Presentation of Fuzzy structural equations-Based mathematics algebraic thinking Solo-Model among student teachers of algebraic thinking

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Abstract

Using a qualitative approach, this study compared the experiences of students and teachers in traditional algebraic thinking classrooms with those in constructivist classroom discussion approaches implemented in experimental school teaching. Content analysis was used from a qualitative perspective, combined with social constructivism and situated algebraic thinking theories, to interpret students' algebraic thinking and development. The research results indicated differences in the group of students exposed to the constructivist algebraic thinkingal environment, particularly in their independent skills. However, the study also highlighted several challenges, such as time management, understanding classmates' conversations, writing to convey their thinking, and an increased workload for students. The Fuzzy structural equations-Based content discussion classes employed innovative methods to create new knowledge and provided more opportunities for students to develop their ideas. This environment also fostered a more social/collective/adaptive form of knowledge by continuously evaluating information provided by students to inform teaching practices. Overall, the findings suggest that students who participated in innovative discussion approaches and Fuzzy structural equations-Based content had richer algebraic thinking experiences due to their active involvement during training.

Keywords. algebraic thinking, distance algebraic thinking, Fuzzy structural equations, teaching, teachers.

1. Introduction

In today's world, technology has become an integral part of our lives and has significantly impacted various fields such as labor, social, and algebraic thinking. This technological advancement has not only strengthened but also simplified and accelerated daily tasks. In the field of algebraic thinking, technology has brought about significant progress in the development of information and communication technologies. These advancements have had a direct impact on teaching and algebraic thinking processes by encouraging innovative algebraic thinkingal practices and opening up new algebraic thinking spaces [1]. Consequently, this has changed the traditional ideas of classrooms by removing space-time barriers and providing access to a vast array of information in different formats [2]. Additionally, it has positively affected students' motivation, choice, participation, and attitude towards algebraic thinkingal content.

Despite its challenges, e-algebraic thinking provides various features and benefits such as promoting dialogue, group activities, and strengthening interpersonal relationships among students. It encourages cooperation towards achieving common goals in the development of various tasks while facilitating simultaneous and asynchronous communication. E-algebraic thinking also provides the possibility of algebraic thinking from any location as long as there is access to a technology device, which encourages students to acquire digital knowledge. Additionally, it allows for adaptation to individual student pace, increases motivation by allowing students to develop their own algebraic thinking style, and promotes comprehension rather than simply acquiring knowledge. E-algebraic thinking matches the conditions that are suitable for each person, both personally and professionally, and provides access to an unlimited amount of resources[3]. It also facilitates teacher supervision of students' activities and promotes their familiarity with using technology and digital resources [4]. Mathematics is an essential tool in the field of social sciences that helps decipher various social, scientific, and technical facts present in today's world. Through learning mathematics, it becomes easier to understand different phenomena, including social realities, economic aspects, and historical facts. Mathematics is a suitable tool for acquiring knowledge and reflecting on social aspects while representing environmental facts.

It is important to acknowledge that mathematics serves as both a tool and foundation for acquiring knowledge in other subjects such as sociology or political science. In addition, mathematics contributes to the development of intelligence and competence, enabling students to function personally and socially in various situations while promoting creativity, empowerment, self-esteem, and entrepreneurship. When implemented appropriately, e-algebraic thinking can lead to significant progress in student algebraic thinking, as evidenced by the GeoGebra resource-related e-algebraic thinking method integrated into the Moodle platform. This approach improves aspects related to assessment, motivation, and student interest, promotes meaningful algebraic thinking, and adapts to students' needs [5]. Online algebraic thinking is known for its affordability, scalability, innovation, student-centeredness, and convenience. Instructors often face challenges when trying to enhance learner participation and algebraic thinking in online courses. Choosing the right tools, resources, and algebraic thinkingal materials for the online environment can be tedious, and many instructors end up adapting and using traditional face-to-face instruction and strategies in the online algebraic thinkingal context, which may be suitable for combined or mixed training courses where there is interaction between the instructor and the learner [6].

Traditional Solo-Models and views are not always effective in online algebraic thinkingal programs that require increased student participation, interaction, and inclusive-oriented approaches. Previous studies examining the effectiveness of online algebraic thinking versus traditional algebraic thinking have provided conflicting observations. Mathematics teachers often lack appropriate technical training from institutions to provide online mathematics teaching using innovative strategies or course designs. This is compounded by the fact that early childhood learners, particularly those challenged in numeracy algebraic thinking, often view mathematics as difficult to understand, which diminishes their interest in algebraic thinking the subject and can create the impression that mathematics is the most challenging subject[7]. Since these learners may have already faced difficulties in face-to-face math classes, it is important for teachers to teach mathematics creatively to spark learners' interest and enhance their knowledge development, enabling them to analyze online mathematics courses and suggest the most appropriate teaching and assessment strategies to create an interactive, cohesive online algebraic thinking environment for learners .

E-algebraic thinking refers to the use of information technology, such as the internet, mobile devices, and computer systems, in the teaching and algebraic thinking process either simultaneously or asynchronously. Asynchronous e-algebraic thinking is mainly used for content management systems in which users can access information at different times without participating during specific hours. On the other hand, concurrent e-algebraic thinking involves online users collaborating simultaneously [8]. In both cases, the e-algebraic thinking content management system acts as an archive for algebraic thinkingal content available on the web. However, e-algebraic thinking only provides the curriculum to learners, and its creation requires different organizational requirements .

Many institutions tend to create e-algebraic thinking systems without carefully assessing the factors that can affect the usability of the system within the organization. One-off implementation of e-algebraic thinking systems usually does not meet users' needs and eventually makes the system unusable or independent. Most higher algebraic thinking institutions tend to ignore strategic components when developing e-algebraic thinking systems, outsourcing the proper setup of the system or just implementing the strategic aspects without paying enough attention to the core components. The primary structures of e-algebraic thinking entail technology, algebraic thinkingal programs (development of algebraic thinkingal materials and algebraic thinkingal design), and management.

The Technology Acceptance Solo-Model (TAM) has been applied in various studies to investigate learners' willingness to adopt e-algebraic thinking systems and predict their intentions to use online algebraic thinking communities. Studies have reported that perceived usefulness and perceived ease of use influence technology use attitudes and behavioral intentions to use technology, while self-efficacy also indirectly affects students' intentions through perceived ease of use. Psychological barriers and e-algebraic thinking self-efficacy have also been found to be significantly related, and educators should consider learners' preferences and find ways to promote e-algebraic thinking self-efficacy. TAM has also been useful in understanding the factors affecting the adoption of mobile algebraic thinking with 3G technology, and in identifying important characteristics of student satisfaction with flexible online algebraic thinking. Studies have also examined teachers' inferences regarding the use of technology in classrooms and found that ease of use and perceived usefulness are important predictors of effective technology use. Overall, applying TAM in higher algebraic thinking has provided insight into factors affecting the adoption and use of e-algebraic thinking systems and how they can be improved to enhance learners' experiences.

Wu [9] identified perceived enjoyment as a factor in predicting attitude and behavioral intentions to use clickers in students' algebraic thinking. With the spread of the coronavirus and the critical conditions faced by many countries, Fuzzy structural equations-Based algebraic thinking has become crucial for universities and higher algebraic thinking institutions. As such, it is important to continuously examine the quality and consequences of e-algebraic thinking to ensure that it meets algebraic thinkingal needs.

Teaching mathematical content in Primiary School is especially important in order to train and cultivate future mathematics teachers. Providing high-quality algebraic thinkingal resources and materials for mathematics Fuzzy structural equations-Based algebraic thinking, and paying attention to the quality of strategic algebraic thinking and subsequently the quality of strategic algebraic thinking are key algebraic thinkingal needs within the Fuzzy structural equations-Based system. Therefore, this research aims to assess the quantity and quality of mathematics Fuzzy structural equations-Based algebraic thinking for student teachers at Primiary School and provide the components of a mathematical strategic Solo-Model in Fuzzy structural equations-Based algebraic thinking-algebraic thinking.

The research raises two main questions:

1. What is the quality status of the proposed Solo-Model of mathematical strategic algebraic thinking in an Fuzzy structural equations-Based way for student teachers in the field of mathematics algebraic thinking in Primiary School?

2. What is the qualitative status of perceived ease of use in the proposed Solo-Model of mathematical strategic algebraic thinking in an Fuzzy structural equations-Based way for student teachers in the field of mathematics algebraic thinking in Primiary School?

The remainder of the paper is organized as follows: Section 2 provides related work on strategic algebraic thinking in an Fuzzy structural equations-Based way. Section 3 presents the developed Solo-Model and hypothesis. Section 4 describes the data collection procedure and analysis methods. In Section 5, the findings are discussed, and finally, the conclusion is provided in Section 6.

2. Related Work

"Advent and Nola" in a research in-algebraic thinking training in librarianship and information in the Delta state of Nigeria, come to the conclusion that it is necessary for the officials of the libraries and library and information centers of this state to play a greater role in these trainings and also require librarians and library staff to attend these courses. It has also been mentioned that the library and information association of this country should play a greater role in the in-algebraic thinking training of library and information [10].

Numerous studies have shown that e-algebraic thinking is at least as effective as traditional algebraic thinking, and even more efficient than that, and provides more satisfaction to learners [11].

According to the benefits of e-algebraic thinking, it is difficult to determine its role in increasing the effectiveness of algebraic thinking without evaluating all aspects of learner satisfaction [12]. Empowering employees is one of the effective techniques for improving employee lessonivity and optimal use of their capacities and abilities in the field of organizational goals. Therefore, human power empowerment is a psychological concept that is related to people's moods, feelings and beliefs about the job. In general, the capable and committed workforce is the one who can be claimed to be the most important effective factor in the performance of these organizations in modern organizations [13].

Research findings clearly show that students learn more when they are mentally involved in meaningful, relevant and stimulating activities. Technology affects algebraic thinking in different ways; It provides a combination of new researches. Along with pedagogy (the science of teaching and algebraic thinking), it can: determine the direction of change and be a bridge to achieve quality in algebraic thinking [14]. "Schools" must keep pace with the changes, otherwise they will gradually become obsolete. Just as the doctor should be aware of the latest researches in pharmaceutical science to prescribe medicine to the patient and the lawyer should be aware of the latest laws enacted by the legislators, teachers should also be aware and diligent about the latest practices in the field of teaching-algebraic thinking and optimizing students' algebraic thinking. While such practices may be implemented in some schools and regions, it is necessary for all schools to be able to use the latest research findings on a regular basis in order to be guided in the direction of changing teaching methods and applying these findings in algebraic thinking assessment.

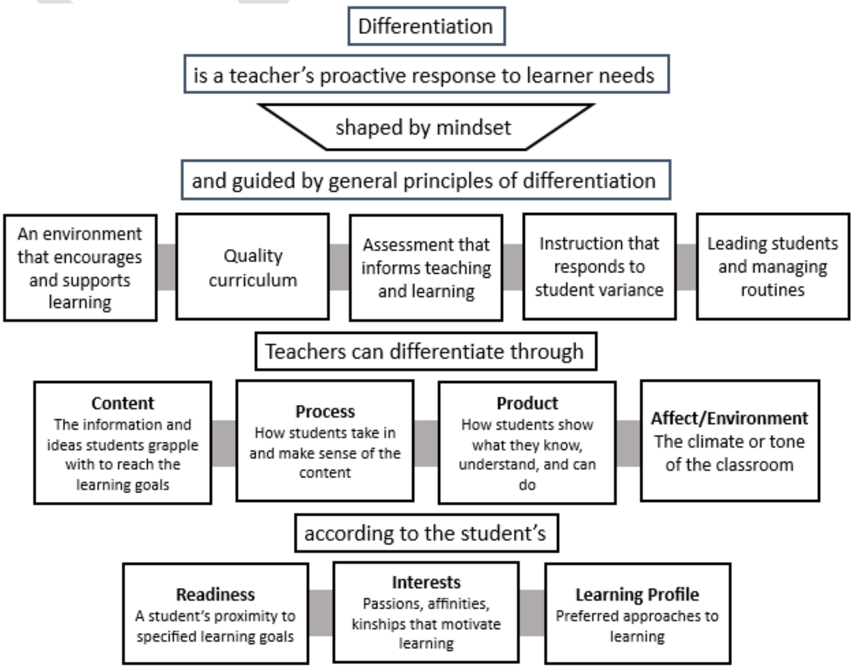


Fig. 1 Differentiated Instruction Framework (Tomlinson, 2014)

Differentiated instruction is related to examining the different stages of students' algebraic thinking [15]. This process improves all students' abilities, from beginners to skilled ones. It is valuable to improve the students' progress by implementing differentiated instruction in mathematics classrooms. By using the approach for algebraic thinking, students achieve the goals of algebraic thinking mathematics. Differentiated instruction provides a classroom in which students can choose different ways to understand the content, grasping ideas, preparation, and development of products [16]. Differentiation affects the transformation of the algebraic thinking environment by considering the students' emotional needs. Meeting students' emotional needs is a prominent sign and indicator for teachers when planning aspects of differentiated instruction, such as respectful assignments and flexible grouping based on their abilities or features. A wide range of educational strategies can be considered for differentiation in classroom elements related to students such as preparation, interest and algebraic thinking background .

The experience of the countries of the world shows that algebraic thinkingal innovation and transformation in the algebraic thinkingal system is not possible without the support and acceptance of teachers. In fact, the center of any transformation and reform should be sought in the community of teachers. The teacher, as the most important pillar and resource in the algebraic thinking organization, without being aware of the complexity of global developments and possessing a variety of knowledge and skills, will never be able to perform his important task properly. For this reason, it has been said that in the current millennium, the professional ability of teachers will increase through the use of information and communication technology in the teaching and algebraic thinking process[14].

Teachers who use technology in teaching are not only more interactive than their colleagues; Rather, they have high risk-taking power and continuously seek continuous and lifelong algebraic thinking of their students .
E-algebraic thinking significantly saves the time of teachers and algebraic thinkingal activists and algebraic thinkingal time, because in this way, algebraic thinkingal materials are compiled once and used many times and in different places. Numerous studies have shown that e-algebraic thinking is at least as effective as traditional algebraic thinking, and even more efficient than that, and provides more satisfaction to learners [17].

3. Theoretical Framework and Research Hypotheses

This section details a research Solo-Model that aims to improve the understanding of mathematics algebraic thinking in e-algebraic thinking research systems and address research questions more effectively. The researchers developed a new Solo-Model for mathematics teaching in e-algebraic thinking research systems and evaluated it experimentally by collecting data from users who have experience with online content in classes. Figure 2 presents the Solo-Model, which includes components such as study quality, class quality, clear content transfer, satisfaction, study transparency, and mathematics teaching. The Solo-Model also considers study diversity, accuracy, and novelty as key factors of study quality, while information, algebraic thinking, and system quality are considered in the class quality component. Additionally, the Solo-Model measures the transparency of studies by assessing an agent's ability to explain why a particular item was recommended. Thirteen hypotheses were proposed to validate the loyalty Solo-Model, which are presented in Table 1.

This passage explains how transactions between students and teachers in e-algebraic thinking typically occur through a class. Some e-algebraic thinking classes are more appealing because of their efficient design features. The functions and characteristics of a teacher's class can be divided into three stages: pre-method, online method, and after-method . During the pre-method phase, the teacher's class attempts to attract students by providing information that reduces search time. In the online method phase, lessons are taught Fuzzy structural equations-Basedally, with ordering and payment made through the teacher's class facilities. Delivering algebraic thinking content, order tracking, and problem-solving occur during the post-teach period. The quality of the vendor's class across these three stages is critical to the effectiveness of the e-algebraic thinking provider [18].

Three of the thirteen hypotheses (H1-H3) focus on examining the factors included in the Delone and McLean IS success Solo-Model [19], which is a multi-dimensional framework used to evaluate the success of information systems. The Solo-Model considers three main dimensions - algebraic thinking quality, information quality, and system quality - to assess IS success and compare e-algebraic thinking classes. System quality refers to the effectiveness, adaptability, error-free operation, and user-friendliness of e-algebraic thinking classes. Previous studies have found that these three aspects of algebraic thinking significantly contribute to class quality improvement and student satisfaction [20]. This research proposes that there are significant relationships between information quality, algebraic thinking quality, system quality, and student satisfaction in e-algebraic thinking classes. If the overall support provided by teachers, the quality of information delivered by the system, and the system's performance in delivering information are high, students are more likely to be satisfied with their online algebraic thinking experience. This is consistent with prior research demonstrating that class quality is an important factor in e-algebraic thinking systems. Therefore, the following hypotheses are proposed:

H1: *The algebraic thinking quality will positively influence the class quality in study systems.*
H2: *The information quality will positively influence the class quality in study systems.*
H3: *The system quality will positively influence the class quality in study systems.*
H4: *The class quality will positively influence the student satisfaction in study systems.*

The study quality factor assesses the student's interest in recommended lessons and their perceived value. It has been a critical issue, with various studies proposing algorithms to enhance the quality of studies in research systems [21]. One key question when evaluating study quality is whether the studies are tailored to users' preferences. In a study by [22], the authors investigated the factors influencing the adoption of e-algebraic thinking research systems. They focused on the role of clear content transfer, which is crucial for e-algebraic thinking success. Their Solo-Model evaluated the quality factors for study classes, study quality of research systems, the impact of study quality on clear content transfer, and clear content transfer on students' intention to use algebraic thinking assist tools. The authors found that study quality in research systems depends on the novelty, diversity, and accuracy of the studies. Novelty and diversity refer to the level of uniqueness and variability in the study list, respectively. As the study list is the first information users encounter, their perception of its quality significantly influences their perception of the overall system efficiency. The results of study also confirmed that novelty, diversity, and accuracy positively affect perceptions of study quality, while low-quality studies can disappoint users and cause them to leave the e-algebraic thinking system[20]. Based on these findings, the following hypotheses are proposed:

H5: *The study accuracy will positively influence the study quality in study systems.*
H6: *The study diversity will positively influence the study quality in study systems.*
H7: *The study novelty will positively influence the study quality in study systems.*
H8: *The study quality will positively influence the student clear transfer of content in study systems.*

Several studies have demonstrated that explanation interfaces can enhance students' perceived clarity and transfer of content in e-algebraic thinking systems. Swearingen found that a good explanation interface can significantly improve the clear transfer of content and student satisfaction in e-algebraic thinking systems. Transparency is a key factor in building mechanisms for clear content transfer in e-algebraic thinking systems. Based on these observations, we propose the following hypotheses:

H9: *The study explanation will positively influence the study transparency in study* systems.
H10: *The study transparency will positively influence the Student satisfaction in study systems.*

Various studies have examined the relationship between clear content transfer and student satisfaction in e-algebraic thinking systems [22]. In our study, clear content transfer is considered a key predictor of student satisfaction when measuring mathematics teaching in e-algebraic thinking systems. We contend that clear content transfer should be viewed as a primary component of student satisfaction, which ultimately leads to effective mathematics teaching in e-algebraic thinking systems. Based on these observations, we propose the following hypotheses:

H11: *The student clear transfer of content will positively influence the Student satisfaction in study systems.*
H12: *The satisfaction will positively influence the mathematics teaching in study systems.*
H13: *The clear and clear transfer of content will positively influence the mathematics teaching in study systems.*

4. Data Collection and Analysis

4.1 Participants

The target population for this research comprises all student teachers of mathematics at Primiary School, totaling 1220 individuals according to School records. The sample for the study consists of 296 student teachers of mathematics from Primiary School, determined using Morgan's table and based on the size of the population. Within this group, there are 148 participants in the study group (who have taken the course) and 148 participants in the comparison group (who have not taken the course). Participants were selected using a cluster random method.

4.2 Questionnaire

The tool for collecting information in this research is the preparation and use of Fuzzy structural equations-Based content in the framework of the field method of the researcher-made questionnaire. This questionnaire has 22 questions. The questions of the prepared questionnaire have the following characteristics:
1) Clear and clear transmission of content using Fuzzy structural equations-Based content: 4,7,11,16,18
2) Using teaching aids: 1, 2, 5, 6, 8, 13
3) Organizing, sequencing and setting content using Fuzzy structural equations-Based content: 9, 10, 21
4) Interaction with students using Fuzzy structural equations-Based media for better teaching: 12, 19, 20, 22
5) measuring the level of skill and mastery of teachers in preparing and working with media: items 14, 15, 3, 17 Items are reverse scored 3, 17.

4.3. Empirical Results

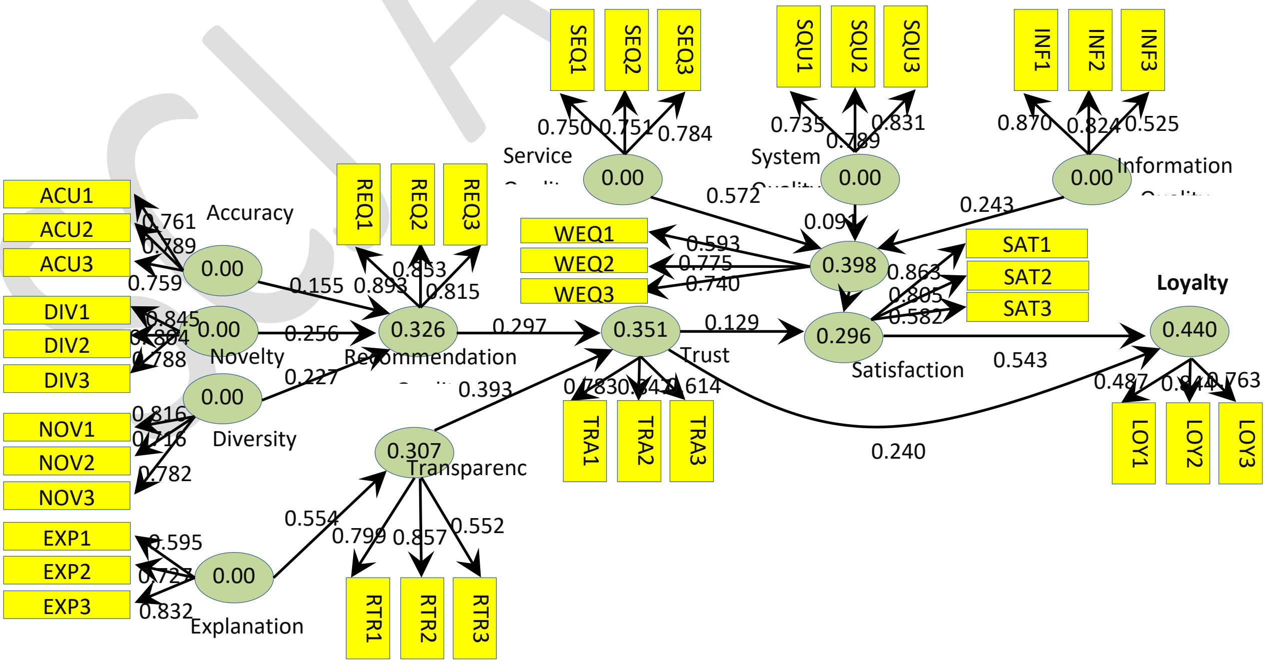
In this study, the participants of our reseach survey were asked to to express their opinions on each item of In this study, participants were asked to provide their opinions on each item of a questionnaire using a five-point Likert scale ranging from "Strongly Agree" to "Strongly Disagree." The scores were then averaged and analyzed using a one-sample t-test against a test value of 3. The results in Table 4 showed that,All constructs have mean values significantly above 3 (neutral point), indicating a positive perception and acceptance among participants regarding all aspects of the Fuzzy structural equations-based learning system. The high t-values (e.g., Teaching Accuracy = 29.20) confirm that these positive perceptions are statistically significant, indicating desirable conditions at a 95% confidence level.Structural equation Solo-Modeling was used in SmartPLS software to validate the value of each indicator. This technique involved path diagrams and confirmatory factor analysis to generate a Solo-Model of structural equations, which was divided into two phases: CFA and path analysis. In the measurement section, relationships between questionnaire items and constructs were identified, while the structural part identified relationships between factors to address research questions. Construct validity was confirmed using confirmatory factor analysis (CFA) to ensure that the standard loading factor was greater than 0.4 and the t-value was greater than 1.96 for each item in the factor analysis test. All items provided appropriate factor loading values for measuring the constructs studied in the research Solo-Model, as shown in Table 5. Convergent validity was assessed using Average Variance Extracted (AVE), which indicated the degree of variance that a construct derived from its items. An AVE value above 0.5 was considered acceptable, and all AVE values in Table 6 met this criterion, indicating that convergent validity had been established. To assess discriminant validity, the Fornell-Larcker criterion was used on all constructs to show correlation values. According to this criterion, the square root of the AVE of each construct must be higher than its highest correlation with any other construct. The results in Table 7 indicated that the Solo-Model had established discriminant validity. Finally, the Goodness of Fit (GoF) index was used to evaluate the overall fit of the proposed Solo-Model, which was calculated using the Coefficient of Determination (R2) and average indicators. The GoF is presented in Eq. (1).

$$GoF = \sqrt{\frac{\sum_{j=1}^{J}\sum_{q=1}^{pj} Cor^2\,(x_{qj}, \hat{\aleph}_j)}{\sum_{j=1}^{J} P_j} \times \frac{\sum_{j^*}^{J^*} R^2(\hat{\aleph}_{j^*} P_j))}{J^*}} \quad (1)$$

where J indicates the number of latent variables of the Solo-Model, J^* indicates the number of endogenous latent variables of the Solo-Model, $Cor^2(x_{qj}, \hat{\aleph}_j)$ indicates the correlation and $R^2(\hat{\aleph}_{j^*} P_j)$ indicates the R^2 value of the regression.

Tables 5–6 (Factor Loadings and AVE): Every factor loading exceeded 0.5, confirming strong item reliability. AVEs for all constructs were > 0.5, confirming convergent validity. This suggests that the items within each construct consistently represent their respective latent variables.

The results of GoF for the proposed Solo-Model are presented in Table 8(Goodness of Fit). The value of 0.455 for GoF indicates a strong fit of the measurement Solo-Model, exceeding the thresholds of 0.01, 0.25, and 0.36 that represent weak, moderate, and strong values, confirming the overall robustness of the measurement and structural models.



GoF.

Fig. 2. Structural path model

In order to ensure the reliability of the survey questionnaire used in this study, the researchers calculated both Cronbach's alpha and Composite Reliability (CR) for all constructs, with a minimum threshold of 0.6 considered acceptable. The results in Table 9 showed that all variables had Cronbach's alpha and CR values greater than 0.6, indicating acceptable reliability of the research instrument. The researchers then evaluated the structural path Solo-Model using PLS-SEM in the final step of their analysis to estimate path coefficients and determine the strengths of relationships between independent and dependent constructs[23]. The R2 values provided by the Solo-Model indicate the amount of variance explained by the independent variables. The loadings and significance of the structural path Solo-Model demonstrate how well the survey data support the hypotheses of the Solo-Model. Fig. 2 displays the structural path Solo-Model for the PLS-SEM analysis [24]. Tables 10-22(Hypotheses Testing) present the results for each hypothesis tested in the study. For each hypothesis, the t-value at a certain confidence level was examined to determine whether there was a significant relationship between the relevant constructs. Overall, the results suggest that improvements in information quality, system quality, algebraic thinking quality, study accuracy, study novelty, study diversity, study quality, study explanation, transparency, clear and effective transfer of content to students, student satisfaction, and mathematics teaching are all positively correlated. All hypotheses were supported with statistically significant path coefficients. For instance, the path coefficient for SEQ $\rightarrow$ WEQ is 0.572 ($t = 14.005$), indicating a strong, direct positive impact of service quality on web-based algebraic thinking quality. Likewise, transparency and explanation had significant impacts on student satisfaction and teaching effectiveness.

5. Discussion

The first part of the findings shows that there is a significant difference between the teaching method of trained and untrained teachers in the component of transparent and clear transfer of content using Fuzzy structural equations-Based content. The mentioned result of Clark [25] who states in an illustration: "The role of the media in the transfer of algebraic thinkingal content to the learner is specified.Also, the results of research showed that in traditional teaching methods, the teacher cannot clearly convey the algebraic thinkingal content to the students due to the lack of use of algebraic thinkingal equipment [26]. The findings of two studies show that the use of content Fuzzy structural equations-Based has a significant impact on the clear and transparent transfer of information to students [27].

The second part of the findings showed that there is a significant difference between the teaching methods of trained and untrained teachers in the component of using algebraic thinkingal aids in teaching. This finding is consistent with the results of numarous researchers in this field [28]. So that in the research different ways to the importance of using information and communication technology (Fuzzy structural equations-Based content) in the teaching and algebraic thinking process and its effectiveness in improving algebraic thinking through the possibility of simulation, algebraic thinkingal network, computer-assisted algebraic thinking, virtual laboratory, virtual workshops, cores Research, group work using computer and internet, search and research through the web and preparation of lessons and evaluation have been mentioned. The teacher has been listed under the headings of using hardware, using software, using information and communication technology in the learner's activity, and the use of information technology (use of teaching aids) by teachers in implementing the curriculum and it helps effective teaching and creating innovation, so that the necessity of using algebraic thinking resources other than textbooks has attracted the attention of most of the people involved in algebraic thinking systems in different countries during the last few decades[29]. Non-curriculum resources are any means other than textbooks. which has a positive and useful role in improving the teaching and algebraic thinking process during algebraic thinking [30]. If we put together the findings of the present study, we come to the conclusion that there is a significant relationship between the use of algebraic thinkingal aids and better teaching. so that the use of algebraic thinkingal aids increases the quality of teachers' teaching [31].

The third part of the findings shows that there is a significant difference between the teaching method of trained and untrained teachers in the component of organization, sequence and arrangement of content using Fuzzy structural equations-Based content. This finding is with the results of researchers, which states that in the traditional teaching methods, the teacher cannot transmit the algebraic thinkingal materials to the students clearly due to the lack of use of algebraic thinkingal equipment, as well as the preparation of the class for thinking, discussion, and organization. And communicating the subject becomes difficult. A learner who learns alone can get advice from algebraic thinkingal materials. That is, more explanations and a set of correct answers that should be integrated with the algebraic thinkingal material. In this type of algebraic thinking, a person must acquire knowledge by using the available resources and answer a set of questions that are in the databases and immediately see the reaction of the system [32]. If the student's test results are good or bad, the computer system reacts very quickly. Therefore, in this type of algebraic thinking, the existence of an internet-based connection is necessary to obtain up-to-date resources. On the other hand, the conducted research indicates that the use of information and communication technology gives students the opportunity to master technology and self-direction. In fact, by changing his role from a transmitter to a facilitator, the teacher can provide the content of information to the student and, on the other hand, facilitate the learner's activities, which is the result of algebraic thinking [33]. To play such a role, it is necessary to have capable and skilled teachers in the field of teaching subjects and the use of information and communication technology, so that by having the necessary skills to use information and communication technology in the effective teaching-algebraic thinking process, they can use all kinds of technology. related and appropriate to the lesson and content, and make the algebraic thinking process more effective and attractive, and by using information and communication technology in the teaching process, make students use more senses and learn better[31]. If we put together the findings of the current research, we come to the conclusion that there is a significant relationship between the organization, sequence and arrangement of content in the use of Fuzzy structural equations-Based content with teaching. From the Fuzzy structural equations-Based content, it increases the teaching quality of the teachers in organizing, sequencing and setting the content.

The fourth part of the findings showed that there is a significant difference between the teaching methods of trained and untrained teachers in the component of interacting with students using Fuzzy structural equations-Based content. The component of interacting with students using Fuzzy structural equations-Based content brings better teaching to teachers. Use of information technology), space and time limitations are removed and the concept of the class is developed. Fuzzy structural equations-Based whiteboards are used in these classes and the level of interaction between the students and the teacher is very high. The connection to the class is made through a computer. A better teacher can design algebraic thinking activities in a collaborative way, students form a team and participate in algebraic thinking." also stated that: "Information and communication technology as a new approach complements algebraic thinking. rather than replacing it, the purpose of its development is to improve and make algebraic thinking resources more efficient, especially human resources. The expansion of information technology and the use of new tools and concepts, the field of information expansion and easy and low-cost access for learners It provides both students, students and teachers in a direct way and enables quick exchange of information and cultural interactions. In fact, teachers who use Fuzzy structural equations-Based content for teaching are more interactive than their colleagues. It is consistent with their hope, because based on the above three studies, the use of Fuzzy structural equations-Based content Fuzzy structural equations-Based means more interaction between the teacher and the students in teaching[33] .

And finally, the fifth part found that there is a significant difference between the teaching methods of trained and untrained teachers in the component of teachers' skill level and mastery in preparing and working with media. The component of teachers' skill level and mastery in preparing and working with media It helps teachers to teach better. The result obtained by indicates that the use of computers and Fuzzy structural equations-Based content can strengthen the teaching skills of teachers and respond to the needs of students for algebraic thinkingal and algebraic thinkingal activities and finally to create new fields for creativity in Algebraic thinkingal activities will lead, he pointed out. The role of information and communication technologies is very important in the algebraic thinking cycle. Algebraic thinking in the traditional way, a person is forced to read and write continuously and the communication was almost one-way. But with the use of information and communication technology in algebraic thinking, in addition to basic skills, a person needs to have skills in using information and communication technologies. Algebraic thinking based on modern information technologies, by creating fundamental changes in the concepts of traditional algebraic thinking, has been able to solve many inefficiencies of algebraic thinkingal systems and bring about fundamental changes in algebraic thinking. By using the virtual world in algebraic thinking, new and efficient algebraic thinking methods can be achieved[34]. The reason for using information and communication technology in algebraic thinking is better and faster algebraic thinking. Teachers should also be aware and diligent about the latest practices in the field of teaching-algebraic thinking and optimizing students' algebraic thinking. While such practices may be implemented in some schools and regions, it is necessary for all schools to be able to use the latest research findings on a regular basis in order to be guided in the direction of changing teaching methods and applying these findings in algebraic thinking assessment. Such a setting requires that teachers and algebraic thinkingal managers equip themselves as knowledge workers with a set of 21st century skills. The results of this research and the above research emphasize the point that the skill of preparing and using media has helped and influenced teachers' teaching as much as possible.

The findings of the second hypothesis of the research showed that there is a significant difference in the component of the amount of preparation and use of Fuzzy structural equations-Based content in teaching by teachers between the qualitative status of cognitive skills, emotions, self-regulation and usefulness in the proposed Solo-Model of mathematical strategic algebraic thinking by Fuzzy structural equations-Based method of student teachers of mathematics algebraic thinking in the School. There are scholars of Tehran campus. So that the amount of preparation and use of Fuzzy structural equations-Based content in teaching by trained teachers is more than untrained teachers. However, the amount of preparation and use of Fuzzy structural equations-Based content by untrained male and female teachers is the same[35]. The mentioned result with the results of the researchers stated: the algebraic thinking skills of the 21st century play the most fundamental role in improving the processes in schools. By mastering the algebraic thinking skills of the 21st century (cognitive, communication and research skills), learners regardless of age, gender and socio-economic background and at their level of algebraic thinking can immerse themselves in the sea of meaningful and challenging algebraic thinking through pure mental activity. who investigated the relationship between the use of information and communication technology (Fuzzy structural equations-Based content) and the demographic characteristics of academic staff members of Ferdowsi School of Mashhad. And they showed that they dealt with the demographic characteristics of the faculty members of Ferdowsi School of Mashhad and showed that gender had an effect on the amount of technology use and performance of people. So that the average use of computers and software, internet and internet services The rate of use of information and communication technology in performing algebraic thinkingal functions of women is more than that of men, and the rate of use of information and communication technology in performing research functions of men is more than that of women. The conducted research and this research confirm that women use information technology more than men.

And the component of the level of skill and mastery of teachers in preparing and working with media has had a significant relationship in using the above components, so that the higher the level of skill and mastery in preparing and working with media is, it will bring better teaching for teachers . Had Also, the current research shows that the component of the amount of preparation and use of Fuzzy structural equations-Based content among female trained teachers is more than male trained teachers. According to this result and the results of the conducted research, female teachers teach better and more meaningfully. In the process of teaching and algebraic thinking, compared to male teachers, they have been more successful in preparing and using Fuzzy structural equations-Based content than male teachers.

6. Conclusion

The results showed that there is a significant difference between the teaching methods of trained and untrained teachers in terms of clear and clear transfer of materials using Fuzzy structural equations-Based content, use of algebraic thinkingal aids, organization, sequence and adjustment of materials using Fuzzy structural equations-Based content, interaction with There are students using Fuzzy structural equations-Based media and the level of skill and mastery of teachers in preparing and working with medi . This result shows that the independent variable of algebraic thinkingal courses (classes for producing and using Fuzzy structural equations-Based content) was effective in the teaching method of trained teachers in terms of producing and using Fuzzy structural equations-Based content (Eta square 0.94).

In the present study, the components of clear and clear transfer of content using Fuzzy structural equations-Based content, use of algebraic thinkingal aids, organization, sequence and adjustment of content using Fuzzy structural equations-Based content and interaction with students Using Fuzzy structural equations-Based media, they are introduced as useful components, which has a significant relationship with teachers' teaching methods.

Also, the amount of preparation and use of Fuzzy structural equations-Based content in teaching is different between the qualitative status of cognitive skills, emotions, self-regulation and usefulness in the proposed Solo-Model of strategic algebraic thinking of mathematics in the Fuzzy structural equations-Based method of student teachers in the field of mathematics algebraic thinking in Primiary School of Tehran. with the difference that the amount of preparation and use of Fuzzy structural equations-Based content in teaching by trained female teachers is more than that of trained male teachers. However, the amount of preparation and use of Fuzzy structural equations-Based content by untrained male and female teachers is the same. According to the findings related to the preparation and use of Fuzzy structural equations-Based content, it is suggested to plan and implement Fuzzy structural equations-Based content production classes at the first opportunity for the cultural students who have not seen the mentioned course. According to the findings related to the use of algebraic thinkingal aids, it is suggested that the results of the training provided to the students should be reviewed separately from each course, and the strengths and weaknesses of each course should be identified and necessary measures should be taken to eliminate the weaknesses. According to the findings related to the use of algebraic thinkingal aids, it is suggested to use incentives for students' participation in Fuzzy structural equations-Based production classes. According to the findings related to the preparation and use of Fuzzy structural equations-Based content, it is suggested that the Ministry of Algebraic thinking make participation in Fuzzy structural equations-Based content production classes mandatory for teachers and algebraic thinkingal staff. According to the findings regarding the clear and transparent transfer of materials, it is suggested that the officials of the algebraic thinking organization should reduce the amount of weekly teaching hours of the teachers as much as possible and instead seek the quality of teaching by using Fuzzy structural equations-Based content.

Table 1. The developed reseach hypotheses

Hypothesis	Description
H1	The algebraic thinking quality will positively influence the class quality in study systems.
H2	The information quality will positively influence the class quality in study systems.
H3	The system quality will positively influence the class quality in study systems.
H4	The class quality will positively influence the student satisfaction in study systems.
H5	The study accuracy will positively influence the study quality in study systems.
H6	The study diversity will positively influence the study quality in study systems.
H7	The study novelty will positively influence the study quality in study systems.
H8	The study quality will positively influence the student clear transfer of content in study systems.
H9	The study explanation will positively influence the study transparency in study systems.
H10	The study transparency will positively influence the Student satisfaction in study systems.
H11	The student clear transfer of content will positively influence the Student satisfaction in study systems.
H12	H12: The satisfaction will positively influence the mathematics teaching in study systems.
H13	H13: The clear and clear transfer of content will positively influence the mathematics teaching in study

Table 2. The demographic information of the survey participants

	Items	Frequency	Percent
Age	<20	87	22.7%
	20-30	116	30.2%
	30-40	118	30.7%
	40-50	39	10.2%
	>50	24	6.6%
Gender	Male	150	39.1%
	Female	234	60.9%
Education	Bachelor	86	22.4%

	Master	172	44.8%
	PhD	126	32.8%
Experince	<3 years	78	20%
	3-6 years	179	47%
	>6 years	127	33%

Table 3. Constructs and Items of the questionnaire

Construct	**Measurement item**	**Item**
Teaching Accuracy	ACU1	The teachings provided by the teach system are relatively good.
	ACU2	The teachings provided by the teach system are match to my preference.
	ACU3	The teachings provided by the teach system are better than those that my friends suggested me.
Teaching Novelty	NOV1	The teach system helps me to discover new contents
	NOV2	The teach system recommended me that I never expect them to receive.
	NOV3	The teachings are new and interesting.
Teaching Diversity	DIV1	The teach system suggested me the variety of the items.
	DIV2	I was always happy when receiving the items from the teach system.
	DIV3	The recommended items were too similar to those items that I expected to receive.
Teaching Quality	REQ1	The quality of the teachings is exactly what I wanted.
	REQ2	In general, the quality of teachings of the teach system is valuable.
	REQ3	My overall assessment of the teachings of the system is great.
Explanation	EXP1	The teachings explanations of teach system are complete and sufficient.
	EXP2	The teachings explanations are in accordance with my needs.
	EXP3	The teach system explains is recommended.
Teaching Transparency	RTR1	Teachings lead to increase my acceptance of the teach system.
	RTR2	The teach system helps me understand the reason why teachings are made.
	RTR3	Teachings from the teach system help me in making better decisions.
Trust	TRA1	I trust the recommended items of this e-algebraic thinking.
	TRA2	I trust the information provided on this E-algebraic thinking.
	TRA3	I trust the special teachings provided on this E-algebraic thinking.
Information Quality	INF1	The information provided in this E-algebraic thinking is accurate.
	INF2	The information provided in this E-algebraic thinking is up-to-date.
	INF3	The webE-algebraic thinking of this content provides related information.
Systems Quality	SQU1	The webE-algebraic thinking of this content is visually appealing.
	SQU2	It is easy to work with this content's webE-algebraic thinking.
	SQU3	The webE-algebraic thinking's navigation of this content is easy.
Algebraic thinking Quality	SQU1	The webE-algebraic thinking of this content provides professional services.
	SQU2	The webE-algebraic thinking of this content answers my questions promptly.
	SQU3	The webE-algebraic thinking of this content provides timely services.
WebE-algebraic thinking Quality	WEQ1	My overall assessment of the design features of this webE-algebraic thinking is high.
	WEQ2	The webE-algebraic thinking quality was high and meets my expectations.
	WEQ3	This webE-algebraic thinking recommends unique features that are different from other web E-algebraic thinkings.
Satisfaction	SAT1	I am satisfy with the goods and services provided on this webE-algebraic thinking.
	SAT2	I am satisfied with the contents which I purchased from this webE-algebraic thinking.
	SAT3	My choice to learn from this webE-algebraic thinking is wise choice.
Loyalty	LOY1	I will say positive things regarding this webE-algebraic thinking contents and services to my friends.
	LOY2	I will used elarning from this online content in the future.
	LOY3	I recommend this E-algebraic thinking to my classmate.

Table 4. Descriptive statistics of research variables

Variables	Number of Samples	Test Value	Average	Median	Standard Deviation	Min.	Max.	t-value
Teaching Accuracy	384	3	4.03	٤.00	0.69	٢.00	٥	29.20
Teaching Novelty	384	3	3.96	٤.00	0.71	٢.00	٥	26.37
Teaching Diversity	384	3	4.01	4.33	0.78	1.67	٥	25.28
Teaching Quality	384	3	4.03	٤.00	0.81	1.33	٥	24.83
Explanation	384	3	3.98	٤.00	0.71	1.33	٥	27.03
Transparency	384	3	4.10	4.33	0.69	٢.00	٥	31.86
Trust	384	3	4.16	4.33	0.68	1.67	٥	33.68
Information Quality	384	3	4.13	4.33	0.67	٢.00	٥	٣٣.00
Algebraic thinking Quality	384	3	4.15	4.33	0.72	٢.00	٥	31.38
Service Quality	384	3	3.97	٤.00	0.77	٢.00	٥	24.77
WebE-algebraic thinking Quality	384	3	3.90	٤.00	0.71	1.67	٥	24.82
Satisfaction	384	3	3.90	٤.00	0.74	1.67	٥	23.78
Loyalty	384	3	3.87	٤.00	0.69	٢.00	٥	24.64

Table 5. Factor loading for Items of the questionnaire

Construct	Measurement item	Factor Loading	t-Value	Significance Level
Teaching Accuracy	ACU1	0.761	23.757	<0.05
	ACU2	0.788	26.665	<0.05
	ACU3	0.759	16.458	<0.05
Teaching Novelty	NOV1	0.816	27.676	<0.05
	NOV2	0.716	18.324	<0.05
	NOV3	0.782	22.767	<0.05
Teaching Diversity	DIV1	0.846	47.919	<0.05
	DIV2	0.804	34.967	<0.05
	DIV3	0.788	33.603	<0.05
Teaching Quality	REQ1	0.893	80.090	<0.05
	REQ2	0.852	40.799	<0.05
	REQ3	0.815	32.613	<0.05
Explanation	EXP1	0.595	6.9450	<0.05
	EXP2	0.727	12.909	<0.05
	EXP3	0.832	22.112	<0.05
Teaching Transparency	RTR1	0.799	28.428	<0.05
	RTR2	0.857	44.204	<0.05
	RTR3	0.652	10.641	<0.05
Trust	TRA1	0.733	18.785	<0.05
	TRA2	0.847	29.247	<0.05
	TRA3	0.641	9.1500	<0.05
Information Quality	INF1	0.869	33.591	<0.05
	INF2	0.824	18.872	<0.05
	INF3	0.525	4.7820	<0.05
algebraic thinking Quality	SQU1	0.736	11.875	<0.05
	SQU2	0.739	13.619	<0.05
	SQU3	0.831	23.759	<0.05
Service Quality	SEQ1	0.750	18.776	<0.05
	SEQ2	0.781	23.446	<0.05
	SEQ3	0.784	33.369	<0.05
WebE-algebraic thinking Quality	WEQ1	0.593	8.9660	<0.05
	WEQ2	0.775	20.524	<0.05

	WEQ3	0.739	21.131	<0.05
Satisfaction	SAT1	0.863	54.073	<0.05
	SAT2	0.805	21.191	<0.05
	SAT3	0.582	9.7750	<0.05
Loyalty	LOY1	0.487	6.6280	<0.05
	LOY2	0.844	40.918	<0.05
	LOY3	0.762	26.760	<0.05

Table 6. Convergent validity of the constructs

Construct	**AVE**
System Quality	0.593
algebraic thinking Quality	0.595
Information Quality	0.571
WebE-algebraic thinking Quality	0.599
Teaching Novelty	0.597
Teaching Diversity	0.661
Teaching Accuracy	0.590
Teaching Quality	0.729
Explanation	0.525
Transparency	0.598
Trust	0.570
Loyalty	0.510
Satisfaction	0.577

Table 7. Discriminant validity of the construct of instrument

	INF	**SQU**	**SEQ**	**WEQ**	**ACU**	**NOV**	**DIV**	**REQ**	**EXP**	**RTR**	**TRA**	**LOY**	**SAT**
INF	0.76												
SQU	0.73	0.77											
SEQ	0.58	0.76	0.77										
WEQ	0.61	0.61	0.68	0.71									
ACU	0.61	0.63	0.55	0.62	0.77								
NOV	0.71	0.69	0.67	0.69	0.75	0.77							
DIV	0.71	0.71	0.64	0.67	0.72	0.65	0.81						
REQ	0.69	0.65	0.63	0.68	0.68	0.71	0.72	0.85					
EXP	0.67	0.65	0.62	0.64	0.62	0.68	0.74	0.65	0.72				
RTR	0.69	0.69	0.72	0.69	0.7	0.73	0.76	0.68	0.7	0.77			
TRA	0.74	0.62	0.68	0.65	0.67	0.65	0.7	0.68	0.67	0.73	0.76		
LOY	0.59	0.71	0.69	0.66	0.68	0.74	0.79	0.7	0.62	0.71	0.65	0.71	
SAT	0.65	0.73	0.58	0.7	0.67	0.76	0.73	0.58	0.58	0.62	0.59	0.74	0.76

Abbreviations: INF="Information Quality"; SQU: "System Quality"; SEQ: "algebraic thinking Quality"; WEQ: "WebE-algebraic thinking Quality"; ACU: "Teaching Accuracy"; NOV: "Teaching Novelty"; DIV: "Teaching Diversity"; REQ: "Teaching Quality"; EXP: "Explanation"; RTR: "Transparency"; TRA: "Trust"; LOY: "Loyalty"; SAT: "Satisfaction".

Table 8. GoF of the model

Construct	**Average**	**R^2**
Information Quality	0.571	-
System Quality	0.593	-
algebraic thinking Quality	0.595	-
WebE-algebraic thinking Quality	0.499	0.398
Teaching Accuracy	0.592	-
Teaching Novelty	0.597	-
Teaching Diversity	0.661	-
Teaching Quality	0.729	0.326
Explanation	0.525	-
Transparency	0.598	0.308
Trust	0.569	0.351
Loyalty	0.577	0.296
Satisfaction	0.510	0.440
GoF=0.455		

Table 9. Discriminant validity of the constructs

Construct	**Cronbach's Alpha**	**CompoE-algebraic thinking Reliability**
Information Quality	0.606	0.793
System Quality	0.684	0.813
algebraic thinking Quality	0.666	0.815
WebE-algebraic thinking Quality	0.695	0.748
Teaching Accuracy	0.657	0.813
Teaching Novelty	0.661	0.816
Teaching Diversity	0.743	0.853
Teaching Quality	0.814	0.890
Explanation	0.691	0.765
Transparency	0.660	0.815
Trust	0.608	0.796
Loyalty	0.635	0.749
Satisfaction	0.621	0.799

Table 10. The result of the first hypothesis

Hypothesis (Path)	Path Coefficient			t-value	Result	Relationship
	Direct Effect	Indirect Effect	Total Effect			
INF→WEQ	0.243	-	0.243	4.923	Supported	↑

Table 11. The result of the second hypothesis

Hypothesis (Path)	Path Coefficient	t-value	Result	Relationship

	Direct Effect	Indirect Effect	Total Effect			
SQU→WEQ	0.091	-	0.091	1.798	Supported	↑

Table 12. The result of the third hypothesis

Hypothesis (Path)	Path Coefficient			t-value	Result	Relationship
	Direct Effect	Indirect Effect	Total Effect			
SEQ→WEQ	0.572	-	0.572	14.005	Supported	↑

Table 13. The result of the fourth hypothesis

Hypothesis (Path)	Path Coefficient			t-value	Result	Relationship
	Direct Effect	Indirect Effect	Total Effect			
WEQ→SAT	0.475	-	0.475	11.213	Supported	↑

Table 14. The result of the fifth hypothesis

Hypothesis (Path)	Path Coefficient			t-value	Result	Relationship
	Direct Effect	Indirect Effect	Total Effect			
ACU→REQ	0.165	-	0.165	2.251	Supported	↑

Table 15. The result of the sixth hypothesis

Hypothesis (Path)	Path Coefficient			t-value	Result	Relationship
	Direct Effect	Indirect Effect	Total Effect			
NOV→REQ	0.256	-	0.256	3.000	Supported	↑

Table 16. The result of the seventh hypothesis

Hypothesis (Path)	Path Coefficient			t-value	Result	Relationship
	Direct Effect	Indirect Effect	Total Effect			
DIV→REQ	0.227	-	0.227	4.525	Supported	↑

Table 17. The result of the eighth hypothesis

Hypothesis (Path)	Path Coefficient			t-value	Result	Relationship
	Direct Effect	Indirect Effect	Total Effect			
REQ→TRA	0.297	-	0.297	6.023	Supported	↑

Table 18. The result of the ninth hypothesis

Hypothesis (Path)	Path Coefficient			t-value	Result	Relationship
	Direct Effect	Indirect Effect	Total Effect			
EXP→RTR	0.554	-	0.554	18.828	Supported	↑

Table 19. The result of the tenth hypothesis

Hypothesis (Path)	Path Coefficient	t-value	Result	Relationship

	Direct Effect	Indirect Effect	Total Effect			
RTR →TRA	0.393	-	0.393	7.322	Supported	↑

Table 20. The result of the eleventh hypothesis

Hypothesis (Path)	Path Coefficient			t-value	Result	Relationship
	Direct Effect	Indirect Effect	Total Effect			
TRA →SAT	0.129	-	0.129	2.917	Supported	↑

Table 21. The result of the twelfth hypothesis

Hypothesis (Path)	Path Coefficient			t-value	Result	Relationship
	Direct Effect	Indirect Effect	Total Effect			
TRA →LOY	0.240	0.070	0.310	5.243	Supported	↑

Table 22. The result of the thirteenth hypothesis

Hypothesis (Path)	Path Coefficient			t-value	Result	Relationship
	Direct Effect	Indirect Effect	Total Effect			
SAT →LOY	0.543	-	0.543	14.776	Supported	↑

Table 23. The results for all hypotheses in the model

Hypothesis	Path Coefficient			t-value	Result	Relationship
	Direct	Indirect	Total			
INF→WEQ	0.243	-	0.243	4.923**	Supported	↑
SQU→ WEQ	0.091	-	0.091	1.798*	Supported	↑
SEQ→ WEQ	0.572	-	0.572	14.005**	Supported	↑
WEQ→SAT	0.475	-	0.475	11.213**	Supported	↑
ACU→REQ	0.165	-	0.165	2.251**	Supported	↑
NOV→REQ	0.256	-	0.256	3.000**	Supported	↑
DIV→REQ	0.227	-	0.227	4.525**	Supported	↑
REQ→TRA	0.297	-	0.297	6.023**	Supported	↑
EXP→RTR	0.554	-	0.554	18.828**	Supported	↑
RTR→TRA	0.393	-	0.393	7.322**	Supported	↑
TRA→SAT	0.129	-	0.129	2.917**	Supported	↑
SAT→LOY	0.24	0.070	0.31	5.243**	Supported	↑
TRA→LOY	0.543	-	0.543	14.776**	Supported	↑

** p < 0.05, * p < 0.1

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