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The effect of field independence on self-control and self-management skills in distance education of freshman college students to the strategy for ADHD students

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Abstract

This research aims to determine the extent to which first-year tertiary students exhibit Field Independence (FI) as a mediator in their self-control and self-management skills (SCMSk). The second phase of the study aimed to investigate strategies for preparing high school students with attention deficit hyperactivity disorder (ADHD) to successfully navigate their academic lives based on the findings from the first phase. Explanatory sequential design was used in this mixed-methods research. The researcher selected 400 first-year students as participants and asked them to respond to a questionnaire based on five major factors. The focus group discussion included 10 special education teachers, four school directors and six psychologists who provided suggestions and strategies to assist ADHD students while attending online lessons. The examination of the goodness-of-fit indices (GFI) for this model was found to be .982 and FI served as a partial mediator in this model. Furthermore, SCMSk was directly influenced by other factors. In the second phase, the stakeholders proposed effective strategies by focusing on the development of five relevant factors. The findings are advantageous for teachers and other stakeholders working with students with ADHD. Variables could serve as indications helping teachers develop effective strategies to enhance online learning.

Keywords: ADHD, Field independence, Online learning, Self-control and self-management skills, Self-directed learning, Trial and error learning.

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Contents

Contribution of this paper to the literature

Most previous research on Field-Dependence-Independence (FDI) has investigated various cognitive styles without concentrating on a sample group defined purely by FI. There has been no specific research on how FI learners particularly those with ADHD might improve their self-control and self-management during remote education.

1. Introduction

The COVID-19 pandemic had a significant impact on global schooling settings. Pokhrel and Chhetri (2021) conducted a literature analysis and discovered that several educational institutions including schools, colleges and universities have terminated in-person instruction. This may extend into the 2020 school year or beyond. Consequently, alternative education systems were created and implemented. According to Engzell, Frey, and Verhagen (2021) the Netherlands is now under a brief period of lockdown. Educational institutions are being provided with fair and sufficient financial support. Furthermore, this nation has unparalleled broadband penetration rates. Students achieved little advancement when learning remotely despite the advantageous circumstances. Self-control and self-management skills (SCMSk) refer to an individual's capacity to regulate their own behaviors and conform to socially accepted norms and acts. They are crucial traits that significantly contribute to achieve success in life. These two abilities described are beneficial for students to be prepared for many types of learning and to navigate the world especially in the current "new normal" situation. According to Mezo (2009) SCMS may be used by students as a tool. Consequently, these abilities seem to be essential for predicting good behaviors as well as students' academic achievement.

One of the notable occurrences is low engagement while studying online which discourages motivation for learning. According to Hollister, Nair, Hill-Lindsay, and Chukoskie (2022) during online lectures, students' active engagement and presence decreased which had a detrimental influence on their whole online learning experience. The majority of students had problems keeping in contact with their classmates and professors as well as regulating the pace of their work. Therefore, self-control and self-management skills must play a role in increasing attention to lessons and the responsibility to complete all assignments on time. Self-control and self-management influence students' adaptation to the e-learning process. Some students have strong self-control abilities while others lack them. Individuals with inadequate self-control abilities need more assistance in setting learning objectives carrying out the learning process and accessing information resources (Schlosser & Simonson, 2009).

Students with ADHD have challenges with self-control while engaging in online activities. They exhibited more difficulties in monitoring their learning compared to students without ADHD symptoms (Becker et al., 2020). Tessarollo et al. (2022) examined how students with ADHD manage their self-control. The findings indicate that online learning exacerbates the challenges of academic performance particularly for students with ADHD. Therefore, students who are required to succeed in online learning must possess essential self-control and self-management abilities.

Therefore, this research responded to the question of whether learners who held the cognitive style known as Field Independence (FI), the cognitive style element involving learners who rely more on internal signals and can effectively separate specialized information from its surrounding environment can generate higher self-control and self-management skills and whether the related factors were significant to be fundamental elements to developing effective teaching and learning strategies for ADHD students. Most former research was conducted on Field-Dependence-Independence (FDI) without the emphasis on only a selected sample group with FI. This research tried to open the window of what factors or elements can be enhanced to maintain the self-control and self-management of students (also ADHD individuals) while participating in distance education.

2. Literature Review

Self-control and self-management skills are the abilities of individuals to control themselves as they behave and practice to suit society's socially acceptable actions (Smadi & Bani-Abduh, 2017). Self-control is one of the mental issues in which individuals can control their desires and give up sudden pleasures for future rewards. According to Fox and Calkins (2003) self-control is the ability of individuals to command and control their practices, behaviors and emotions to participate in a specific proper circumstance. Self-management is the skill or ability to manage one's behaviors, thoughts and emotions consciously and effectively. Individuals who have developed self-management will consciously comprehend how to act in different situations. According to Ghali and Miri (2018) self-management implies the ability of people to oversee and screen their actions and decisions. This skill helps students become self-motivated contributing to the achievement of tasks. The concepts of SCMSk are widely accepted since self-management is a reflection of self-control (Halford, 2003). This concept extended the scope of the processes' specificity to encompass knowledge and beliefs, self-regulation skills and talents, and social facilitation (Ryan & Sawin, 2009).

In this study, Kanfer (1970) and Bandura (1991) suggested the use of self-control and self-management abilities. There are three constructions consisting of three interrelated processes. Self-monitoring (SM) is the first component serving as the primary stage for students. During this stage, students observe and oversee the behaviors that need to be altered or sustained including actions, ideas, or emotions and prioritize instructive inputs. In the second step, known as self-evaluating (SE), students assess their own progress by comparing their conduct against an internalized standard. They determine whether they have successfully met the monitored stimuli and made progress towards their desired goals. The last element is self-reinforcing (SR). In this context, students participate in SR which might entail self-rewarding or self-punishment (Mezo & Short, 2012).

Field-Dependence-Independence (FDI) is a well-researched aspect of cognitive styles. The notion which has been extensively studied for many years serves as the fundamental basis for several research projects. It has been successfully used to assess individuals' skills in visuospatial and perceptual processing (Üstünel & Meral, 2015). This cognitive learning style elucidates the learners' methodologies for acquiring knowledge in many disciplines. Furthermore, Field-dependence-independence (FDI) has served as a basis for the study of information acquisition, storage and analysis to produce new knowledge. This includes the cognitive processes of

decision-making, problem-solving and perception among others. According to Farmaki, Sakkalis, Loesche, and Nisiforou (2019) learning and teaching methods are related to two different cognitive processes called Field Dependence (FD) and Field Independence (FI).

When comparing FD and FI, the word "field" refers to the context or circumstances that have a distinct impact on an individual's competence and learning in varying ways. Witkin, Moore, Goodenough, and Cox (1977) initiated an experiment with this particular learning method. FD learners tend to be more inclined towards social material and depend heavily on a supplied framework. However, they are less self-motivated since they strongly react to external reinforcement. Conversely, FI learners are less dependent on a prescribed framework and instead are driven by their motivation. FI learners are often characterized as those with high levels of general intelligence.

According to Witkin and Goodenough (1981) three aspects recognized in the cognitive styles of FD and FI include 1) reliance on internal vs. external referents. 2) Cognitive restructuring skills. 3) Interpersonal competencies. Students with FD and FI exhibit differing cognitive learning strategies based on their reliance on internal and external referents. FD students may need to distinguish between inputting data and the surrounding context. External stimuli often have an effect on individuals as seen by Guisande, Páramo, Tinajero, and Almeida (2007). Conversely, students in the field of FI depend more on internal signals and are capable of comfortably isolating specific knowledge from its surrounding environment. Guisande et al. (2007) found that individuals with FD learning styles prioritize overall information views while those with FI learning styles concentrate on specific components. Moreover, individuals with FD are classified as having limited ability to effectively manage their cognitive processes resulting in reduced efficiency in the allocation of attentional resources based on existing research.

Witkin and Goodenough (1981) found that FD students had higher interpersonal competencies compared to FI students because FD students are more socially engaged and pay more attention to social signals. In addition, they have a strong affinity for socializing which motivates them to actively seek out chances for interpersonal interaction. Nevertheless, students in the FI group exhibit superior performance on formal operation tasks compared to students in the FD group.

According to Garner, Godley, and Bair (2011) attitudes are defined as the favorable or unfavorable assessments of behavior. Attitudes often arise from a blend of beliefs about the outcomes and judgements of a certain matter. A Positive Attitude towards Online Learning (PAOL) is described as the positive or negative evaluations of conduct in online learning. Attitudes are often formed by a combination of ideas about the outcomes and judgements of a certain subject. According to Garner et al. (2011) attitudes are the result of positive and negative beliefs that are decided by assessments of such beliefs (Carrera & Lambooij, 2015). Attitude is often composed of three domains: an emotional component (related to emotions), a behavioral component (influencing behavior) and a cognitive component (including beliefs and knowledge) (Rosenberg, Hovland, Hovland, & Rosenberg, 1960). The second component is referred to as the cognitive aspect, including ideas, thoughts and traits associated with a certain subject. The behavioral component of an attitude refers to a person's inclination to act in a certain manner towards something. Hamutoglu, Unveren-Bilgic, Salar, and Sahin (2021) identified the following three characteristics in their study: preparation, attitude and self-control or self-management. This enhances the plausibility of adopting a favorable mindset towards online education as a mediator for elucidating SCMSk to first-year university students in Thailand.

Experimentation and iterative problem-solving learning is a stochastic human reaction in a given context that remains stochastic until successfully attaining the desired objective (Cyr & Anderson, 2012). Thorndike (1898) posited that learning occurs through the process of trial and error. The trial-and-error technique involves the learner engaging in random activities and serendipitously achieving the desired outcome. Initially, these actions may seem haphazard but the circumstances indicate a certain course of action and the learner follows suit. The learner should thoroughly examine our objectives, impediments, unpredictable actions or various solutions, instances of success, options and points of focus.

Self-directed Learning (SDL) is another strategy guided by the fundamentals of humanism that stresses the individual learner and believes that every human being has the capacity and inclination to be attentive, interested, and ready to learn on his or her own. This learning process in which learners initiate self-learning based on their interests, needs, and aptitudes has goals. Learners know how to seek learning resources and choose a method until they assess their learning. This may or may not be done independently or in cooperation with others. Loeng (2020) asserts that self-directed learning is a basic idea. The phrase originated in the field of adult education during the 1970s and continues to be often used in present times. Self-regulation is a word that has been recently introduced and some writers may use it interchangeably with self-control.

This study examines the impact of field independence as a mediator for self-control and self-management skills among first-year university students in Thailand taking into account various learning styles and methodologies.

Attention is a crucial factor in online learning since it greatly influences the quality of learning. This is particularly true for students with ADHD as their emotional condition and desire to study are often called into question. He et al. (2021) categorized the participants with ADHD into two categories based on the DSM-V criteria: those who had significant challenges during online learning (HDOL) and those who experienced minimal challenges during online learning (LDOL). The assessment of these problems was done using the Home Quarantine Investigation of the Pandemic (HQIP). Students in the HDOL program had disruptive behaviors that negatively impacted their capacity to learn specifically in terms of inattention, hyperactivity and oppositional defiance. These behaviors hindered the overall quality of online learning.

In particular, self-control is difficult for students with ADHD while they are participating in online activities. More specifically, they showed more challenges in keeping track of their learning compared to those without signs of ADHD (Becker et al., 2020). Academic performance problems are made worse by online learning especially for ADHD. As a result, students must have some fundamental skills related to self-control and self-management to excel in online learning. For individuals with ADHD, self-reinforcement—a component of SCMSk influences how successful online learning is. The capacity to set goals and assess one's own performance to improve the attainment of those goals is known as self-evaluation (Bandura, 1976).

It is possible to improve their self-management through numerous means while students with ADHD face the difficulties of online learning. According to DuPaul, Stoner, and O'Reilly (2002) self-management may enhance students' academic performance in the classroom. Engaging in regular activities and actively participating in parenting contribute to positive outcomes. The second part of the project aimed to investigate proactive strategies for preparing high school students with attention deficit hyperactivity disorder (ADHD) to succeed in post-secondary education. These strategies were determined based on the findings from the first phase of the study.

This research addresses whether learners with the cognitive style known as Field Independence (FI) exhibit higher levels of self-control and self-management skills by examining the related factors. This study seeks to identify fundamental elements crucial for developing effective teaching and learning strategies tailored for ADHD students. This approach is especially important since it seeks to improve educational achievements for a demographic that frequently experiences specific challenges in traditional and online educational environments. Enhancing the understanding of how FI can influence self-control and self-management abilities in ADHD students could lead to more personalized and effective educational interventions.

Most prior research on Field-Dependence-Independence (FDI) has broadly considered various cognitive styles without specifically focusing on a sample group characterized solely by FI. There has been a lack of targeted investigation into how FI learners especially those with ADHD can optimize their self-control and self-management during distance education. This study seeks to fill this gap by exploring the specific factors and elements that can be leveraged to support and enhance the self-regulatory capabilities of FI learners. It opens a new window into understanding the distinct needs of these students and developing strategies that can better support their academic success in distance learning settings.

3. Materials and Methods

3.1. Research Design

This study employs a mixed-methods design and Structural Equation Modeling (SEM) (casual design) for the first phase. A five-variable model is proposed including self-control and self-management skills (SCMSk) as a dependent variable, Field Independence (FI) as a mediator and Positive Attitude towards Online Learning (PAOL), Trial and Error Learning (TEL) and Self-Directed Learning (SDL) as exogenous variables. In addition, the researcher will analyze Confirmatory Factor Analysis (CFA), path analysis and regression analysis to examine whether the model fits.

For the second phase, a qualitative research design was conducted. Data was collected through a focus group discussion that had been organized in three sessions including agents (session 1), contents (session 2), and approaches (session 3) to construct a proactive plan to prepare high school students with ADHD to improve the academic performance of distance education at the tertiary level.

3.2. Research Population

The population of the first phase of research was 377,691 first-year students registered with the Office of the Higher Education Commission (OHEC). The sample groups were 400 first-year students registered in the Office of the Higher Education Commission in five regions of Thailand: central, northern, eastern, southern, and north-eastern regions. They were selected by multi-stage cluster sampling designs (May, 1997). The researcher calculated it using the formula of Taro Yamane from the total number of respondents. Each stratum was considered by the regions where the representative institutions offered the undergraduate programs (see Table 1).

Table 1. The representative universities of each region.

Regions	Educational institutions	Samples
Northern	1. Chiang Mai University	16
	2. Maejo University	16
	3. Mae Fah Luang University	16
	4. University of Phayao	16
	5. Naresuan University	16
Northeastern	1. Khon Kaen University	20
	2. Suranaree University of Technology	20
	3. Kalasin University	20
	4. Ubon Ratchathani University	20
Central	1. Chulalongkorn University	20
	2. Kasetsart University	20
	3. Silpakorn University	20
	4. Srinakharinwirot University	20
Eastern	1. Burapha University	28
	2. Rambhai Barni Rajabhat University	26
	3. Rajabhat Rajanagarindra University	26
Southern	1. Prince of Songkla University	28
	2. Walailak University	26
	3. Princess of Naradhiwas University	26

The mentioned institutes have been selected for this study as shown in Figure 1.

Firstly, the researcher divided the frame into 5 regions: north, northeast, center, east and south of Thailand. After that, simple random sampling with the use of a table of random numbers, the names of the institutes in each region was employed. Eventually, the number of respondents from each region and institute was divided equally.

For the second phase, ten special education teachers, four school directors and six psychologists were included in the focus group discussion to address the proactive plans to prepare high school students with ADHD to improve the academic performance of distance education during tertiary education. A content analysis analyzed the qualitative data.

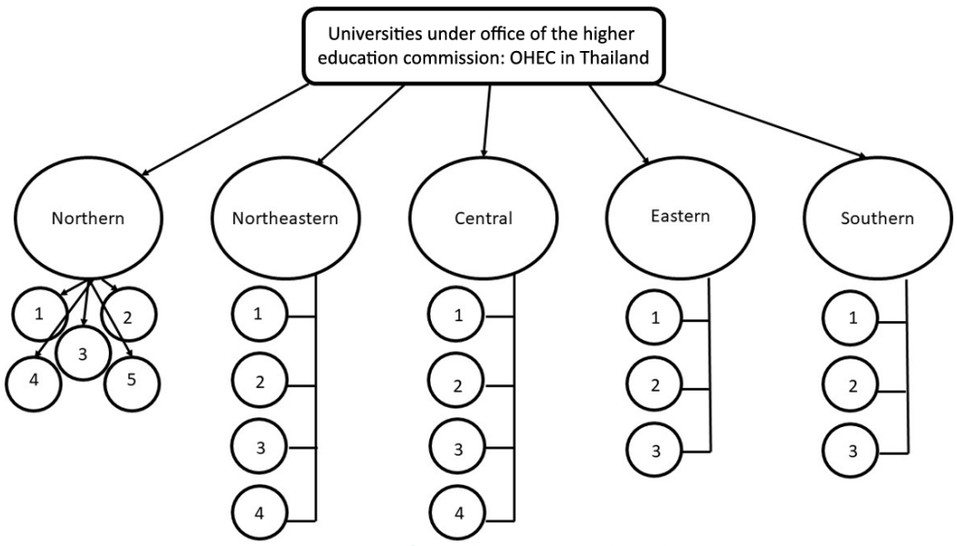

Figure 1. An approach to select representative universities.

3.3. Instrument

There were seven sections to the questionnaire and the details were as follows:

Section 1: Personal information

Section 2: SCMSk was based on Kanfer (1970) and Bandura (1991). There were three constructs comprising three processes interconnected with one another: Self-monitoring (SM), self-evaluating (SE) and self-reinforcing (SR).

Section 3: PAOL was based on Rosenberg et al. (1960). The components of the attitude exhibited three domains: an affective component (feelings), a behavioral component (the effect of the attitude on behavior) and a cognitive component (belief and knowledge).

Sections 4 and 5: FD and FI were based on Witkin and Goodenough (1981) three aspects recognized in the cognitive styles of FD and FI included 1) reliance on internal vs. external referents; 2) cognitive restructuring skills and 3) interpersonal competencies.

Section 5: TEL was based on Thorndike (1949) trial-and-error theory. The concept included the law of readiness, the law of exercise and the law of effect.

Section 6: SDL was based on Guglielmino (1977) Self-directed Learning Readiness Scale (SDLRS) but emphasized for online learners.

However, Confirmatory Factor Analysis (CFA) was employed to confirm whether all items were effective or not.

3.4. Validity and Reliability

3.4.1. Content Validity of Questionnaires

Validity is the degree to which a test measures what it is supposed to measure (Gay, 1992). The content validity of the question, like accuracy, suitability of language, content coverage, relevance to the research dimensions and other ambiguities of the items was rectified and finalized based on the feedback received from the three experts on Item-Object Congruence (IOC). Items that had an IOC between 0.5 and 1 were used. The used items (overall = 46) ranged between 0.67 and 1.

3.4.2. Reliability of the Questionnaire

Items for the six-variable model were proposed including Self- Control and Self-Management Skills (SCMSk), Positive Attitude towards Online Learning (PAOL), Field Dependence (FD), Field Independence (FI), Trial and Error Learning (TEL) and Self-Directed Learning (SDL) which were examined by 50 respondents who were not included in the study sample using Cronbach (1970) to test the reliability. The Cronbach's alpha result was .937 which was acceptable.

3.5. Research Hypotheses

According to Endler and Magnusson (1976) an interactionism paradigm was employed to generate the following hypotheses (see Figure 2):

3.6. Measures

All variables in this research were regularly measured by the summated rating method. A five-point scale ranging from "mostly agree" to "mostly disagree" was used to measure all aspects. The researcher constructed all items in the inventory based on the reviewed concepts and theories. Five groups of variables are exhibited in Figure 2.

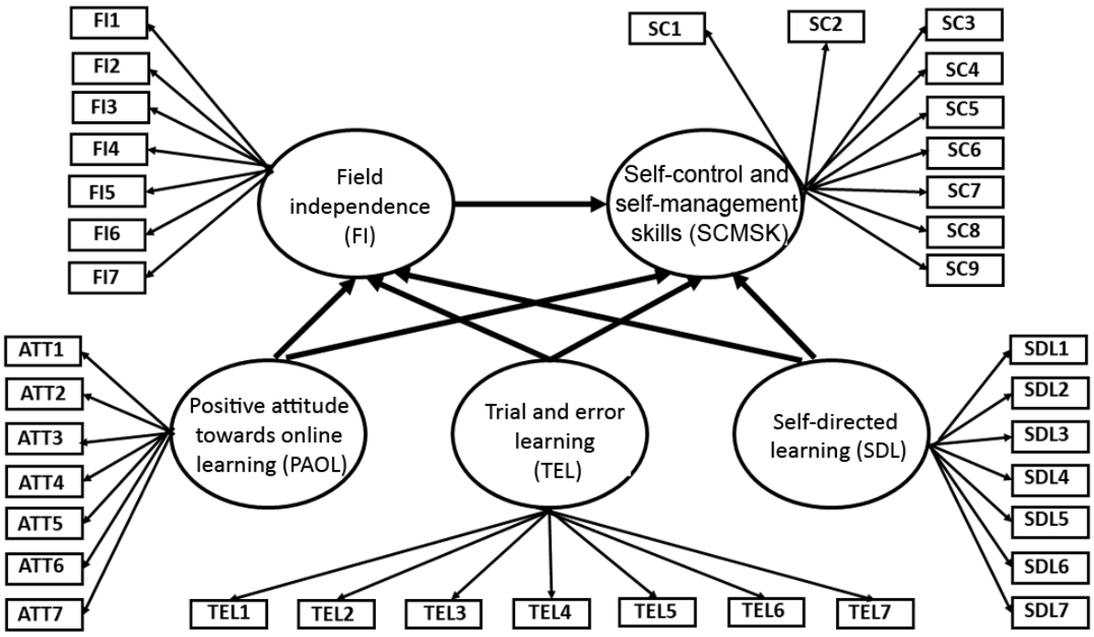

Figure 2. Hypothetical model of the study.

The latent variable, SCMSk comprised nine items for endogenous variables—all of which involved self-monitoring, self-evaluating and self-reinforcing. The alpha reliability score was .81. In terms of FI as another latent variable, this played a role as a mediator of this proposed model. There were seven items, including less reliance and self-motivation. The score of alpha reliability was .80.

Three exogenous latent variables in this research included PAOL, TEL and SDL. The latent PAOL construct consists of an affective component (feelings), a behavioral component (the effect of the attitude on behavior) and a cognitive component (belief and knowledge) (Rosenberg et al., 1960). The alpha reliability score was .87. Another latent variable was TEL which included learning styles and approaches. The alpha reliability score was .85. The last latent variable was SDL which involved self-learning and self-regulation. The score of alpha reliability was .84.

4. Results

4.1. Phase 1 Study

4.1.1. Descriptive Statistics

The sample group was 400 first-year students from the 377,691 population registered with the Office of the Higher Education Commission (OHEC) in Thailand. The research participants included 263 female freshmen (65.7%) and 137 male freshmen (37.8%).

4.1.2. Confirmatory Factor Analysis (CFA)

This research used CFA to validate the proposed hypothesized elements of latent variables' contructs. Statistical software was used to conduct the model evaluation test for a first-order measurement model.

Table 2. All items as observed variables.

Questions
Self-control and self-management skills
1. I can control myself by focusing on my activities (SC1).
2. I express myself appropriately for the situation and the circumstances (SC2).
3. I am always observing my behavior and emotions (SC3).
4. I always assess my abilities before deciding to do something (SC4).
5. I know what my weaknesses and strengths are (SC5).
6. I was able to control unexpected situations very well (SC6).
7. I am always looking for ways to motivate myself (SC7).
8. I am always innovating to improve myself and achieve my goals (SC8).
9. I always change myself so that I can achieve my goals (SC9).
Field-independence
1. I can analyze situations well (FI1).
2. When working, I focus on the task and do not need any framework or structure to help guide the solution (FI2).
3. I can relate to and compare things very well (FI3).
4. I have a high degree of independence. They make decisions based on their ideas (FI4).
5. I prefer having the freedom to learn something rather than being framed by someone (FI5).
6. I always set my own goals for my work (FI6).
7. I like to develop self-learning strategies (FI7).
Positive attitude towards online learning
1. I think online learning is a good alternative to learning (ATT1).
2. I believe that online learning can develop human beings (ATT2).
3. I would rather have the opportunity to study online than passively (ATT3).
4. I like to study online (ATT4).
5. I feel that teaching online can be developed to make students feel fun (ATT5).
6. I chose to take other online courses besides my university subjects (ATT6).
7. I study online effectively (ATT7).
Trial-and-error learning

	1. I always learn by experimenting with it until I get the results I want (TEL1). 2. When I learn new things, I always notice them and try to do them until the goal is achieved (TEL2). 3. I avoid passive learning without taking action (TEL3). 4. I learn well through trial and error (TEL4). 5. I can understand lessons through a variety of practices (TEL5). 6. I am always looking for the best way to understand what I am studying (TEL6). 7. I always learn new things through trial-and-error learning. (TEL7).
Self-directed learning	
	1. I am happy when assigned to a self-study job even though it is online (SDL1). 2. I have enough responsibility to learn online without being supervised (SDL2). 3. I know what is essential to achieving my academic goals (SDL3). 4. I can control myself when I am free to learn independently such as through unsupervised online learning (SDL4). 5. I was able to understand the lessons through self-learning (SDL5). 6. I always complete work when assigned to online self-study (SDL6). 7. I would rather learn by myself than have someone teach me (SDL7).
Total 37 items	

Table 2 indicates the total indicators of observed variables conducted in this research. Nine items were used to measure students' self-control and self-management skills and six items each for the rest.

For construct validity analysis, the researcher examined Pearson's Product Moment Correlation to test the assumption of Structural Equation Model analysis; one assumption for CFA is that all variables must be correlated. The correlational matrix was analyzed to demonstrate that each pair of variables indicated a correlation among all observed variables that was significantly different from zero (p <.0). The highest correlation was between SC7 and SC8 (r =61). On the other hand, the lowest correlation was seen between SC1 and TEL3 (r . =1). Besides, the correlation matrix shows a positive correlation among all observed variables. According to Kline (2005) if the correlation coefficient among variables is higher than .85, multicollinearity rejects the assumption. However, no observed variables exceeded. 85 which means each latent variable was dependent on others.

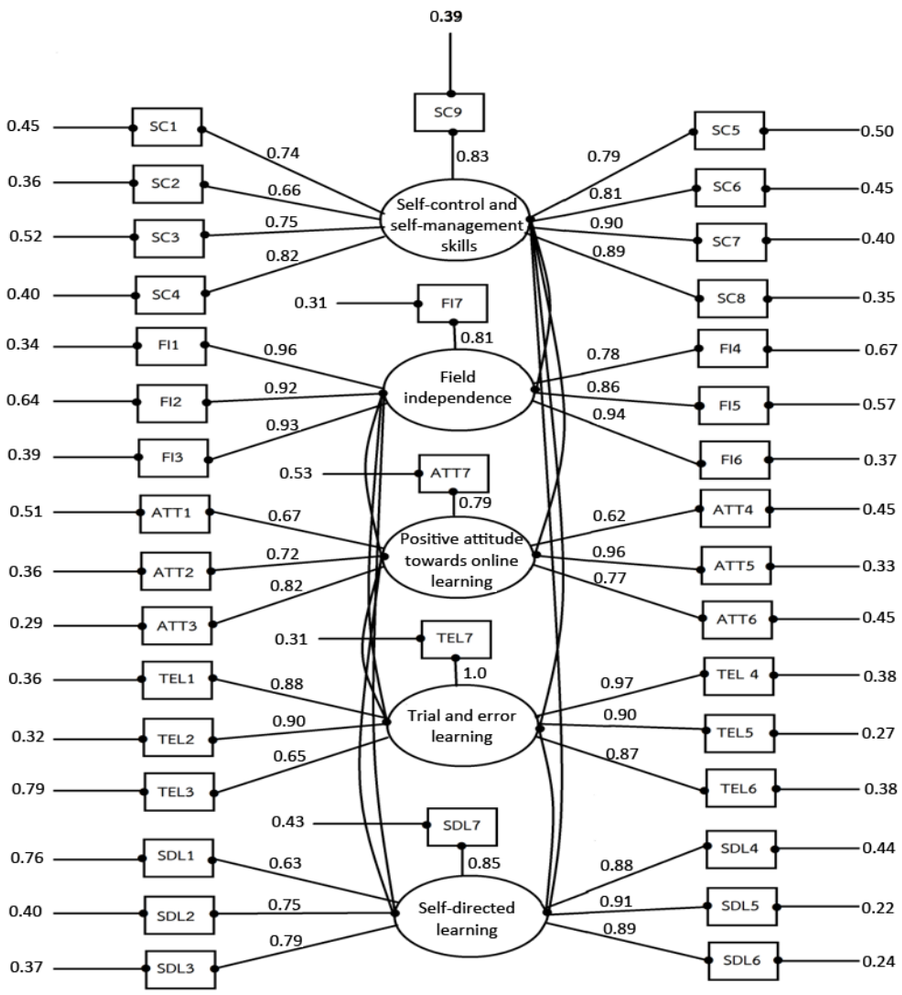

Figure 3. CFA of the latent variables studied in this research.

Figure 3 delineates the first-order factor and the researcher conducted confirmatory factor analysis for all variables, including exogenous and endogenous latent variables which were SCMSk, FI, SDL, TEL and PAOL.

The researcher conducted CFA on both exogenous and endogenous variables as mentioned. The result of measurement model analysis indicated goodness-of-fit indices (GFI) for the CFA model (907). The model yielding 619 degrees of freedom is over-identified. Therefore, the proposed model can be tested. In addition, other indices were a measure of the difference between the observed and expected frequencies of the outcomes of a set of events or variables or Chi-square (2002.612), Goodness-of-fit index or GFI (907), Comparative Fit Index or CFI (966) and Root Mean Square Error of Approximation or RMSEA (0.22) which all indicated the model fit or achieved recommended values.

4.1.3. Path Model

The researcher analyzed both direct and indirect effects of endogenous variables, SCMSk and FI to test the hypotheses of this research. In addition, the mediator variable was indicated as data computed by Baron and Kenny (1986) who stated that mediation usually occurs when the independent variable directly affects the mediator and the dependent variable is directly affected by the mediator.

The researcher then conducted multiple regression analysis to examine the influence of each dependent variable when the proposed mediator (FI) was controlled. The result discovered that the coefficients of each dependent variable (PAOL, TEL, SDL) and the dependent variable, SCMSk decreased to .162, .281, and .218, respectively.

The regression analysis results indicate that when FI was included as a control variable, the coefficients of PAOL, TEL, and SDL on SCMSk decreased. This suggests that FI weakens the influence of SCMSk on these dependent variables, potentially supporting a mediation effect. From the analysis of Baron and Kenny (1986) the finding indicated that FI was the partial mediator.

Table 3. Report of model fit indices

Indices	Criteria	Statistics
Chi-square	P>0.05	0.079
GFI	>0.90	0.982
AGFI	>0.90	0.912
NFI	>0.90	00.973
IFI	>0.90	0.969
CFI	>0.90	0.912
RMR	<0.05	0.024
RMSEA	<0.05	0.022

Table 3 indicates the model fits at the appropriate levels according to the criteria. Chi-square was not significant at .05 (P = .079). The result of measurement model analysis indicated goodness-of-fit indices (GFI) for the model was 982. In addition, other indices were adjusted goodness-of-fit or AGFI was .912, Normed Fit Index or NFI was .973, Comparative Fit Index or CFI was .912, Root Mean Square Residual or RMR was .024 and RMSEA was .022 which all indicated the model fit or achieved recommended values as exhibited in Table 3.

Table 4. Regression weights of the proposed model.

Path	Estimate	S.E.	C.R.	Sig.
FI <---PAOL	0.101	0.038	3.014	***
FI <---TEL	0.332	0.037	9.091	***
FI <---SDL	0.391	0.035	11.328	***
SCMSk <---FI	0.209	0.048	4.374	***
SCMSk <---PAOL	0.150	0.037	4.118	***
FI <---TEL	0.226	0.038	5.891	***
FI <---SDL	0.170	0.038	4.482	***

Note: *** Significant at p-value < 0.01.

According to Table 4, the regression weights of the proposed model reveal a decrease in the effect sizes of all exogenous variables, PAOL, TEL, and SDL from .24, .28, .22 (direct effect on SCMSk) to .15, .23, .17 respectively. The decline in the regression weight indicated that FI was the partial mediator of this model.

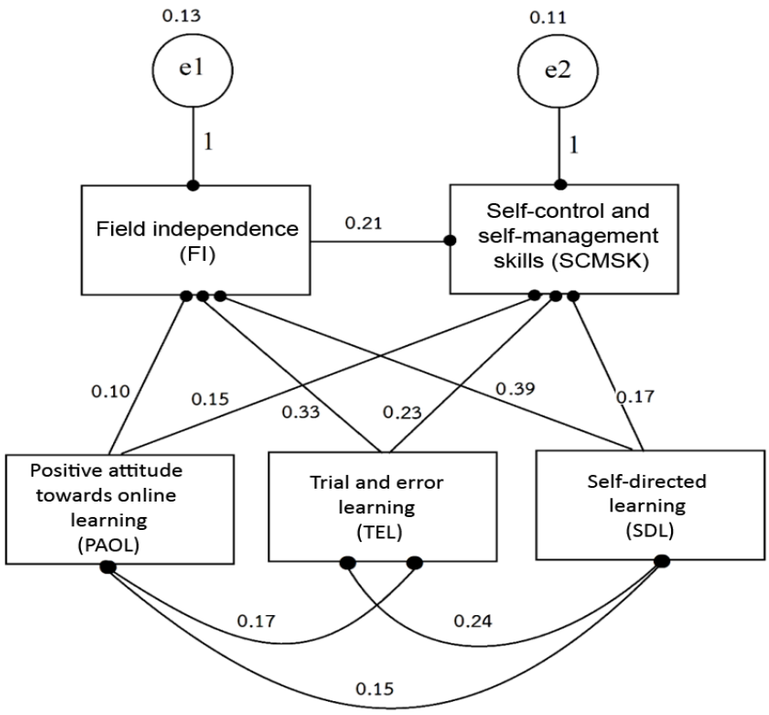

Figure 4. Model of self-control and self-management skills of Thai first-year tertiary students (hypothesis 3).

The final model in Figure 4 exhibited that latent SCMSk was directly affected by latent FI, SDL, TEL and PAOL. Moreover, SCMSk were indirectly affected by PAOL, TEL and SDL with FI as a mediator.

Overall, this research investigated the relationships between variables using a structural equation model (SEM) based on the data analysis. The construct validity test indicates all observed variables were significantly correlated demonstrating they are not entirely independent. Moreover, no correlations exceeded 0.85 indicating no multicollinearity issues (variables excessively influencing each other). To test model fit, the initial model (analyzed in Figure 3) showed good fit according to various indices (NFI, CFI, RMSEA). Similarly, the final model (presented in Figure 4) also demonstrated a good fit based on the criteria in Table 3. To conclude, the proposed model provided a good fit for the data suggesting the relationships between variables were well-represented and evidence supported a partial mediation effect of FI between SCMSk and other variables like PAOL, TEL and SDL.

4.2. Phase 2 Study

After the model was tested, the key informants collaborated in constructing proactive plans. The plans were generated according to the analyzed data from the discoveries of the phase 1 study and the focus group discussion of phase 2.

Self-control and self-management skills and their other determinants were discussed. Twenty experts collaborated in creating a model to develop students with ADHD based on this research finding in phase I and the synthesized model was generated as follows:

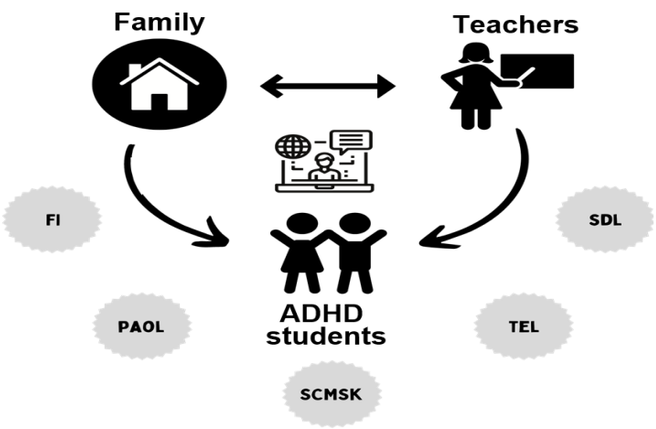

Figure 5. A model of the establishment of accommodations for ADHD students to achieve SCMSK.

Figure 5 highlights the interdependence of different parties involved in the online education of students with ADHD. Successful outcomes depend on the cooperative efforts of teachers, parents and students who must collectively acknowledge the unique challenges online learning poses for students with ADHD. These four factors, including Positive Attitude towards Online Learning (PAOL), Field Independence (FI), Trial-and-Error Learning (TEL), and Self-Directed Learning (SDL) contribute significantly to the development of Self-Control and Self-Management Skills (SCMSk).

4.2.1. Three-Agent-Support

According to all experts, it is essential for instructors, families and students to cooperate and acknowledge the potential challenges of maintaining full focus while online learning to accomplish teaching students with ADHD online. Prior to the start of the classes, teachers and parents had engaged in communication as shown by the following statements:

"We worked as a team. Some parents moved the study room for them to naturally monitor their kids".

"Parents helped limit the online time so that teachers would never be worried about a given assignment".

Furthermore, the setting is regarded as one of the foremost essential variables facilitating the proper learning of online classes for students with ADHD. In a solitary environment devoid of actual peers, individuals find it effortless to totally focus on the web classes. However, to obtain excellent learning outcomes, it is crucial to have a calm and tranquil setting. Therefore, parents were mindful of creating an appropriate area for online learning, particularly for children with ADHD as previously noted.

"My boy can learn well when there is no disturbing sound or motion. It is my trick to keep my cat away and turn TV off when he is having an online class."

Table 5. Characteristics and practices of three agents.

Teachers	Families	ADHD students
1. Understand students' behaviors.	1. Be good collaborators.	1. Hold a growth mindset.
2. Speak the same language as ADHD does.	2. Be keen on space management.	2. Be effective goal setters.
3. Be game creators.	3. Never be dictators.	3. Be easily motivated.
4. Be lifelong learners.	4. Monitor students' progress.	4. Respect set rules.
5. Be patient and encouraging.	5. Support resources.	5. Build self- discipline.
6. Be positive actors.	6. Be an observer.	6. Participate in every activity.
7. Be empowering teachers and mentors.	7. Provide positive encouragement.	7. Have digital literacy.

According to Table 5, the support of ADHD students in distance learning is contingent upon the collaboration of teachers, families and students. Teachers are essential because they must possess knowledge about ADHD, effectively communicate information and create a learning environment that is pleasurable. Furthermore, they are required to exhibit a steadfast dedication to their ongoing professional development as well as to provide assistance

and be delicate. Families contribute to creating a secure and affectionate environment at home, collaborate with teachers and monitor the development of their children. Students with ADHD demonstrate resilience by adopting a growth mindset, establishing objectives and enhancing self-discipline. Facilitating the realization of the full potential of individuals with ADHD requires a multifaceted approach that combines the expertise of educators, families and students themselves.

4.2.2. Effective Practices for ADHD Students to Accomplish SCMSk

4.2.2.1. Self-Control and Self-Management Skills (SCMSk)

Students diagnosed with attention deficit hyperactivity disorder (ADHD) have challenges maintaining complete focus on educational materials during online learning sessions. Furthermore, assignments might be daunting since they require a high level of self-control and self-management skills. Initially, experts provided practical advice for lesson planning and developing online activities. Here are some recommendations for teachers:

1. Start with extrinsic motivation to strengthen intrinsic motivation.
2. Try to use the same language such as from games or anime (Japanese cartoons).
3. Create a sharing environment or certain situations to promote their decision-making.
4. When making a decision themselves, set rules to urge their responsibility.
5. Be helpful assistants.

Teachers must have a clear understanding of the nature of ADHD and the different learning styles of children with this condition. Under such circumstances, individuals might plan pertinent tasks that promote their concentration in an online class ensuring that no external disruptions divert their attention. Nevertheless, the existing activities must include substantial incentives and chances to be involved in the decision-making process. These strategies have the potential to enhance self-control and self-management skills in students with ADHD as they need more autonomy and responsibility for their decision-making.

4.2.2.2. Field Independence (FI)

Field Independence *(FI)* is one of the relevant skills contributing to promoting self-control and self-management skills of ADHD students. Field-independent students prefer autonomy, meaning that they like the direction of their learning. Therefore, it is essential for teachers not to be too structured and to allow students several options. To enhance FI, teachers can follow these tips: 1) ADHD students should be allowed to participate in decision-making on what assignment to submit and when the deadline is; 2) encourage ADHD students to find and propose solutions and 3) try not to be too strict on the textbook but let them try several resources and hands-on activities.

4.2.2.3. Trial-and-Error Learning (TEL)

Teachers confront a difficult task in giving ADHD students the opportunity to experience failure during online sessions since it requires a significant amount of time and lacks the benefits of in-person connection. Nevertheless, the majority of professionals have a unanimous opinion on the need to design workouts that push individuals to exert effort and learn from their failures. For instance, in online mathematics courses, students will be assigned four specific tasks: visual representations, mathematical exercises, standard equations, and real-world scenarios related to commerce. The students diagnosed with attention deficit hyperactivity disorder (ADHD) were instructed to participate in each series of activities in a random manner. Each job presented the possibility of errors that might be resolved by another group. Engaging in activities may elicit a feeling of achievement making them a prominent strategy for efficiently capturing the attention of children with ADHD. Assume that teachers and other individuals involved may encourage them to engage in trial-and-error learning by designing various tasks that are somewhat simple to moderately challenging. Under such circumstances, individuals may increase their focus on the instructional material with greater effectiveness even while participating in online learning.

4.2.2.4. Self-Directed Learning (SDL)

Individuals with ADHD can benefit from self-directed learning (SDL) since it allows them to personalize their learning experiences to their requirements, interests and skills. However, it is critical to add tactics and activities that correspond with their preferences and help them stay involved because of the difficulties that ADHD presents. The experts discussed and concluded the deep process as follows:

1. Research: It might be challenging somehow to urge the curiosity of ADHD mainly online. However, the key is to research the up-to-date interests of the whole class by asking small questions or encouraging the vote (through an instant communication app) whose answers can be beneficial for planning the lessons.
2. Contract: To break down larger tasks into manageable tasks seems like a significant initial start. ADHD students have to understand the set rules to complete each set goal. Signing a contract and pooling with positive reinforcers must be embarked upon.
3. Triggering: To be up-to-date is essential, as teachers can take hot issues from posted threads or social media platforms to start with. Problem-based learning is a potential method to motivate their critical and analytical thinking especially when linked to current trendy issues.
4. Be an actor: To be an online motivating teacher requires drama skills. Improving ADHD's self-esteem and curiosity can be done by acting like they are explorers and discoverers. However, it is crucial to make sure no one is left behind.
5. Hi-Tech: To be trustworthy online teachers, students must perceive teachers' technological skills; therefore, teachers must be well-prepared and utilize different technological tools to be reliable for ADHD students.

4.2.2.5. Positive Attitude towards Online Learning (PAOL)

Building a positive attitude towards online learning for individuals with ADHD involves creating an environment that supports their learning style, incorporates their strengths and addresses their challenges.

Teachers should be favorable to ADHD students, create a positive learning climate (online) and have positive conversations to cultivate a positive attitude towards online learning. The perception of teachers is crucial as they have to understand an individual's background. This comprehension assists teachers in finding appropriate solutions for effectively teaching and giving feedback to ADHD students. Games and competitions must be included in each class to enhance learners' positive attitudes towards online learning.

5. Discussion

The inevitable pandemic has significantly hindered students' ability to learn effectively due to changes in educational methods. It is essential for students to possess key personality traits such as self-control and self-management skills which are critical for the motivation required to accomplish tasks to maintain high academic performance (Ghali & Miri, 2018). The research finding indicates that cognitive learning style plays a crucial role in fostering self-management which coincides with Witkin et al. (1977) who found that field-independent (FI) learners are less dependent on externally provided structures and more self-motivated. The student participants were likely to develop self-management skills as they were capable of self-regulation and decision-making, particularly in the context of distance learning. Additionally, research findings highlight the significant contributions of a positive attitude, a trial-and-error learning approach and self-directed learning to the development of self-control and self-management skills. Participants who maintained an optimistic outlook towards online learning demonstrated better discipline. This aligns with the study by Hamutoglu et al. (2021) which found that a positive attitude helps students control and manage themselves during online classes. Furthermore, adopting a trial-and-error method supports field-independent learning by enabling learners to acquire knowledge without relying on pre-existing solutions. Self-directed learning also plays a crucial role as it empowers learners to effectively plan and manage their learning resources. This approach allows individuals to take control of their educational journey, setting goals, identifying resources, and evaluating their progress. The emphasis on self-directed learning reflects a broader educational trend towards fostering independent learning skills which are essential for lifelong learning and adaptability in various contexts (Mera, Rodríguez, & Marin-Garcia, 2022).

Research findings indicate that a positive attitude towards online learning significantly enhances self-control and self-management abilities in students with ADHD. Embracing digital education with optimism increases their motivation and engagement, thereby improving self-regulation (Smith & Davis, 2021). Consequently, stakeholders have developed supportive strategies to foster a positive attitude among ADHD students and enhance their engagement during online classes. Additionally, viewing online learning as a flexible platform that accommodates individual pacing nurtures a sense of empowerment can aid in task initiation and time management (Johnson, Brown, & Williams, 2020). Thus, fostering this positive outlook aligns with ADHD students' learning preferences, bolstering their self-control and self-management skills which are crucial for success in the online learning environment. Experts participating in the research asserted that developing self-control and self-management skills in ADHD students during online learning is essential for academic success. Recommended strategies include setting clear goals (Barkley, 2020) and using tools such as timers and task lists (Dawson & Guare, 2010) which enhance focus and organization, thereby fostering more effective online learning experiences. To promote field independence in ADHD students, structured self-paced modules provide clear learning paths allowing students to manage their own pace and reduce cognitive overload (Smith & Johnson, 2020). Additionally, granting students the autonomy to choose assignments and set deadlines can further support their self-regulation. Findings also highlight that scaffolded learning activities as noted by Brown and Davis (2019) enhance autonomy by transitioning ADHD students from supported tasks to independent work, thereby strengthening their self-regulation skills. Experts generally agreed on the importance of designing exercises that encourage effort and learning from mistakes for ADHD students. Therefore, it is reasonable to implement trial-and-error learning in online education for ADHD students, promoting experimentation and learning from errors. For example, interactive simulations offer practical engagement (Johnson, Smith, & Davis, 2021) while gamified platforms turn learning into a dynamic process that leverages their preference for novel stimuli (Parker, Adams, & Carter, 2018). Moreover, the stakeholders recommended that facilitating self-directed learning (SDL) for ADHD students in online education requires personalized strategies that emphasize the use of goal-setting techniques to enhance focus (Smith, Davis, & Martin, 2022) aligning with findings that teachers should understand students' needs to set effective goals.

6. Conclusion

According to the research findings, the pandemic disrupted learning highlighting the importance of self-control and self-management in students especially for ADHD students in online environments. A positive attitude, trial-and-error approaches and self-directed learning fostered these skills. Experts recommended strategies like clear goals, timers and scaffolder activities to support ADHD students' self-regulation and independence in online learning. The discoveries of this research first assist teachers in serving the proper lessons to students with ADHD. Moreover, these could pave the way for teachers to be aware of students' diverse learning styles and approaches to develop proper assessments for students' academic performance and achievement evaluations. Furthermore, educational institutions and relevant stakeholders can adopt the verified model or research findings to prepare their students for unexpected circumstances influencing their learning, like distance education during the COVID-19 pandemic especially for ADHD students. Furthermore, the findings of this research indicate diverse learning styles and approaches influencing students' attitudes towards online learning, which contributes to instructors and lecturers finding effective methods to deliver motivating classes. Furthermore, the model as an outcome of this study helps ignite the idea that the different learning styles play a role in students' learning behaviors and attitudes that could benefit ADHD students practically. Finally, teachers, researchers, educational institutions and relevant stakeholders can adopt the discoveries of this research to conduct further studies to promote students' distance learning behaviors.

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