) indicated that they had their own children, and 219 participants (96.9%) stated that they had no children. A total 31.86% (72 participants) reported having working experience with kindergarten children, 45.13% (102 participants) of the participants indicated their working experience with elementary school students, while 50.44% (115 participants) stated that they had working experience with secondary school students. Moreover, the majors/specialization of respondents were quite diverse and, included the following: Kazakh language and literature, primary school specialist, physical education, mathematics, physics, biology, kindergarten, geography, foreign languages, informatics, Russian language and literature, and chemistry.

Table 12

Descriptive Statistics

Item	Description	*M*	*SD*	*Median*	*Min*	*Max*	*Skew*
	Practicum Satisfaction						
Q10_1	I was assigned meaningful tasks during my internship	4.42	1.19	4	1	6	-0.18
Q10_2	My internship assignments were relevant to my academic coursework	4.05	1.34	4	1	6	-0.06
Q10_3	My internship assignments were relevant to my interests	4.3	1.36	4	1	6	-0.24
Q10_4	I had regular supervision and guidance from my supervisor	3.9	1.3	4	1	6	0.02
Q10_5	My supervisor and other staff were available if I had questions	4.5	1.35	5	1	6	-0.45
Q10_6	**I learned new knowledge in my internship**	4.37	1.57	5	1	6	-0.39
Q10_7	**I learned new skills in my internship**	4.66	1.24	5	1	6	-0.62
Q10_8	**I learned something new about myself**	4.21	1.58	4	1	6	-0.28
Q10_9	**I was fully satisfied with internship**	4.33	1.37	5	1	6	-0.36
Q10_10	The internship fully met your needs	4.1	1.3	4	1	6	-0.05
Q10_11	The internship fully corresponded to your first original expectations	3.91	1.36	4	1	6	0.1
Q10_12	**The internship Program has helped to develop professional competence**	4.6	1.15	5	1	6	-0.4

Note. Practicum satisfaction and supervising teacher competence variables response options: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly agree, 4 = moderately agree, 5 = mostly agree, 6 = strongly agree; response options for self-efficacy (classroom management, instruction, student engagement): 1 = not at all, 2 = to some extent, 3 =quite a bit, 4 =a lot; response options for motivational questions: 1 = not important at all, 2 = of low importance, 3 = of moderate importance, 4 = of high importance; response options for intention to become a teacher: 1 = not at all, 2 = to some extent, 3 = quite a bit, 4 = fully.

Table 2

Descriptive Statistics (Continued….)

Item	Description	*M*	*SD*	*Median*	*Min*	*Max*	*Skew*
	Perceived Supervising Teacher Competence						
Q11_1	Communication	4.53	1.15	5	1	6	-0.67
Q11_2	Teaching Style	4.36	1.17	4	1	6	-0.48
Q11_3	Best practices with children	4.2	1.21	4	1	6	-0.2
Q11_4	Behaviour Management	4.68	1.13	5	1	6	-0.77
Q11_5	Goals for children	4.11	1.28	4	1	6	-0.05
Q11_6	Child development	4.19	1.27	4	1	6	-0.13
	Self-Efficacy (Classroom Management)						
Q12_1	Get students to follow classroom rule	2.98	0.76	3	1	4	-0.16
Q12_2	**Calm students who is disruptive**	2.81	0.95	3	1	4	0.08
Q12_3	**Make expectations about behavior clear**	2.87	0.95	3	1	4	-0.25
Q12_4	**Controlling disruptive behavior**	2.67	0.86	2	1	4	0.32

Note. Practicum satisfaction and supervising teacher competence variables response options: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly agree, 4 = moderately agree, 5 = mostly agree, 6 = strongly agree; response options for self-efficacy (classroom management, instruction, student engagement): 1 = not at all, 2 = to some extent, 3 =quite a bit, 4 =a lot; response options for motivational questions: 1 = not important at all, 2 = of low importance, 3 = of moderate importance, 4 = of high importance; response options for intention to become a teacher: 1 = not at all, 2 = to some extent, 3 = quite a bit, 4 = fully.

Table 2

Descriptive Statistics (Continued…)

Item	Description	*M*	*SD*	*Median*	*Min*	*Max*	*Skew*
	Self-Efficacy (Instruction)						
Q13_1	Craft good questions for my students	3.23	0.86	3	1	4	-0.67
Q13_2	Use a variety of assessment strategies	2.99	0.98	3	1	4	-0.45
Q13_3	**Provide alternative explanations when students are confused**	3.07	0.8	3	1	4	-0.17
Q13_4	**Vary instructional strategies**	2.82	0.9	3	1	4	0.05
	Self-Efficacy (Student Engagement)						
Q14_1	Help students think critically	3.02	0.89	3	1	4	-0.32
Q14_2	Help students think creatively	3.16	0.77	3	1	4	-0.47
Q14_3	**Motivate students who show low interest**	2.97	0.86	3	1	4	-0.3
Q14_4	**Get students to believe they can do well**	3.13	0.95	3	1	4	-0.58

Note. Practicum satisfaction and supervising teacher competence variables response options: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly agree, 4 = moderately agree, 5 = mostly agree, 6 = strongly agree; response options for self-efficacy (classroom management, instruction, student engagement): 1 = not at all, 2 = to some extent, 3 =quite a bit, 4 =a lot; response options for motivational questions: 1 = not important at all, 2 = of low importance, 3 = of moderate importance, 4 = of high importance; response options for intention to become a teacher: 1 = not at all, 2 = to some extent, 3 = quite a bit, 4 = fully.

Table 2

Descriptive Statistics (Continued…)

Item	Description	*M*	*SD*	*Median*	*Min*	*Max*	*Skew*
	Motivational Questions						
Q15_2	Teaching will provide a reliable income	3.36	0.74	4	1	4	-0.89
Q15_3	Teaching will be a secure job	3.34	0.82	4	1	4	-0.89
Q15_4	The teaching schedule (e.g. hours, holidays, part-time positions) will fit with the responsibilities in my personal life	3.18	0.75	3	1	4	-0.58
Q15_5	Teaching will allow me to influence the development of children and young people	3.41	0.66	4	1	4	-0.77
Q15_6	Teaching will allow me to benefit the socially disadvantaged	2.93	1.03	3	1	4	-0.55
Q15_7	Teaching will allow me to provide a contribution to society	3.44	0.65	4	1	4	-0.81

Note. Practicum satisfaction and supervising teacher competence variables response options: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly agree, 4 = moderately agree, 5 = mostly agree, 6 = strongly agree; response options for self-efficacy (classroom management, instruction, student engagement): 1 = not at all, 2 = to some extent, 3 =quite a bit, 4 =a lot; response options for motivational questions: 1 = not important at all, 2 = of low importance, 3 = of moderate importance, 4 = of high importance; response options for intention to become a teacher: 1 = not at all, 2 = to some extent, 3 = quite a bit, 4 = fully.

Table 2

Descriptive Statistics (Continued…)

Item	Description	*M*	*SD*	*Median*	*Min*	*Max*	*Skew*
	Intention to Become a Teacher						
Q16_1	The teaching profession was my priority and main choice	3.08	0.93	3	1	4	-0.63
Q16_2	I will get a job as a teacher after receiving a diploma	3.24	0.84	3	1	4	-0.76
Q16_3	I think I will work in the field of teaching for the next 10-15 years	2.99	0.92	3	1	4	-0.37
Q16_4	In the future, I see myself as a competent teacher	3.18	0.83	3	1	4	-0.58
Q16_5	There are problems in the teaching profession that scare and worry me	2.31	0.98	2	1	4	0.33
Q16_6	I may change my teaching profession to another one	2.47	1.03	2	1	4	0.17

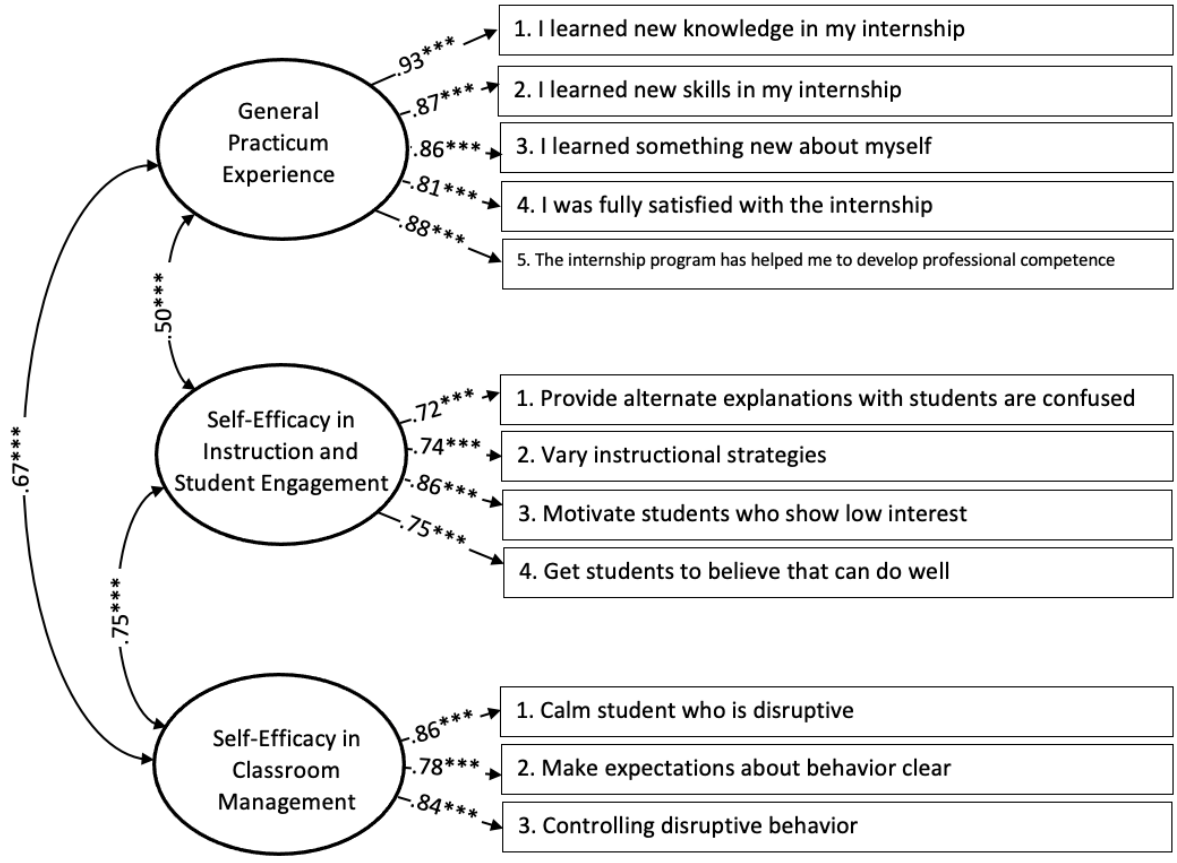
Note. Practicum satisfaction and supervising teacher competence variables response options: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly agree, 4 = moderately agree, 5 = mostly agree, 6 = strongly agree; response options for self-efficacy (classroom management, instruction, student engagement): 1 = not at all, 2 = to some extent, 3 =quite a bit, 4 =a lot; response options for motivational questions: 1 = not important at all, 2 = of low importance, 3 = of moderate importance, 4 = of high importance; response options for intention to become a teacher: 1 = not at all, 2 = to some extent, 3 = quite a bit, 4 = fully.

5.2 RQ1: Measurement Model for Student-Teacher Practicum Satisfaction, Teacher Self-Efficacy, and Student-Teacher Motivation?

After a series of revisions (see Appendix A, R code), a final three-factor 12-item measurement model (Figure 1) was deemed as an appropriate representation of the data.

Figure 1

Three-Factor 12-Item Measurement Model of Teacher Practicum Experience and Self-Efficacy



Note. ***$p < .001$, **$p < .01$, *$p < .05$.

Table 23

Heterotrait-Monotrait Ratio (HTMT) for Inter-Item Correlations

Factor	prctxp	SECM	SEIAE
Prctxp	1.000	-	-
SECM	0.504	1.000	-
SEIAE	0.656	0.764	1.000

***Note**:* prctxp = Practicum experience; SECM = Self-efficacy classroom management; SEIAE – Self-efficacy instruction and student engagement.

It is noted that the "Intention to become a teacher" and "teacher motivational" scales did not exhibit sufficient psychometric properties to be included as factors in the current study. However, in order to maximize information from the data, the single intention item, "I think I will work in the field of teaching for the next 10-15 years" and the single motivational item, "Teaching will allow me to provide a contribution to society" were retained as independent variables for the final model.

This single intentional item exhibited the following three bivariate correlations with the factors in the measurement model above: with General Practicum Experience, $r = .21$ ($p < .01$), with Self-Efficacy in Instruction and Student Engagement, $r = .29$ ($p < .001$), and with Self-Efficacy in Classroom Management, $r = .33$ ($p < .001$). In addition, the single motivation item exhibited the following three bivariate correlations with the factors in the measurement model above: with General Practicum Experience, $r = .58$ ($p < .001$), with Self-Efficacy in Instruction and Student Engagement, $r = .62$ ($p < .001$), and with Self-Efficacy in Classroom Management, $r = .49$ ($p < .001$). The correlation between the single intentional and motivation items was $r = .32$ ($p < .001$). These generally low correlations (under .85) suggested that the item was

sufficiently distinct from the three factors of interest in the measurement model so was therefore this single-item retained as an independent variable in the structural model.

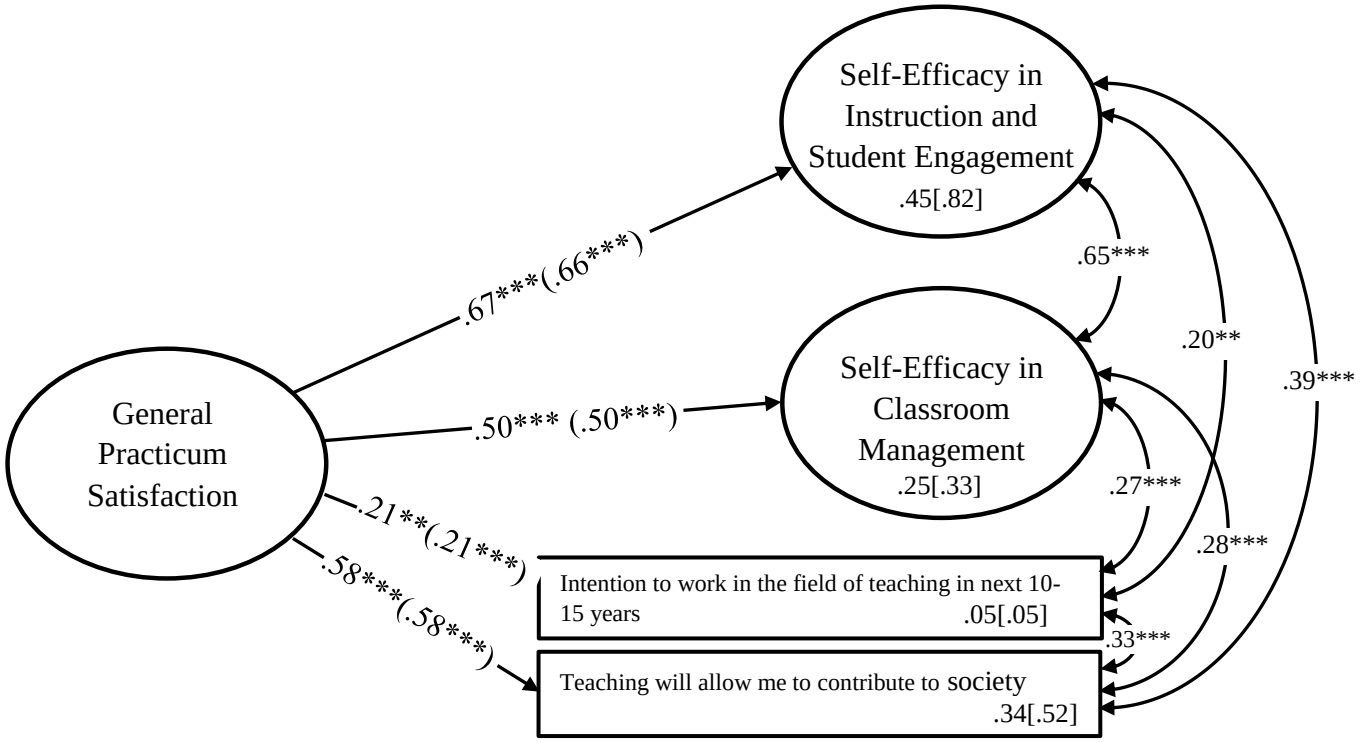
The model fit indices for the final measurement model (Figure 1) were RMSEA = .113, CFI = .93, SRMR = .06, gamma hat = .90 (Chi-square = 189.25, *df* = 51). Therefore, the measurement model met all the necessary requirements for model fit in accordance with the literature (Hu & Bentler, 1999).

5.3 RQ2: Structural Model for Student-Teacher Practicum Satisfaction, Teacher Self-Efficacy, Intention, and Student-Teacher Motivation?

The single level model for teacher practicum satisfaction, self-efficacy, intention, and motivation is provided in Figure 2.

Figure 2

Single Level Model of Student-Teacher Practicum Satisfaction, Teacher Self-Efficacy, Intention, and Student-Teacher Motivation

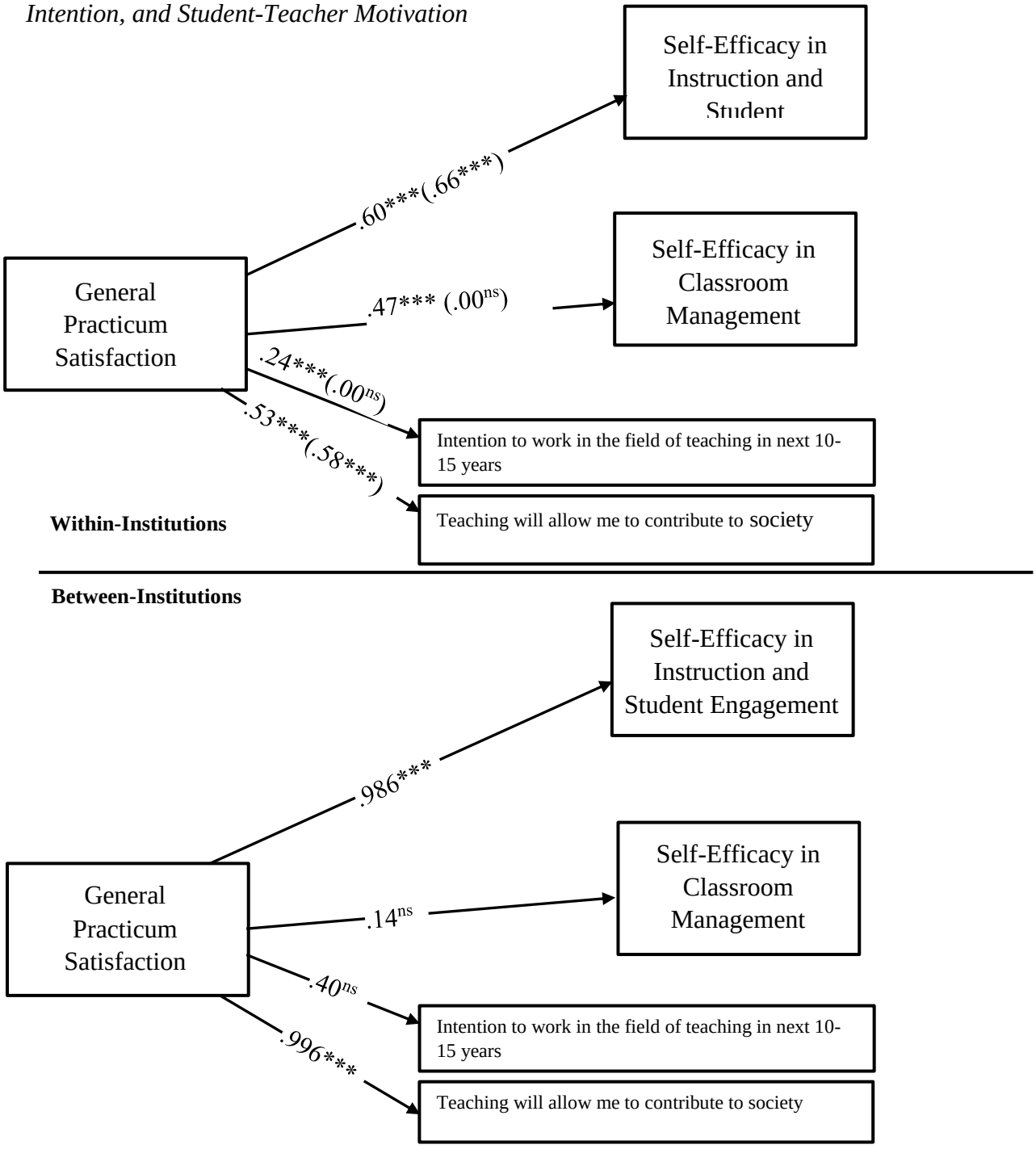


Note. Regression coefficients while controlling for age and gender in parentheses; all effects of age and gender not statistically significant (p > .05); $R^2[f^2]$ estimates inside factors/variables; ***p < .001, **p < .01, *p < .05.

Given the level of variance between institutions, a multi-level model was also specified to discern within- and between-institution effects.

Figure 3

Multilevel Level Model of Student-Teacher Practicum Satisfaction, Teacher Self-Efficacy, Intention, and Student-Teacher Motivation



Note. Regression coefficients while controlling for age and gender in parentheses; all effects of age and gender not statistically significant ($p > .05$); $R^2[f^2]$ estimates inside factors/variables; ***$p < .001$, **$p < .01$, *$p < .05$.

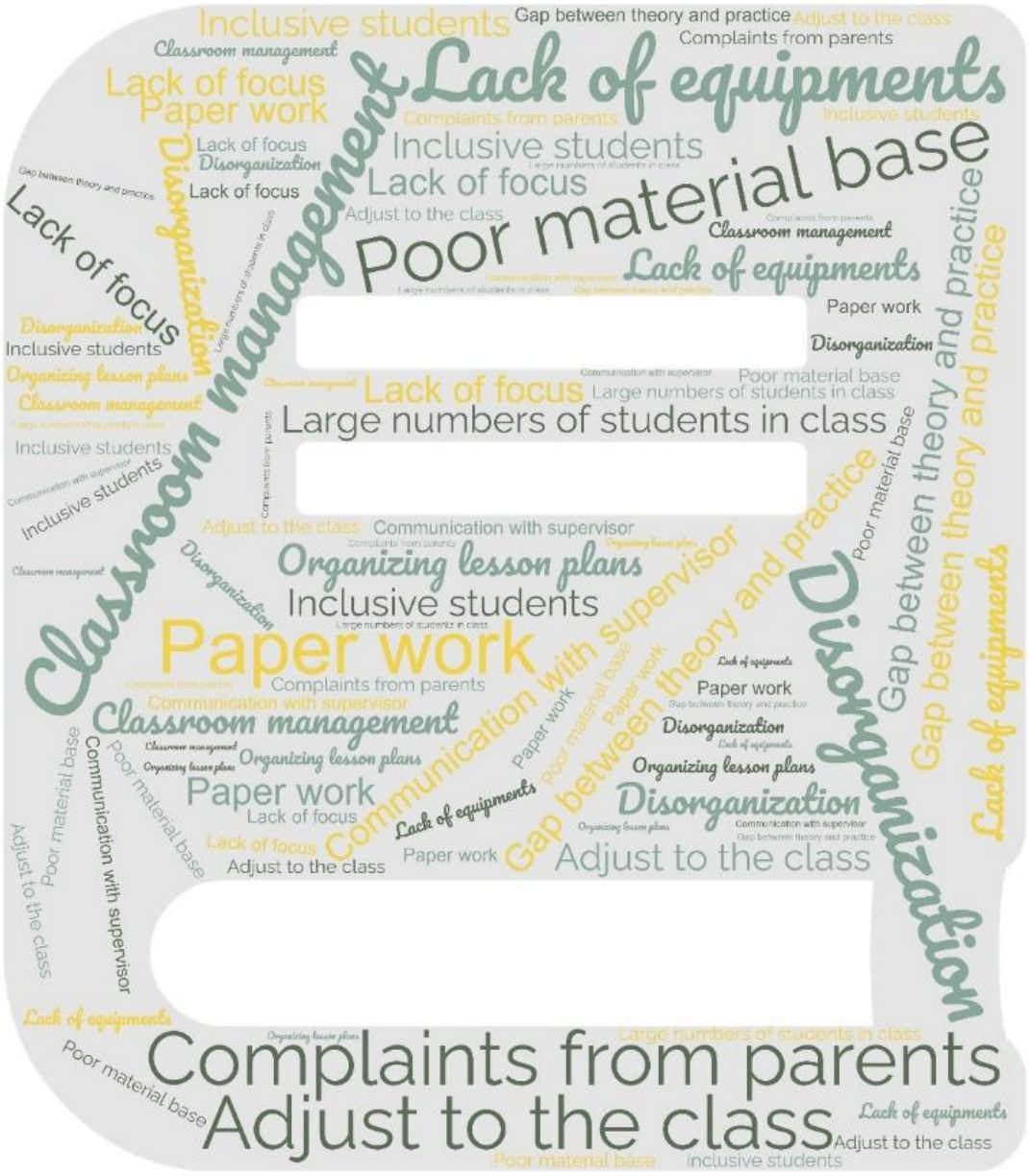
Results from the multilevel model reinforce and extend the findings from the single-level model. Within institutions, the size of the coefficients appears to be similar. However, between institutions, it is noted that the average experience of student-teachers on practicum was almost linearly associated with average levels of student-teachers' institutional self-efficacy in instruction and student engagement their average conception that teaching will allow them to contribute to society. This suggests that the overall school practicum experience of students drives student-teachers' collective perception of the self-efficacy in instruction and student engagement and their belief that they will be able to contribute to society.

5.4 RQ3: Student-Teachers' Feelings about the Practicum Experience and How Such Experiences Might be Improved

Semantic analysis was undertaken on the open-ended responses for each of the six open-ended questions. Figures 4 to 9 provide visualizations for written responses. My interpretation involves a general thematic analysis of the responses in light of the quantitative findings. The intention here was to provide a supplement to the key quantitative results.

Figure 4

Student-Teacher Responses: What Did you Find Most Challenging about the Practicum?



Note. Graph produced with the assistance the online word-cloud software, www.wordclouds.com.

Visual inspection of the responses above suggests that the most commonly reported challenge of the practicum was time management, followed by difficulty in adapting to the work environment and lack of guidance from supervisors. Other challenges mentioned by some

participants included communication issues with colleagues and clients, the pressure to perform under tight deadlines, and dealing with unexpected situations.

Figure 5

Student-Teacher Responses: Is There Anything about the Structure of the Practicum that Can be Improved Upon to Support your Learning?

Note. Graph produced with the assistance the online word-cloud software, www.wordclouds.com.

Visual inspection of the responses above suggests that some participants felt that the structure of the practicum could be improved upon to better support their learning. The most commonly suggested improvement was to provide more opportunities for hands-on experience and practical training, followed by more structured supervision and feedback, and clearer learning objectives and expectations. Other suggestions included better coordination and communication between different departments or teams, more flexibility in the scheduling and organization of the practicum, and more opportunities for networking and professional development.

Figure 6

Student-Teacher Responses: What was Your Favorite Part/Activity/Action During the Practicum? Please Explain

Note. Graph produced with the assistance the online word-cloud software, www.wordclouds.com.

Visual inspection of the responses above suggests that the favorite parts, activities, or actions during the practicum varied among participants. However, some common themes

emerged, including the opportunity to work with students and contribute to meaningful projects, the chance to learn new skills and gain practical experience, and the positive and supportive work environment. Some participants also mentioned specific activities or projects they enjoyed, such as organizing events, attending lessons of other student-teachers, or preparing creative assessment for class work. Overall, the responses suggest that the most enjoyable aspects of the practicum were those that provided opportunities for personal and professional growth, as well as a sense of purpose and fulfillment.

Figure 7

Student-Teacher Responses: What are the Skills You Know You Need to Improve Upon as a Future Teacher?

Note. Graph produced with the assistance the online word-cloud software, www.wordclouds.com.

Visual inspection of the responses above suggests that the skills that future teachers feel they need to improve upon vary, but some common themes emerged. The most commonly mentioned skill was classroom management, followed by lesson planning and preparation, and

communication and interpersonal skills with students, colleagues, and parents. Other skills mentioned by some participants included technology integration, assessment and evaluation, and cultural competence and sensitivity. Overall, the responses suggest that future teachers recognize the importance of a wide range of skills in order to be effective educators, and are aware of the areas in which they need to improve in order to succeed in their roles.

Figure 8

Student-Teacher Responses: How Does the Practicum Support You in Improving Those Skills?

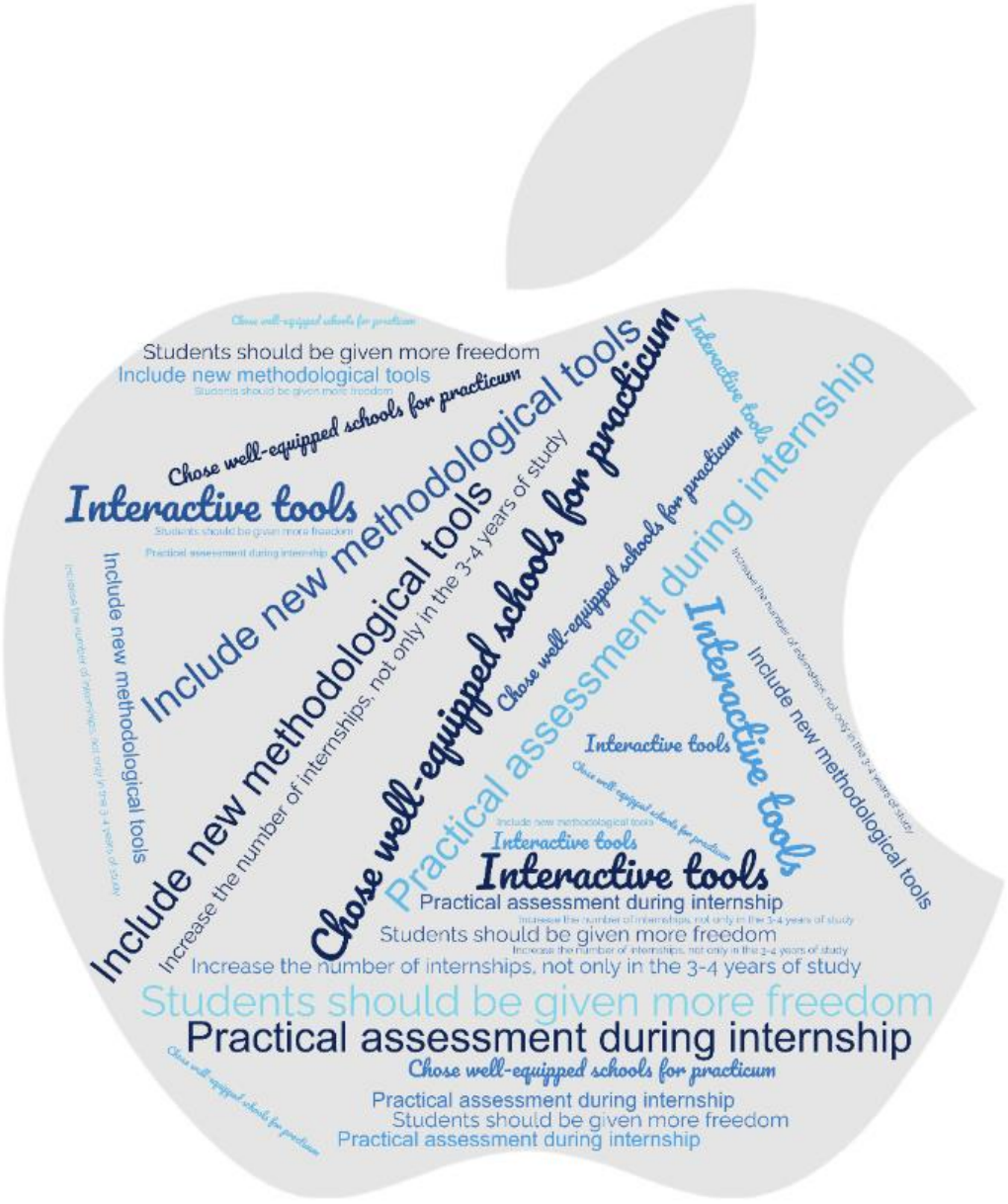
Note. Graph produced with the assistance the online word-cloud software, www.wordclouds.com.

Visual inspection of the responses above suggests that participants perceive the practicum as a valuable opportunity to improve the skills they identified as areas for growth. The most commonly cited way in which the practicum supports skill development is through

hands-on experience and practical training, followed by feedback and guidance from supervisors and colleagues, and the opportunity to observe and learn from experienced teachers. Some participants also mentioned the chance to reflect on their own practice and receive constructive criticism, as well as the exposure to diverse teaching styles and student populations. Overall, the responses suggest that participants view the practicum as a crucial component of their professional development, and recognize its potential to support their growth as future teachers.

Figure 9

Student-Teacher Responses: Is There Any Suggestion about how the Practicum Should be Organized, and be More Efficient for Future Teachers?



Note. Graph produced with the assistance the online word-cloud software, www.wordclouds.com.

Visual inspection of the responses above suggests that participants have several suggestions for how the practicum could be organized and made more efficient for future teachers. The most commonly mentioned suggestion was to provide more structured supervision and feedback, followed by more opportunities for hands-on experience and practical training, and clearer learning objectives and expectations. Other suggestions included better coordination and communication between different departments or teams, more flexibility in the scheduling and organization of the practicum, and more opportunities for networking and professional development. Some participants also suggested incorporating more technology into the practicum, such as online resources and virtual classroom simulations. Overall, the responses suggest that participants have a clear vision of what they believe would make the practicum a more effective and meaningful experience, and are eager to share their ideas for improvement.

6. Discussion

This chapter offers an interpretation and discourse on the primary findings that were presented in the preceding results chapter. The aim of this study was to gain insight into practicum students' experiences and pinpoint factors that may be influenced by their contentment and feeling of effectiveness in their practicum environment. In their research, Woodcock (2011) highlighted the significance of assessing teaching efficacy and finding ways to enhance it within teacher education programs. By exploring the undergraduate and TVET practicum experience, this study adds to the limited literature on the topic that precedes student teaching. Past research on teaching has recognized that the first year of taking on a teaching role can be a sobering realization of its realities and may leave new teachers feeling discouraged (Siwatu, 2011; Weinstein, 1988; Woolfolk Hoy & Spero, 2005). One potential reason for this could be that new teachers may not feel adequately equipped to teach in a setting that differs from their previous experiences during teacher education. Consequently, investigating the factors that impact efficacy, attitude, and ultimate commitment to the profession during teacher training and education can guide programs in creating a valuable learning experience that will prepare teachers well, so they feel capable of and committed to achieving success when they embark on their teaching career. The findings herein suggest that the practicum experience is positively related to teacher self-efficacy, satisfaction with the profession, and intention to become a teacher. This is consistent with previous studies that have shown the importance of practicum experience in teacher education (Darling-Hammond, 2006; Lortie, 1975), though highlights the particular importance of student-teacher practicums in pedagogical institutions in Kazakhstan.

Previous research has demonstrated that a teacher's level of efficacy is linked to student achievement (Goddard, Hoy, & Woolfolk Hoy, 2000; Ross, 1992). Given that research on teachers has confirmed the significance of efficacy in terms of excellent teaching and overall

outcomes for teachers, it is crucial to investigate the factors that could affect teacher efficacy during the initial stages of teacher development, particularly during early practical experiences such as practicums. However, only a limited number of studies have explored how early, supervised, practical classroom experiences contribute to teacher efficacy.

This study at hand is particularly notable as, until now, only a few studies have investigated practicum experiences from the viewpoint of practicum students. Along with offering new insights into the level of teacher efficacy among practicum students, this study sheds light on various aspects of the practicum experience that may impact the development of efficacy, improved altruism, and ultimate commitment to the profession. As Tschannen-Moran, Woolfolk Hoy, and Hoy (1998) have highlighted, only a limited number of studies have explored the antecedents of efficacy among novice teachers (i.e., those in their first year of teaching). Additionally, to the best of my knowledge, this study is the first of its kind in the teacher practicum literature in Kazakhstan that examines students' personal impressions during the practicum classroom experience, their perceptions of compatibility with their supervising teacher, and how these factors relate to both practicum satisfaction and efficacy. To address the research aim, the following three research questions were formulated: What measurement model best represents student-teacher practicum satisfaction, teacher self-efficacy, and student-teacher motivation? What structural model best represents the role of student teachers' practicum experience on their level of self-efficacy, motivation, and intention to become a teacher? and (a) How do student-teachers feel about their practicum experience in Kazakhstani educational institutions and (b) how do they think that these experiences be improved?

Before providing a discussion on the research questions themselves, it is necessary to afford some attention to the levels of practicum satisfaction, self-efficacy, foreseen contribution to society, and intention to remain in the teaching profession among the sampled students. The mean values for the five items defining practicum satisfaction ranged between 4.21 to 4.66

suggesting that on average student-teachers were “moderately (4)” to “mostly (5)” satisfied, though this was not consistent. In terms of self-efficacy in classroom management, student-teacher responses ranged between 2.99 and 3.07 suggesting that student-teachers exhibited a moderate level of SE in this regard (to some extent = 2, quite a bit = 3, a lot = 4). Again, SDs ranged between 0.85 to 0.95 suggesting that there was quite a lot of inconsistency in self-reported classroom management skills. Self-efficacy in instruction and student engagement told a similar story with a moderate average and high level of variation (*Ms* = 2.82 to 3.13, *SDs* = 0.80 to 0.98). In terms of projected contribution to society, student-teacher responses were generally quite positive averaging 3.44/4.00 (of moderate importance = 3, of high importance = 4), with a generally lower level of variation (*SD* = 0.65), boding well for Kazakhstani teacher education. Finally, in terms of intention to be a teacher, the student-teachers appeared moderately committed with an average of 2.99 (*SD* = 0.92; to some extent = 2, quite a bit = 3, fully = 4), though there was certainly a large amount of variance in this response too.

To sum, an examination of the descriptive statistics suggests that while student teachers were generally exhibited moderate levels of satisfaction with their practicum experience, their level of SE, projected contribution to the profession, and intention to be a teacher, there was a lot of variances in responses that warranted explanation.

6.1 Discussion of RQ1: What Measurement Model best Represents Student-Teacher Practicum Satisfaction, Teacher Self-Efficacy, and Student-Teacher Motivation?

The results of the CFA suggested that two of the initial scales, “Intention to become a teacher” and “teacher motivation”, did not exhibit sufficient psychometric properties to be included as factors in the final model. However, to maximize information from the data, single intention and motivational items were retained as independent variables for the final model.

The single intention item ("I think I will work in the field of teaching for the next 10-15 years") showed moderate positive correlations with General Practicum Experience, Self-Efficacy in Instruction and Student Engagement, and Self-Efficacy in Classroom Management. This Indicates that students who had a stronger intention to become a teacher had a better overall practicum experience and felt more confident in their ability to instruct and engage students, as well as manage classroom behavior. Similarly, the single motivation item ("Teaching will allow me to provide a contribution to society") exhibited strong positive correlations with General Practicum Experience, Self-Efficacy in Instruction and Student Engagement, and moderate positive correlation with Self-Efficacy in Classroom Management. This suggests that students who were motivated to become teachers because of their desire to contribute to society had a better overall practicum experience and felt more confident in their ability to instruct and engage students, as well as manage classroom behavior. Overall, the results suggest that students' intentions to become a teacher and motivation to contribute to society are important factors in their practicum experience and development of teacher efficacy. These findings are consistent with previous research conducted by Ciftci, Ozgun, and Erden (2011), which has shown that personal motivation and commitment to teaching are important predictors of teacher effectiveness and job satisfaction. The reason for this correlation could be that when students are satisfied with certain aspects of their practicum experience, such as the feedback they receive from cooperating teachers, their responsibilities in the classroom, and the opportunities they have to practice teaching skills, they may feel more confident in their teaching abilities, leading to a greater sense of teacher efficacy.

We found statistically significant positive correlations between all five constructs in the measurement model. However, the model demonstrates that each construct is sufficiently distinct suggestive of discriminant validity. Beyond the measurement model, we test the structural model. Though this model does not posit any of the constructs as mediators. On a

speculative note, it may be that mediation effects may also be the motivation of students, that, at this stage, did not exhibit sufficient psychometric properties. Speculatively, it is possible that mediating effects exist between intention, motivation, and practicum efficacy. For example, Ciftci, Ozgun, and Erden (2011) found that efficacy had a mediating effect on student-teachers' satisfaction and the predicator variables such as their perception of classmates. It is possible that there is a directional relationship between satisfaction with practicum and teacher efficacy, though this was not ultimately explored. Nonetheless, these findings emphasize the importance of understanding practicum students' perceptions of satisfaction and their sense of efficacy.

The results of the CFA (Figure 1) suggest that the three latent constructs are moderately to strongly correlated with each other, with correlations ranging from r = .504 to .764. This suggests that the constructs are related but not identical, indicating good discriminant validity (see Table 3, HTMT ratio). The average variance extracted (AVE) for each construct is above the recommended threshold of 0.5, indicating adequate convergent validity. These results are important to the field and support previous research on self-efficacy being defined as two distinct constructs for Kazakhstani students. These results differ from recent research by Courtney et al. (2023) which demonstrated that *teacher* self-efficacy in Kazakhstan is best conceived as one construct, not the pre-conceived three separate constructs (see Table A2, Courtney et al., 2023). However, this may reveal that general SE might be measured among teachers with experience but, for student-teachers, "instruction and engagement" represents one construct and "classroom management" represents another. This suggests that student management is a more unique and personal skill, especially for student teachers.

The standardized factor loadings are all significant (p < .001) and range from 0.714 to 0.933, indicating that each observed variable contributes to the corresponding latent construct in substantive way. This suggest that the conceived three-factor model might also be useful for future studies of student-teachers in Kazakhstan.

Overall, the results suggest that the CFA model provides a reasonable fit to the data and that the constructs being measured are distinct but related. However, further investigation may be necessary to improve the model fit or to examine other aspects of construct validity.

6.2 RQ2: Structural Model for Student-Teacher Practicum Satisfaction, Teacher Self-Efficacy, Intention, and Student-Teacher Motivation?

The structural model includes five variables: Student-Teacher General Practicum Satisfaction, Teacher Self-Efficacy Classroom Management, Teacher Self-Efficacy Instruction and Student Engagement, Intention to Become a Teacher, and Student-Teacher Motivation.

The independent variable, Student-Teacher Practicum Satisfaction, *in order of standardized effect*, has an impact on SE in Instruction and Student Engagement, perceived contribution to society, SE in Classroom Management, and intention to work in the field, respectively. The general practicum experience explained close to 45% of the variance in teacher SE in Instruction and student engagement, the largest effect in the model. Student-teacher SE in instruction and student engagement is critical to student-teacher confidence and student confidence in the teacher. Therefore, it is an imperative for teacher training institutions to ensure that student-teachers become more satisfied with their practicum experience.

Overall, the model also highlights the significance of practicum satisfaction and teacher self-efficacy in facilitating positive outcomes for aspiring teachers, suggesting that there is a cluster of related positive outcomes tied to student-teacher practicum experience.

The multilevel model analysis further supports and extends the results obtained from the single-level model analysis. The findings confirm that the relationship between practica satisfaction and self-efficacy, intention to be a teacher, and motivation is consistent across different institutions. The coefficients at the within-institution level in the multilevel model are similar in magnitude to those in the single-level model. However, there is a notable difference

at the between-institution level, as the average practicum experience of student-teachers is strongly associated with their average institutional self-efficacy in instruction and average student engagement as well as their belief that teaching can contribute to society. This implies that the overall quality of the practicum experience afforded to the institutions influences the collective perception of self-efficacy in instruction and student engagement among student-teachers in different institutions. These findings highlight the importance of providing systemic high-quality practicum experiences for student-teachers, as they can have a significant impact on student-teachers' overall perception of their own abilities and their motivation to become effective teachers who can make a positive contribution to society.

In addition, the results of the structural model reveal several important relationships between the outcomes measured. For example, the correlation between "self-efficacy classroom management" and "self-efficacy instruction and engagement" is $r = .65$, indicating a significant strong positive correlation between these constructs. This suggests that these outcomes are, comparatively, more related to each other than the other two (i.e., contribution to society, and intention to be a teacher). Clearly, all of these outcomes are entangled and warrant further investigation.

The results of this study suggest that the practicum experience is critical in shaping teachers' beliefs about their ability to teach and their overall satisfaction with and commitment to the profession. This finding is consistent with previous studies that have shown the importance of the practicum experience in developing teacher self-efficacy (Tschannen-Moran & Woolfolk Hoy, 2007) and satisfaction with the profession (Klassen & Chiu, 2010).

The positive relationship between practicum experience and intention to become a teacher is also an important finding. This suggests that the quality of the practicum experience can play a significant role in attracting and retaining individuals in the teaching profession. This is consistent with previous research that has shown that positive practicum experiences

can lead to increased interest in pursuing a teaching career (Anderson, 2006; Darling-Hammond, 2006).

To summarize, the model proposes that a positive practicum experience results in higher levels of satisfaction, which leads to increased teacher self-efficacy, ultimately resulting in greater intention to pursue a career in teaching and higher motivation among students in teacher education programs. Furthermore, we note that there are effects associated with the general level of practicum experience organized and managed by specific institutions. It is noted that the overall practicum experience of an institution drives overall teacher SE in instruction and engagement and overall altruistic sentiments as expressed by teacher trainees.

6.3 RQ3: Student-Teachers' Feelings about the Practicum Experience and How Such Experiences Might be Improved

As part of the study, open-ended questions were also included to gain a deeper understanding of the issues and to gather opinions and possible solutions to improve the practicum syllabus. Participants were asked to share their thoughts on what they considered the most important topics to include in a teacher education syllabus and what teaching methods they believed would be most effective in preparing future teachers for their roles. Overall, there were six questions, and, further, we will take a look at each of them separately. There were different types of responses to these questions, but we will focus on those responses that provide useful insights and information.

The first question was: What did you find most challenging about the practicum? The results of the open-ended question about the most challenging aspects of the practicum reveal several key areas of concern for student-teachers. The most frequently mentioned challenge was the amount of paperwork required during the practicum, which included keeping a diary and additional paperwork assigned by supervising teachers. Another significant challenge was

related to the poor material base of educational organizations and the lack of sports equipment for physical education classes. Communication with supervising and experienced teachers was also noted as a challenge, indicating that building relationships with these individuals can be difficult for some student-teachers.

Another issue identified was the disorganization of the practicum, which resulted in wasted time for students. Additionally, student-teachers reported struggling with classroom management and the large numbers of students in classrooms, which could lead to complaints from parents. Some student-teachers also mentioned difficulty in handling students with special needs, indicating a need for more support in this area.

Finally, there was a concern about the gap between theory and practice, highlighting a perceived lack of relationship between some university coursework and the realities of the school environment. These findings suggest that there are several areas in which the practicum experience can be improved, including reducing paperwork requirements, providing better resources and support for student-teachers, and improving communication and organization within educational organizations. Additionally, bridging the gap between theory and practice may be beneficial for improving the overall quality of the practicum experience. A focus on these aspects might be the best way to improve the current moderate level of practicum satisfaction experienced by students.

The second question was: Is there anything about the structure of the practicum that can be improved upon to support your learning? The results from the second question reveal some valuable insights into how the structure of the practicum can be improved to support student learning. Firstly, it is interesting to note that many students feel that the duration of the practicum should be extended to allow for more opportunities to gain experience and understanding of teaching. This suggests that students feel that the current length of the practicum may not be sufficient to fully prepare them for their future roles as teachers.

Another important finding is related to the feedback provided by the supervising and experienced teachers. Students reported that they want more qualitative feedback from their teachers, as well as the opportunity to observe and participate in lessons taught by experienced teachers. In conjunction with the moderately higher averages for student-teacher practicum satisfaction, this finding suggests that in many instances, students valued the expertise and guidance of experienced teachers and wanted to learn from their teaching methods.

Moreover, some students also mentioned that they want teachers to timely check their work and progress. This indicates that students want to receive consistent feedback on their performance throughout the practicum, which can help them improve their teaching skills and make the necessary adjustments. Overall, the results of the second question highlight the importance of extending the duration of the practicum, providing more qualitative feedback, and incorporating opportunities for students to observe and learn from experienced teachers.

The third question was: What was your favorite part/activity/action during the practicum? Please explain. The results of the third question provide insights into the aspects of the practicum that were enjoyable and engaging for student-teachers. Working with students, communicating with them, and creating interesting assessments were mentioned as the most favorite part of the practicum. This suggests that student-teachers highly value the opportunity to interact with students and create meaningful learning experiences for them. The importance of creating a warm and positive classroom environment was also highlighted, indicating that a supportive and welcoming classroom climate can positively impact the teaching and learning process.

In addition, the organization of events and extracurricular activities was mentioned as a favorite part of the practicum. This suggests that student-teachers appreciate the opportunity to be involved in activities beyond the traditional classroom setting, and recognize the importance of holistic education. Interestingly, attending lessons of other student-teachers was

also mentioned as an enjoyable activity. This highlights the value of peer learning and the potential benefits of observing and learning from other teachers. Overall, these findings provide important insights into the aspects of the practicum that are most valued and engaging for student-teachers, and can help inform the development of future practicum programs.

The fourth question was: What are the skills you know you need to improve upon as a future teacher? The results from the fourth question provide valuable insights into the areas where future teachers need to focus on improving their skills and competencies. It is noteworthy that some of these skills, such as communication with students, adaptability, creativity, and empathy, are considered to be essential for effective teaching. These skills are often difficult to learn in a theoretical setting and require practical experience, such as the practicum, to develop. The importance of IT competency is also highlighted, as technology plays an increasingly important role in the classroom. Furthermore, the need for lifelong learning and stress resistance is emphasized, as teaching can be a challenging and demanding profession. The findings suggest that the practicum can be designed to provide more opportunities for future teachers to develop and improve these essential skills and competencies. By doing so, the current moderate levels of practicum satisfaction might be improved generating new cohorts of specialists better prepared for their future careers as effective and competent teachers.

The fifth question was: How does the practicum support you in improving those skills? The responses to the fifth question revealed different perceptions about the effectiveness of the practicum in improving the skills that were identified in the previous question. Some students expressed that the practicum provided them with a valuable opportunity to apply the skills they learned in their education program in real-life situations. They emphasized that they were able to use the skills that they learned in their lessons and in preparing for their lessons. In light of the moderate average levels of satisfaction exhibited by the student-teacher respondents, this

suggests that the experience can have a positive impact on students' ability to apply the knowledge and skills that they acquired in their academic program.

Other students highlighted the importance of the practicum in helping them make informed decisions about their career path. They expressed that the practicum allowed them to gain valuable experience and insights into the teaching profession, which helped them decide whether it was a suitable career path for them. This suggests that the practicum can serve as an important tool for career exploration and decision-making. This finding helps describe the relationship in the structural model where practicum experience is associated with career commitment. Here, it appears that the students may be exposed to the realities of teaching and the classroom. Thus, early positive exposure to classrooms, i.e., in freshman and sophomore years, may be beneficial.

However, some students reported that the practicum did not help them improve their skills and that they face learning on their own. This indicates that there may be room for improvement in the structure and design of the practicum and the levels of responsibility of the supervising teacher, to ensure that it effectively supports students' skill development.

Overall, the responses to the fifth question underscore the importance of the practicum in providing students with valuable opportunities to apply their knowledge and skills in real-life settings, explore their career interests, and develop as professionals. However, there may be areas for improvement to ensure that the practicum effectively supports students' skill development. More qualitative research may be useful in this regard.

The last question was: Is there any suggestion about how the practicum should be organized, and be more efficient for future teachers? The responses to the final question suggest that there are some areas where improvements can be made in the organization of the practicum to make it more efficient and effective for future teachers. As inferred prior, one common suggestion was to increase the number of practicums, beyond the current 3rd and 4th year of

study, in order to provide more opportunities for students to gain practical experience and develop their skills. Another suggestion was to give students more freedom during their practicum, which would allow them to try out different teaching methods and approaches, and to experiment with new ideas.

Other suggestions included the need for more practical assessments during the internship, which would provide students with real-time feedback and help them to identify areas where they need to improve. Some students suggested that interactive assessments, such as group projects and presentations, would be more engaging and effective than traditional written assignments. However, any changes should ensure that the supervising teacher is not overburdened.

Another common suggestion was to include new methodological tools in the practicum, such as technology and online resources, in order to keep pace with the changing needs of modern education. Finally, some students suggested that schools with good material settings and resources should be chosen for the practicum, as this would provide a more conducive environment for learning and development. Overall, these suggestions provide valuable insights into how the practicum can be improved and made more effective for future teachers.

Based on the literature review, it is clear that the practicum experience is an essential component of teacher preparation programs. Tuli and File (2009) argued that the practicum experience provides student-teachers with the opportunity to recognize their capabilities and creative potential, which will support them in their future teaching endeavors. Similarly, Smith and Lev-Ari (2005) emphasized that participating in a practicum experience enables student-teachers to develop their classroom practices by bridging the gap between theory and practice, building their professional and personal skills, and gaining a deeper understanding of the school context and educational best practices.

6.4 Summary

The results of this study have several implications for teacher education programs in Kazakhstan. Firstly, teacher education programs should prioritize the quality of the practicum experience. This includes providing opportunities for student-teachers to engage in meaningful and authentic teaching experiences, as well as providing adequate support and feedback from experienced teachers. Secondly, teacher education programs should consider the practicum experience as an important factor in attracting and retaining individuals in the teaching profession. This may involve developing marketing strategies that highlight the positive aspects of the practicum experience.

Limitations of the study include the small sample size and the use of self-report measures. Future research could use larger sample sizes and objective measures of teacher self-efficacy, satisfaction with the profession, and intention to become a teacher. Additionally, future research could explore the factors that contribute to the quality of the practicum experience, such as the characteristics of the cooperating teacher, the school environment, and the curriculum. Finally, another limitation of the current study is that the financial agreement between the pedagogical institutions and the practicum schools is not known. Anecdotally, some schools receive payments for every student-teacher supervised while others do not. Further investigation into how such arrangements might affect the levels of practicum satisfaction are also warranted.

In conclusion, this study provides evidence that the quality of the practicum experience is positively related to teacher self-efficacy, satisfaction with the profession, and intention to become a teacher in Kazakhstan. The findings suggest that teacher education programs in Kazakhstan should prioritize the quality of the practicum experience in order to attract and retain individuals in the teaching profession.

7.Conclusion

7.1 Summary of the Major Findings

In conclusion, the study aimed to investigate the relationship between student-teacher practicum satisfaction, teacher self-efficacy, and student-teacher motivation, and their impact on the intention to become a teacher. The results of the CFA suggested that single intention and motivational items were retained as independent variables for the final model. The findings suggested that students' intentions to become a teacher and motivation to contribute to society are important factors in their practicum experience and development of teacher efficacy. Additionally, satisfaction acted as a mediator between intention, motivation, and practicum efficacy. The model proposed that a positive practicum experience leads to increased teacher self-efficacy, ultimately resulting in greater intention to pursue a career in teaching and higher motivation among students in teacher education programs. The study highlights the importance of providing high-quality practicum experiences for student-teachers, as it can have a significant impact on their perception of their own abilities and their motivation to become effective teachers who can make a positive contribution to society.

Additionally, the study identified the most challenging issues as paperwork, poor material base, and difficulties with communication with supervising and experienced teachers. On the other hand, the favorite parts of the practicum were working with students and organizing events and extracurricular activities. Furthermore, the study identified important skills that future teachers need to improve upon, such as class management, communication with students, and IT competency. The practicum was found to be effective in supporting the development of these skills. Finally, suggestions were made to increase the number of practicums, provide more freedom to students, use interactive and practical assessments, and choose schools with better material settings. Overall, the findings of this study provide

important insights for improving the practicum experience of student-teachers and enhancing their preparation for future teaching careers.

7.2 Limitations and Future Research

The present study, despite its valuable contributions to the field of student-teacher education, has several limitations that should be taken into consideration. One of the major limitations of this study is the small sample size (N=214), which restricts the generalizability of the findings to larger populations. Furthermore, the majority of the participants were from the TVET, which also could affect the representativeness of the sample. With a larger sample size, other constructs could be investigated more thoroughly (e.g., trend level significance findings) in relation to practicum satisfaction and efficacy. Although the discussion proposes a potential mediation of satisfaction between self-efficacy and practicum experience, the current study lacks sufficient statistical power to confidently support this relationship, requiring additional power for further investigation.

The study also has a measure-related limitation in the confirmatory factors analysis, where factors with items showed insufficient psychometric properties to be included as factors. This limited the researchers' ability to understand how each item was defined by the practicum students, and it made it difficult to determine whether these impressions were positive or negative. However, these factors measure did provide preliminary evidence that the practicum students experience in the practicum setting were associated with their satisfaction and efficacy. Factors which were not included in the final model should be revised and further need to be tested and validated in similar samples of practicum students to establish their reliability and validity.

The current study provides several avenues for future research. One of the suggested directions is to explore how to differentiate impressions of the supervising teacher competence experienced in the practicum classroom. future research should investigate communication

between practicum students and supervising teachers, as it may be a critical aspect of the practicum experience and an important indicator of the students' experience during the practicum. Although the current study dropped the question regarding the competence fit from the supervising teacher to practicum student measure to improve the alpha level, it does not preclude the possibility that the competence fit is an essential construct to explore. Thus, revising and creating a separate measure for competence fit and communication could help researchers better understand how supervising teacher competence is related to practicum satisfaction and teacher self-efficacy.

For future research it would be beneficial to conduct a larger-scale study with a more diverse sample to increase the generalizability of the findings. Additionally, it would be useful to investigate the perceptions and experiences of supervising teachers and experienced teachers to gain a more comprehensive understanding of the practicum. Furthermore, future research can explore the impact of different teaching methods and approaches on the development of student-teachers' skills during the practicum. Lastly, it would be interesting to investigate the long-term effects of the practicum on the professional development and career paths of student-teachers.

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Appendices

Appendix A

Data Collection Tool

Survey items

i. Practicum satisfaction questionnaire

1. I was assigned meaningful tasks during my internship
Strongly disagree 1 2 3 4 5 Strongly agree

2. My internship assignments were relevant to my academic coursework
Strongly disagree 1 2 3 4 5 Strongly agree

3. My internship assignments were relevant to my interests.
Strongly disagree 1 2 3 4 5 Strongly agree

4. I had regular supervision and guidance from my supervisor
Strongly disagree 1 2 3 4 5 Strongly agree

5. My supervisor and/or other staff were available if I had questions
Strongly disagree 1 2 3 4 5 Strongly agree

6. I learned new knowledge in my internship
Strongly disagree 1 2 3 4 5 Strongly agree

7. I learned new skills in my internship
Strongly disagree 1 2 3 4 5 Strongly agree

8. I learned something new about myself.
Strongly disagree 1 2 3 4 5 Strongly agree

9. How satisfied are you with your internship?
Low satisfaction 1 2 3 4 5 High satisfaction

10. How well did your internship meet your needs?

Low satisfaction 1 2 3 4 5 High satisfaction

11. To what extent did your internship meet your original expectations?
Low satisfaction 1 2 3 4 5 High satisfaction

12. The Internship Program has helped to develop professional competence.
Strongly disagree 1 2 3 4 5 Strongly agree

ii. Questionnaire to determine the competence of the teacher who guided you in practice.

My supervisor/lead teacher is ..... very strong in this regard

a) Communication
b) Teaching style
c) Best practice with children
d) Behavior management
e) Goals for children
f) Child development

Response options are: 1 = strongly disagree, 2 = mostly disagree, 3 = slightly agree, 4 = moderately agree, 5 = mostly agree, 6 = strongly agree

iii. Self-efficacy questionnaire

How much of the following can you actually do when you teach?

Response options are: 1 = not at all, 2= to some extent, 3= quite a bit, 4= a lot

Self-efficacy (Classroom)

1. Get Students to follow classroom rules
2. Calm student who is disruptive

3. Make expectations about behavior clear

4. Controlling disruptive behavior

Self-efficacy (Instruction)

5. Craft good questions for my students

6. Use a variety of assessment strategies

7. Provide alternative explanations when students are confused

8. Vary instructional strategies

Self-efficacy (Student Engagement)

9. Help students think critically

10. Help students think critically

11. Motivate students who show low interest

12. Get students to believe they can do well

iv. Intention to become a teacher

Motivational Questions:

Response options: 1= not important at all, 2= of low importance, 3= of moderate importance, 4= of high importance.

1. Teaching will offer a steady career path

2. Teaching will provide a reliable income.

3. Teaching will be a secure job.

4. The teaching schedule (e.g. hours, holidays, part-time positions) will fit with the responsibilities in my personal life.

5. Teaching will allow me to influence the development of children and young people.

6. Teaching will allow me to benefit the socially disadvantaged.

7. Teaching will allow me to provide a contribution to society.

Intention to Become a Teacher:

How much do you agree with the following statements?

Response options are: 1 = not at all, 2= to some extent, 3= quite a bit, 4= fully

1. The teaching profession was my priority and main choice
2. I will get a job as a teacher after receiving a diploma
3. I think I will work in the field of teaching for the next 10-15 years
4. In the future, I see myself as a competent teacher
5. There are problems in the teaching profession that scare and worry me
6. I may change my teaching profession to another one

Open-ended questions:

This section will ask you to share your thoughts and suggestions.

1. What did you find most challenging about the practicum?

2. Is there anything about the structure of the practicum that can be improved upon to support your learning?

3. What was your favorite part/activity/action during the practicum? Please explain.

4. What are the skills you know you need to improve upon as a future teacher?

5. How does the practicum support you in improving those skills?

6. Is there any suggestion about how the practicum should be organized, and be more efficient for future teachers?

Appendix B

R Code

```
# This is the analysis for my thesis
####Assylbek Zhamalashov data analysis#################################
# set the working directory
getwd()
setwd("C:/Users/admin/Desktop/master nu/results")
getwd()
dir()
################ Load Statistical Packages ############################
if (!require("pacman")) {
  install.packages("pacman", dependencies = TRUE)
  library(pacman)
}
pacman::p_load(readxl, psych, bnstruct, semTools, car, misty, tm, wordcloud, RColorBrewer, wordcloud2)              # packages for loading
        packages!
#####################################################################
my_data <- readxl::read_xlsx("last results.xlsx")
str(my_data)
dim(my_data)   # 231 rows, 60 columns
head(my_data)
colnames(my_data)
colnames(my_data)[41:46] <- c("Q15_1", "Q15_2", "Q15_3", "Q15_4", "Q15_5", "Q15_6")
colnames(my_data)
str(my_data)
########### missing data analysis ###########################################
apply(my_data, 2, FUN = function(x)sum(is.na(x)))
```

```
# let's not focus on columns 54 to 60 as these are open ended
apply(my_data[,1:53], 2, FUN = function(x)sum(is.na(x)))
# missing data ranges from 3 to 19 for the key quant items (probably not too problematic)
# Missing data by person
apply(my_data[,1:53], 1, FUN = function(x)sum(is.na(x)))    # We can identify the cases with a high number of missing values
# Seems to be an issue with last 3 rows as all missing
apply(my_data[,1:53], 1, FUN = function(x)sum(is.na(x))) / 53 == 1   # logical vector for all missing for cases
sum(apply(my_data[,1:53], 1, FUN = function(x)sum(is.na(x))) / 53 == 1 )  # 3
# Let's remove the last three cases
dim(my_data)
my_data <- my_data[-c(229:231),]
dim(my_data)  # 228
# Identify persons who missed more than 20% (check my PhD thesis for citation about this, Brown, 2008)
apply(my_data[,1:53], 1, FUN = function(x)sum(is.na(x)))  / 53 < .20     # cases who completed 20% or more quant items
twenty.plus <- apply(my_data[,1:53], 1, FUN = function(x)sum(is.na(x)))  / 53 < .20
dim(my_data)
my_data <- my_data[twenty.plus, ]
dim(my_data)                                                  # We remove 14 cases which a re a threat to validity due to missingness.
apply(my_data[,1:53], 1, FUN = function(x)sum(is.na(x)))  / 53 < .20
str(my_data)

######### Check for Jokesters ##############################################
# Check if any respondents gave same response to all quant items.
sort(apply(my_data[,11:53], 1, FUN = function(x)sd(x, na.rm=T)))
which(apply(my_data[,11:53], 1, FUN = function(x)sd(x, na.rm=T)) == 0)  # 8th case
dim(my_data)
my_data <- my_data[-8, ]
dim(my_data)   # 213
```

```
###### Double-Check Missingness for Qaunt Items ############################
apply(my_data, 2, FUN = function(x)sum(is.na(x)))   # Q5 has 7 missing.
sort(apply(my_data, 2, FUN = function(x)sum(is.na(x))) )  # Q5 has 7 missing.
table(my_data$Q5)
colnames(my_data)

apply(my_data, 2, FUN = function(x)str(x))
colnames(my_data)[11:53]   # these are quant items
str(my_data)
apply(my_data[11:53], 2, FUN = function(x)mean(x, na.rm=T))
apply(my_data[11:53], 2, FUN = function(x)sum(is.na(x), na.rm=T))
my_data <- as.data.frame(my_data)
print(my_data[11:53])  # appears to be somewhat at random

########## Imputation Step for Missing Data ##############################
apply(my_data[11:53], 2, FUN = function(x)sum(is.na(x)))  # check
my_data <- as.data.frame(my_data)
options(max.print = 99999)
my_data[11:53]     # Data appears to be missing quite at random

quant.matrix <- as.matrix(my_data[11:53])
quant.matrix.imp <- bnstruct::knn.impute(quant.matrix)
# Visual inspect
quant.matrix.imp
citation("bnstruct")
my_data[11:53] <- quant.matrix.imp
apply(my_data[11:53], 2, FUN = function(x)sum(is.na(x)))  # check, and done
```

```
######################################################################
# Descriptive statistics (categorical)
colnames(my_data)
# User lang
str(my_data$UserLanguage)
table(my_data$UserLanguage)
round(table(my_data$UserLanguage) / sum(table(my_data$UserLanguage)) * 100, 2)

str(my_data$Q1) #Table of Universities
table(my_data$Q1)
length(table(my_data$Q1))  # 16
sort(table(my_data$Q1))

print(my_data$Q1)
round(table(my_data$Q1) / sum(table(my_data$Q1)) * 100, 2)

str(my_data$Q2)  #age of participants
table(my_data$Q2)
round(table(my_data$Q2) / sum(table(my_data$Q2)) * 100, 2)

str(my_data$Q3) #ethnicity
table(my_data$Q3)
round(table(my_data$Q3) / sum(table(my_data$Q3)) * 100, 2)

str(my_data$Q4)  #gender
table(my_data$Q4)
round(table(my_data$Q4) / sum(table(my_data$Q4)) * 100, 2)
```

```
str(my_data$Q5)  #major
table(my_data$Q5)
round(table(my_data$Q5) / sum(table(my_data$Q5)) * 100, 2)

str(my_data$Q6) # have their own kids
table(my_data$Q6)
round(table(my_data$Q6) / sum(table(my_data$Q6)) * 100, 2)

str(my_data$Q7)   #experience with kindergarden students
table(my_data$Q7)
round(table(my_data$Q7) / sum(table(my_data$Q7)) * 100, 2)

str(my_data$Q8) # experience with elementary school students
table(my_data$Q8)
round(table(my_data$Q8) / sum(table(my_data$Q8)) * 100, 2)

str(my_data$Q9)  # experience with high school students
table(my_data$Q9)
round(table(my_data$Q9) / sum(table(my_data$Q9)) * 100, 2)

#########################################################################
# Descriptive statistics (ordinal, Likert)
apply(my_data[,11:53], 2, FUN = function(x)psych::describe(x))
quant.df.describe <- describe(my_data[,11:53])
print(quant.df.describe)
str(quant.df.describe)   # Its a list so cant write to csv.
#########################################################################
# Intra-class correlation and design effect
```

```
dim(my_data)
sort(table(my_data$Q1), decreasing = T)                                  # 8 institutions with five or less
length(table(my_data$Q1))                                                       # 16 total institutions
five.or.less.inst <- names(sort(table(my_data$Q1), decreasing = T))[9:16]
my_dataMLM <- my_data[!my_data$Q1 %in% five.or.less.inst,]
dim(my_dataMLM)
sort(table(my_dataMLM$Q1), decreasing = T)                  # 8 institutions with six or more institutions


#################### Check ICCs ###################
# First check variance for each variable by school
tapply(my_dataMLM$Q10_1, my_dataMLM$Q1, FUN = function(x)sd(x))
apply(my_dataMLM[,11:53], 2, FUN = function(x)tapply(x, my_dataMLM$Q1, FUN = function(x)sd(x)))


# School 44 had no variance for item Q16_3, so let's also remove that school
sort(table(my_dataMLM$Q1), decreasing = T)
my_dataMLM <- my_dataMLM[!my_dataMLM$Q1 %in% "44. PђC,C‹CЪP°CґCЃPєPёP№ PiPsCЃCґPrP°CЪCЃC,PIPµPSPSC‹P№ CґPSPёPIPµCЪCЃPёC,PµC, PёPj.Pґ.
        P”PsCЃPjCґC…P°PjPµPrPsPIP°",]
sort(table(my_dataMLM$Q1), decreasing = T)
apply(my_dataMLM[,11:53], 2, FUN = function(x)tapply(x, my_dataMLM$Q1, FUN = function(x)sd(x)))     # no problem


# Check ICCs
apply(my_dataMLM[,11:53], 2, FUN = function(x)misty::multilevel.icc(x, my_dataMLM$Q1))
round(apply(my_dataMLM[,11:53], 2, FUN = function(x)misty::multilevel.icc(x, my_dataMLM$Q1)), 2)
sort(round(apply(my_dataMLM[,11:53], 2, FUN = function(x)misty::multilevel.icc(x, my_dataMLM$Q1)), 2), decreasing = T)


# Calculate design effects
ICCs <- round(apply(my_dataMLM[,11:53], 2, FUN = function(x)misty::multilevel.icc(x, my_dataMLM$Q1)), 3)
clusters.inst <- length(table(my_dataMLM$Q1))
avg.clust <- nrow(my_dataMLM) / clusters.inst
```

```
1 + (ICCs*(avg.clust-1))
# note length(11:53)  43 total variables

# Total variables with de over 2
sum(1 + (ICCs*(avg.clust-1)) > 2)  # 33 of 43, therefore do multilevel model for final model.
############################################################
########### Independent variables ##########
# Practicum Experience(12)
colnames(my_data)[11:22]
# "Q10_1"  "Q10_2"  "Q10_3"  "Q10_4"  "Q10_5"  "Q10_6"  "Q10_7"  "Q10_8"  "Q10_9"  "Q10_10" "Q10_11" "Q10_12"
# Experience of Supervising Teacher(6)
colnames(my_data)[23:28]
# "Q11_1" "Q11_2" "Q11_3" "Q11_4" "Q11_5" "Q11_6"
# Motivation(7)
colnames(my_data)[41:47]
# "Q15_1" "Q15_2" "Q15_3" "Q15_4" "Q15_5" "Q15_6" "Q15_7"
########### Dependent Variables ############
# Self Efficacy
# ~~~~~~~~~~~~~~~~~~
# SE Classroom (management): Q12_1 to Q12_4
# SE Instruction: Q13_1 to Q13_4
# SE Student Engagement: Q14_1 to Q14_4

colnames(my_data)[29:40]
# "Q12_1" "Q12_2" "Q12_3" "Q12_4" "Q13_1" "Q13_2" "Q13_3" "Q13_4" "Q14_1" "Q14_2" "Q14_3" "Q14_4"

# Intention to become a teacher (6 items)
colnames(my_data)[48:53]
```

```
# "Q16_1" "Q16_2" "Q16_3" "Q16_4" "Q16_5" "Q16_6"

################################################################
# Reverse code
my_data$Q16_5 <- abs(my_data$Q16_5 - 5)
print(my_data$Q16_5)
my_data$Q16_6 <- abs(my_data$Q16_6 - 5)
print(my_data$Q16_6)

#####################################################################
library("lavaan")
colnames(my_data)
cfa.model <- 'practexp  =~ Q10_1 + Q10_2 + Q10_3 + Q10_4 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12
              est =~       Q11_1 + Q11_2 + Q11_3 + Q11_4 + Q11_5 + Q11_6
              mot =~       Q15_1 + Q15_2 + Q15_3 + Q15_4 + Q15_5 + Q15_6 + Q15_7
              SECM =~      Q12_1 + Q12_2 + Q12_3 + Q12_4
              SEI =~       Q13_1 + Q13_2 + Q13_3 + Q13_4
              SESE =~      Q14_1 + Q14_2 + Q14_3 + Q14_4
              ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4 + Q16_5 + Q16_6'
fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)
semTools::htmt(cfa.model, my_data)
#           prctxp est   mot   SECM  SEI   SESE  ITBT
# practexp 1.000
# est      0.912  1.000                            * issue
# mot      0.749  0.681 1.000
# SECM     0.667  0.697 0.667 1.000
# SEI      0.680  0.655 0.765 0.627 1.000
# SESE     0.649  0.541 0.778 0.511 0.948 1.000     * issue
```

```
# ITBT     0.451  0.523 0.511 0.474 0.498 0.497 1.000

#* We note that "pracexp and est" and "SESE and SEI" don't meet minimum requirements for discriminant validity.
summary(fit, fit.measures = TRUE)
# Chi-square = 3370.366 df =  839
# CFI = 0.695
# TLI = 0.672
# RMSEA                                          0.119
# 90 Percent confidence interval - lower         0.115
# 90 Percent confidence interval - upper         0.123
# P-value RMSEA <= 0.05                          0.000
# SRMR = 0.094

estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:43, 94:114), c(1,2,3,7,11)]
#          lhs op    rhs pvalue std.all
# 1   practexp =~  Q10_1  0.000   0.525
# 2   practexp =~  Q10_2  0.000   0.661
# 3   practexp =~  Q10_3  0.000   0.759
# 4   practexp =~  Q10_4  0.000   0.510
# 5   practexp =~  Q10_5  0.000   0.806
# 6   practexp =~  Q10_6  0.000   0.910
# 7   practexp =~  Q10_7  0.000   0.843
# 8   practexp =~  Q10_8  0.000   0.826
# 9   practexp =~  Q10_9  0.000   0.874
# 10  practexp =~ Q10_10  0.000   0.810
# 11  practexp =~ Q10_11  0.000   0.742
# 12  practexp =~ Q10_12  0.000   0.875
```

```
# 13       est =~  Q11_1  0.000   0.781
# 14       est =~  Q11_2  0.000   0.818
# 15       est =~  Q11_3  0.000   0.845
# 16       est =~  Q11_4  0.000   0.742
# 17       est =~  Q11_5  0.000   0.852
# 18       est =~  Q11_6  0.000   0.851

# 19       mot =~  Q15_1  0.000   0.687
# 20       mot =~  Q15_2  0.000   0.699
# 21       mot =~  Q15_3  0.000   0.769
# 22       mot =~  Q15_4  0.000   0.503
# 23       mot =~  Q15_5  0.000   0.836
# 24       mot =~  Q15_6  0.000   0.765
# 25       mot =~  Q15_7  0.000   0.848

# 26      SECM =~  Q12_1  0.000   0.366  ** Can you get students to follow the class rules
# 27      SECM =~  Q12_2  0.000   0.847  ** clam student if they are disruptive
# 28      SECM =~  Q12_3  0.000   0.779  ** Make expectations about behavior clear
# 29      SECM =~  Q12_4  0.000   0.853  ** Controlling disruptive behavior

# 30       SEI =~  Q13_1  0.000   0.589
# 31       SEI =~  Q13_2  0.000   0.709
# 32       SEI =~  Q13_3  0.000   0.765
# 33       SEI =~  Q13_4  0.000   0.769

# 34      SESE =~  Q14_1  0.000   0.732
# 35      SESE =~  Q14_2  0.000   0.703
```

```
# 36      SESE =~  Q14_3  0.000   0.835
# 37      SESE =~  Q14_4  0.000   0.787

# Intention TBT
# 38      ITBT =~  Q16_1  0.000   0.807
# 39      ITBT =~  Q16_2  0.000   0.813
# 40      ITBT =~  Q16_3  0.000   0.777
# 41      ITBT =~  Q16_4  0.000   0.732
# 42      ITBT =~  Q16_5  0.184   0.097  ** There are problems in the teaching profession that scare or worry me
# 43      ITBT =~  Q16_6  0.000   0.403  ** I may change my teaching profession to another one

# 94  practexp ~~    est  0.000   0.880  ** above .85
# 95  practexp ~~    mot  0.000   0.754
# 96  practexp ~~   SECM  0.000   0.551
# 97  practexp ~~    SEI  0.000   0.620
# 98  practexp ~~   SESE  0.000   0.701
# 99  practexp ~~   ITBT  0.000   0.433
# 100      est ~~    mot  0.000   0.678
# 101      est ~~   SECM  0.000   0.646
# 102      est ~~    SEI  0.000   0.629
# 103      est ~~   SESE  0.000   0.563
# 104      est ~~   ITBT  0.000   0.538
# 105      mot ~~   SECM  0.000   0.603
# 106      mot ~~    SEI  0.000   0.738
# 107      mot ~~   SESE  0.000   0.752
# 108      mot ~~   ITBT  0.000   0.663
# 109     SECM ~~    SEI  0.000   0.694
# 110     SECM ~~   SESE  0.000   0.613
```

```
# 111     SECM ~~   ITBT  0.000   0.429
# 112      SEI ~~   SESE  0.000   0.895  ** above .85
# 113      SEI ~~   ITBT  0.000   0.482
# 114     SESE ~~   ITBT  0.000   0.467

#########################################################################
# Remove items ITBT Q16_5 and Q16_6.
cfa.model <- 'practexp  =~ Q10_1 + Q10_2 + Q10_3 + Q10_4 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12
              est =~       Q11_1 + Q11_2 + Q11_3 + Q11_4 + Q11_5 + Q11_6
              mot =~       Q15_1 + Q15_2 + Q15_3 + Q15_4 + Q15_5 + Q15_6 + Q15_7
              SECM =~      Q12_1 + Q12_2 + Q12_3 + Q12_4
              SEI =~       Q13_1 + Q13_2 + Q13_3 + Q13_4
              SESE =~      Q14_1 + Q14_2 + Q14_3 + Q14_4
              ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)
summary(fit, fit.measures = TRUE)
# Chi-square = 3011.284 df =  758
# CFI = 0.719
# TLI = 0.695
# RMSEA                                          0.118
# 90 Percent confidence interval - lower         0.114
# 90 Percent confidence interval - upper         0.123
# P-value RMSEA <= 0.05                          0.000
# SRMR = 0.083

estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:41, 90:110), c(1,2,3,7,11)]
```

```
# lhs op    rhs pvalue std.all
# 1   practexp =~  Q10_1      0   0.524
# 2   practexp =~  Q10_2      0   0.660
# 3   practexp =~  Q10_3      0   0.760
# 4   practexp =~  Q10_4      0   0.510
# 5   practexp =~  Q10_5      0   0.805
# 6   practexp =~  Q10_6      0   0.910
# 7   practexp =~  Q10_7      0   0.843
# 8   practexp =~  Q10_8      0   0.825
# 9   practexp =~  Q10_9      0   0.875
# 10  practexp =~ Q10_10      0   0.811
# 11  practexp =~ Q10_11      0   0.743
# 12  practexp =~ Q10_12      0   0.874

# 13       est =~  Q11_1      0   0.782
# 14       est =~  Q11_2      0   0.818
# 15       est =~  Q11_3      0   0.843
# 16       est =~  Q11_4      0   0.741
# 17       est =~  Q11_5      0   0.853
# 18       est =~  Q11_6      0   0.853

# 19       mot =~  Q15_1      0   0.685
# 20       mot =~  Q15_2      0   0.699
# 21       mot =~  Q15_3      0   0.768
# 22       mot =~  Q15_4      0   0.504
# 23       mot =~  Q15_5      0   0.837
# 24       mot =~  Q15_6      0   0.764
```

```
# 25       mot =~  Q15_7      0   0.849

# 26      SECM =~  Q12_1      0   0.366
# 27      SECM =~  Q12_2      0   0.847
# 28      SECM =~  Q12_3      0   0.780
# 29      SECM =~  Q12_4      0   0.853

# 30       SEI =~  Q13_1      0   0.591
# 31       SEI =~  Q13_2      0   0.710
# 32       SEI =~  Q13_3      0   0.763
# 33       SEI =~  Q13_4      0   0.768

# 34      SESE =~  Q14_1      0   0.732
# 35      SESE =~  Q14_2      0   0.704
# 36      SESE =~  Q14_3      0   0.834
# 37      SESE =~  Q14_4      0   0.787

# 38      ITBT =~  Q16_1      0   0.803
# 39      ITBT =~  Q16_2      0   0.801
# 40      ITBT =~  Q16_3      0   0.745
# 41      ITBT =~  Q16_4      0   0.769
#
# 90  practexp ~~    est      0   0.880   *** above .85
# 91  practexp ~~    mot      0   0.753
# 92  practexp ~~   SECM      0   0.552
# 93  practexp ~~    SEI      0   0.620
# 94  practexp ~~   SESE      0   0.700
# 95  practexp ~~   ITBT      0   0.465
```

```
# 96       est ~~    mot      0   0.677
# 97       est ~~   SECM      0   0.646
# 98       est ~~    SEI      0   0.629
# 99       est ~~   SESE      0   0.562
# 100      est ~~   ITBT      0   0.540
# 101      mot ~~   SECM      0   0.603
# 102      mot ~~    SEI      0   0.739
# 103      mot ~~   SESE      0   0.752
# 104      mot ~~   ITBT      0   0.705
# 105     SECM ~~    SEI      0   0.694
# 106     SECM ~~   SESE      0   0.613
# 107     SECM ~~   ITBT      0   0.442
# 108      SEI ~~   SESE      0   0.896  *** above .85
# 109      SEI ~~   ITBT      0   0.523
# 110     SESE ~~   ITBT      0   0.516



#################################################################
# Strategy is to combine practexp~~est  and  SEI~~SESE


cfa.model <- 'practexptc  =~ Q10_1 + Q10_2 + Q10_3 + Q10_4 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 +
         Q11_3 + Q11_4 + Q11_5 + Q11_6
              mot =~       Q15_1 + Q15_2 + Q15_3 + Q15_4 + Q15_5 + Q15_6 + Q15_7
              SECM =~      Q12_1 + Q12_2 + Q12_3 + Q12_4
              SEIAE =~       Q13_1 + Q13_2 + Q13_3 + Q13_4 + Q14_1 + Q14_2 + Q14_3 + Q14_4
              ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4'


fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)
```

```
summary(fit, fit.measures = TRUE)
# Chi-square = 3213.221 df =  769
# CFI = 0.695 (.90 or more)
# TLI = 0.674 (.90 or more)
# RMSEA                                       0.122  (.80 or less)
# 90 Percent confidence interval - lower      0.118
# 90 Percent confidence interval - upper      0.127
# P-value RMSEA <= 0.05                       0.000
# SRMR = 0.083                                       (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:41, 88:97), c(1,2,3,7,11)]

# lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_1      0   0.529
# 2  practexptc =~  Q10_2      0   0.648
# 3  practexptc =~  Q10_3      0   0.774
# 4  practexptc =~  Q10_4      0   0.542
# 5  practexptc =~  Q10_5      0   0.784
# 6  practexptc =~  Q10_6      0   0.876
# 7  practexptc =~  Q10_7      0   0.818
# 8  practexptc =~  Q10_8      0   0.797
# 9  practexptc =~  Q10_9      0   0.880
# 10 practexptc =~ Q10_10      0   0.830
```

```
# 11 practexptc =~ Q10_11      0   0.771
# 12 practexptc =~ Q10_12      0   0.844
# 13 practexptc =~  Q11_1      0   0.733
# 14 practexptc =~  Q11_2      0   0.761
# 15 practexptc =~  Q11_3      0   0.783
# 16 practexptc =~  Q11_4      0   0.719
# 17 practexptc =~  Q11_5      0   0.816
# 18 practexptc =~  Q11_6      0   0.796

# 19        mot =~  Q15_1      0   0.686
# 20        mot =~  Q15_2      0   0.702
# 21        mot =~  Q15_3      0   0.773
# 22        mot =~  Q15_4      0   0.505
# 23        mot =~  Q15_5      0   0.836
# 24        mot =~  Q15_6      0   0.758
# 25        mot =~  Q15_7      0   0.849

# 26       SECM =~  Q12_1      0   0.367 * remove
# 27       SECM =~  Q12_2      0   0.843
# 28       SECM =~  Q12_3      0   0.776
# 29       SECM =~  Q12_4      0   0.859

# 30      SEIAE =~  Q13_1      0   0.624
# 31      SEIAE =~  Q13_2      0   0.730
# 32      SEIAE =~  Q13_3      0   0.696
# 33      SEIAE =~  Q13_4      0   0.695
# 34      SEIAE =~  Q14_1      0   0.716
# 35      SEIAE =~  Q14_2      0   0.703
```

```
# 36      SEIAE =~  Q14_3      0   0.827
# 37      SEIAE =~  Q14_4      0   0.758

# 38       ITBT =~  Q16_1      0   0.805
# 39       ITBT =~  Q16_2      0   0.790
# 40       ITBT =~  Q16_3      0   0.722
# 41       ITBT =~  Q16_4      0   0.790

# CORRELATIONS
# 88 practexptc ~~    mot      0   0.747
# 89 practexptc ~~   SECM      0   0.601
# 90 practexptc ~~  SEIAE      0   0.675
# 91 practexptc ~~   ITBT      0   0.511
# 92        mot ~~   SECM      0   0.604
# 93        mot ~~  SEIAE      0   0.767
# 94        mot ~~   ITBT      0   0.718
# 95       SECM ~~  SEIAE      0   0.650
# 96       SECM ~~   ITBT      0   0.448
# 97      SEIAE ~~   ITBT      0   0.554

##########################################################################
# Potential guidelines? Too strict?
# out <- ezCutoffs::ezCutoffs(model = cfa.model, n_obs = 213, n_rep = 1000, n_cores = 1)
# options(scipen = 999)
# summary(out)
##########################################################################
# Strategy is to combine practexp~~est  and  SEI~~SESE
```

```
cfa.model <- 'practexptc  =~ Q10_1 + Q10_2 + Q10_3 + Q10_4 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 +
        Q11_3 + Q11_4 + Q11_5 + Q11_6
              mot =~       Q15_1 + Q15_2 + Q15_3 + Q15_4 + Q15_5 + Q15_6 + Q15_7
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~       Q13_1 + Q13_2 + Q13_3 + Q13_4 + Q14_1 + Q14_2 + Q14_3 + Q14_4
              ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

summary(fit, fit.measures = TRUE)
# Chi-square = 3074.807 df =  730
# CFI = 0.702 (.90 or more)
# TLI = 0.682 (.90 or more)
# RMSEA                                          0.123
# 90 Percent confidence interval - lower         0.118
# 90 Percent confidence interval - upper         0.127
# P-value RMSEA <= 0.05                          0.000
# SRMR = 0.081                                        (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:40, 86:95), c(1,2,3,7,11)]

# lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_1      0   0.529
# 2  practexptc =~  Q10_2      0   0.648
```

```
# 3  practexptc =~  Q10_3      0   0.774
# 4  practexptc =~  Q10_4      0   0.541
# 5  practexptc =~  Q10_5      0   0.784
# 6  practexptc =~  Q10_6      0   0.876
# 7  practexptc =~  Q10_7      0   0.818
# 8  practexptc =~  Q10_8      0   0.797
# 9  practexptc =~  Q10_9      0   0.880
# 10 practexptc =~ Q10_10      0   0.830
# 11 practexptc =~ Q10_11      0   0.771
# 12 practexptc =~ Q10_12      0   0.844

# 13 practexptc =~  Q11_1      0   0.732
# 14 practexptc =~  Q11_2      0   0.761
# 15 practexptc =~  Q11_3      0   0.783
# 16 practexptc =~  Q11_4      0   0.719
# 17 practexptc =~  Q11_5      0   0.816
# 18 practexptc =~  Q11_6      0   0.796

# 19        mot =~  Q15_1      0   0.686
# 20        mot =~  Q15_2      0   0.702
# 21        mot =~  Q15_3      0   0.773
# 22        mot =~  Q15_4      0   0.505  ** remove
# 23        mot =~  Q15_5      0   0.836
# 24        mot =~  Q15_6      0   0.758
# 25        mot =~  Q15_7      0   0.849

# 26       SECM =~  Q12_2      0   0.847
# 27       SECM =~  Q12_3      0   0.777
```

```
# 28       SECM =~  Q12_4      0   0.857

# 29      SEIAE =~  Q13_1      0   0.623
# 30      SEIAE =~  Q13_2      0   0.729
# 31      SEIAE =~  Q13_3      0   0.697
# 32      SEIAE =~  Q13_4      0   0.697
# 33      SEIAE =~  Q14_1      0   0.715
# 34      SEIAE =~  Q14_2      0   0.702
# 35      SEIAE =~  Q14_3      0   0.828
# 36      SEIAE =~  Q14_4      0   0.758

# 37       ITBT =~  Q16_1      0   0.805
# 38       ITBT =~  Q16_2      0   0.790
# 39       ITBT =~  Q16_3      0   0.721
# 40       ITBT =~  Q16_4      0   0.790
# COR
# 86 practexptc ~~    mot      0   0.747
# 87 practexptc ~~   SECM      0   0.594
# 88 practexptc ~~  SEIAE      0   0.675
# 89 practexptc ~~   ITBT      0   0.511
# 90        mot ~~   SECM      0   0.596
# 91        mot ~~  SEIAE      0   0.767
# 92        mot ~~   ITBT      0   0.719
# 93       SECM ~~  SEIAE      0   0.654
# 94       SECM ~~   ITBT      0   0.434
# 95      SEIAE ~~   ITBT      0   0.554

##############################################
```

```
# Remove Q15_4

cfa.model <- 'practexptc  =~ Q10_1 + Q10_2 + Q10_3 + Q10_4 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 +
         Q11_3 + Q11_4 + Q11_5 + Q11_6
              mot =~       Q15_1 + Q15_2 + Q15_3 + Q15_5 + Q15_6 + Q15_7
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~       Q13_1 + Q13_2 + Q13_3 + Q13_4 + Q14_1 + Q14_2 + Q14_3 + Q14_4
              ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4'


fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)


summary(fit, fit.measures = TRUE)
# Chi-square = 2964.272 df =  692
# CFI = 0.707 (.90 or more)
# TLI = 0.686 (.90 or more)
# RMSEA                                          0.124
# 90 Percent confidence interval - lower         0.120
# 90 Percent confidence interval - upper         0.129
# P-value RMSEA <= 0.05                          0.000
# SRMR = 0.081                                       (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:39, 84:93), c(1,2,3,7,11)]

# lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_1      0   0.529 ** remove
```

```
# 2  practexptc =~  Q10_2      0   0.648
# 3  practexptc =~  Q10_3      0   0.774
# 4  practexptc =~  Q10_4      0   0.542 ** remove
# 5  practexptc =~  Q10_5      0   0.784
# 6  practexptc =~  Q10_6      0   0.876
# 7  practexptc =~  Q10_7      0   0.818
# 8  practexptc =~  Q10_8      0   0.798
# 9  practexptc =~  Q10_9      0   0.879
# 10 practexptc =~ Q10_10      0   0.829
# 11 practexptc =~ Q10_11      0   0.771
# 12 practexptc =~ Q10_12      0   0.844

# 13 practexptc =~  Q11_1      0   0.732
# 14 practexptc =~  Q11_2      0   0.761
# 15 practexptc =~  Q11_3      0   0.783
# 16 practexptc =~  Q11_4      0   0.719
# 17 practexptc =~  Q11_5      0   0.817
# 18 practexptc =~  Q11_6      0   0.796

# 19        mot =~  Q15_1      0   0.689
# 20        mot =~  Q15_2      0   0.701
# 21        mot =~  Q15_3      0   0.769
# 22        mot =~  Q15_5      0   0.839
# 23        mot =~  Q15_6      0   0.757
# 24        mot =~  Q15_7      0   0.854

# 25       SECM =~  Q12_2      0   0.847
# 26       SECM =~  Q12_3      0   0.777
```

```
# 27       SECM =~  Q12_4      0   0.857

# 28      SEIAE =~  Q13_1      0   0.624
# 29      SEIAE =~  Q13_2      0   0.729
# 30      SEIAE =~  Q13_3      0   0.697
# 31      SEIAE =~  Q13_4      0   0.698
# 32      SEIAE =~  Q14_1      0   0.715
# 33      SEIAE =~  Q14_2      0   0.701
# 34      SEIAE =~  Q14_3      0   0.828
# 35      SEIAE =~  Q14_4      0   0.758

# 36       ITBT =~  Q16_1      0   0.803
# 37       ITBT =~  Q16_2      0   0.792
# 38       ITBT =~  Q16_3      0   0.722
# 39       ITBT =~  Q16_4      0   0.790
# COR
# 84 practexptc ~~    mot      0   0.748
# 85 practexptc ~~   SECM      0   0.594
# 86 practexptc ~~  SEIAE      0   0.675
# 87 practexptc ~~   ITBT      0   0.511
# 88        mot ~~   SECM      0   0.592
# 89        mot ~~  SEIAE      0   0.760
# 90        mot ~~   ITBT      0   0.709
# 91       SECM ~~  SEIAE      0   0.654
# 92       SECM ~~   ITBT      0   0.434
# 93      SEIAE ~~   ITBT      0   0.554

##############################################################################
```

```
# Remove Q10_1 Q10_4
cfa.model <- 'practexptc  =~ Q10_2 + Q10_3 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 + Q11_3 + Q11_4 +
         Q11_5 + Q11_6
               mot =~       Q15_1 + Q15_2 + Q15_3 + Q15_5 + Q15_6 + Q15_7
               SECM =~      Q12_2 + Q12_3 + Q12_4
               SEIAE =~       Q13_1 + Q13_2 + Q13_3 + Q13_4 + Q14_1 + Q14_2 + Q14_3 + Q14_4
               ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

semTools::htmt(cfa.model, my_data)

#            prctxp mot   SECM  SEIAE ITBT
# practexptc 1.000
# mot        0.772  1.000
# SECM       0.596  0.606 1.000
# SEIAE      0.665  0.760 0.616 1.000
# ITBT       0.500  0.639 0.412 0.488 1.000

summary(fit, fit.measures = TRUE)
# Chi-square = 2685.314 df =  619
# CFI = 0.721 (.90 or more)
# TLI = 0.700 (.90 or more)
# RMSEA                                          0.125
# 90 Percent confidence interval - lower         0.120
# 90 Percent confidence interval - upper         0.130
# P-value RMSEA <= 0.05                          0.000
# SRMR = 0.081                                       (.80 or less), Hu and Bentler, 1999
```

```
#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:37, 80:89), c(1,2,3,7,11)]

#           lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_2      0   0.638  ** remove
# 2  practexptc =~  Q10_3      0   0.765
# 3  practexptc =~  Q10_5      0   0.787
# 4  practexptc =~  Q10_6      0   0.877
# 5  practexptc =~  Q10_7      0   0.818
# 6  practexptc =~  Q10_8      0   0.799
# 7  practexptc =~  Q10_9      0   0.885
# 8  practexptc =~ Q10_10      0   0.833
# 9  practexptc =~ Q10_11      0   0.777
# 10 practexptc =~ Q10_12      0   0.844

# 11 practexptc =~  Q11_1      0   0.730
# 12 practexptc =~  Q11_2      0   0.758
# 13 practexptc =~  Q11_3      0   0.779
# 14 practexptc =~  Q11_4      0   0.718
# 15 practexptc =~  Q11_5      0   0.816
# 16 practexptc =~  Q11_6      0   0.797

# 17        mot =~  Q15_1      0   0.689
```

```
# 18        mot =~  Q15_2      0   0.701
# 19        mot =~  Q15_3      0   0.770
# 20        mot =~  Q15_5      0   0.839
# 21        mot =~  Q15_6      0   0.757
# 22        mot =~  Q15_7      0   0.854

# 23       SECM =~  Q12_2      0   0.847
# 24       SECM =~  Q12_3      0   0.777
# 25       SECM =~  Q12_4      0   0.857

# 26      SEIAE =~  Q13_1      0   0.623  ** remove
# 27      SEIAE =~  Q13_2      0   0.729
# 28      SEIAE =~  Q13_3      0   0.697
# 29      SEIAE =~  Q13_4      0   0.697
# 30      SEIAE =~  Q14_1      0   0.715
# 31      SEIAE =~  Q14_2      0   0.701
# 32      SEIAE =~  Q14_3      0   0.828
# 33      SEIAE =~  Q14_4      0   0.758

# 34       ITBT =~  Q16_1      0   0.803
# 35       ITBT =~  Q16_2      0   0.792
# 36       ITBT =~  Q16_3      0   0.723
# 37       ITBT =~  Q16_4      0   0.790
# COR
# 80 practexptc ~~    mot      0   0.746
# 81 practexptc ~~   SECM      0   0.589
# 82 practexptc ~~  SEIAE      0   0.674
# 83 practexptc ~~   ITBT      0   0.511
```

```
# 84        mot ~~   SECM      0   0.592
# 85        mot ~~  SEIAE      0   0.760
# 86        mot ~~   ITBT      0   0.709
# 87       SECM ~~  SEIAE      0   0.654
# 88       SECM ~~   ITBT      0   0.434
# 89      SEIAE ~~   ITBT      0   0.554


########################################################################


# Remove Q10_2 Q13_1
cfa.model <- 'practexptc  =~ Q10_3 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 + Q11_3 + Q11_4 + Q11_5 +
         Q11_6
              mot =~       Q15_1 + Q15_2 + Q15_3 + Q15_5 + Q15_6 + Q15_7
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_2 + Q13_3 + Q13_4 + Q14_1 + Q14_2 + Q14_3 + Q14_4
              ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

semTools::htmt(cfa.model, my_data)

#            prctxp mot   SECM  SEIAE ITBT
# practexptc 1.000
# mot        0.772  1.000
# SECM       0.596  0.606 1.000
# SEIAE      0.665  0.760 0.616 1.000
# ITBT       0.500  0.639 0.412 0.488 1.000

summary(fit, fit.measures = TRUE)
```

```
# Chi-square = 2395.771 df =  550
# CFI = 0.736 (.90 or more)
# TLI = 0.714 (.90 or more)
# RMSEA                                          0.126
# 90 Percent confidence interval - lower         0.120
# 90 Percent confidence interval - upper         0.131
# P-value RMSEA <= 0.05                          0.000
# SRMR = 0.079                                  (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:35, 76:85), c(1,2,3,7,11)]

#           lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_3      0   0.759
# 2  practexptc =~  Q10_5      0   0.788
# 3  practexptc =~  Q10_6      0   0.872
# 4  practexptc =~  Q10_7      0   0.817
# 5  practexptc =~  Q10_8      0   0.796
# 6  practexptc =~  Q10_9      0   0.887
# 7  practexptc =~ Q10_10      0   0.836
# 8  practexptc =~ Q10_11      0   0.782
# 9  practexptc =~ Q10_12      0   0.841
# 10 practexptc =~  Q11_1      0   0.735
# 11 practexptc =~  Q11_2      0   0.761
```

```
# 12 practexptc =~  Q11_3      0   0.778
# 13 practexptc =~  Q11_4      0   0.720
# 14 practexptc =~  Q11_5      0   0.819
# 15 practexptc =~  Q11_6      0   0.801

# 16        mot =~  Q15_1      0   0.689 ** remove
# 17        mot =~  Q15_2      0   0.700
# 18        mot =~  Q15_3      0   0.770
# 19        mot =~  Q15_5      0   0.839
# 20        mot =~  Q15_6      0   0.757
# 21        mot =~  Q15_7      0   0.855

# 22       SECM =~  Q12_2      0   0.846
# 23       SECM =~  Q12_3      0   0.778
# 24       SECM =~  Q12_4      0   0.856

# 25      SEIAE =~  Q13_2      0   0.716
# 26      SEIAE =~  Q13_3      0   0.711
# 27      SEIAE =~  Q13_4      0   0.714
# 28      SEIAE =~  Q14_1      0   0.689 ** remove
# 29      SEIAE =~  Q14_2      0   0.684 ** remove
# 30      SEIAE =~  Q14_3      0   0.847
# 31      SEIAE =~  Q14_4      0   0.757

# 32       ITBT =~  Q16_1      0   0.804
# 33       ITBT =~  Q16_2      0   0.793
# 34       ITBT =~  Q16_3      0   0.725
# 35       ITBT =~  Q16_4      0   0.787
```

```
# COR
# 76 practexptc ~~    mot      0   0.739
# 77 practexptc ~~   SECM      0   0.587
# 78 practexptc ~~  SEIAE      0   0.658
# 79 practexptc ~~   ITBT      0   0.512
# 80        mot ~~   SECM      0   0.592
# 81        mot ~~  SEIAE      0   0.755
# 82        mot ~~   ITBT      0   0.707
# 83       SECM ~~  SEIAE      0   0.668
# 84       SECM ~~   ITBT      0   0.433
# 85      SEIAE ~~   ITBT      0   0.538

#############################################################################


# Remove Q15_1, Q14_1 and Q14_2
cfa.model <- 'practexptc  =~ Q10_3 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 + Q11_3 + Q11_4 + Q11_5 +
         Q11_6
              mot =~       Q15_2 + Q15_3 + Q15_5 + Q15_6 + Q15_7
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_2 + Q13_3 + Q13_4 + Q14_3 + Q14_4
              ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4'


fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)


semTools::htmt(cfa.model, my_data)


#             prctxp mot   SECM  SEIAE ITBT
# practexptc 1.000
# mot        0.742  1.000
```

```
# SECM       0.592  0.577 1.000
# SEIAE      0.646  0.750 0.695 1.000
# ITBT       0.503  0.667 0.412 0.518 1.000

semTools::AVE(fit)   # another assessment for convergent validity
# practexptc        mot       SECM      SEIAE       ITBT
#      0.648      0.596      0.683      0.561      0.602

summary(fit, fit.measures = TRUE)
# Chi-square = 2052.196 df =  454
# CFI =  0.751 (.90 or more)
# TLI = 0.728 (.90 or more)
# RMSEA                                          0.129
# 90 Percent confidence interval - lower         0.123
# 90 Percent confidence interval - upper         0.134
# P-value RMSEA <= 0.05                          0.000
# SRMR = 0.077                                 (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:32, 70:79), c(1,2,3,7,11)]

#           lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_3      0   0.759
# 2  practexptc =~  Q10_5      0   0.787
```

```
# 3  practexptc =~  Q10_6      0   0.871
# 4  practexptc =~  Q10_7      0   0.817
# 5  practexptc =~  Q10_8      0   0.795
# 6  practexptc =~  Q10_9      0   0.887
# 7  practexptc =~ Q10_10      0   0.837
# 8  practexptc =~ Q10_11      0   0.782
# 9  practexptc =~ Q10_12      0   0.840

# 10 practexptc =~  Q11_1      0   0.735
# 11 practexptc =~  Q11_2      0   0.762
# 12 practexptc =~  Q11_3      0   0.779
# 13 practexptc =~  Q11_4      0   0.720
# 14 practexptc =~  Q11_5      0   0.819
# 15 practexptc =~  Q11_6      0   0.802

# 16        mot =~  Q15_2      0   0.702
# 17        mot =~  Q15_3      0   0.757
# 18        mot =~  Q15_5      0   0.847
# 19        mot =~  Q15_6      0   0.744
# 20        mot =~  Q15_7      0   0.869

# 21       SECM =~  Q12_2      0   0.852
# 22       SECM =~  Q12_3      0   0.782
# 23       SECM =~  Q12_4      0   0.848

# 24      SEIAE =~  Q13_2      0   0.675 ** remove
# 25      SEIAE =~  Q13_3      0   0.737
# 26      SEIAE =~  Q13_4      0   0.751
```

```
# 27      SEIAE =~  Q14_3      0   0.846
# 28      SEIAE =~  Q14_4      0   0.747

# 29       ITBT =~  Q16_1      0   0.802
# 30       ITBT =~  Q16_2      0   0.791
# 31       ITBT =~  Q16_3      0   0.722
# 32       ITBT =~  Q16_4      0   0.792
# COR
# 70 practexptc ~~    mot      0   0.718
# 71 practexptc ~~   SECM      0   0.587
# 72 practexptc ~~  SEIAE      0   0.656
# 73 practexptc ~~   ITBT      0   0.514
# 74        mot ~~   SECM      0   0.569
# 75        mot ~~  SEIAE      0   0.740
# 76        mot ~~   ITBT      0   0.728
# 77       SECM ~~  SEIAE      0   0.722
# 78       SECM ~~   ITBT      0   0.432
# 79      SEIAE ~~   ITBT      0   0.547
#########################################################################
# Remove Q13_2
cfa.model <- 'practexptc  =~ Q10_3 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 + Q11_3 + Q11_4 + Q11_5 +
        Q11_6
              mot =~       Q15_2 + Q15_3 + Q15_5 + Q15_6 + Q15_7
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4
              ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)
semTools::htmt(cfa.model, my_data)
```

```
#            prctxp mot   SECM  SEIAE ITBT
# practexptc 1.000
# mot        0.742  1.000
# SECM       0.592  0.577 1.000
# SEIAE      0.649  0.744 0.764 1.000
# ITBT       0.503  0.667 0.412 0.494 1.000

semTools::AVE(fit)   # another assessment for convergent validity
# practexptc        mot       SECM      SEIAE       ITBT
#      0.648      0.597      0.684      0.590      0.603

summary(fit, fit.measures = TRUE)
# Chi-square = 1966.305 df =  424
# CFI =  0.753 (.90 or more)
# TLI = 0.729 (.90 or more)
# RMSEA                                       0.131
# 90 Percent confidence interval - lower      0.125
# 90 Percent confidence interval - upper      0.137
# P-value RMSEA <= 0.05                       0.000
# SRMR = 0.077                               (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:31, 68:77), c(1,2,3,7,11)]
```

```
# lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_3      0   0.759
# 2  practexptc =~  Q10_5      0   0.787
# 3  practexptc =~  Q10_6      0   0.871
# 4  practexptc =~  Q10_7      0   0.817
# 5  practexptc =~  Q10_8      0   0.795
# 6  practexptc =~  Q10_9      0   0.887
# 7  practexptc =~ Q10_10      0   0.837
# 8  practexptc =~ Q10_11      0   0.782
# 9  practexptc =~ Q10_12      0   0.840

# 10 practexptc =~  Q11_1      0   0.735
# 11 practexptc =~  Q11_2      0   0.762
# 12 practexptc =~  Q11_3      0   0.779
# 13 practexptc =~  Q11_4      0   0.720
# 14 practexptc =~  Q11_5      0   0.819
# 15 practexptc =~  Q11_6      0   0.802

# 16        mot =~  Q15_2      0   0.701
# 17        mot =~  Q15_3      0   0.758
# 18        mot =~  Q15_5      0   0.847
# 19        mot =~  Q15_6      0   0.745
# 20        mot =~  Q15_7      0   0.868

# 21       SECM =~  Q12_2      0   0.853
# 22       SECM =~  Q12_3      0   0.785
# 23       SECM =~  Q12_4      0   0.844
```

```
# 24      SEIAE =~  Q13_3      0   0.734
# 25      SEIAE =~  Q13_4      0   0.759
# 26      SEIAE =~  Q14_3      0   0.840
# 27      SEIAE =~  Q14_4      0   0.737

# 28       ITBT =~  Q16_1      0   0.802
# 29       ITBT =~  Q16_2      0   0.792
# 30       ITBT =~  Q16_3      0   0.724
# 31       ITBT =~  Q16_4      0   0.790

# 68 practexptc ~~    mot      0   0.719
# 69 practexptc ~~   SECM      0   0.587
# 70 practexptc ~~  SEIAE      0   0.655
# 71 practexptc ~~   ITBT      0   0.513
# 72        mot ~~   SECM      0   0.568
# 73        mot ~~  SEIAE      0   0.732
# 74        mot ~~   ITBT      0   0.726
# 75       SECM ~~  SEIAE      0   0.755
# 76       SECM ~~   ITBT      0   0.431
# 77      SEIAE ~~   ITBT      0   0.527

#############################################################################################################

# Remove mot
cfa.model <- 'practexptc  =~ Q10_3 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 + Q11_3 + Q11_4 + Q11_5 +
         Q11_6
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4
```

```
              ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

semTools::htmt(cfa.model, my_data)

#            prctxp SECM  SEIAE ITBT
# practexptc 1.000
# SECM       0.592  1.000
# SEIAE      0.649  0.764 1.000
# ITBT       0.503  0.412 0.494 1.000

semTools::AVE(fit)   # another assessment for convergent validity
# practexptc       SECM      SEIAE       ITBT
#      0.648      0.684      0.591      0.609

summary(fit, fit.measures = TRUE)
# Chi-square = 1508.271 df =  293
# CFI =  0.764 (.90 or more)
# TLI = 0.738 (.90 or more)
# RMSEA                                       0.140
# 90 Percent confidence interval - lower      0.133
# 90 Percent confidence interval - upper      0.147
# P-value RMSEA <= 0.05                       0.000
# SRMR = 0.079                               (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
```

```
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)



##############################################################################################

# Remove SECM
cfa.model <- 'practexptc  =~ Q10_3 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 + Q11_3 + Q11_4 + Q11_5 +
         Q11_6
              mot =~       Q15_2 + Q15_3 + Q15_5 + Q15_6 + Q15_7
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4
              ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

semTools::htmt(cfa.model, my_data)

#             prctxp mot   SEIAE ITBT
# practexptc 1.000
# mot        0.742  1.000
# SEIAE      0.649  0.744 1.000
# ITBT       0.503  0.667 0.494 1.000

semTools::AVE(fit)   # another assessment for convergent validity
# practexptc        mot      SEIAE       ITBT
#      0.648      0.597      0.591      0.602

summary(fit, fit.measures = TRUE)
```

```
# Chi-square = 1756.886 df =  344
# CFI =  0.751 (.90 or more)
# TLI = 0.727 (.90 or more)
# RMSEA                                       0.139
# 90 Percent confidence interval - lower      0.132
# 90 Percent confidence interval - upper      0.145
# P-value RMSEA <= 0.05                       0.000
# SRMR = 0.078                               (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)



##############################################################################################

# Remove SEIAE
cfa.model <- 'practexptc  =~ Q10_3 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 + Q11_3 + Q11_4 + Q11_5 +
         Q11_6
              mot =~       Q15_2 + Q15_3 + Q15_5 + Q15_6 + Q15_7
              SECM =~      Q12_2 + Q12_3 + Q12_4
              ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

semTools::htmt(cfa.model, my_data)
```

```
#            prctxp mot   SECM  ITBT
# practexptc 1.000
# mot        0.742  1.000
# SECM       0.592  0.577 1.000
# ITBT       0.503  0.667 0.412 1.000

semTools::AVE(fit)   # another assessment for convergent validity
# practexptc        mot       SECM       ITBT
#      0.648      0.596      0.682      0.604

summary(fit, fit.measures = TRUE)
# Chi-square = 1570.929 df =  318
# CFI =  0.769 (.90 or more)
# TLI = 0.745 (.90 or more)
# RMSEA                                       0.136
# 90 Percent confidence interval - lower      0.129
# 90 Percent confidence interval - upper      0.143
# P-value RMSEA <= 0.05                       0.000
# SRMR = 0.075                               (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)
```

```
#############################################################################################################

# Remove ITBT
cfa.model <- 'practexptc  =~ Q10_3 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 + Q11_3 + Q11_4 + Q11_5 +
         Q11_6
              mot =~       Q15_2 + Q15_3 + Q15_5 + Q15_6 + Q15_7
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

semTools::htmt(cfa.model, my_data)

#             prctxp mot   SECM  SEIAE
# practexptc 1.000
# mot        0.742  1.000
# SECM       0.592  0.577 1.000
# SEIAE      0.649  0.744 0.764 1.000

semTools::AVE(fit)   # another assessment for convergent validity
# practexptc        mot       SECM      SEIAE
#      0.648      0.604      0.684      0.590

summary(fit, fit.measures = TRUE)
# Chi-square = 1491.279 df =  318
# CFI =  0.783 (.90 or more)
# TLI = 0.760 (.90 or more)
# RMSEA                                          0.132
# 90 Percent confidence interval - lower         0.125
```

```
# 90 Percent confidence interval - upper         0.138
# P-value RMSEA <= 0.05                          0.000
# SRMR = 0.068                                  (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)



#############################################################################################
# Remove practexptc
cfa.model <- 'mot =~       Q15_2 + Q15_3 + Q15_5 + Q15_6 + Q15_7
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4
              ITBT =~      Q16_1 + Q16_2 + Q16_3 + Q16_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

semTools::htmt(cfa.model, my_data)

#         mot   SECM  SEIAE ITBT
# mot   1.000
# SECM  0.577 1.000
# SEIAE 0.744 0.764 1.000
# ITBT  0.667 0.412 0.494 1.000
```

```
semTools::AVE(fit)   # another assessment for convergent validity
# mot  SECM SEIAE  ITBT
# 0.590 0.683 0.589 0.603

summary(fit, fit.measures = TRUE)
# Chi-square = 416.209 df =  98
# CFI =  0.859 (.90 or more)
# TLI = 0.828 (.90 or more)
# RMSEA                                       0.123
# 90 Percent confidence interval - lower      0.111
# 90 Percent confidence interval - upper      0.136
# P-value RMSEA <= 0.05                       0.000
# SRMR = 0.074                               (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)

##############################################################################################
##############################################################################################
##############################################################################################
# Given options, we choose to explore the following four-factor solution:

# ITBT removing. We propose, for theoretical reasons, to remove motivation as this is less central

# Remove mot
```

```
cfa.model <- 'practexptc  =~ Q10_3 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 + Q11_3 + Q11_4 + Q11_5 +
        Q11_6
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

semTools::htmt(cfa.model, my_data)

#           prctxp SECM  SEIAE
# practexptc 1.000
# SECM       0.592  1.000
# SEIAE      0.649  0.764 1.000

semTools::AVE(fit)   # another assessment for convergent validity
# practexptc       SECM      SEIAE
#      0.648      0.684      0.590

summary(fit, fit.measures = TRUE)
# Chi-square = 1114.246 df =  206
# CFI =  0.794 (.90 or more)
# TLI = 0.769 (.90 or more)
# RMSEA                                          0.144
# 90 Percent confidence interval - lower         0.136
# 90 Percent confidence interval - upper         0.152
# P-value RMSEA <= 0.05                          0.000
# SRMR = 0.070                                (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
```

```
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:22, 48:50), c(1,2,3,7,11)]

# lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_3      0   0.759
# 2  practexptc =~  Q10_5      0   0.786
# 3  practexptc =~  Q10_6      0   0.868
# 4  practexptc =~  Q10_7      0   0.816
# 5  practexptc =~  Q10_8      0   0.791
# 6  practexptc =~  Q10_9      0   0.888
# 7  practexptc =~ Q10_10      0   0.840
# 8  practexptc =~ Q10_11      0   0.784
# 9  practexptc =~ Q10_12      0   0.838
# 10 practexptc =~  Q11_1      0   0.738 88 remove
# 11 practexptc =~  Q11_2      0   0.761
# 12 practexptc =~  Q11_3      0   0.778
# 13 practexptc =~  Q11_4      0   0.717 ** remove
# 14 practexptc =~  Q11_5      0   0.822
# 15 practexptc =~  Q11_6      0   0.807

# 16       SECM =~  Q12_2      0   0.854
# 17       SECM =~  Q12_3      0   0.786
# 18       SECM =~  Q12_4      0   0.842

# 19      SEIAE =~  Q13_3      0   0.724
```

```
# 20      SEIAE =~  Q13_4      0   0.755
# 21      SEIAE =~  Q14_3      0   0.851
# 22      SEIAE =~  Q14_4      0   0.738
# COR
# 48 practexptc ~~   SECM      0   0.588
# 49 practexptc ~~  SEIAE      0   0.654
# 50       SECM ~~  SEIAE      0   0.752


#### Prelimanary SEM ####


sem.model <- 'practexptc  =~ Q10_3 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_1 + Q11_2 + Q11_3 + Q11_4 + Q11_5 +
         Q11_6
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4
              SECM ~ practexptc
              SEIAE ~ practexptc'


fit <- lavaan::sem(sem.model, std.lv=TRUE, data = my_data)
estim.M1 <- parameterestimates(fit, standardized=TRUE, rsquare = TRUE)


estim.M1[c(1:24, 48:50, 73:74), c(1,2,3,4, 7,11)]  # 35% and 43%


#############################################################################################
# Remove Q11_1 and Q11_4


# Remove mot
cfa.model <- 'practexptc  =~ Q10_3 + Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_2 + Q11_3 + Q11_5 + Q11_6
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4'
```

```
fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

semTools::htmt(cfa.model, my_data)

#            prctxp SECM  SEIAE
# practexptc 1.000
# SECM       0.593  1.000
# SEIAE      0.666  0.764 1.000

semTools::AVE(fit)   # another assessment for convergent validity
# practexptc       SECM      SEIAE
#      0.662      0.684      0.590

summary(fit, fit.measures = TRUE)
# Chi-square = 959.998 df =  167
# CFI =  0.801 (.90 or more)
# TLI = 0.774 (.90 or more)
# RMSEA                                       0.149
# 90 Percent confidence interval - lower      0.140
# 90 Percent confidence interval - upper      0.159
# P-value RMSEA <= 0.05                       0.000
# SRMR = 0.071                              (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.
```

```
estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:20, 44:46), c(1,2,3,7,11)]

#           lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_3      0   0.758 **
# 2  practexptc =~  Q10_5      0   0.783
# 3  practexptc =~  Q10_6      0   0.878
# 4  practexptc =~  Q10_7      0   0.819
# 5  practexptc =~  Q10_8      0   0.797
# 6  practexptc =~  Q10_9      0   0.893
# 7  practexptc =~ Q10_10      0   0.843
# 8  practexptc =~ Q10_11      0   0.787
# 9  practexptc =~ Q10_12      0   0.840
# 10 practexptc =~  Q11_2      0   0.748  **
# 11 practexptc =~  Q11_3      0   0.762  **
# 12 practexptc =~  Q11_5      0   0.817
# 13 practexptc =~  Q11_6      0   0.799

# 14       SECM =~  Q12_2      0   0.854
# 15       SECM =~  Q12_3      0   0.786
# 16       SECM =~  Q12_4      0   0.842

# 17      SEIAE =~  Q13_3      0   0.721
# 18      SEIAE =~  Q13_4      0   0.751
# 19      SEIAE =~  Q14_3      0   0.854
# 20      SEIAE =~  Q14_4      0   0.741
# COR
# 44 practexptc ~~   SECM      0   0.584
```

```
# 45 practexptc ~~  SEIAE      0   0.664
# 46       SECM ~~  SEIAE      0   0.751

#############################################################################################
# Remove Q10_3 and Q11_2 and Q11_3

# Remove mot
cfa.model <- 'practexptc  =~ Q10_5 + Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_11 + Q10_12 + Q11_5 + Q11_6
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

semTools::htmt(cfa.model, my_data)

#            prctxp SECM  SEIAE
# practexptc 1.000
# SECM       0.577  1.000
# SEIAE      0.654  0.764 1.000

semTools::AVE(fit)   # another assessment for convergent validity
# practexptc       SECM      SEIAE
#       0.687      0.684      0.590

summary(fit, fit.measures = TRUE)
# Chi-square = 721.193 df =  116
# CFI =  0.817 (.90 or more)
# TLI = 0.786 (.90 or more)
```

```
# RMSEA                                          0.157
# 90 Percent confidence interval - lower         0.146
# 90 Percent confidence interval - upper         0.168
# P-value RMSEA <= 0.05                          0.000
# SRMR = 0.077                                (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:17, 38:40), c(1,2,3,7,11)]

# lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_5      0   0.789 **
# 2  practexptc =~  Q10_6      0   0.881
# 3  practexptc =~  Q10_7      0   0.814
# 4  practexptc =~  Q10_8      0   0.803
# 5  practexptc =~  Q10_9      0   0.906
# 6  practexptc =~ Q10_10      0   0.848
# 7  practexptc =~ Q10_11      0   0.789 **
# 8  practexptc =~ Q10_12      0   0.853
# 9  practexptc =~  Q11_5      0   0.804
# 10 practexptc =~  Q11_6      0   0.780 **

# 11       SECM =~  Q12_2      0   0.855
# 12       SECM =~  Q12_3      0   0.786
# 13       SECM =~  Q12_4      0   0.842
```

```
# 14      SEIAE =~  Q13_3      0   0.713
# 15      SEIAE =~  Q13_4      0   0.744
# 16      SEIAE =~  Q14_3      0   0.859
# 17      SEIAE =~  Q14_4      0   0.748

# 38 practexptc ~~   SECM      0   0.566
# 39 practexptc ~~  SEIAE      0   0.657
# 40       SECM ~~  SEIAE      0   0.748


#############################################################################################
# Remove Q10_5, Q10_11, and Q11_6

# Remove mot
cfa.model <- 'practexptc  =~ Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_10 + Q10_12 + Q11_5
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

semTools::htmt(cfa.model, my_data)

#           prctxp SECM  SEIAE
# practexptc 1.000
# SECM       0.553  1.000
# SEIAE      0.652  0.764 1.000
```

```
semTools::AVE(fit)   # another assessment for convergent validity
# practexptc       SECM      SEIAE
#       0.719      0.684      0.591

summary(fit, fit.measures = TRUE)
# Chi-square = 400.554 df =  74
# CFI =  0.868 (.90 or more)
# TLI = 0.838 (.90 or more)
# RMSEA                                       0.144
# 90 Percent confidence interval - lower      0.130
# 90 Percent confidence interval - upper      0.158
# P-value RMSEA <= 0.05                       0.000
# SRMR =  0.070                              (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:14, 32:34), c(1,2,3,7,11)]

#           lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_6      0   0.914
# 2  practexptc =~  Q10_7      0   0.848
# 3  practexptc =~  Q10_8      0   0.840
# 4  practexptc =~  Q10_9      0   0.867
# 5  practexptc =~ Q10_10      0   0.798 **
# 6  practexptc =~ Q10_12      0   0.873
```

```
# 7  practexptc =~  Q11_5      0   0.762 **

# 8         SECM =~  Q12_2      0   0.856
# 9         SECM =~  Q12_3      0   0.784
# 10        SECM =~  Q12_4      0   0.842

# 11       SEIAE =~  Q13_3      0   0.714
# 12       SEIAE =~  Q13_4      0   0.742
# 13       SEIAE =~  Q14_3      0   0.858
# 14       SEIAE =~  Q14_4      0   0.751
# COR
# 32 practexptc ~~   SECM      0   0.533
# 33 practexptc ~~  SEIAE      0   0.667
# 34        SECM ~~  SEIAE      0   0.748

#############################################################################################
# Remove Q10_10, and Q11_5

# Remove mot
cfa.model <- 'practexptc  =~ Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_12
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)

semTools::htmt(cfa.model, my_data)

#            prctxp SECM  SEIAE
```

```
# practexptc 1.000
# SECM       0.504  1.000
# SEIAE      0.656  0.764 1.000

semTools::AVE(fit)   # another assessment for convergent validity
# practexptc       SECM      SEIAE
# 0     .763      0.684      0.591

summary(fit, fit.measures = TRUE)
# Chi-square = 189.253 df =  51
# CFI =  0.929 (.90 or more)
# TLI = 0.908 (.90 or more)
# RMSEA                                       0.113
# 90 Percent confidence interval - lower      0.096
# 90 Percent confidence interval - upper      0.130
# P-value RMSEA <= 0.05                       0.000
# SRMR =   0.061                             (.80 or less), Hu and Bentler, 1999

#Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indices in covariance structure analysis:
# Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1вЂ“55.
# doi: 10.1080/10705519909540118.

semTools::moreFitIndices(fit)  # Gamma fit index 0.902 (above .90)
# CFI is .93  (above .90)
# RMSEA = .11
# SRMR = .06 (under .08)
# we meet three of four best fit indices.
```

```
estim.M1 <- parameterestimates(fit, standardized=TRUE)
estim.M1[c(1:12, 28:30), c(1,2,3,7,11)]

#           lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_6      0   0.933
# 2  practexptc =~  Q10_7      0   0.870
# 3  practexptc =~  Q10_8      0   0.858
# 4  practexptc =~  Q10_9      0   0.814
# 5  practexptc =~ Q10_12      0   0.875

# 6        SECM =~  Q12_2      0   0.857
# 7        SECM =~  Q12_3      0   0.783
# 8        SECM =~  Q12_4      0   0.841

# 9       SEIAE =~  Q13_3      0   0.716
# 10      SEIAE =~  Q13_4      0   0.740
# 11      SEIAE =~  Q14_3      0   0.856
# 12      SEIAE =~  Q14_4      0   0.754
# COR
# 28 practexptc ~~   SECM      0   0.497
# 29 practexptc ~~  SEIAE      0   0.673
# 30       SECM ~~  SEIAE      0   0.748

#############################################################################################
# Measurement Model is now done
colnames(my_data)

# Add the following single items:
```

```
# Q16_3: I think I will work in the field of teaching for the next 10-15 years
# Q15_7: Teaching will allow me to provide a contribution to society

cfa.model <- 'practexptc  =~ Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_12
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4
              practexptc ~ SECM + SEIAE + Q16_3 + Q15_7
              SECM  ~~ SEIAE + Q16_3 + Q15_7
              SEIAE ~~ Q16_3 + Q15_7
              Q16_3 ~~ Q15_7'

fit <- lavaan::cfa(cfa.model, std.lv=TRUE, data = my_data)
estim.M1 <- parameterestimates(fit, standardized=TRUE)
print(estim.M1)
estim.M1[c(1:22), c(1,2,3,7,11)]

# lhs op    rhs pvalue std.all
# 1  practexptc =~  Q10_6  0.000   0.934
# 2  practexptc =~  Q10_7  0.000   0.869
# 3  practexptc =~  Q10_8  0.000   0.859
# 4  practexptc =~  Q10_9  0.000   0.812
# 5  practexptc =~ Q10_12  0.000   0.874
# 6        SECM =~  Q12_2  0.000   0.850
# 7        SECM =~  Q12_3  0.000   0.786
# 8        SECM =~  Q12_4  0.000   0.847
# 9       SEIAE =~  Q13_3  0.000   0.736
# 10      SEIAE =~  Q13_4  0.000   0.754
# 11      SEIAE =~  Q14_3  0.000   0.842
```

```
# 12      SEIAE =~  Q14_4  0.000   0.739

# 13 practexptc  ~   SECM  0.864  -0.018
# 14 practexptc  ~  SEIAE  0.000   0.519 ***
# 15 practexptc  ~  Q16_3  0.493  -0.041
# 16 practexptc  ~  Q15_7  0.000   0.283 ***

# 17       SECM ~~  SEIAE  0.000   0.753
# 18       SECM ~~  Q16_3  0.000   0.334
# 19       SECM ~~  Q15_7  0.000   0.489
# 20      SEIAE ~~  Q16_3  0.000   0.289
# 21      SEIAE ~~  Q15_7  0.000   0.623
# 22      Q16_3 ~~  Q15_7  0.000   0.382

##############################################################################################
# Check variables for ICCs

sem.model <- 'practexptc  =~ Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_12
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4
              SECM ~ practexptc
              SEIAE ~ practexptc
              Q16_3 ~ practexptc
              Q15_7 ~ practexptc
              SECM ~~ SEIAE + Q16_3 + Q15_7
              SEIAE ~~ Q16_3 + Q15_7
              Q16_3 ~~ Q15_7'
```

```
fit <- lavaan::sem(sem.model, std.lv=TRUE, data = my_data)
estim.M1 <- parameterestimates(fit, standardized=TRUE, rsquare = T)
print(estim.M1)
estim.M1[c(1:22, 52:55), c(1,2,3,4, 7,11)]

# lhs op        rhs   est pvalue std.all
# 1  practexptc =~      Q10_6 1.465  0.000   0.934
# 2  practexptc =~      Q10_7 1.077  0.000   0.869
# 3  practexptc =~      Q10_8 1.354  0.000   0.859
# 4  practexptc =~      Q10_9 1.111  0.000   0.812
# 5  practexptc =~     Q10_12 1.004  0.000   0.874
# 6         SECM =~      Q12_2 0.697  0.000   0.850
# 7         SECM =~      Q12_3 0.643  0.000   0.786
# 8         SECM =~      Q12_4 0.626  0.000   0.847
# 9        SEIAE =~      Q13_3 0.438  0.000   0.736
# 10       SEIAE =~      Q13_4 0.499  0.000   0.754
# 11       SEIAE =~      Q14_3 0.538  0.000   0.842
# 12       SEIAE =~      Q14_4 0.520  0.000   0.739

# 13        SECM  ~ practexptc 0.574  0.000   0.498
# 14       SEIAE  ~ practexptc 0.903  0.000   0.670
# 15       Q16_3  ~ practexptc 0.195  0.002   0.211
# 16       Q15_7  ~ practexptc 0.375  0.000   0.582

# 17        SECM ~~      SEIAE 0.652  0.000   0.652
# 18        SECM ~~      Q16_3 0.244  0.000   0.270
# 19        SECM ~~      Q15_7 0.148  0.000   0.282
# 20       SEIAE ~~      Q16_3 0.183  0.010   0.203
```

```
# 21      SEIAE ~~      Q15_7 0.202  0.000   0.386
# 22      Q16_3 ~~      Q15_7 0.154  0.000   0.326

# 52      Q16_3 r2      Q16_3 0.045     NA      NA
# 53      Q15_7 r2      Q15_7 0.339     NA      NA
# 54       SECM r2       SECM 0.248     NA      NA
# 55      SEIAE r2      SEIAE 0.449     NA      NA

#############################################################################################
# with covariates gender and age
colnames(my_data)
my_data$Q2 <- as.numeric(my_data$Q2)

table(my_data$Q4)
my_data$Q4 <- car::recode(my_data$Q4, "'Р–РµРЅСЃРєРёР№' = 2; 'РњСѓР¶СЃРєРѕР№' = 1")

sem.model <- 'practexptc  =~ Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_12
              SECM =~      Q12_2 + Q12_3 + Q12_4
              SEIAE =~     Q13_3 + Q13_4 + Q14_3 + Q14_4
              SECM ~ practexptc + Q2 + Q4
              SEIAE ~ practexptc + Q2 + Q4
              Q16_3 ~ practexptc + Q2 + Q4
              Q15_7 ~ practexptc + Q2 + Q4
              SECM ~~ SEIAE + Q16_3 + Q15_7
              SEIAE ~~ Q16_3 + Q15_7
              Q16_3 ~~ Q15_7'

fit <- lavaan::sem(sem.model, std.lv=TRUE, data = my_data)
```

```
estim.M1 <- parameterestimates(fit, standardized=TRUE, rsquare = T)

print(estim.M1)

estim.M1[c(1:22, 52:55), c(1,2,3,4, 7,11)]


#############################################################################################

# Consider ICCs and de of such items

modelled.items <- c("Q10_6", "Q10_7", "Q10_8", "Q10_9", "Q10_12", "Q12_2", "Q12_3", "Q12_4", "Q13_3", "Q13_4", "Q14_3", "Q14_4", "Q16_3",
         "Q15_7")

model.items.only <- which(colnames(my_dataMLM) %in% modelled.items)

print(model.items.only)


# Check ICCs

apply(my_dataMLM[,model.items.only], 2, FUN = function(x)misty::multilevel.icc(x, my_dataMLM$Q1))

round(apply(my_dataMLM[,model.items.only], 2, FUN = function(x)misty::multilevel.icc(x, my_dataMLM$Q1)), 2)

sort(round(apply(my_dataMLM[,model.items.only], 2, FUN = function(x)misty::multilevel.icc(x, my_dataMLM$Q1)), 2), decreasing = T) # OK, but note
         10_7 is an issue


# Calculate design effects

ICCs <- round(apply(my_dataMLM[,model.items.only], 2, FUN = function(x)misty::multilevel.icc(x, my_dataMLM$Q1)), 3)

clusters.inst <- length(table(my_dataMLM$Q1))

avg.clust <- nrow(my_dataMLM) / clusters.inst

1 + (ICCs*(avg.clust-1))

1 + (ICCs*(avg.clust-1))    > 2

sum(1 + (ICCs*(avg.clust-1))    > 2)

sum(1 + (ICCs*(avg.clust-1))    > 2) / length(model.items.only)  # 78.6% so model as multilevel model as well

# note length(11:53)  43 total variables


#############################################################################################

# remove the NA cluster
```

```
table(my_dataMLM$Q1)
sum(is.na(my_dataMLM$Q1))
my_dataMLM$Q1    # 76 and 143
my_dataMLM <- my_dataMLM[-c(76, 143),]

model <- '
    level: 1
        practexptc  =~ Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_12
        SECM        =~ Q12_2 + Q12_3 + Q12_4
        SEIAE       =~ Q13_3 + Q13_4 + Q14_3 + Q14_4
        SECM        ~ practexptc
        SEIAE       ~ practexptc
        Q16_3       ~ practexptc
        Q15_7       ~ practexptc
        SECM       ~~ SEIAE + Q16_3 + Q15_7
        SEIAE      ~~ Q16_3 + Q15_7
        Q16_3      ~~ Q15_7

    level: 2
        practexptc  =~ Q10_6 + Q10_7 + Q10_8 + Q10_9 + Q10_12
        SECM        =~ Q12_2 + Q12_3 + Q12_4
        SEIAE       =~ Q13_3 + Q13_4 + Q14_3 + Q14_4
        practexptc  ~ SECM + SEIAE + Q16_3 + Q15_7
        SECM        ~ practexptc
        SEIAE       ~ practexptc
        Q16_3       ~ practexptc
        Q15_7       ~ practexptc
        SECM       ~~ SEIAE + Q16_3 + Q15_7
```

```
        SEIAE      ~~ Q16_3 + Q15_7
        Q16_3      ~~ Q15_7'

fit <- lavaan::sem(model = model, std.lv=TRUE, data = my_dataMLM, cluster = "Q1", verbose = TRUE,
                   optim.method = "em", em.iter.max = 1000000, em.fx.tol = 1e-08, em.dx.tol = 1e-08, estimator = "MLR")
summary(fit)
estim.M1 <- parameterestimates(fit, standardized=TRUE, rsquare = T)
print(estim.M1)
print(estim.M1)[c(13:22, 69:78, 113:138), c(1,2,3,5,6, 9,13)]
# failed baseline model so try with removal of 10_7 as this had little within-institutional variance

#############################################################################################
model <- '
    level: 1
        practexptc  =~ Q10_6 + Q10_8 + Q10_9 + Q10_12
        SECM        =~ Q12_2 + Q12_3 + Q12_4
        SEIAE       =~ Q13_3 + Q13_4 + Q14_3 + Q14_4
        SECM        ~ practexptc
        SEIAE       ~ practexptc
        Q16_3       ~ practexptc
        Q15_7       ~ practexptc
        SECM       ~~ SEIAE + Q16_3 + Q15_7
        SEIAE      ~~ Q16_3 + Q15_7
        Q16_3      ~~ Q15_7

    level: 2
        practexptc  =~ Q10_6 + Q10_8 + Q10_9 + Q10_12
        SECM        =~ Q12_2 + Q12_3 + Q12_4
```

```
        SEIAE       =~ Q13_3 + Q13_4 + Q14_3 + Q14_4
        practexptc  ~ SECM + SEIAE + Q16_3 + Q15_7
        SECM        ~ practexptc
        SEIAE       ~ practexptc
        Q16_3       ~ practexptc
        Q15_7       ~ practexptc
        SECM       ~~ SEIAE + Q16_3 + Q15_7
        SEIAE      ~~ Q16_3 + Q15_7
        Q16_3      ~~ Q15_7'

fit <- lavaan::sem(model = model, std.lv=TRUE, data = my_dataMLM, cluster = "Q1", verbose = TRUE,
                   optim.method = "em", em.iter.max = 1000000, em.fx.tol = 1e-08, em.dx.tol = 1e-08, estimator = "MLR")
summary(fit)
estim.M1 <- parameterestimates(fit, standardized=TRUE, rsquare = T)
print(estim.M1)
print(estim.M1)[c(12:21, 69:78, 113:138), c(1,2,3,5,6, 9,13)]
# Level 2 standardize main coefficients far too high! Try path analysis

# practexptc for path analysis (pa)
colnames(my_dataMLM) # 16, 17, 18, 19, 22
practexptc.pa <- apply(my_dataMLM[,c(16, 17, 18, 19, 22)], 1, FUN = function(x)sum(x))

# SECM for path analysi (pa)
colnames(my_dataMLM) # 30,31,32
SECM.pa <- apply(my_dataMLM[,c(30,31,32)], 1, FUN = function(x)sum(x))

# SEIAE for path analysi (pa)
colnames(my_dataMLM) # 35,36,39,40
```

```
SEIAE.pa <- apply(my_dataMLM[,c(35,36,39,40)], 1, FUN = function(x)sum(x))

my_dataMLM <- cbind.data.frame(my_dataMLM, practexptc.pa, SECM.pa, SEIAE.pa)

#############################################################################################################
model <- '
    level: 1
        SECM.pa     ~ practexptc.pa
        SEIAE.pa    ~ practexptc.pa
        Q16_3       ~ practexptc.pa
        Q15_7       ~ practexptc.pa

    level: 2
        SECM.pa     ~ practexptc.pa
        SEIAE.pa    ~ practexptc.pa
        Q16_3       ~ practexptc.pa
        Q15_7       ~ practexptc.pa'

fit <- lavaan::sem(model = model, std.lv=TRUE, data = my_dataMLM, cluster = "Q1", verbose = TRUE,
                   optim.method = "em", em.iter.max = 1000000, em.fx.tol = 1e-06, em.dx.tol = 1e-06, estimator = "MLR")

summary(fit, rsquare = T, standardized=TRUE)

estim.M1 <- parameterestimates(fit, standardized=TRUE, rsquare = T)
print(estim.M1)[c(1:4, 21:24, 41:48) , c(1:6,9, 13)]

#############################################################################################################
########## Question 17 ############
```

```
# get data
print(my_data$Q17)
text <- my_data$Q17
docs <- Corpus(VectorSource(text))

# clean
docs <- docs %>%
  tm_map(removeNumbers) %>%
  tm_map(removePunctuation) %>%
  tm_map(stripWhitespace)
docs <- tm_map(docs, content_transformer(tolower))
docs <- tm_map(docs, removeWords, stopwords("russian"))

# create matrix
dtm <- TermDocumentMatrix(docs)
matrix <- as.matrix(dtm)
words <- sort(rowSums(matrix),decreasing=TRUE)
df <- data.frame(word = names(words),freq=words)

# create word cloud
set.seed(1234) # for reproducibility
wordcloud(words = df$word, freq = df$freq, min.freq = 1,
          max.words=50, random.order=FALSE, rot.per=0.35,
          colors=brewer.pal(8, "Dark2"))


########## Question 18 ############
# get data
```

```
print(my_data$Q18)
text <- my_data$Q18
docs <- Corpus(VectorSource(text))

# clean
docs <- docs %>%
  tm_map(removeNumbers) %>%
  tm_map(removePunctuation) %>%
  tm_map(stripWhitespace)
docs <- tm_map(docs, content_transformer(tolower))
docs <- tm_map(docs, removeWords, stopwords("russian"))

# create matrix
dtm <- TermDocumentMatrix(docs)
matrix <- as.matrix(dtm)
words <- sort(rowSums(matrix),decreasing=TRUE)
df <- data.frame(word = names(words),freq=words)

# create word cloud
set.seed(1234) # for reproducibility
wordcloud(words = df$word, freq = df$freq, min.freq = 1,
          max.words=50, random.order=FALSE, rot.per=0.35,
          colors=brewer.pal(8, "Dark2"))
```

```
########## Question 19 ############
# get data
print(my_data$Q19)
text <- my_data$Q19
docs <- Corpus(VectorSource(text))

# clean
docs <- docs %>%
  tm_map(removeNumbers) %>%
  tm_map(removePunctuation) %>%
  tm_map(stripWhitespace)
docs <- tm_map(docs, content_transformer(tolower))
docs <- tm_map(docs, removeWords, stopwords("russian"))

# create matrix
dtm <- TermDocumentMatrix(docs)
matrix <- as.matrix(dtm)
words <- sort(rowSums(matrix),decreasing=TRUE)
df <- data.frame(word = names(words),freq=words)

# create word cloud
set.seed(1234) # for reproducibility
wordcloud(words = df$word, freq = df$freq, min.freq = 1,
          max.words=50, random.order=FALSE, rot.per=0.35,
          colors=brewer.pal(8, "Dark2"))
```

```
########## Question 20 ############
# get data
print(my_data$Q20)
text <- my_data$Q20
docs <- Corpus(VectorSource(text))

# clean
docs <- docs %>%
  tm_map(removeNumbers) %>%
  tm_map(removePunctuation) %>%
  tm_map(stripWhitespace)
docs <- tm_map(docs, content_transformer(tolower))
docs <- tm_map(docs, removeWords, stopwords("russian"))

# create matrix
dtm <- TermDocumentMatrix(docs)
matrix <- as.matrix(dtm)
words <- sort(rowSums(matrix),decreasing=TRUE)
df <- data.frame(word = names(words),freq=words)

# create word cloud
set.seed(1234) # for reproducibility
wordcloud(words = df$word, freq = df$freq, min.freq = 1,
          max.words=50, random.order=FALSE, rot.per=0.35,
          colors=brewer.pal(8, "Dark2"))
```

```
########## Question 21 ############
# get data
print(my_data$Q21)
text <- my_data$Q21
docs <- Corpus(VectorSource(text))

# clean
docs <- docs %>%
  tm_map(removeNumbers) %>%
  tm_map(removePunctuation) %>%
  tm_map(stripWhitespace)
docs <- tm_map(docs, content_transformer(tolower))
docs <- tm_map(docs, removeWords, stopwords("russian"))

# create matrix
dtm <- TermDocumentMatrix(docs)
matrix <- as.matrix(dtm)
words <- sort(rowSums(matrix),decreasing=TRUE)
df <- data.frame(word = names(words),freq=words)

# create word cloud
set.seed(1234) # for reproducibility
wordcloud(words = df$word, freq = df$freq, min.freq = 1,
          max.words=50, random.order=FALSE, rot.per=0.35,
          colors=brewer.pal(8, "Dark2"))
```

```
########## Question 21 ############
# get data
print(my_data$Q25)
text <- my_data$Q25
docs <- Corpus(VectorSource(text))

# clean
docs <- docs %>%
  tm_map(removeNumbers) %>%
  tm_map(removePunctuation) %>%
  tm_map(stripWhitespace)
docs <- tm_map(docs, content_transformer(tolower))
docs <- tm_map(docs, removeWords, stopwords("russian"))

# create matrix
dtm <- TermDocumentMatrix(docs)
matrix <- as.matrix(dtm)
words <- sort(rowSums(matrix),decreasing=TRUE)
df <- data.frame(word = names(words),freq=words)

# create word cloud
set.seed(1234) # for reproducibility
wordcloud(words = df$word, freq = df$freq, min.freq = 1,
          max.words=50, random.order=FALSE, rot.per=0.35,
          colors=brewer.pal(8, "Dark2"))
## END ##
```