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Research Article

The Effects of Teacher's Competencies in the Application of Online Teaching and Learning on Students' Academic Stress, Learning Motivation, and Academic Achievement in Statistics Subject

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Abstract.

Online learning may lead to several problems, causing academic stress that lowers student motivation. Thus, great instructor skills are needed to overcome challenges and automatically build a successful and efficient online learning process. The study examines how teacher competencies in four dimensions – Teacher's technological pedagogical content knowledge (TPACK), teacher's belief (TB), teacher's self-efficacy (TSE), and teacher's enthusiasm (TE) – affect students' academic stress in the cognitive (CD), behavioral (BD), affective (AD), and physiological domains (PD), as well as learning motivation (SLM) and academic achievement (AA). The study uses multivariate regression analysis, the ordinal logistic regression, and the Structural Equation Model (SEM). Multivariate regression analysis is utilized to examine the effects partially and simultaneously of dependent and independent variables. The ordinal logistic regression is used for the same purpose but on the data with an ordinal scale; the final grade shows the AA variable. Whereas, SEM is used to investigate the relationship between complex variables. The sample retrieval technique is conducted using non-probabilistic sampling by the method of accidental sampling with 219 college students. Results show that TPACK, which is one dimension of a teacher's competencies, negatively affects students' academic stress, which is BD, AD, and PD. However, TPACK does not significantly affect CD. Adverse effects suggest increasing teacher's competencies in integrating technology and pedagogies in the development of educational content, especially in online learning, and reducing or minimizing students' academic stress. Besides that, TPACK also has a positive effect on SLM, and SLM in turn positively affects AA. On the other hand, the variable component of teachers' competencies, such as TSE and TE, has a positive effect on CD. Likewise, CD positively affects AA, so indirectly, TSE and TE positively affect AA. Of every effect and relationship between independent and dependent variables studied, the variable to contribute most effectively to online learning is the TPACK variable.

Keywords: online teaching, teacher's competencies, student's academic stress, student's learning motivation, academic achievement, TPACK, SEM, multivariate regression, logistic ordinal regression

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1. INTRODUCTION

Covid-19 that was allegedly infected began on December 31, 2019, in Wuhan, Hubei, China, and is now rapidly spreading to nearly every corner of the globe, so that on March 11, 2020, the World Health Organization (WHO) will declare this a global pandemic. Hundreds of thousands of people worldwide have been exposed to the virus, and more than tens of thousands have died. The complexity of the treatment of this plague has led world leaders to adopt super-strict policies to break the chain of Covid-19. Social distancing is a heavy choice for any country in implementing a policy to prevent the Covid-19 spread because it harms all aspects of life.

Education is also affected by this policy. The sudden decision of the government to move the learning process from school to home is overwhelming for many. Government, school stakeholders, students, and public inaction in carrying out online learning make online learning not work effectively in the middle of the pandemic [1]. However, governments and policymakers continue to maximize efforts in finding the right strategies to create effective and efficient learning processes. The efforts made by governments and policymakers are to facilitate infrastructure, free internet provision, the provision of teacher competence training, give a webinar, and even update the curriculum according to the condition.

On the other hand, the online learning method is not a new thing anymore because, in some developed countries, it is customary to do this. In addition, rapid technological developments are pushing all parties to adapt quickly. Many schools and universities stimulate their learning online and engage in Online Teaching and Learning. Nonetheless, it cannot be denied that the implementation of Online Teaching and Learning requires instructors to possess considerable expertise. The impact of Online Teaching and Learning applications may or may not be maximal; that is, the purpose of learning may or may not be conveyed optimally, depending on how instructors use Online Teaching and Learning as a learning model and medium.

Online Teaching and Learning in Afghanistan are used in some models such as self- learning with support provided by Radio, distance learning with delivery broadcast through television, and teachers teaching small groups of students in remote areas in the open air. Meanwhile, Buthan used various online platforms like WhatsApp, Google Classrooms, and Zoom to deliver lessons and used Radio and television to broadcast lessons. Likewise, India uses online classes (17% of total households have access to connectivity and a smartphone), television (Approximately two-thirds of Indian households

and one-third of the poorest Indian households own a television), and Radio (All India Radio surveyed to have a massive reach of 92 percent across the country). Besides that, WhatsApp and interactive voice response systems were also used. Nearly ninety percent of teachers surveyed reported using the platform to interact with their pupils by sending recorded classes, worksheets, and reference links. Teachers utilize all the learning strategies and models to make Online Teaching and Learning run effectively and efficiently.

Teachers have an important role in ensuring that the teaching and learning processes run smoothly, and that the aim of students' education is successfully communicated. The ability of the teacher is critical in determining a successful and efficient learning process. Curriculum knowledge, classroom management, planning, assessment and evaluation, professional relations, self-assessment, and qualifications are the six categories of teacher competences identified by the Council for Accreditation of Teacher Education (CATE) in England [2]. In addition, According to Kismet Selvi, there are nine different dimensions in the general framework for teacher competencies: lifelong learning, research, field, emotional, social-cultural, curriculum, communication, environmental, and information and communication technology (ICT) competencies. Besides that, teacher competence is the ability to deliver lesson materials [3], select a learning method or approach that matches the topic being taught [4], utilize the learning media, creates innovative and creative learning, presents fun learning and can stimulate students to think critically and be able to solve problems, the teacher's ability to handle situations and conditions that occur outside the scenario, to handle their anxiety levels in dealing with students [3], and to process emotions becomes motivations. Teachers with teaching anxiety will spend less time learning and prefer to adopt more traditional teaching methods [5]. To ensure student quality, a teacher's abilities must be properly evaluated. In online teaching and learning, a lack of instructor competence in the use of technology prevents teachers from adequately delivering their lessons.

The teacher's ability or competence is essential to the purpose of learning, but it is undeniable that the study with the Online Teaching and Learning model often finds constraints for students. Because students are unable to communicate with their teachers and peers when learning online, their motivation to learn suffers. Face-to-face learning encounters enable students feel more comfortable asking questions and witnessing the teacher explain the topic firsthand. Besides that, students tend to lose focus in online learning because of difficulties such as the instability of internet networks interfering with the learning process, external disturbances due to crowded conditions

in the house, and so on [6]. In addition, the frequently complex nature of comprehending the teacher's learning gives rise to a number of benefits. It has resulted in poor students applying the knowledge they have learned to more complex problems or even in everyday problem-solving. Teacher competence lacking in the utilization of technology added to the discovery of constraints during online learning can make students feel very difficult.

The difficulties that students face can trigger the level of stress they feel. Stress is a feeling of physical tension or anxiety caused by the belief that a person cannot meet the demands that have been imposed on them [7]. In other words, stress arises from environmental demands that are difficult for us to meet. Students, who struggle with understanding the material during online learning, when given a stack of problem solutions or applications, will tend to accept it as a burden that can trigger their stress level. Not just in online learning but multiple transactions on the internet also increase the level of perceived stress of individuals [8].

Likewise, the difficulties students face can trigger their stress levels and affect their learning motivation. Motivation is an important topic in education because it serves as the foundation for mobilizing the student, learning a lesson, and influencing the student to accomplish what he or she should do [9]. Motivation is also manifested as academic participation, which influences student performance more than any other variable [10]. Students who are dissatisfied with the online teaching and learning process will be less motivated to learn than those who are satisfied with the process. The more pupils enjoy the process of learning, the more motivated they will be to continue studying.

Many examples show that learning difficulties that affect students' learning motivation also automatically affect their academic achievements. Students' academic achievement is influenced by both internal and external variables. Internal factors are those that arise within the student. It is divided into three parts such as physical factor (health and disability), physical factor (intelligence, attention, genuine interest, talent, motive, learning skills, and maturity and preparedness), and factor exhaustion (physical and spiritual). In contrast, external factors are those that exist outside of the students. Some external factors include the Family factor (the way parents educate, parental treatment of children, the relationship between parents and children, the house's atmosphere, parental understanding, cultural background, and the family's economic situation), the School factor (infrastructure tool, school discipline, teaching methods, learning tools, teacher and student contact curriculum, and chores), and the Social factor (such as

peer pressure, student activities in the community, friends, mass media, and student activities in the community) [11].

The study aimed to analyze and determine whether teachers' competence (TC) in applying Online Teaching and Learning affects the students' academic stress (SAS), students learning motivation (SLM), and student's academic achievement (AA), and how greatly affected, especially in statistic subject. The relationship between teachers' competence (TC), students' academic stress (SAS), students' learning motivation (SLM), and students' academic achievement (AA) also will be discussed and investigated with structural equation modeling.

This problem has a lot to do with the education field. As teachers, we often discover problems that arise or even impact both teachers and students. There are many problems affecting students due to the student factors. However, it turns out that there are also problems that impact the students because of the teacher's underlying factors. Thus, from this study, we as teachers can recognize any mistakes that we make that could harm students and how significant they can be so that we can improve and achieve the purpose of learning effectively and efficiently.

2. RESEARCH QUESTIONS AND HYPOTHESES

2.1. Research questions

1. Does the TC in applying Online Teaching and Learning in four dimensions which are TPACK, TB, TSE, and TE affect :
   a. CD ?
   b. BD ?
   c. AD ?
   d. PD ?
   e. SLM ?
   f. AA ?

2. Is there a correlation between TC in applying Online Teaching and Learning in four dimensions (TPACK, TB, TSE, and TE), student's academic stress level in four domain (CD, BD, AD, and PD), SLM, and AA?

2.2. Hypotheses

H1: There is no influence on a teacher's competences in applying Online Teaching and Learning in four dimensions —TPACK, TB, TSE, and TE— to student's:

1. Academic stress in cognitive domain (CD),
2. Academic stress in behavioral domain (BD),
3. Academic stress in affective domain (AD),
4. Academic stress in phisiological domain (PD),
5. Learning motivation (SLM),
6. Academic achievement (AA).

H2: There is an influence of teachers' competencies in applying Online Teaching and Learning in four dimensions —TPACK, TB, TSE, and TE— to student's:

1. Academic stress in cognitive domain (CD),
2. Academic stress in behavioral domain (BD),
3. Academic stress in affective domain (AD),
4. Academic stress in phisiological domain (PD),
5. Learning motivation (SLM),
6. Academic achievement (AA).

H3: There is no correlation between a teacher's competence in applying Online Teaching and Learning in four dimensions —TPACK, TB, TSE, and TE—, student's academic stress level in four domain —CD, BD, AD, and PD—, learning motivation (SLM), and academic achievement (AA).

H4: There is a correlation between a teacher's competence in applying Online Teaching and Learning in four dimensions —TPACK, TB, TSE, and TE—, student's academic stress level in four domain —CD, BD, AD, and PD—, learning motivation (SLM), and academic achievement (AA).

3. LITERATURE REVIEW

3.1. Teacher's Competence

The process of teaching is greatly influenced by the teacher's competence. Besides that, the teacher's competence influences the future development and academic achievement of their students. Teacher competence is divided into two categories: cognitive

competence and motivational competence. The cognitive domain emphasizes the need of instructors having a specific sort of knowledge, which includes teachers' content knowledge (TCK), general pedagogical knowledge (GPK), and pedagogical content knowledge (PCK) [12].

The use of digital technology in the classroom has made it more important for teachers to know how to use digital technology in the classroom. So, teachers' knowledge and skills need to be improved, and they need to be taught how to use technology in the classroom successfully. In other words, instructors' professional competence should include technological pedagogical knowledge (TPK) (König et al., 2020). Teachers' motivational competency—self-efficacy and teaching excitement—directly affects their instructional activities and professional engagement [13].

The use of online teaching assessed teachers' technical pedagogical knowledge (TPK) and determined if present instructors' self-efficacy and excitement could adapt successfully to online teaching during the COVID-19 outbreak. As a result, teacher competency in online teaching is critical in the online teaching and learning process. During the COVID-19 epidemic, teacher competence is a vital aspect in assisting instructors in mastering the core problems.

Teachers must have two types of competence in order to satisfy their high professional requirements and expand the concept of teacher competence: cognitive and motivating [14]. Most research has concentrated on teachers' knowledge (such as PCK and TPK) and beliefs [15]; self-efficacy is a part of teachers' competency structure in the motivational aspect [16] and teacher enthusiasm [17].

According to Day and Gu, developing and maintaining teacher resilience is one strategy for raising student accomplishment in the classroom [18]. We should consider the impact of technology on education as well as teachers' skill in technology-assisted instruction. It has been suggested that large levels of pleasure can only be obtained when online learning is carried out successfully. Student happiness is a key predictor of online learning results [19]. Previous research suggests that teacher competence may influence student learning results indirectly through instructional quality [20].

3.2. Students' Academic Stress

Stress has been characterized by researchers as the sense of a mismatch between individual capacity to meet these needs and environmental demands (stressors) [21].

Furthermore, stress is also defined as people's unfavorable reaction to excessive pressure or other types of demands imposed on them [22]. When a person is confronted with a situation that they perceive to be overwhelming and beyond their ability to handle, they become stressed. Many studies on academic stress in students have been conducted, and researchers have determined that the causes of students' stress are competition with other students, failures, too many assignments, and a lack of pocket money, as well as poor relationships with family or home problems, and problem with other students or lecturers [23]. Overcrowded lecture halls [24], [25], university-level challenges include the semester system and a lack of resources to complete academic work. When these events occur, an individual feels confused, disoriented, and thus less able to manage, which leads to stress-related health problems [26].

Due to the pressure to perform well in the examination or test, as well as the limited time available, the academic environment is extremely stressful [26], [27], [28]. Because there is a clash with the social aspect of human life, social connections within and outside of the University are likely to be disrupted [23]. It has an impact on a person's life in terms of devotion to reaching goals. When university administrators understand the sources of student stress, they can better monitor and control the students' stress factors. Poor interpersonal relationships, poor working conditions, poor work performance, sitting for long periods of time, insufficient time to complete specific assignments, insufficient or lack of resources, overcrowded workstations, excessive paperwork, and many other factors contribute to stress in the workplace [24], [29], [30]. University administrations can help alleviate students' stress by putting in place measures that allow for early detection of stress symptoms and their root causes.

Researchers identified stress symptoms such as depression, the use of over-the-counter medications, a lack of energy, an increase in appetite, high blood pressure, restlessness, difficulty concentrating, tension, and anxiety [21], [24], [25], [30]. One of these things is likely to cause stress in a person. However, this may also be contingent upon the individual's resiliency and evaluation of the situation. A student's vulnerability to stress is a function of their unique history with adversity and their capacity for self-improvement. Stressors can cause either physiological or emotional responses, depending on how the individual perceives them [31]. High levels of stress in the workplace have been linked to poor health in the past [32]. It suggests that the individual's performance is likely to suffer as his or her health deteriorates.

University students are more likely to stress over deadlines and test pressure [33]. Student stress has been neglected because most scholars were preoccupied on work-related stress. Universities worldwide have not conducted extensive student health studies because students are only there for a short time and their stress has no direct impact on the institution's functioning. Students' stress is also unrelated to their schooling. The university's failure to protect students' health may compromise their education [34]. Stress is also linked to how people assess situations and cope [35].

Stress kills students. Unfortunately, stress patients never explain their conduct. The University's counseling center collects statistics on students who seek aid, but this hasn't been enough to identify causes and coping strategies. Some kids have been aggressive and have missed classes. As future leaders, youth are the nation's hope. Thus, students must comprehend stress's causes, symptoms, and effects. It will assist university officials in developing the best solutions to help students cope with these challenges while continuing their academic pursuits. Suicide, violence, and drug misuse, among other stress-related effects, have occurred often in the institution and should be addressed. Anxious and unhappy students may participate in conflict [25].

3.3. Student's Learning Motivation

The term "motivation" refers to a set of ideas that scientists have developed to account for why people act in certain ways, particularly when they are trying to achieve something [36]. It considers the learner's cognitive and emotional reactions to the statement, as well as the learner's dynamic interaction with the learning environment and its factual and social features as facilitators and impediments [37]. Students' levels of intrinsic motivation significantly impact what, how, and when they learn. Students are stated to be motivated when they are given challenging learning activities that allow them to take an active role in their own education and the discovery of effective strategies for boosting learning [38]. According to research by Ryan and Deci (2000), intrinsic motivation occurs when an individual engages in an activity without expecting to receive any reward from it. It's connected to personal factors like how much an activity means to you, how much you love it, how much of a challenge it presents, and so on. Extrinsic motivation is the state of mind that arises anytime an action is taken with the explicit goal of gaining some external benefit. It depends on things outside of oneself, such rewards or other people's praise for one's efforts [39].

3.3.1. Intrinsic Motivation

The three types of learning behaviors linked to intrinsic motivation hypothesis of self-determination theory: the desire to learn and acquire new knowledge (e.g., the enjoyment of learning new things), the desire to experience encouragement and physical pleasure (e.g., the enjoyment of learning interesting learning materials), and the desire to engage in challenging learning activity (e.g., completing a difficult assignment). Awareness, aspiration, interest, competency, ambition, and physiology and psychology all play a role in determining levels of intrinsic motivation.

3.3.2. Extrinsic Motivation

In contrast, extrinsic motivation is linked to the desire to receive praise or avoid criticism (external regulation), such as performing well on a challenging assignment, to avoid a negative experience or the perception of guilt (interjected regulation), such as mastery of a new topic is an example of exhibiting competence in a new setting, and gaining advantage and necessity from having completed a learning activity (recognized regulation). Study surroundings, family circumstances, social variables, and helpful resources all play a role in extrinsic motivation.

3.3.3. Amotivation

Amotivation is defined as the lack of internal and extrinsic motivation. Amotivation happens when students are uninterested or lack motivation to learn. They have low self- efficacy and believe they are incompetent since learning will not result in the desired end and executing the activities has no value [39]. Figure 1 depicts Deci and Ryan's (1985) taxonomy of human motivation categories.

3.4. Academic Achievement

Academic achievement is the ability students acquire through learning activities. Academic achievement is the process of changes that occur in students, both changes in knowledge and changes in behavior, demonstrated by test scores. There are some expert views on academic achievement. Academic achievement is a result of the process using a measurement of a well-arranged test, both a written test and an oral

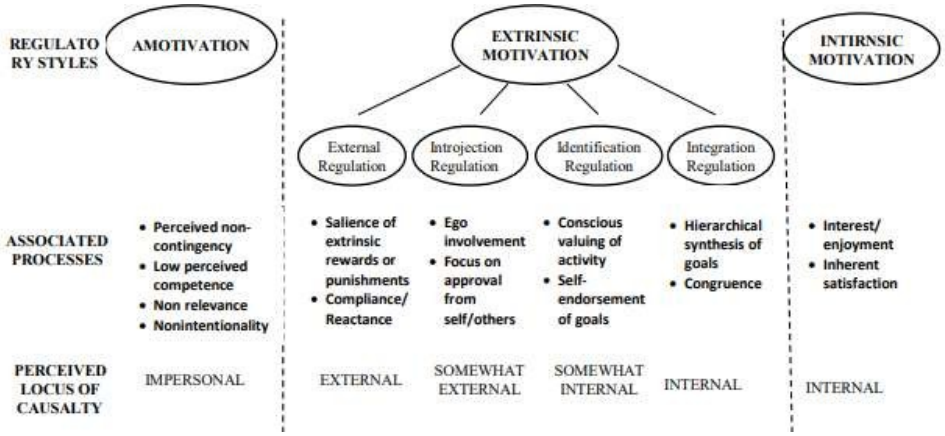

Figure 1: Motivation in Humans: A Taxonomy (Deci & Ryan, 1985).

test [40]. In addition, academic achievement is the process of changing behavior in the person, such as from ignorance to knowledge, and from not understanding to understanding [41]. Academic achievement is a better level of mental development than those before learning. Based on these definitions of academic achievement, it can be concluded that academic achievement is a change in behavior after learning a teaching process that involves the cognitive, affective, and psychomotor domains. Academic achievement, according to Benyamin Bloom, can be classified into three domains: cognitive, emotional, and psychomotor.

3.4.1. Cognitive Domain

The cognitive domain encompasses mental or brain activity. There are six stages of thinking in the cognitive domain: knowledge, understanding, application, analysis, synthesis, and evaluation. Changes that occur in the cognitive domain depend on the learning depth level experienced by students. With the understanding that changes occur in the cognitive domain is expected that students will be able to solve problems faced by the field of study.

3.4.2. Affective Domain

The affective Domain is a domain that involves value and attitude. The type of the affective domain category, which includes absorbing, responding, valuing, organizing, and characterizing, as determined by Value or Value Complex [42]. In this domain, students are more sensitive to the values and ethics that apply to their science.

3.4.3. Psychomotor Domain

Psychomotor Domain is a domain that is associated with the skill or ability to act after the student receives a certain learning experience.

According to Slameto, the factors affecting the academic achievement of study are among other things both internal and external factors [43]. An internal factor influences the academic achievement that comes from within the students. These internal factors include intelligence and talents, physical and spiritual health, interests and motivations, and how to learn [44]. In contrast, an external factor is a factor affecting the academic achievement that comes from outside the student. The external factor includes family, school, society, and the neighborhood [44].

3.5. Online Learning

Learning that takes place over the internet and worldwide web is known as online learning [45]. Learning that takes place online and that includes the use of the Internet to gain access to course materials, interact with the content, the teacher, and other students, gain support during the learning process, study, make sense of what one has learned, and grow as a person [46]. However, Hartnett combined Bates' and Ally's definitions of online learning in her book [39]. She explained that it is a form of distance learning facilitated by technological means in which the learner and the primary institution are physically separated.

3.5.1. Principles of Online Learning

Several research [47], [48], [49] have concluded that there are two main components of online learning: content and instructions. To begin, students' final grades and other outcomes directly reflect the quality of the online course's material. Interactivity in the form of audio, video, animation, and simulation is essential if it is to be used by distant learners over the internet. The content can be changed and personalized for each student so they can show they have grasped the concepts and are ready for the next lesson.

Second, students can provide immediate feedback on their work while it is being taught. The instructions, like the material, can be adapted and customised to suit the pedagogical needs, interaction norms, and technology of the institution offering the

course. Teachers present lessons through simultaneous communication channels, like Zoom or Google Meet video conferencing, and sequential communication channels, such email or chat texting apps. These methods of contact need to be universally accessible.

3.5.2. Online Learning during the Covid-19 Pandemic

As Covid-19 has spread, its effects have done away with the need for traditional methods of education. Around the world, one billion kids attend non-formal educational settings [50]. Schools now use digital platforms to provide remote learning in place of traditional classroom education. The UN Sustainable Development Group (UNSDG, 2020) reports that online education is now a standard part of the curriculum at most universities. Several educational institutions still cannot deploy fully online education systems due to insufficient IT infrastructure in support of both faculty and students. This is especially true of classrooms in many underdeveloped countries like Indonesia, where face- to-face instruction is still widely used. Since this educational system is undergoing such a rapid and comprehensive upheaval, there will be unexpected adjustments to the curricula. Zoom Cloud Meeting, Google Meet, Cisco WebEx, and Mikogo are just some of the digital platforms that make educational apps like these available to students. Textbooks, modules, and lecture recordings in audio or video format are all available online for students to use as supplemental resources. Computers are used for everything from homework and exercises to quizzes and finals [51].

To prevent the spread of Covid-19, the Indonesian government has made online education compulsory. However, many schools are unable to move their curricula online because to a lack of supporting information technology infrastructure [52]. Instructors have trouble making the switch from traditional classroom pedagogy to online learning in part because they lack knowledge of online teaching methods. They did not receive adequate instruction in computer use or internet expertise during their time in service. Many students have problems, such as a lack of computer skills, that hinder them from participating in online learning, even if certain schools and teachers can facilitate it. This was especially true for people who had limited access to computers, laptops, or smartphones, or who had slow connections to the internet [53].

4. METHODOLOGY

4.1. Participants and Procedure

The target population of this study consists of college students who took the statistics subject and followed the course online. The number of participants gathered was 219 students at several colleges in Manado-Indonesia that fit the population qualification. Online questionnaires were distributed via Google Forms. Students enrolled in the statistics course were the focus of the inquiry, thus they were emailed a link to the online questionnaire.

4.2. Instrument

Our questionnaires used the teacher competence scale, students' academic stress, and learning motivation scale to measure the variables. Each scale was a 5-point Likert type. The first section of the questionnaire aimed to obtain basic demographic data from respondents. Besides that, there are two questions at the beginning of the questionnaire's form aimed at confirming whether the students were among the qualification of the sample that the researcher needed or not. For instance, "Whether you have already taken a statistical course?", "Did you follow the lectures online?". All the instruments that will be distributed to students will be translated and presented in "Bahasa" because most students in Indonesia have difficulty understanding English words/sentences. The instruments that will be distributed to measure the teacher's competencies have been adopted and changed, from which the question was initially meant for teachers to students. It is because the teacher's competencies assessment would be more objective if the students directly judged the teacher's competencies than the teacher himself. Hence, the researcher changed the statements in the questionnaire for the teacher's competencies variable according to the needs and objectives to be achieved. The data for measuring the students' academic achievement was used for the report of GPA in statistic subject from students, where they sent the proof by pictures. According to the Indonesia assessment, the score of GPA converted from the letter (A-E) to a score (4-0).

4.2.1. Teacher Competence in the Online Teaching Scale

A questionnaire with the following four dimensions was applied, which are teachers' technological pedagogical and content knowledge (TPACK), belief (TB), self-efficacy (TSE), and enthusiasm (TE), to measure teacher competence in online teaching. The items for this measurement were mainly adapted from Santos and Castro's Technological Pedagogical Content Knowledge (TPACK) Scale, Warwas, Hertel, and Labuhn's Constructivist Beliefs Scale, Bandura's Instrument Teacher Self-Efficacy Scale, and Kunter's Teaching Enthusiasm Scale. The scale of teacher competence consisted of 5 items of TPACK, three items of TB, four items of TSE, and four items of TE. All items were rated on 5-point options (from "(1) never" to "(5) always"), where the higher the score, the higher their level of teacher's competencies in online teaching. Students' Academic Stress in the Online Teaching Scale

A questionnaire with the following four domains was applied, which are cognitive (CD), behavioral (BD), affective (AD), and physiological domain (PD), to measure the student's academic stress in online learning. The questionnaire was adapted from Crispino's Stress Scale in the Context of Online Learning. The scale of the student's academic stress consisted of 4 items in each domain rated on 5-point options (from "(1) never" to "(5) always"), so the total questionnaire is 16 items, where the higher the score, the higher their level of academic stress in online teaching and learning.

4.2.2. Student's Learning Motivation

A questionnaire adapted from Aydin's Academic Motivation Scale was modified to measure the student's learning motivation. The scale of the student's learning motivation consisted of 6 items rated on 5-point options (from "(1) strongly disagree" to "(5) strongly agree"), where the higher the score, the higher their level of learning motivation in the statistic subject.

4.2.3. Student's Academic Achievement

he data for measuring the students' academic achievement was used for the report of GPA in statistics subject from students, where they sent the proof by pictures of the final report on the statistic course. According to the Indonesia assessment, the score of GPA converted from the letter (A-E) to a score (4-0).

4.3. Data Analysis

In this study, predictor or independent variables used are respectively teacher's competence measured by their technological pedagogical and content knowledge (TPACK), teacher's competence measured by their belief (TB), by their self-efficacy (TSE), and by their enthusiasm (TE). In addition, the response or dependent variables used are as follows:

1. Student's academic stress (SAS)

Y_1: Student's academic stress in Cognitive domain (CD).

Y_2: Student's academic stress in Behavioral domain (BD).

Y_3: Student's academic stress in Affective domain (AD).

Y_4: Student's academic stress in Phisiological domain (PD).

2. Y_5: Student's Learning Motivation (SLM).

Y_6: Student's Academic Achievement (AA) (shown from Final Grade).

Data analysis was performed using IBM SPSS Statistics and SPSS-AMOS Software. Multivariate regression analysis and Ordinal Logistic Regression were used to answer research question 1. Besides that, to answer research question number 2, using Structural Equation Modelling (SEM).

5. RESULT AND DISCUSSION

The study uses questionnaires to get analyzed data before being used to ascertain its worthiness and quality. The questionnaire's analysis is a validity and reliability test, followed by classical assumption tests, including Normality, Multicollinearity, and heteroscedasticity.

5.1. Validity Test

Sugiyono states that validity is the degree of accuracy between data that occurs in power objects that researchers can report [54]. Validity tests are used to know the questionnaire's validity in data collection. Validity tests were conducted with bivariate person correlation formula using SPSS software version 20. The questionnaire's item in the validity test is said to be valid if Item r-value > r-table at a 5% significance value.

Otherwise, the item is said to be invalid if r-value < r-table at a 5% significance value. The following table contains the validity test analysis of the variables used in this study.

Table 1: Validity Test Analysis for TPACK, TB, TSE, and TE.

No. of question	TPACK (X1)	TB (X2)	TSE (X3)	TE (X4)	r-table	Note.
	r-value	r-value	r-value	r-value		
1	0.891	0.726	0.660	0.624	0.138	valid
2	0.895	0.655	0.753	0.766	0.138	valid
3	0.927	0.736	0.717	0.749	0.138	valid
4	0.875		0.608	0.622	0.138	valid
5	0.830				0.138	valid

Table 2: Validity Test Analysis for Student's Academic Stress in CD, BD, AD, and PD.

No. of question	CD (Y1)	BD (Y2)	AD (Y3)	PD (Y4)	r-table	Note.
	r-value	r-value	r-value	r-value		
1	0.707	0.815	0.922	0.624	0.138	valid
2	0.804	0.870	0.928	0.837	0.138	valid
3	0.840	0.871	0.826	0.831	0.138	valid

Table 3: Validity Test Analysis for SLM (Y5).

No. of question	r-value	r-table	Note.
1	0.758	0.138	valid
2	0.809	0.138	valid
3	0.841	0.138	valid
4	0.802	0.138	valid
5	0.855	0.138	valid
6	0.745	0.138	valid

Based on the validity test, all independent and dependent variables instruments show that r- value > r-table (0.138). Hence, every instrument used is valid.

5.2. Realibility Test

According to Mardapi, reliability is a coefficient showing a test's severity or consistency [55]. Each measuring instrument should have the ability to give consistent measurements. Reliability tests were performed using Alpha formulas. Significant testing was

carried out at Y = 0.05. The instrument can be said to be reliable if the alpha > r-table (0.138).

TABLE 4: Realibility Test Analysis.

Variable	Cronbach's Alpha	Note.
Teachers' technological pedagogical, and content knowledge (TPACK) (X1)	0.930	Reliabel
Teacher's Belief (X2)	0.480	Reliabel
Teacher's Self-Efficacy (X3)	0.612	Reliabel
Teacher's Enthusiasm (X4)	0.613	Reliabel
Cognitive Domain (Y1)	0.685	Reliabel
Behavioral Domain (Y2)	0.804	Reliabel
Affective Domain (Y3)	0.871	Reliabel
Phisiological Domain (Y4)	0.649	Reliabel
Student's learning motivation (Y5)	0.881	Reliabel

According to the reliability test, all of the independent and dependent variables got Cronbach's Alpha > 0.138. Hence, it can be concluded that all instruments used in this study are reliable.

5.3. Uji Asumsi Klasik

5.3.1. Uji Normalitas

According to Imam Ghozali, regression models are said to be normal distribution if the suggested data plotting that describes the data follows a diagonal line [56]. Here is a table that contains data plotting images of independent and dependent variables.

The above shows that all models are distributed normally. However, we should use the Kolmogorov-Smirnov normality test to be sure that all our models are distributed well normally. Regression models are said to be a normal distribution of Asymp. Sig. (2-tailed) value using Kolmogorov-Smirnov normality test > Y (0.05). Normality tests using Kolmogorov-Smirnov were obtained Asymp. Sig. (2-tailed), as follows:

X_1, X_2, X_3, X_4 variables simultaneously > 0.05, so that can be conclude that Y_1, Y_2, Y_3, Y_4 to X_1, X_2, X_3, X_4 normally distributed.

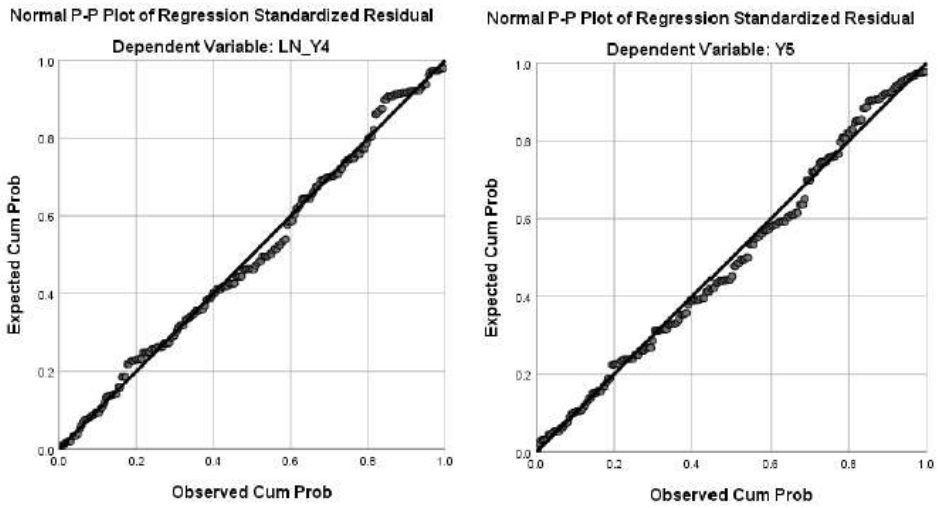

Figure 2: Data Plotting.

TABLE 5: Normality Test Result Using One-Sample Kolmogorov-Smirnov Test.

Variables toward : X_1, X_2, X_3, X_4	Asymp. Sig. (2-tailed)	Alpha	*Note.*
Y_1	0.02	0.05	Normal
Y_2	0.94	0.05	Normal
Y_3	0.200	0.05	Normal
Y_4	0.51	0.05	Normal
Y_5	0.200	0.05	Normal

5.4. Uji Multikolinearitas

Imam Ghozali states there is no multicollinearity, if the Tolerance > 0.100 and VIF < 10.00. The following is a multicollinearity test table using version 20 SPSS software [56].

From the result in the table of multicollinearity test, all variables show VIF < 10 dan tolerance > 0.100. It could be concluded that the free multicollinearity model.

5.5. Heteroscedasticity Test

According to Imam Ghozali, there is no heteroscedasticity if there is no obvious pattern (surging, widening, then narrowing) on the scatterplot figure and the dots spread up and down 0 on the y-axis [56]. Here are the scatterplot figures of independent and dependent variables.

Table 6: Multicolinearity test result X_1, X_2, X_3, and X_4 with Y_4.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	12.147	1.505		8.070	.000		
	TPACK	-.073	.040	-.143	-1.849	.066	.736	1.359
	Teacher's Belief	-.121	.070	-.128	-1.730	.085	.806	1.240
	Teacher's Self Efficacy	.141	.057	.190	2.474	.014	.751	1.332
	Teacher's Enthusiasm	.202	.094	.151	2.159	.032	.902	1.108
a. Dependent Variable: Cognitive Domain								

Table 7: Multicolinearity Test Result X_1, X_2, X_3, and X_4 with Y_2.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	14.894	1.686		8.833	.000		
	TPACK	-.142	.045	-.249	-3.196	.002	.736	1.359
	Teacher's Belief	.026	.078	.025	.331	.741	.806	1.240
	Teacher's Self Efficacy	.044	.064	.052	.682	.496	.751	1.332
	Teacher's Enthusiasm	.083	.105	.056	.792	.429	.902	1.108
a. Dependent Variable: Behavioral Domain								

Table 8: Multicolinearity test result X_1, X_2, X_3, and X_4 with Y_3.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	15.443	2.025		7.627	.000		
	TPACK	-.118	.053	-.172	-2.199	.029	.736	1.359
	Teacher's Belief	-.141	.094	-.112	-1.507	.133	.806	1.240
	Teacher's Self Efficacy	.078	.077	.079	1.019	.309	.751	1.332
	Teacher's Enthusiasm	.071	.126	.040	.564	.573	.902	1.108
a. Dependent Variable: Affective Domain								

TABLE 9: Multicolinearity Test Result X_1, X_2, X_3, and X_4 with Y_4.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	16.631	2.145		7.754	.000		
	TPACK	-.141	.057	-.195	-2.496	.013	.736	1.359
	Teacher's Belief	-.076	.099	-.057	-.763	.446	.806	1.240
	Teacher's Self Efficacy	.016	.081	.015	.191	.849	.751	1.332
	Teacher's Enthusiasm	.069	.133	.037	.520	.604	.902	1.108
a. Dependent Variable: Physiological Domain								

TABLE 10: Multicolinearity Test Result X_1, X_2, X_3, and X_4 with Y_4.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	9.834	3.651		2.693	.008		
	TPACK	.237	.096	.182	2.460	.015	.736	1.359
	Teacher's Belief	.040	.169	.017	.235	.815	.806	1.240
	Teacher's Self Efficacy	.458	.139	.243	3.302	.001	.751	1.332
	Teacher's Enthusiasm	-.084	.227	-.025	-.369	.713	.902	1.108
a. Dependent Variable: Student's Learning Motivation								

The figures show that all models are not in the heteroscedasticity problems. However, we should be able to make sure that all of our models are free of the problem of heteroscedasticity. The regression model did not have heteroscedasticity problems if the significance value > alpha (0.05). Heteroscedasticity test result using the Glejser test obtained the significance value of independent variables to dependent variables greater than 0.05. Hence, it can be concluded that there are no heteroscedasticity problems.

5.6. Multivariate Linear Regression Analysis

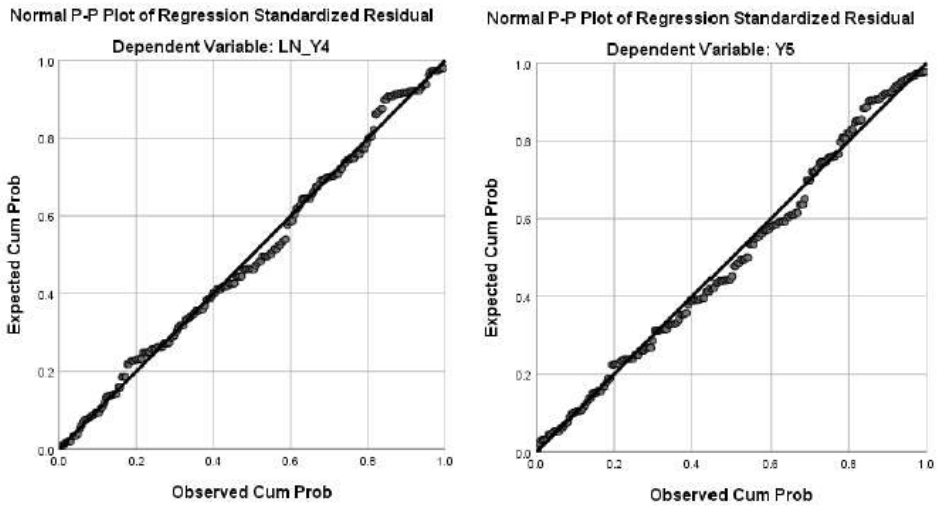

Figure 3: Scatterplots to See the Heterosticidity.

5.6.1. T-Test partially

According to Imam Ghozali, if significant value < 0.05 means independent variables (X1, X2, X3, X4) partially affect the dependent variables (Y1, Y2, Y3,Y4,Y5) [56]. Here is the output using SPSS software.

Independent Variables: TPACK (X1), TB (X2), TSE (X3), TE (X4) with dependent variable: Student's academic stress in Cognitive Domain (Y1).

TABLE 11: Model Summary.

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.239[a]	.057	.040	1.148	1.868

Predictors: (Constant), Teacher's Enthusiasm, Teacher's Self Efficacy, Teacher's Belief, TPACK
Dependent Variable: Cognitive Domain

Based on the table, R2 = 0.057 means using those variables was able to explain the CD (Y1) variable by 5.7%, and the other 94.3% explained by the other variables. Then, we will interpret the relationship between independent variables and Y1. The table below shows that the TSE (X3) and TE (X4) variables were significant. In other words, the TSE (X3) and TE (X4) variables partially affect academic stress in the cognitive domain (CD) (Y1).

According to the result in the table obtained regression formula for student's academic stress in Cognitive Domain (SAS_{CD}) as follows:

Table 12: Coefficients Table.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	12.147	1.505		8.070	.000		
	TPACK	-.073	.040	-.143	-1.849	.066	.736	1.359
	Teacher's Belief	-.121	.070	-.128	-1.730	.085	.806	1.240
	Teacher's Self Efficacy	.141	.057	.190	2.474	.014	.751	1.332
	Teacher's Enthusiasm	.202	.094	.151	2.159	.032	.902	1.108
a. Dependent Variable: Cognitive Domain								

$$SAS_{CD} = 12.147 + 0.141(TeacherSelfEfficacy) + 0.202(TeacherEnthusiasm) + e$$

The regression equation above shows the relationship between independent and dependent variables partially. From that equation can be concluded that:

The constant is 12.147, which means if there is a change in the TSE and TE variables, then the student's academic stress in the cognitive domain (CD) is thereby 12.147 units.

The regression coefficient of TSE dan TE, respectively 0.141 and 0.202, means that the TSE variable affects or contributes positively to students' academic stress in the Cognitive domain (CD) so that the higher the teacher's self-efficacy and teacher belief increases as students' academic stress in the cognitive domain.

It may be concluded that insignificant variables do not partially affect the student's academic stress in cognitive domain variables, such as TPACK (X1) and teacher's belief (X2).

Independent Variables: TPACK (X1), TB (X2), TSE (X3), TE (X4) with dependent variable: Student's academic stress in Behavioral Domain (Y2).

Table 13: Model Summary.

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.219[a]	.048	.030	1.286	2.007
a. Predictors: (Constant), Teacher's Enthusiasm, Teacher's Self Efficacy, Teacher's Belief, TPACK b. Dependent Variable: Behavioral Domain					

Based on the table, R^2 = 0.048 means using those variables was able to explain the BD (Y2) variable by 4.8%, and the other 95.2% explained by the other variables.

Table 14: Coefficient Table.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	14.894	1.686		8.833	.000		
	TPACK	-.142	.045	-.249	-3.196	.002	.736	1.359
	Teacher's Belief	.026	.078	.025	.331	.741	.806	1.240
	Teacher's Self Efficacy	.044	.064	.052	.682	.496	.751	1.332
	Teacher's Enthusiasm	.083	.105	.056	.792	.429	.902	1.108
a. Dependent Variable: Behavioral Domain								

The table above shows that the TPACK variable is the only significant variable among the other variables. According to the result in the table obtained regression formula for student's academic stress in Behavioral Domain (SAS_{BD}), as follows:

$$SAS_{BD} = 14.894 - 0.142(TPACK) + e$$

The regression equation above shows the relationship between independent and dependent variables partially. From that equation can be concluded that:

The constant is 14.894, meaning if there is a change in the TPACK variables, then the student's academic stress in the behavioural domain (BD) is 14.894 units.

The regression coefficient of TPACK is −0.142; it means that the TPACK variable affects or contributes negatively to a student's academic stress in the Behavioral domain (BD), so the lower the teacher's TPACK, the higher the student's academic stress in the behavioral domain.

It may be concluded that insignificant variables do not partially affect the student's academic stress in behavioral domain variables, such as the teacher's belief (X2), the teacher's self-efficacy (X3), and the teacher's enthusiasm (X4).

C. Independent Variables: TPACK (X1), TB (X2), TSE (X3), TE (X4) with dependent variable: Student's academic stress in Affective Domain (Y3)

Table 15: Model Summar Y.

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.201[a]	.040	.023	1.544	1.818
a. Predictors: (Constant), Teacher's Enthusiasm, Teacher's Self Efficacy, Teacher's Belief, TPACK b. Dependent Variable: Affective Domain					

Based on the table, R^2 = 0.040 means using those variables was able to explain the AD (Y3) variable by 4%, and the other 96% explained by the other variables.

Table 16: Coefficient.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	15.443	2.025		7.627	.000		
	TPACK	-.118	.053	-.172	-2.199	.029	.736	1.359
	Teacher's Belief	-.141	.094	-.112	-1.507	.133	.806	1.240
	Teacher's Self Efficacy	.078	.077	.079	1.019	.309	.751	1.332
	Teacher's Enthusiasm	.071	.126	.040	.564	.573	.902	1.108
a. Dependent Variable: Affective Domain								

The table above shows that the TPACK variable is the only significant variable among the other variables. According to the result in the table obtained regression formula for student's academic stress in Affective Domain (SAS_{BD}), as follows:

$$SAS_{BD} = 15.443 - 0.118(TPACK) + e$$

The above regression equation illustrates partially the relationship between independent and dependent variables. From that equation can be concluded that:

The constant is 15.443, which means if there is a change in the TPACK variables, then the student's academic stress in the affective domain (AD) is there by 15.443 units.

The regression coefficient of TPACK is −0.118, which means that the TPACK variable affects or contributes negatively to students' academic stress in the Affective domain (AD), so the lower the teacher's TPACK, the higher the student's academic stress in the affective domain.

It may be concluded that insignificant variables do not partially affect the student's academic stress in the affective domain, such as the teacher's belief (X2), the teacher's self-efficacy (X3), and the teacher's enthusiasm (X4).

Independent Variables: TPACK (X1), TB (X2), TSE (X3), TE (X4) with dependent variable: Student's academic stress in Phisiological Domain (Y4)

Based on the table, R^2 = 0.043 means using those variables was able to explain the PD (Y4) variable by 4.3%, and the other 95.7% explained by the other variables.

Table 17: Model Summary.

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.207[a]	.043	.025	1.636	1.921
Predictors: (Constant), Teacher's Enthusiasm, Teacher's Self Efficacy, Teacher's Belief, TPACK Dependent Variable: Physiological Domain					

Table 18: Coefficient.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	16.631	2.145		7.754	.000		
	TPACK	-.141	.057	-.195	-2.496	.013	.736	1.359
	Teacher's Belief	-.076	.099	-.057	-.763	.446	.806	1.240
	Teacher's Self Efficacy	.016	.081	.015	.191	.849	.751	1.332
	Teacher's Enthusiasm	.069	.133	.037	.520	.604	.902	1.108
a. Dependent Variable: Physiological Domain								

The table above shows that the TPACK variable is the only significant variable among the other variables. According to the result in the table obtained regression formula for student's academic stress in Physiological Domain (SAS_{BD}), as follows:

$$SAS_{PD} = 16.631 - 0.141(TPACK) + e$$

The given regression equation somewhat depicts the link between independent and dependent variables. From that equation can be concluded that:

The constant is 0, which means if there is a change in the TPACK variables, then the student's academic stress in the physiological domain is there by 16.631 units.

The regression coefficient of TPACK is −0.141; it means that the TPACK variable affects or contributes negatively to a student's academic stress in the physiological domain (PD), so the lower the teacher's TPACK, the higher the student's academic stress in the physiological domain.

It may be concluded that insignificant variables do not partially affect the student's academic stress in the affective domain, such as teacher's belief (X2), teacher's self-efficacy (X3), and teacher enthusiasm (X4).

Independent Variables: TPACK (X1), TB (X2), TSE (X3), TE (X4) with dependent variable: Student's Learning Motivation (Y5)

Table 19: Model Summary.

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.365[a]	.133	.117	2.784	2.048

Predictors: (Constant), Teacher's Enthusiasm, Teacher's Self Efficacy, Teacher's Belief, TPACK
Dependent Variable: Student's Learning Motivation

Based on the table, nilai R^2 = 0.133 SLM variable by 13%, and the other 87% explained by the other variables.

Table 20: Coefficients.

Coefficients[a]								
Model		Unstandardized Coefficients			Standardized Coefficients	t	Sig.	Collinearity Statistics
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	9.834	3.651		2.693	.008		
	TPACK	.237	.096	.182	2.460	.015	.736	1.359
	Teacher's Belief	.040	.169	.017	.235	.815	.806	1.240
	Teacher's Self Efficacy	.458	.139	.243	3.302	.001	.751	1.332
	Teacher's Enthusiasm	-.084	.227	-.025	-.369	.713	.902	1.108

a. Dependent Variable: Student's Learning Motivation

The table above shows that the TPACK and TSE variables are significant variables. Thus, the researcher removed the TB variable by looking at the highest significance and nominal contribution values. The output results obtained when the researcher removed the TB variable found that the TSE variable was also insignificant. Hence, the researcher would also eject the TSE variable and get the output below:

According to the result in the table obtained regression formula for Student's Learning Motivation (SLM) is as follows:

$$SLM = 8.984 + 0.236(TPACK) + 0.460(Teacher'sSelfEfficacy) + e$$

The above regression equation illustrates partially the relationship between independent and dependent variables. From that equation can be concluded that:

The constant is 8.984, which means if there is a change in the TPACK and TSE variables, then the student's learning motivation (SLM) is there by 8.984 units.

Table 21: Coefficients.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	8.984	2.112		4.254	.000		
	TPACK	.236	.092	.182	2.552	.011	.793	1.261
	Teacher's Self Efficacy	.460	.134	.244	3.429	.001	.793	1.261
a. Dependent Variable: Student's Learning Motivation								

The regression coefficient of TPACK and TSE, respectively 0.236 and 0.460, means that the TPACK and TSE affect or contribute positively to students' learning motivation so that the higher the teacher's TPACK and their self- efficacy increases as well as student's learning motivation.

It may be concluded that insignificant variables do not partially affect the student's learning motivation, such as the teacher's belief (X2) and enthusiasm (X4).

5.7. F-Test Simultaneously

According to Imam Ghozali, if the significance value < 0.05 means the independent variables (X1, X2, X3, X4) simultaneously affect the dependent variables (Y1, Y2, Y3, Y4, Y5) [56]. Here is the ANOVA table containing the significant value that can be used to determine whether the independent variables affect the dependent variables simultaneously.

Table 22: Testing Table to Determine the Affect of IV to DV Simultaneously.

Variables X_1, X_2, X_3, **to :**	Sig.	$Y2$
Cognitive Domain (Y_1)	0.013	0.057
Behavioral Domain (Y_2)	0.032	0.048
Affective Domain (Y_3)	0.064	-
Physiological Domain (Y_4)	0.051	-
Student's Learning Motivation(Y_5)	0.000	0.133

According to the table above, obtained the significance values Y1, Y2, and Y5 < 0.05. It means the TPACK (X1), TB (X2), TSE (X3), and TE (X4) variables simultaneously affect the Y1, Y2, and Y5 variables. Otherwise, the output result shows that the significance

value of Y3 and Y4 > 0.05, which means the independent variables in this study do not simultaneously affect the Y3 and Y4 variables.

Based on the R^2 = 0.13, we can see how much the simultaneously impact percentage of the independent variables to dependent variables. Y1 variable has an R^2 = 0.057, which means the TPACK (X1), TB (X2), TSE (X3), and TE (X4) variables simultaneously affect the Student's academic stress in the Cognitive Domain (Y1) by 5.7%. Besides that, more negligible influences are demonstrated by the Student's academic stress in Behavioral Domain (Y2) variable at 4.8%. In contrast, according to the R^2 value, Student's learning motivation (Y5) variable show that the independent variable has the greatest simultaneous effect between the other variables at 13.3%.

Furthermore, will be analyzed the teacher's competencies in four dimensions, which are TPACK (X1), TB (X2), TSE (X3), and TE (X4), to student's academic achievement (AA) (Y6) shown by student's Final Grade. In this instance, the final grade is ordinal, so ordinal logistic regression will be used to observe the independent variables influencing the AA (Y6).

The following is the result of an output of ordinal logistic regression test analysis using SPSS Software.

Table 23: Case Processing Summary.

Case Processing Summary			
		N	Marginal Percentage
Academic Achievement	C	67	30.6%
	B	90	41.1%
	A	62	28.3%
Valid		219	100.0%
Missing		0	
Total		219	

The output gives information on the number of research samples that students get an "A" final grade of 67, a "B" grade of 90, and a "C" grade of 62 students. As for the total students who have been analyzed, 219 students. All the data is declared valid to be passed on to the next phase. Researchers are further assessing a fit model with the additional independent variables using SPSS to obtain the output tables below.

This table informs whether or not there are independent variables in a multinomial logistic regression model that better output rather than the model that only inputs the intercept. The basis of decision-making is to see if there is a drop in the -2 log

Table 24: Model Fitting Information.

Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	456.079			
Final	.000	456.079	4	.000
Link function: Logit.				

Likelihood value from intercept only to the final. If there is a decline in that value, then the multinomial logistic regression model is better. The table above shows that the -2 log-likelihood value declined, from 456.079 to 0.000 with a significance $0.000 < 0.05$ (alpha). It means the model with an independent variable is better than an intercept model. So, it can be concluded that the model fits.

In addition, the researcher will assess the model's goodness of fit. Decisions are made based on the significance of the Chi-square test; if the result is larger than the threshold set by the significance level alpha (0.05), the multinomial logistic regression model is consistent with the observation data. The significance value of the observation table was $1.000 > 0.05$. It indicates that the ordinal logistic regression is compatible with observation data for further research. The information in the table below indicates whether the multinomial logistic regression model matches the observation data or not.

Table 25: Goodness of Fit.

Goodness-of-Fit			
	Chi-Square	df	Sig.
Pearson	16.297	190	1.000
Deviance	19.922	190	1.000

Furthermore, it will be studied how much the contributions of X_1, X_2, X_3, X_4 variables affect Academic Achievement (Y_6). Based on output results using SPSS obtained, the following table.

Table 26: Pseudo R-Square.

Pseudo R-Square	
Cox and Snell	.875
Nagelkerke	.988
McFadden	.960
Link function: Logit.	

This table describes the extent to which an independent variable can explain a dependent variable. The three models produced are Cox and Snell, Nagelkerke, and McFadden, as shown in the table above. We are free to choose the models we employ, but in this instance we will use the Nagelkerke model with the highest R-square value. It indicates that the independent variables TPACK (X1), TB (X2), TSE (X3), and TE (X4) can have a 98.8% effect on the dependent variable AA (Y6). Assuming that independent variables can influence dependent variables by 98.8%, other variables influence dependent variables by 1.2%.

The researcher, in turn, analyzed the partial effect between independent and dependent variables Y_6. Based on the output results with SPSS, they obtained the following table.

Table 27: Parameter Estimates.

Parameter Estimates								
		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[Y6 = 2]	129.501	31.760	16.626	1	.000	67.252	191.749
	[Y6 = 3]	147.251	36.476	16.297	1	.000	75.760	218.742
Location	X1	6.199	1.631	14.439	1	.000	3.002	9.397
	X2	.407	.279	2.127	1	.145	-.140	.955
	X3	.226	.264	.737	1	.390	-.290	.743
	X4	.168	.407	.171	1	.679	-.630	.967

From the above table, it appears that the X_1 (TPACK) variable has a significance value by 0.000. It value < alpha (0.000 < 0.05), means TPACK partially affect the student's academic achievement (Y_6). Otherwise, X_2, X_3, and X_4 (TB, TSE, and TE) variables, respectively have significance values that greater than alpha value. It means the Teacher's Beliefs, self-efficacy, and Enthusiasm do not affect the student's academic achievement in online teaching and learning.

The result will be interpreted in this study only the effect of TPACK (X_1) variable to AA (Y_6) variable.

5.8. Model Shapping

The data-processing program with the SPSS presents the opposite direction at the output of the location in the estimates parameters of the ordinal logistic (Norusis, 2011).

Therefore, for writing a coefficient model, the direction of parameters at a location must be behind its direction. So, by inserting the value that is obtained on the table for the estimate in the formula comes up with the following equations:

$$ln[P(Y \leq 2|x)] = 129.501 - 6.199X_1 * -0.407X_2 - 0.226X_3 - 0.168X_4$$

$$ln[P(Y \leq 2|x)] = 147.251 - 6.199X_1 * -0.407X_2 - 0.226X_3 - 0.168X_4$$

(*) Independent variable (significance) have an influence on a dependent variable.

Equation of TPACK (X_1):

We are adding the estimate's coefficient value into the equation, resulting in the following equation.

$$\frac{Exp(129.501 + 6.199)}{p_2 - 1 - Exp(129.501 + 6.199)} = -1.000000000000022$$

$$p_2 + p_3 = \frac{Exp(147.251 + 6.199)}{1 - Exp(147.251 + 6.199)} = -1.000000000000035$$

$$p_3 = -1.000000000000035 + 1.000000000000022 = ?0.000000000000013$$

The above equations attained, the value of AA (Y6) and the regression coefficient TPACK (X_1) variable is one positive direction. It may be concluded that the higher the teacher's TPACK, the higher the student's academic achievement. So, for 1% increase in teacher's TPACK () will lower the probability of students obtaining the Final Grade of C by 1.000000000000035% and lower the probability of students obtaining the final grade of B by 0.000000000000044%.

In addition, the value of regression coefficient of TPACK (X_1) variable is 6.199 which when it is ecponentially gained Exp (6.199) = 492.25. It means, that every 1% increases of TPACK (X_1) variable will tend to increase the Odd rasio of Grade A 492.25 times greater than the other category.

5.9. Structural Equation Modelling (SEM)

The researcher uses Structural Equation Modelling (SEM) analysis with SPSS-AMOS software to find the connection between the independent and dependent variables.

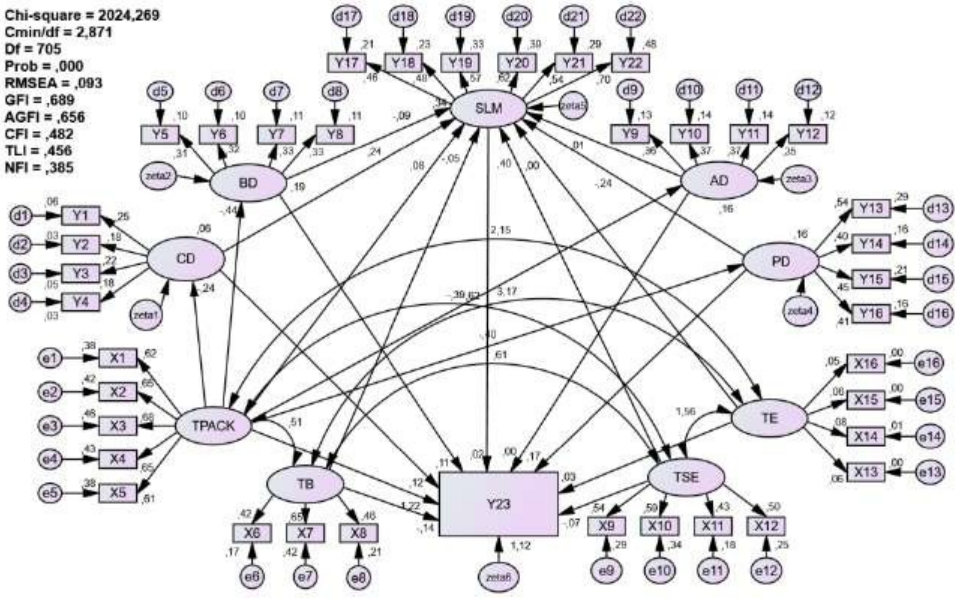

Figure 4: Full Model Analysis of Relationship Between Independent and Dependent Variable.

The figure above is a full model analysis of the relationship among TPACK (X_1), TB (X_2), TSE (X_3), TE (X_4), CD (X_1), BD (X_2), AD (X_3), PD (X_4), SLM (X_5), and AA (X_6). Having obtained an estimate, the next step is judging the model's goodness of fit. Based on the above output, the Chi-Square value is getting smaller and better, the p-value, and the standardized loading factors. It means that the research model does not have the right level of compatibility.

A model could use the modification indices to improve the overall goodness of fit. The modification indices could be done with an addition of track or covariances. The researcher chooses to perform modified indices with the addition of error and covariances.

After modification indices, a new model of measurement was obtained. The Chi-Square and p-value after the modification indices indicate that the model already has a reasonable fit rate. Calculating the results of the goodness of the overall fit model can be seen in the following table. This study's overall goodness of fit test model has a chi-square of 791,559 (much smaller than before). Statistics Chi-Square is a statistical test for key needs in which the lower the chi-square value, the better the data fit. The Goodness of Fit size in this model indicates that the model is an excellent fit.

TABLE 28: Overall Model Goodness of Fit (GOF)Test.

GOF	Acceptable levels of GOF	Model Indices	Note.
Chi-square	The smaller the value the better	601,392	Good
RMSEA	RMSEA ≤ 0,05 Good fit	0,027	Good Fit
Probability	Prob. ≤ 0,05 Good	0.006	Good
GFI	GFI ≥ 0,90 good fit 0,80 ≤ $GFI \leq$ 0,90 marginal fit	0,886	Marginal Fit
AGFI	AGFI ≥ 0,90 good fit 0,80 ≤ $GFI \leq$ 0,90 marginal fit	0,828	Marginal Fit
CFI	CFI ≥ 0,90 good fit	0,967	Good Fit
TLI	TLI ≥ 0,90 good fit	0,953	Good Fit
NFI	NFI ≥ 0,90 good fit 0,80 ≤ $NFI \leq$ 0,90 marginal fit	0,817	Marginal Fit
CN	CN ≥ 200 good	219	Good

Hooper et al. (2008) examine the chi-square test, RMSEA, CFI, and RMSR value to determine the magnitude of GOF created. As a result of the GOF test revealing a fit model, it is possible to conclude that the model utilized in the study is the foundation for assessing the research problem.

5.10. Model Interpretation

The index for each construction is shown with the number of variances extracted by the variable formations developed. The high extracted value suggests that the indicators already represent both developed variables. According to Ghozali [56], the value can be obtained in the following formula:

$$\frac{\sum \sigma_{ij}^2}{\sum \sigma_{ij}^2 + \sum \varepsilon j}$$

Variance Extracted =

Based on the formula, the step to find variances must first be known as the Sum of square standardized loading ($\sum \lambda^2$) and the Sum measurement error ($\sum \varepsilon_i$) variables. The numbers used in this formula are coefficients obtained after modification indices. So that the value of sum of square standardized loading ($\sum \lambda^2$) for each indicator is as follows:

$$Var1 = 0.271^2 + 0.187^2 + 0.231^2 + 0.191^2 = 0.198$$

$$Var2 = 0.252^2 + 0.256^2 + 0.261^2 + 0.268^2 = 0.269$$

$$Var3 = 0.336^2 + 0.334^2 + 0.341^2 + 0.315^2 = 0.439$$

$$Var4 = 0.493^2 + 0.372^2 + 0.410^2 + 0.375^2 = 0.690$$

$$Var5 = 0.509^2 + 0.526^2 + 0.613^2 + 0.639^2 + 0.595^2 + 0.819^2 = 2.345$$

$$TRACK = (-0.277)^2 + (-0.529)^2 + (-0.352)^2 + (-0.371)^2 = 0.618$$

The sum measurement error ($\sum \varepsilon_i$) value for each indicators as follows:

$$Var1 = 0.06^2 + 0.03^2 + 0.05^2 + 0.03^2 = 0.0079$$

$$Var2 = 0.10^2 + 0.10^2 + 0.11^2 + 0.11^2 = 0.0442$$

$$Var3 = 0.13^2 + 0.14^2 + 0.14^2 + 0.12^2 = 0.0705$$

$$Var4 = 0.29^2 + 0.16^2 + 0.21^2 + 0.16^2 = 0.1794$$

$$Var5 = 0.21^2 + 0.23^2 + 0.33^2 + 0.39^2 + 0.29^2 + 0.48^2 = 0.6725$$

$$TRACK = 0.38 + 0.42 + 0.46 + 0.43 + 0.38 = 2.07$$

From these calculations the presentage of the index for each construction is as follows:

$$TPACK = \frac{0.198}{0.198 + 0.0079} = 0.9616$$

$$TP = \frac{0.269}{0.269 + 0.0442} = 0.858876$$

$$TSE = \frac{0.439}{0.439 + 0.0705} = 0.8616$$

$$TE = \frac{0.269}{0.1794 + 0.690} = 0.7936$$

$$SLM = \frac{2.345}{2.345 + 0.6725} = 0.7771$$

Based on the analysis of the application of SEM on the relationship between TPACK (X_1) and the dependent variables obtained the conclusion that the percentage index contribution of TPACK (X_1) to CD (Y_1), BD (Y_2), AD (Y_3), and PD (Y_4), respectively by 96.16%, 85.88%, 86.16%, and 79.36%. It shows the importance of a teacher's competencies to know, understand, and use technology to reduce a student's academic stress in online learning. In addition, the presentation index of the TPACK (X_1) to SLM (Y_5) by 77.71%. It suggests that teachers' abilities to make use of technology are crucial and have a major bearing on their pupils' desire to learn. In the table below, we can see the magnitude of the coefficient of the independent variable's effect on the dependent variable.

Table 29: Coefficient Value in the Affect of the Independent Variables to Dependent Variable.

Variable	Coef.	Variable	Coef.	Note.
TPACK -> SLM	0,329	TPACK -> Y23	1,118	Y23 = AA (academic achievement)
TB -> SLM	-0,206	TB -> Y23	-0,105	TPACK = Teacher's technological, pedagogical, and content knowledge. TB = Teacher's Belief
TSE -> SLM	0,583	AD -> Y23	0,134	TSE = Teacher's Self Efficacy
CD -> SLM	-0,275	TSE -> Y23	-0,162	TE = Teacher's Enthusiasm
BD -> SLM	0,490	SLM -> Y23	0,054	CD = Student's academic stress in cognitive domain
AD -> SLM	-0,303	CD -> Y23	0,014	BD = Student's academic stress in behavioral domain
PD -> SLM	0,393	BD -> Y23	-0,149	AD = Student's academic stress in Affective domain
		PD -> Y23	0,075	PD = Student's academic stress in phisiological domain
				SLM = Student's learning motivation.

The above table shows that TPACK (X_1), TSE (X_3), BD (Y_2), and PD (Y_4) have positively affect to SLM (Y_5). It means that the greater the teacher's technological competency

and self-efficacy, the greater the student's learning motivation in online learning. It may appear strange that the more the student's academic stress in behavioral and physiological areas, the more motivated they are to learn online. Academic stress in the cognitive and affective domains, on the other hand, has a detrimental impact on students' learning motivation. It suggests that the less academic stress students experience in the cognitive and affective areas, the more motivated they are to study online.

Look also the relationship between the variables with AA (Y_6), which the TPACK (X_1) variable has highest coefficient and positively affect. Besides that, SLM (Y_5), CD (Y_1), AD (Y_3), and PD (Y_4) variables, also positivelly affect the AA (Y_6). In contrast, TB, TSE, and BD variables harm the AA, which means if the teacher's belief and self-efficacy increase will affect the student's decline in academic achievement shown by the final grade. It makes sense to the BD variable that if a student's academic stress in the behavioral domain increases, their academic achievement will decrease.

The following table contains the value of the variable coefficient on each question of the factor questionnaires.

Table 30: Value of Factor Questionnaire Coefficient on Each Factor Variable.

Relationships	Coef.	Relationships	Coef.	Relationships	Coef.	Relationships	Coef.
CD -> Y1	0,271	BD -> Y5	0,252	AD -> Y9	0,336	PD -> Y13	0,493
CD -> Y2	0,187	BD -> Y6	0,256	AD -> Y10	0,334	PD -> Y14	0,372
CD -> Y3	0,231	BD -> Y7	0,261	AD -> Y11	0,341	PD -> Y15	0,410
CD -> Y4	0,191	BD -> Y8	0,268	AD -> Y12	0,315	PD -> Y16	0,375
Relationships	**Coef.**	**Relationships**	**Coef.**	**Relationships**	**Coef.**	**Relationships**	**Coef.**
TPACK->X1	0,601	TB -> X6	0,408	TSE -> X9	0,590	SLM -> Y17	0,509
TPACK->X2	0,634	TB -> X7	0,678	TSE -> X10	0,594	SLM -> Y18	0,526
TPACK->X3	0,661	TB -> X8	0,433	TSE -> X11	0,453	SLM -> Y19	0,613
TPACK->X4	0,631			TSE -> X12	0,548	SLM -> Y20	0,639
TPACK->X5	0,600					SLM -> Y21	0,595
						SLM -> Y22	0,819

The output above obtained the highest coefficient results on the TPACK variable is the X3 factor (questionnaire number 3), which contains the statement; "My lecturers know the ITC application that can be used to understand better the content of the material from the subject of the statistics." It means that students as respondents feel that what they need most in online learning is when teachers use technology with a

purpose to make it easier for them to understand the content of the lesson, especially in statistics lessons.

The factor with the highest coefficient on the Teacher's Belief (TB) variable is X7 (questionnaire number 7), which contains statements regarding the teacher's belief that pupils should be able to develop their own ideas and pursue their own learning paths. That means having an effective learning process can build a teacher's trust in the student's competencies to process and develop their ideas individually without having to depend solely on a teacher so that the learning can become two-way learning.

On the other hand, the factor with the highest coefficient in the teacher's self-efficacy (TSE) is x10, which contains the statement "My lecturers can keep students busy with difficult tasks." It means students feel important if teachers can make them perform complex tasks. It is not based on coercion but on the student's delight in meeting the challenge and evidence of their interest in the lesson.

Furthermore, the factor that has the highest coefficient in the variable teacher's enthusiasm (TE) is X14 which contains the statement, "My lecturers found statistics to be an interesting subject and tried to convey that enthusiasm to the students." Students realize that enthusiasm in the teaching process is urgently needed, especially in statistical subjects requiring high concentration. In addition, love or interest in the teacher's teacher's lesson will also manifest enthusiasm so that it will overflow and provide the students with the same energy.

The factor that has the highest coefficient in the student's learning motivation is Y22, which consists of the statement "I was eager to do my homework on a statistical course." Students realize that the spirit of learning and missionary work is one form of motivating themselves.

On the student's academic stress in the cognitive domain variable, students most often feel disturbed at home when learning, as shown at the highest coefficient value of the Y1 factor. Online learning is hampering and often makes it hard for students to focus. It is the result of differing home conditions or educational environments. Children who live in rural communities or crowded places often feel disturbed and unfocused when studying. Therefore, many students are distressed by online learning about such things. In the behavioral domain, students stressed that online learning often puts off the jobs they should be doing. Irregular online learning schedules, teacher lack of supervision, and excessive amounts of one-on-one online learning make them think

they have much free time. It, in the end, caused them to build up tasks that made them more depressed.

On the other hand, in the affective domain, students are so stressed with online learning that they find it challenging to do the job they should be doing. It makes them sleep difficulties as shown in the highest coefficient of the physiological domain, the Y13 factor, which contains the statement "During my online studies I was having trouble sleeping."

6. CONCLUSION

The Covid-19 pandemic necessitates that all disciplines utilize technological advances to keep the system online. Adapting to online learning is a challenge that the field of education also faces. Due to numerous factors, offline study is sometimes ineffective and inefficient. One of the factors is the teacher's class management skills. Teachers must assess and update their skills to facilitate online student learning.

The analysis and discussion of the results of this study suggest that TPACK, one of the dimensions of teacher's competencies, negatively affect the components of students' academic stress, such as student academic stress in the Behavioral, Affective, and Physiological domain. Although surprisingly, TPACK does not affect the student's academic stress in the cognitive domain. Negative influences suggest that a growing teacher's competencies integrate technology and pedagogies in developing educational content, especially online learning, lower or minimize students' academic stress. So, it can be interpreted that if the teacher's competencies in integrating pedagogy technology and content increase, then the SLM increases, and automatically the AA will increase.

Besides that, the other component of a teacher's competence variable, such as teacher's self-efficacy (TSE) and enthusiasm (TE), affect the student's academic stress in the cognitive domain (CD) as well as CD positively affect academic achievement (AA), so that indirectly TSE and TE positively affect the student's academic achievement. The relationship created between TSE, TE, SLM, and AA variables seems strange because it is unusual. However, it is undeniable that administering final grades to students is influenced by many factors, not only by low levels of stress and high motivation for learning. So, it may be considered another factor that can logically influence the increase in a student's final grade. From the relationship between these variables, we might say that increased teacher competencies may have triggered students' academic

stress in studying online because teachers with high competencies tend to be active and seemingly tireless in learning. In fact, online learning makes students accustomed to relaxing and procrastinating because they think they have so much free time that they habitually lounge. Therefore, students who are used to relaxing tend to stress when meeting teachers with high self-efficacy and enthusiasm. The same is true of students' academic stress and academic achievement relationships. Usually, a low level of stress will increase the student's academic achievement, but, on the other hand, their stress level can also trigger them to achieve good achievement. Of all the impacts and interactions between independent and dependent variables investigated in this study, the teacher's technical pedagogical and content knowledge (TPACK) has the biggest impact on online learning.

It shows the importance of teachers' competencies to integrate technology and pedagogies in presenting the learning content in matters online. Teachers need to assess their competencies to utilize technology and develop the innovation, strategies, and methods that can promote success in conveying the learning content to students. So that students' academic stress can be minimized, and their learning motivation is enhanced. Therefore, it requires training to increase teacher competence and provide sufficient infrastructure tools to support online learning.

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