International Journal of Instruction *October 2024 ● Vol.17, No.4*
e-ISSN: 1308-1470 ● www.e-iji.net *p-ISSN: 1694-609X*
pp. 195-218

Article submission code: 20240123023647
Received: 23/01/2024 Revision: 19/04/2024
Accepted: 30/04/2024 OnlineFirst: 01/07/2024

Social Influences, Cognitive Competence, Problem-Solving Skills: A Case Study of Problem-Solving Skills in the Context of Digitalization Adoption

Thuc Duc Tran
Ho Chi Minh University of Banking, Vietnam, *thuctd@hub.edu.vn*

Ha Thanh Doan
President of Ho Chi Minh University of Banking, Vietnam, *hadt@hub.edu.vn*

Thong Van Pham
Thu Duc College of Economics and Technology, Vietnam, *pttm5642@gmail.com*

Thu Minh Thi Truong
Southern Branch of Joint Vietnam-Russia Tropical Science and Technology Research Center, Vietnam, *minhthutruong231078@gmail.com*

The purpose of this research was to investigate the relationships between social influences related to digital transformation adoption and cognitive competency in forming problem-solving skills. A deduction approach associated with the positivist philosophy was employed in order to build up the research model to explain the process of shaping problem-solving skills. By sending questionnaires randomly via Google Forms, a cross-sectional study with 337 respondents aged 17 years and older, including men and women with an education level of high school or higher, was conducted in southern Vietnam. Prior to assessing the measurement and structural models, the reliability and validity of measurement scales were examined by Cronbach's alpha using SPSS software. The SmartPLS software then was utilized to analyze the measurement and structural models and test the hypotheses using partial least squares structural equation modelling. According to research findings, social influences associated with the implementation of digital transformation had a direct positive impact on workers' cognitive competency as well as their problem-solving skills. In addition, the research model also demonstrated the effects of cognitive processes when receiving social impacts through direct and indirect mechanisms on problem-solving skills, in which low thinking ability was the foundation for high thinking and creative abilities. Based on these findings, the research opened a novel approach to problem-solving skills through the mechanism of the impacts of stimuli on organisms and organisms on responses that were a premise for managers to provide and orient information to improve employees' cognitive abilities and problem-solving skills.

Keywords: social influences, cognitive competency, problem-solving skills, digitalization, S-CP model

Citation: Tran, T. D., Doan, H. T., Pham, T. V., & Truong, T. M. T. (2024). Social influences, cognitive competence, problem-solving skills: A case study of problem-solving skills in the context of digitalization adoption. *International Journal of Instruction*, *17*(4), 195-218.

INTRODUCTION

The explosion of the digital economy and the fifth industrial revolution have brought many new challenges and opportunities to countries, especially emerging economies (Skagerlund et al., 2022; Tran, 2023). Although artificial intelligence and automation programmes support the majority of manufacturing activities, human skills in problem-solving relevant to manufacturing obstacles remain a critical foundation (Noble et al., 2022). Nevertheless, a significant concern is the lack of qualified and high-quality human resources (Blanka et al., 2022; Briggs, 2019; Gfrerer et al., 2021; Volberda et al., 2021). Numerous studies have been carried out to explore the skills needed in the digital age to improve the current quality of human resources, including in education (AlDhaen, 2023; Olszewski & Crompton, 2020) and operational practice (Jardim, 2021; Van Laar et al., 2020). In parallel with the significant findings from previous research on problem-solving skills (PS) in recent years (AlDhaen, 2023; Jardim, 2021; Olszewski & Crompton, 2020; Van Laar et al., 2020), challenges have also emerged, the most concerning of which is the process of forming these skills.

Related to problem-solving skills, Braunstein (1972) indicated that the term "heuristics" referred to " problem-solving approaches that were likely to produce efficient solutions for difficult issues by narrowing the search across a wide range of viable answers based on certain assessments of the nature of the problem". Besides, problem-solving skills could be gained through problem-based learning (Fitriani et al., 2020). It can be concluded that problem-solving skills will be formed by cognitive processes, in which cognition can be the ability to recognize difficult problems or remember skills, and personal experiences to solve those problems (Fitriani et al., 2020). Chi et al. (2014) mentioned that the problem-solving skills of experts stemmed from their memory or knowledge related to problems while remembering and knowing were low thinking levels in the Taxonomy of Educational Objectives (Bloom et al., 1956). In terms of the relationship between cognition and problem-solving skills, previous studies were conducted to examine the effects of rational aspects on problem-solving skills, mostly focused on critical and creative thinking (Akpur, 2020; Almulla & Al-Rahmi, 2023; Artika & Nurmaliah, 2023). Based on these findings, problem-solving skills can be formed not only at a low cognitive level (recognizing difficult problems or remembering skills, and personal experiences to solve those problems) but also at a high cognitive level (critical and creative thinking). Pennebaker et al. (1990) found that high and low levels of thinking were associated with emotions and health. However, Pennebaker et al. (1990) encountered a severe constraint when evaluating thinking levels via writing and speaking skills since language, social expectations, and other factors influenced cognitive processes while participants tried to write and express their content. Based on these limitations, Pennebaker et al. (1990) called for papers to investigate true thinking without any processes that misrepresented its manifestation. Therefore, the interaction between low-level and high-level cognition (recognizing or remembering problems to creative and critical thinking to solve problems) needs to be explored, especially in the context of applying digital transformation, and problem-solving skills are the result of cognitive processes (Russell et al., 2020; TRAN et al., 2024).

In another approach to problem-solving skills, social influences were considered factors that affected cognitive processes directly in forming problem-solving skills and affected problem-solving skills both directly and indirectly via the cognitive processes (Almulla & Al-Rahmi, 2023; Perlmutter et al., 1989). Most studies indicated positive relationships between social influences (e.g., the effect of individuals on others or the impact of social environments on individuals) and rational aspects (e.g., perceived behavioural control, perceived usefulness, attitudes towards behaviours, reflective thinking, creative thinking, and critical thinking) in shaping problem-solving skills (Almulla & Al-Rahmi, 2023; Bruch & Feinberg, 2017; Croes & Bartels, 2021; Dai & Cheng, 2022; Nguyen Thi et al., 2022), while few studies demonstrated the direct relationship between social influences and problem-solving skills, almost all in educational sectors (Perlmutter et al., 1989; Van Laar et al., 2020). In the context of digital transformation applications, changes in operations require workforces not only to have basic problem-solving skills (requiring a low level of thinking) but also to solve complex problems (requiring a high level of thinking) (Russell et al., 2020). Nevertheless, how will problem-solving skills be formed under the impact of individuals and social characteristics (digital society) on workforces? As a result, there is a need to investigate the impact of social influences on cognitive competency, and problem-solving skills (Skagerlund et al., 2022).

Based on the above arguments, there were two gaps in the field of problem-solving skills in the context of digitalization adoption. First, previous studies highlighted the significant role of cognitive competency in forming problem-solving skills (Akpur, 2020; Almulla & Al-Rahmi, 2023; Bruch & Feinberg, 2017; Skagerlund et al., 2022); however, these studies did not specify the individual's cognitive processes (related to cognitive competency, including low and high thinking ability and creativity). Second, in the context of digital transformation adoption, Russell et al. (2020) argued that there was too little evidence that research on digital transformation adoption decision-making involved a cognitive perspective. Most previous studies on digital transformation leaned towards examining post-rational rather than ex-ante perceptions of digital transformation (Russell et al., 2020), where problem-solving skills were one of the important links in making decisions (especially useful and beneficial decisions) under the specific context (related to social influences) (Bruch & Feinberg, 2017; TRAN et al., 2024; Tran, 2023). In alignment with the above gaps, the purpose of this study is to identify how problem-solving skills will be formed in the context of digitalization adoption, in which the first aim is to examine the relationships between low thinking ability, high thinking ability, creativity, and problem-solving skills, and the second aim is to investigate the impact of social influences on both cognitive competency and problem-solving skills. Recognizing the vital role of problem-solving skills in operation as well as the research objectives, the research approach was identified by investigating the relationship between social influences towards digitalization adoption, cognitive competency (low thinking ability, high thinking ability, creativity), and problem-solving skills. By applying the stimulus-organism-response (S-O-R) framework (Mehrabian & Russell, 1974), social influences regarded as stimulus factors affected directly organisms (low thinking ability, high thinking ability, creativity) and responses (problem-solving skills). Thereby, the novelty and uniqueness of this research approach

were also demonstrated by explaining the process of forming problem-solving skills under the influences of social context (through social influences) and gave an overall view of the cognitive processes from low to high levels as well as the correlation between them when receiving stimulating signals from the digital transformation environment. In addition, another feature of this research was the successful development of cognitive competence scales that encompassed low to high cognitive levels (from low thinking ability to creativity) and could adequately explain human cognitive processes.

The rest of the study is divided into five sections. Section 2 presents the literature review, the research approach, and the development of research hypotheses. Research methods, including respondents' data, data collection methods, and data analysis, are presented in Section 3. Section 4 presents the research results, and the research discussion will be presented in Section 5. The final section includes conclusions, limitations, and future research directions.

Literature Review and Hypotheses

Literature review

S-O-R framework, Cognitive competency, Problem-solving skills, and Social influences related to digitalization adoption

The SOR framework is the model of psychology that is utilized for defining consumer behaviours and decision-making processes (Mehrabian & Russell, 1974; Zhao & Liu, 2023). Stimuli are regarded as stimulus factors such as social influences, marketing messages, or situational factors (Bilro et al., 2018; Peng & Kim, 2014). Organism refers to the individual or the inner processes within an individual and contains cognitive, emotional, and physiological components that drive behaviours or behavioural intents (Tuan Mansor et al., 2022). Response is regarded as the behavioural or cognitive results of the interplay between external stimuli and the organism's internal processes (Liu et al., 2023). In the context of digitalization adoption, the S-O-R framework was mostly applied to explain customer behaviours and decision-making processes (Liu et al., 2023; Peng & Kim, 2014; Tuan Mansor et al., 2022), while there has not been any research examining problem-solving skills as a result of the influence of stimulating factors and changes within the individual related to cognition.

To provide a strong argument for this research approach, the authors carefully reviewed numerous studies in this field and identified three significant findings related to the relationship between cognitive competency, problem-solving skills, and social influences in digitalization adoption:

- A number of studies focused on the relationship between cognition and problem-solving skills via learning processes (Almulla & Al-Rahmi, 2023; Çiftci & Bildiren, 2020; He et al., 2021; Mangaroska et al., 2022; Shanta & Wells, 2022; Tangkui & Keong, 2023); however, these studies mainly examined the role of critical thinking in forming problem-solving skills (e.g., positive or negative effects) and tended to students (from preschool to university)(Van Laar et al., 2020). Critical thinking was not only linked with solving problems (O'Flaherty & Costabile, 2020; Van Laar et al., 2020) but

also the application of rational, high-level thinking processes such as analyzing, synthesizing, recognizing and solving difficulties, concluding, and assessing (Astuti et al., 2020; Pursitasari et al., 2020). Nevertheless, no previous research has examined the whole links between low cognitive levels, high cognitive levels, or even creativity and problem-solving skills while low thinking ability (remembering and understanding) is the first stage of cognitive processes (Bloom et al., 1956).

- A few studies concentrated on identifying problem-solving skills under social context (e.g., social influences) and emphasizing the needed skills in the digital age or recognizing them in educational and enterprise environments (AlDhaen, 2023; Annosi et al., 2023; De Wever et al., 2023; Jardim, 2021). For example, De Wever et al. (2023) investigated the relationship between teachers' problem-solving skills and sociodemographic, work-related, and everyday-life background characteristics. According to Wang et al. (2023), social media technologies have a significant effect on problem-solving skills via students' use of media and students' attitudes towards social media. Despite providing insight related to problem-solving skills in the digital age (AlDhaen, 2023; Jardim, 2021), these studies did not indicate the direct impacts of social influences (e.g., individuals on others or the impact of social environments on individuals) on problem-solving skills.
- Few studies have concentrated on the relationship between social influences, cognitive competency, and problem-solving skills (Almulla & Al-Rahmi, 2023; Azmitia & Perlmutter, 1989). The elements of social cognitive theory (e.g., social engagement, social interaction, social influence, social identity, and social support) were considered factors affecting problem-solving skills via reflective thinking and inquiry learning style (Almulla & Al-Rahmi, 2023). However, this research approach mainly focused on high levels of thinking (such as analyzing, synthesizing, recognizing and solving difficulties, concluding, and assessing) and lacked examination of the cognitive processes from low levels of thinking (e.g., remembering and understanding) to creativity or how they might affect problem-solving skills.

Via these findings, this research approaches problem-solving skills by employing the S-O-R framework to examine the relationship between social influences related to digitalization adoption (individuals on others or the impact of social environments on individuals), cognitive competency (low thinking ability, high thinking ability, and creativity), and problem-solving skills, in which stimuli were regarded as social influences; organisms referred to low thinking ability, high thinking ability, and creativity; responses referred to problem-solving skills. The unique point of this study is to view problem-solving skills as the outcomes of cognitive processes through the reception (influence) of the social context (in the context of digitalization adoption). Besides, social influences were considered in a direct relationship, affecting cognitive processes from low cognitive levels (low thinking ability) to high cognitive levels (high thinking ability and creativity) and problem-solving skills. Another highlight of this approach is the successful development of cognitive competency scales associated with problem-solving skills aimed at personnel in the digital age.

Regarding cognitive competency, the cognitive attributes in this context are the outcomes of learning and life experiences that conform to the taxonomy of educational

objectives (Bloom et al., 1956). Despite its primary focus on instructional purposes, the taxonomy of educational objectives is still regarded as a basic tool for developing goals, systematizing questions and exercises used for testing, and assessing learning results for learners. The updated version of the Taxonomy of Educational Objectives covers the following objectives: remembering, understanding, applying, analyzing, evaluating, and creating. On the other hand, Tran et al., 2024 have been successful in developing the cognitive competency scales (Linkert scales) following this approach and demonstrated the suitability of these scales in many sectors (e.g., in the context of digitalization adoption, in educational activities, etc.).

Hypothesis development

The correlation between social influences related to digitalization adoption and cognitive competency (low thinking ability, high thinking ability, and creativity)

The phrase "social influences" refers to any of the different changes that can occur in an individual (physiological, cognitive, emotional, or behavioural) as a result of other people's presence or activity, whether actual, imagined, or inferred (Latané, 1981). The relationship between social influences and cognitive competency has been identified in a variety of contexts and sectors (e.g., in the context of digitalization adoption, in education, etc.) (Gao & Tang, 2023; Olszewski & Crompton, 2020; Perlmutter et al., 1989; Pursitasari et al., 2020). Based on the research results of Gao and Tang (2023), digitalization technology impacted directly attitudes towards digitalization, subjective norms and perceived behavioural control while attitudes and perceived behavioural control were regarded as low thinking ability (recognizing, understanding or even applying). In line with this, Tran (2023) indicated that social influences might occur in the context of social commerce when clients of social commerce sites communicate online to exchange evaluations and ideas. According to Paulus and Dzindolet (2008), it was usually difficult to distinguish social influence elements from cognitive ones since cognitive processes were formed from social interaction and social influence processes were somewhat intellectually mediated. Furthermore, Dionne (2008) demonstrated that social influences were a broad field in which to characterize connections between a person's creativity and almost every feature that might influence that creativity or, conversely, affect the creativity of a group, leader, or even organization. Besides, Almulla and Al-Rahmi (2023) demonstrated the significant effects of social influences on high thinking ability (e.g., reflective thinking, critical thinking, etc.) in explaining learning performance. Based on these arguments, the following hypotheses were proposed:

H1: Social influences related to digitalization adoption have a positive impact on low thinking ability.

H2: Social influences related to digitalization adoption have a positive impact on high thinking ability.

H3: Social influences related to digitalization adoption have a positive impact on creativity.

The correlation between social influences related to digitalization adoption, cognitive competency and problem-solving skills

Former researchers have examined the direct relationship between social influences and problem-solving skills (Azmitia & Perlmutter, 1989; Perlmutter et al., 1989), and the majority have examined the indirect relationship of social influences on problem-solving skills via cognitive processes (Perlmutter et al., 1989; Van Laar et al., 2020). Based on Bruch and Feinberg (2017), a substantial corpus of empirical evidence illustrated how the social environment impacted people's behaviour in a wide range of fields (Carrillo et al., 2016; Pachucki et al., 2011; Perna & Titus, 2005; Rosenquist et al., 2010). Cognitive impacts would lead to more effective or accurate problem-solving when participants worked together (Perlmutter et al., 1989). In addition, Almulla and Al-Rahmi (2023) indicated that social influences impacted not only reflective thinking but also problem-solving skills in explaining learning performance. In line with this, Bloom et al. (1956) stated that creativity was the greatest degree of human cognitive capacity, and via creativity, individuals developed new information and more effective solutions to problems. According to Gigerenzer (2004), thinking ability is a receptive process that involves devising a solution to a problem before making a choice. On the other hand, creativity was often defined as the capacity to think outside the box and build and implement novel solutions (Ward, 2004), allowing the individual to stay adaptive and create an effective problem solver (Runco, 2010). Therefore, the following hypotheses were proposed:

H4: Social influences related to digitalization adoption have a positive impact on problem-solving skills.

H5: Low thinking ability has a positive impact on problem-solving skills.

H6: High thinking ability has a positive impact on problem-solving skills.

H7: Creativity has a positive impact on problem-solving skills.

According to Bloom et al. (1956), there were six domains of cognitive levels in the taxonomy of educational objectives, with remembering and understanding defined as low cognitive levels, applying, analyzing, and evaluating as high cognitive levels, and creativity defined as the highest cognitive level. However, the drivers of creativity and critical thinking were less researched in a digital world (Van Laar et al., 2020). Based on these findings, the following hypotheses were proposed:

H8: Low thinking ability has a positive impact on high thinking ability.

H9: Low thinking ability has a positive impact on creativity.

H10: High thinking ability has a positive impact on creativity.

In accordance with the research approach and the hypotheses, a conceptual model related to problem-solving skills in the context of digitalization adoption was proposed as follows:

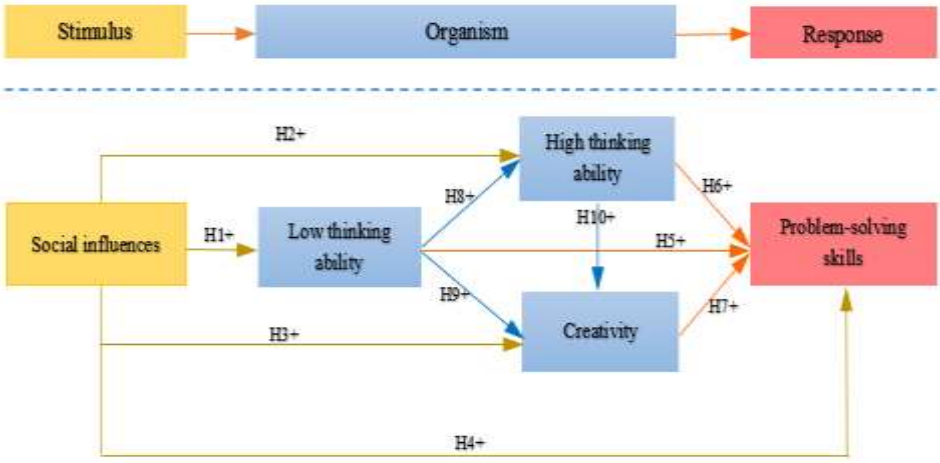

Figure 1
Conceptual framework of problem-solving skills towards digital transformation adoption
*Note: SI: Social influences; LTK: Low thinking ability; HTK: High thinking ability; CR: Creativity; PS: Problem-solving skills.

METHOD

To evaluate a theory's validity by contrasting its predictions to what has currently been observed, a deductive research approach aligned with positivist philosophy was the most suitable to employ (Gammelgaard, 2004). This section will present the three main contents, including data collection, measurement scales, and analysis procedures.

Data collection and measurement instruments

As previously stated, the target respondents were existing workforces in the context of digitalization adoption; hence, primary data were gathered from current personnel based in southern Vietnam. Via the convenience sampling method, questionnaires were sent to respondents randomly using Google Forms. In terms of the sample size, in the partial least squares structural model, the smallest sample size should be equal to ten times the maximum number of arrows in the latent variable at any point (Hair et al., 2011). Although the study collected data through an online survey, it reached more than 500 personnel and received 337 valid responses. The demographic data of respondents is presented in Table 1.

Table 1
Respondents' profiles

Indicator	Value	N/337	Percentage
Gender	Female	216	64.1
	Male	121	35.9
Age group	17-30	245	72.7
	31-40	58	17.2
	41-50	27	8.0
	>50	7	2.1
Educational level	Graduated high school	78	23.1
	Vocational intermediate	8	2.4
	College	21	6.2
	University	198	58.8
	Postgraduate	32	9.5
Seniority after graduating high school	1-5	148	43.9
	6-10	40	11.9
	11-20	132	39.2
	> 20	17	5

In terms of the measurement instruments, this research employed the five-point Linkert scale: 1 = strongly disagree; 5 = strongly agree (shown in Table 2).

Table 2
Description of measurement instruments

Item code	Items/Indicators	Cronbach's Alpha (α)	Source
Social influences (SI): *Social influences on the adoption of digital transformation can be understood as an adjustment in a person's beliefs, feelings, attitudes, or behaviours as a result of interacting with another person or a group or social systems related to digital transformation adoption.*			
SI1	Smart and agile people around me often love to apply digital transformation.	0.908	Adapted from Rashotte (2007) & Lu et al. (2005) & Latané (1996)
SI2	Those who apply digital transformation will solve problems faster and better.		
SI3	People around me applying digital transformation are creative at work.		
SI4	The opinions of digital transformation practitioners influence my decision-making.		
SI5	My friends think I should apply digital transformation to my work.		
SI6	Information on social networks and media about digital transformation affects my decision-making.		
SI7	Services that apply digital transformation appeal to my decision-making.		
Low thinking ability (LTK): low thinking ability about digital transformation is the basic ability of the mind to work with information from the environment and create consciousness and understanding of problems in the context of digital transformation; specifically, being able to quickly recognize and understand situations objectively.			
LTK1	I can list 3-5 problems that I need to solve in the near future.	0.727	Adapted from Bloom et al. (1956)
LTK2	I always remember well and can restate events that have just happened.		
LTK3	I always grasp quickly and clearly understand the context of situations that occur.		
LTK4	Accumulated knowledge helps me recognize and solve problems in life.		
High thinking ability (HTK): High thinking ability about digital transformation is the ability of the mind based on understanding to consider, analyze, evaluate, and solve problems in the context of digital transformation; specifically, having a confident attitude and trying to solve difficult problems clearly when faced.			
HTK1	I am confident when facing difficult problems	0.831	Adapted from Bloom et al. (1956)
HTK2	I always try to reason and think accurately when solving difficult problems		
HTK3	I always try to look at things and phenomena objectively		
HTK4	I often answer questions with highly logical reasoning		
Creativity (CR): Creativity is an activity of perception—the ability to create new ideas, sometimes overcoming the limits of traditional concepts or existing information under the context of digital transformation. This is the ability to combine, transform, and create unique ideas, solutions, or products in a creative and groundbreaking way, specifically through analysis and evaluation activities from which to propose and synthesize new solutions and products.			
CR1	I always know how to flexibly apply knowledge and experience to real-life situations	0.911	Adapted from Bloom et al. (1956)
CR2	I always feel flexible and creative in the problem-solving process		
CR3	I always have backup plans when making decisions		
CR4	I always feel that I am quick and handle complex situations well		
CR5	I prioritize using reason in my decisions		
CR6	I am capable of evaluating and selecting the best options.		
CR7	The more difficult the problems I have to solve, the faster I feel like I can handle the situation		
CR8	I find I often get accurate results when solving difficult problems		
Problem-solving skills (PS): Problem-solving skills under the context of digital transformation are the ability to solve problems in a logical sequence, including the ability to search for information, analyze situations with the aim of identifying problems to create alternative courses of action, prompt for alternative courses of action for desired or expected outcomes, and select and implement an appropriate plan of action			
PS1	When I encounter difficulties, I always find a way to solve problems in a clear, logical order	0.915	Adapted from Janis and Mann (1977) & Bloom et al. (1956) & Mumford et al. (2017)
PS2	I quickly identified the issues that needed to be prioritized to be resolved		
PS3	I always clearly define the goals to be achieved when planning my actions		
PS4	I always clearly distinguish what is relevant and what is not relevant to the situation under consideration		
PS5	When analyzing the situation, I try to discover the main causes of the problem		
PS6	I always look for different ways to solve problems		
PS7	I always carefully consider options when coming up with solutions		
PS8	I visualize the possible consequences/possibilities when choosing an option to solve a problem		

Analysis procedures

To avoid common method bias, the reliability of initial measurement scales was examined by Cronbach's Alpha (α) using the SPSS programme (shown in Table 2). To consolidate the reliability of the scale, Cronbach's Alpha index must be above 0.6 (Hair et al., 2006). In addition, Kock and Lynn (2012) indicated that the model was devoid of common method bias when all VIF values from a comprehensive collinearity test were equal to or less than 3.3. This research has tested the VIF values, and all were under 3.3; hence, the common method bias was not a concern.

After testing common method bias, this study assessed the measurement and structural models by using the SmartPLS programme. In terms of the assessment of the measurement model, convergent validity, composite reliability, and discriminant validity were evaluated based on the criteria of (Hair Jr et al., 2021). In addition, the authors advise utilizing Partial Least Squares Structural Equation Modelling (PLS-SEM) to evaluate the structural model and test hypotheses since it pertains to evaluating the complicated interactions between the multiple indirect and direct outcomes (Hair Jr et al., 2021).

FINDINGS

Assessing the measurement model

Related to the reliability and validity of scales, Cronbach's alpha and composite reliability should be higher than the threshold of 0.6 (Hair Jr et al., 2021). Based on the results (Table 3), the minimum Cronbach's alpha and composite reliability values were 0.729 and 0.831, respectively. Hence, the reliability and validity of the scales were assured.

Regarding the convergent validity, Hair Jr et al. (2021) indicated that the outer loading values should be higher than 0.6 and the average variance extracted (AVE) should be higher than 0.5 in the exploratory research. Based on these conditions Hair Jr et al. (2021), the convergent validity of the measurement scales was assured since the minimums of outer loading and AVE were 0.623 and 0.553, respectively (Table 3).

Table 3
Outer loadings, reliability and convergent validity

Variables	Items	Loading	α	CR	AVE
Social influences	SI1	0.764	0.908	0.927	0.644
	SI2	0.807			
	SI3	0.830			
	SI4	0.802			
	SI5	0.797			
	SI6	0.795			
	SI7	0.823			
Low thinking ability	LTK1	0.623	0.729	0.831	0.553
	LTK2	0.744			
	LTK3	0.833			
	LTK4	0.760			
High thinking ability	HTK1	0.769	0.831	0.888	0.664
	HTK2	0.838			
	HTK3	0.790			
	HTK4	0.859			
Creativity	CR1	0.809	0.913	0.931	0.658
	CR2	0.855			
	CR3	0.761			
	CR4	0.861			
	CR6	0.824			
	CR7	0.747			
	CR8	0.815			
Problem-solving skills	PS1	0.775	0.915	0.931	0.628
	PS2	0.816			
	PS3	0.816			
	PS4	0.785			
	PS5	0.795			
	PS6	0.819			
	PS7	0.791			
	PS8	0.739			

To assess the discriminant validity of the measurement model, the Fornell-Larcker criterion and the Heterotrait-Monotrait ratio (HTMT) were both employed. Garson (2016) indicated that the HTMT index should be smaller than 1. Therefore, the discriminant validity of the measurement model was assured since all values were under 1 (Table 4).

Table 4
Heterotrait-Monotrait ratio results

	1	2	3	4	5
1. Creativity					
2. High thinking ability	0.854				
3. Low thinking ability	0.793	0.930			
4. Problem-solving skills	0.826	0.920	0.927		
5. Social influences	0.573	0.551	0.600	0.603	

Assessing the structural model

Figure 2 and Table 5 highlight the results of hypothesis testing and structural coefficient paths. All direct relationships between social influences, cognitive competency, and problem-solving skills were positive and significant ($p < 0.01$). Specifically, social influences have positive effects on low thinking ability ($\beta = 0.494$), high thinking ability ($\beta = 0.158$), creativity ($\beta = 0.171$), and problem-solving skills ($\beta = 0.115$). Therefore, H1, H2, H3, and H4 were accepted. In terms of the association between cognitive competency and problem-solving skills, low thinking ability, high thinking ability, and creativity have positive impacts on problem-solving skills ($\beta = 0.281$, $\beta = 0.360$, $\beta = 0.242$, respectively); hence, H5, H6, and H7 were accepted. Similarly, low thinking ability has positive impacts on both high thinking ability ($\beta = 0.657$) and creativity ($\beta = 0.204$), as well as the positive impact of high thinking ability on creativity ($\beta = 0.518$). As a result, H8, H9, and H10 were accepted.

Table 5
Hypothesized structural paths

Hypothesis	Relationships	Estimate	SD	T -value	P value	Result
H1	Social influences → Low thinking ability	0.494	0.044	11.287*	0.000	Accepted
H2	Social influences → High thinking ability	0.158	0.046	3.415*	0.001	Accepted
H3	Social influences → Creativity	0.171	0.045	3.782*	0.000	Accepted
H4	Social influences → Problem-solving skills	0.115	0.034	3.350*	0.001	Accepted
H5	Low thinking ability → Problem-solving skills	0.281	0.057	4.933*	0.000	Accepted
H6	High thinking ability → Problem-solving skills	0.360	0.062	5.762*	0.000	Accepted
H7	Creativity → Problem-solving skills	0.242	0.050	4.891*	0.000	Accepted
H8	Low thinking ability → High thinking ability	0.657	0.043	15.338*	0.000	Accepted
H9	Low thinking ability → Creativity	0.204	0.060	3.378*	0.001	Accepted
H10	High thinking ability → Creativity	0.518	0.060	8.584*	0.000	Accepted

Note: SD = standard deviation; *significant at $p<0.01$; **significant at $p<0.05$; ns = not significant.

$R^2_{\text{Low thinking ability}} = 0.244$, $R^2_{\text{High thinking ability}} = 0.559$, $R^2_{\text{Creativity}} = 0.614$, $R^2_{\text{Problem-solving skills}} = 0.753$

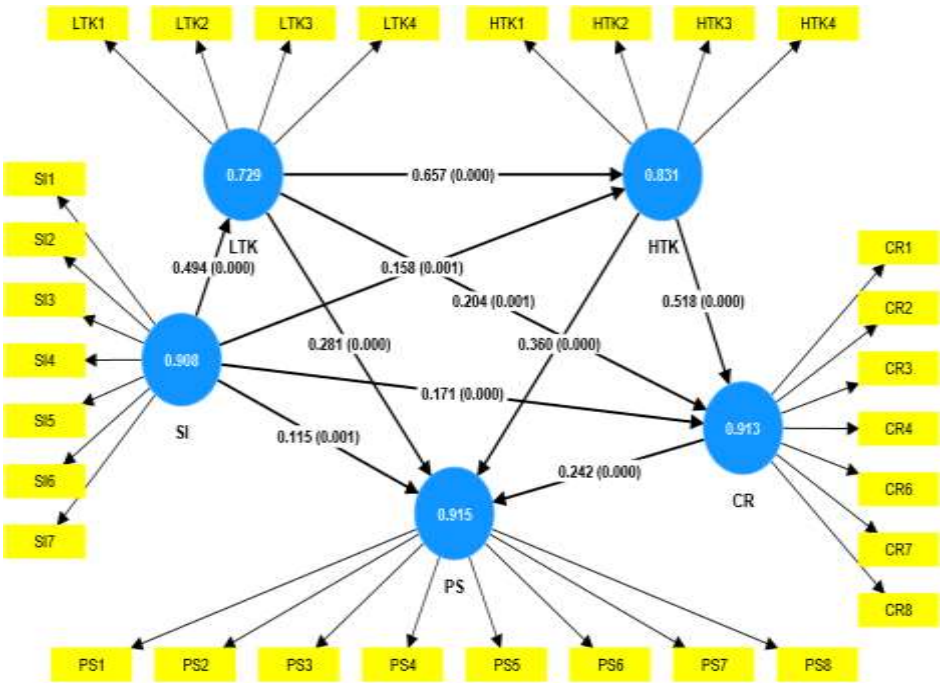

Figure 2
Results of structural paths
*Note: SI: Social influences; LTK: Low thinking ability; HTK: High thinking ability; CR: Creativity; PS: Problem-solving skills

Regarding the indirect effects in this model, all associations between social influences, low thinking ability, high thinking ability, creativity, and problem-solving skills were positive and significant ($p < 0.01$). These findings will be discussed deeply in the next section.

Table 6
Presenting the indirect impacts

Relationships	Estimate	SD	T -value	P value	Result
SI → LTK → HTK	0.324	0.037	8.864*	0.000	Accepted
SI → LTK → CR	0.101	0.031	3.269*	0.001	Accepted
SI → LTK → PS	0.139	0.031	4.430*	0.000	Accepted
SI → HTK → PS	0.057	0.019	2.991*	0.003	Accepted
SI → CR → PS	0.041	0.014	2.947*	0.003	Accepted
SI → LTK → HTK → CR	0.168	0.027	6.129*	0.000	Accepted
SI → LTK → HTK → PS	0.117	0.024	4.848*	0.000	Accepted
SI → LTK → CR → PS	0.024	0.009	2.639*	0.008	Accepted
SI → HTK → CR	0.082	0.025	3.227*	0.001	Accepted
SI → HTK → CR → PS	0.020	0.008	2.634*	0.008	Accepted
SI → LTK → HTK → CR → PS	0.041	0.010	4.055*	0.000	Accepted
LTK → HTK → CR	0.341	0.046	7.363*	0.000	Accepted
LTK → HTK → PS	0.237	0.043	5.491*	0.000	Accepted
LTK → CR → PS	0.049	0.019	2.657*	0.008	Accepted
LTK → HTK → CR → PS	0.083	0.020	4.231*	0.000	Accepted
HTK → CR → PS	0.126	0.029	4.308*	0.000	Accepted

Note: SD = standard deviation; *significant at $p<0.01$; **significant at $p<0.05$; ns = not significant

DISCUSSION

As presented above, problem-solving skills played a critical role in the context of the digital age, and it was found to be challenging to explain how problem-solving skills were formed in education and operation. The results of this study successfully provided obvious evidence to explain the process of forming problem-solving skills via the effects of social influences related to digitalization adoption and cognitive processes ($R^2_{\text{Problem-solving skills}} = 0.753$). According to the research findings, the mechanism of forming problem-solving skills was identified, and the main discussions of this mechanism were divided into two parts, including: (1) the effects of social influences on cognitive processes and problem-solving skills; and (2) the effects of cognitive competency (including the interplays between low and high thinking abilities and creativity) on problem-solving skills. Based on the significant explanation, the research model emphasized its suitability not only in educational aspects but also in an operational environment. Besides, this study also responded to the call for papers (Van Laar et al., 2020) to build up a holistic model which not only offered insight into theories in this field but also the specification of the associations between stimuli (social influences), organisms (cognitive processes), and responses (problem-solving skills).

First, social influences regarded as stimulus factors (including the effect of individuals on others or the impact of social environments on individuals) directly affected the cognitive processes (the interplays between low and high thinking abilities, and creativity) and problem-solving skills. Specifically, social influences had significant positive impacts on low thinking ability ($\beta = 0.494$; $p < 0.01$), on high thinking ability ($\beta = 0.158$; $p < 0.01$), on creativity ($\beta = 0.171$, $p < 0.01$), and on problem-solving skills ($\beta = 0.115$; $p < 0.01$). These results indicated that social influences related to the application of digital transformation had a positive relationship with the cognitive processes, in which low thinking has the highest path relationship ($\beta = 0.494$). Thus, interventions or messages sent to digital transformation participants need to positively impact surrounding relationships and increase exposure to information that will help improve participants' cognitive processes and problem-solving skills.

Second, three components of cognitive competency (low thinking ability, high thinking ability, and creativity) had significant positive impacts on problem-solving skills ($\beta_{LTK\rightarrow PS} = 0.281$, $\beta_{HTK\rightarrow PS} = 0.360$, $\beta_{CR\rightarrow PS} = 0.242$). In addition, the cognitive processes were clarified based on the interplays between low thinking ability, high thinking ability, and creativity. In the first stage of the cognitive processes after exposure to social influences (low thinking processes), participants begin recognizing information, then remembering it, and finally understanding the content of the information. In the second stage of the cognitive processes (high thinking processes), the results indicated that "lower thinking was the first step towards higher level thinking" ($\beta_{LTK\rightarrow HTK} = 0.657$, $\beta_{LTK\rightarrow CR} = 0.204$). At this stage, after understanding information (from social influences), participants were able to apply, analyse, evaluate or even create, thereby, forming their skills or making appropriate choices ($\beta_{LTK\rightarrow HTK\rightarrow CR} = 0.341$, $\beta_{LTK\rightarrow HTK\rightarrow PS} = 0.237$). Furthermore, to be creative, the influence of high-level thinking processes has a significant and major impact compared to lower-level thinking ($\beta_{HTK\rightarrow CR} = 0.518 > \beta_{LTK\rightarrow CR} = 0.204$). These findings were consistent with the results of Bloom et al. (1956) when considering the cognitive processes of students via the Taxonomy of Educational Objectives, including six dimensions (remembering, understanding, applying, analysing, evaluating, and creating).

In terms of theoretical contributions, this study offered a novel research approach when employing the S-O-R framework to explain the process of shaping problem-solving skills in the context of the digital age. As mentioned, the direct effects of social influences on problem-solving skills were mostly focused on educational purposes and aimed at students. This study highlighted not only the direct impacts of social influences on cognitive processes but also problem-solving skills, and these findings were consistent with the results of Perlmutter et al. (1989). On the other hand, the uniqueness of relationships between cognitive competency and problem-solving skills in this study was also emphasized by providing the cognitive processes from low levels of thinking (e.g., remembering, understanding, and applying) to high levels of thinking (analyzing, evaluating, and creating) when exposing the social influences. These findings also revealed the important role of low thinking ability in shaping high thinking ability, creativity, and problem-solving skills as well as responding to the call of Pennebaker et al. (1990) related to levels of thinking.

Regarding the direct effects in this model, social influences have greatly positive impacts on both cognitive competency (low thinking ability, high thinking ability, and creativity) and problem-solving skills. Similarly, cognitive competency has a considerably positive impact on problem-solving skills. In addition, the relationships between the components of cognitive competency are significantly positive. Specifically, low thinking ability has positive impacts on both high thinking ability and creativity. High thinking ability has a positive impact on creativity. Based on these direct relationships, this study provided the foundations to propose the practical and management implications for managers and policymakers in both educational and operational aspects. In addition to the direct effects, the indirect effects in this model offer significant contributions to both practical and theoretical aspects. From a theoretical perspective, the research results once again emphasize the mediating role of cognition in receiving information (social influences); through cognitive processes, problem-solving skills will be shaped. These findings are consistent with the results of previous studies (Almulla & Al-Rahmi, 2023; Annosi et al., 2023; Olszewski & Crompton, 2020; Pursitasari et al., 2020). From a practical perspective, recognizing the bridging relationship between social influences on cognition and the process of forming problem-solving skills is the main key for managers and policymakers to provide intervention measures to improve the cognitive competency and problem-solving skills of the current workforce. A current practical paradox is that developing countries always want to improve human resource quality and focus on developing people at a high cognitive level (for example, previous studies focused on critical thinking and high thinking), although social influences have a significant and strong influence on low thinking levels. In other words, lower thinking ability is the initial step towards higher levels of thinking after being influenced by social influences. Based on the significant effects of low thinking ability on the components of this model (both direct and indirect), the results raised questions about how to train the workforce via cognitive domains.

According to the direct and indirect effects between the associations of social influences, cognitive competency, and problem-solving skills, several management implications were proposed:

- Combine face-to-face and online communication with practical instructions for handling operational issues related to digital transformation.
- Ensure communication messages (direct and indirect) are standard, simple, easy to understand, and educational in order to raise the awareness level of the recipient audience.
- Combine building role models and setting examples of individuals who handle situations well in operational practice as well as creating conditions for individuals to share certain challenges in their current work.
- Ensure the directionality of messages that will be transmitted on network channels about problem-solving skills to improve the ability to understand, apply, analyze and evaluate core issues in organizations and businesses.

- Create conditions for individuals to be creative within the framework and in accordance with current work circumstances and characteristics to improve problem-solving skills.
- Ensure human resource training aligns with organizational standards (focus on low thinking ability to high thinking ability) to improve cognitive competence and problem-solving abilities throughout digital transformation.
- Ensure there is a connection between organizations and schools to share learning skills and practice solving core issues in management and administration.

CONCLUSIONS, LIMITATIONS, AND FUTURE RESEARCH DIRECTIONS

Along with the results, this study reaffirmed the relevance of the research approach by explaining well the process of forming problem-solving skills of current human resources in the digital age. The research results also met the initial research objectives set out well. First, social influences and cognitive competency are determinants of forming problem-solving skills. Second, with the initial goal of investigating the relationship between low thinking ability, high thinking ability, creativity, and problem-solving skills, the research findings revealed that low thinking ability serves as the foundation for high thinking ability and creativity and that all components of cognitive competency have a positive impact on the process of acquiring problem-solving skills. Finally, the individual's influence on others or the impact of the social environment on the individual is a factor that directly affects the cognitive processes and problem-solving skills of the individual in the context of digitalization.

In addition to the contributions of both practical and theoretical aspects, this study has some limitations. First, some biases may be due to the cross-sectional study. Second, this study mostly focuses on rational aspects when exposing social influences in explaining the process of forming problem-solving skills. Therefore, other factors (e.g., emotional aspects) need to be explored in further research to refine the current research model. Finally, this research is aimed at the current workforce, so future studies can consider expanding this research model to other audiences (e.g., students and pupils).

DECLARATIONS

Data Availability Statement

The data presented in this study are available on request from the corresponding author.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest

The author declares that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors

REFERENCES

Akpur, U. (2020). Critical, reflective, creative thinking and their reflections on academic achievement. *Thinking Skills and Creativity*, *37*, 100683. https://doi.org/10.1016/j.tsc.2020.100683

AlDhaen, E. (2023). Education skills for digital age toward sustainable development–analysis and future directions. *Development and Learning in Organizations: An International Journal*, *37*(3), 11-14. https://doi.org/10.1108/DLO-06-2022-0108

Almulla, M. A., & Al-Rahmi, W. M. (2023). Integrated social cognitive theory with learning input factors: the effects of problem-solving skills and critical thinking skills on learning performance sustainability. *Sustainability*, *15*(5), 3978. https://doi.org/10.3390/su15053978

Annosi, M. C., Capo, F., Appio, F. P., & Bedetti, I. (2023). Unveiling micro-foundations of digital transformation: Cognitive models, routines, and organizational structures in agri-food SMEs. *Technological Forecasting and Social Change*, *197*, 122922. https://doi.org/10.1016/j.techfore.2023.122922

Artika, W., & Nurmaliah, C. (2023). Improving Critical Thinking Skills Through Higher Order Thinking Skills (HOTS)-Based Science. *International Journal of Instruction*, *16*(4). https://doi.org/10.29333/iji.2023.16417a

Astuti, T. N., Sugiyarto, K. H., & Ikhsan, J. (2020). Effect of 3D Visualization on Students' Critical Thinking Skills and Scientific Attitude in Chemistry. *International Journal of Instruction*, *13*(1), 151-164. https://doi.org/10.29333/iji.2020.13110a

Azmitia, M., & Perlmutter, M. (1989). Social influences on children's cognition: State of the art and future directions. *Advances in child development and behavior*, *22*, 89-144. https://doi.org/10.1016/S0065-2407(08)60413-9

Bilro, R. G., Loureiro, S. M. C., & Ali, F. (2018). The role of website stimuli of experience on engagement and brand advocacy. *Journal of Hospitality and Tourism Technology*, *9*(2), 204-222. https://doi.org/10.1108/JHTT-12-2017-0136

Blanka, C., Krumay, B., & Rueckel, D. (2022). The interplay of digital transformation and employee competency: A design science approach. *Technological Forecasting and Social Change*, *178*, 121575. https://doi.org/10.1016/j.techfore.2022.121575

Bloom, B. S., Engelhart, M. D., Furst, E., Hill, W. H., & Krathwohl, D. R. (1956). *Handbook I: cognitive domain*.

Braunstein, M. L. (1972). Perception of rotation in depth: a process model. *Psychological Review*, *79*(6), 510. https://doi.org/10.1037/h0033459

Briggs, V. M. (2019). Human resource development and the formulation of national economic policy. In *Evolutionary Economics: v. 1* (pp. 257-290). Routledge. https://doi.org/10.1080/00213624.1987.11504701

Bruch, E., & Feinberg, F. (2017). Decision-making processes in social contexts. *Annual review of sociology*, *43*, 207-227. https://doi.org/10.1146/annurev-soc-060116-053622

Carrillo, L., Pattillo, M., Hardy, E., & Acevedo-Garcia, D. (2016). Housing decisions among low-income Hispanic households in Chicago. *Cityscape*, *18*(2), 109-150.

Chi, M. T., Glaser, R., & Farr, M. J. (2014). *The nature of expertise*. Psychology Press.

Çiftci, S., & Bildiren, A. (2020). The effect of coding courses on the cognitive abilities and problem-solving skills of preschool children. *Computer science education*, *30*(1), 3-21. https://doi.org/10.1080/08993408.2019.1696169

Croes, E., & Bartels, J. (2021). Young adults' motivations for following social influencers and their relationship to identification and buying behavior. *Computers in Human Behavior*, *124*, 106910. https://doi.org/10.1016/j.chb.2021.106910

Dai, Q., & Cheng, K. (2022). What drives the adoption of agricultural green production technologies? An extension of TAM in agriculture. *Sustainability*, *14*(21), 14457. https://doi.org/10.3390/su142114457

De Wever, B., Hämäläinen, R., Nissinen, K., Mannonen, J., & Van Nieuwenhove, L. (2023). Teachers' problem-solving skills in technology-rich environments: a call for workplace learning and opportunities to develop professionally. *Studies in Continuing Education*, *45*(1), 86-112. https://doi.org/10.1080/0158037X.2021.2003769

Dionne, S. D. (2008). Social influence, creativity, and innovation: Boundaries, brackets, and non-linearity. In *Multi-level issues in creativity and innovation* (pp. 63-73). Emerald Group Publishing Limited. https://doi.org/10.1016/S1475-9144(07)00002-1

Fitriani, A., Zubaidah, S., Susilo, H., & Al Muhdhar, M. H. I. (2020). The effects of integrated problem-based learning, predict, observe, explain on problem-solving skills and self-efficacy. *Eurasian Journal of Educational Research*, *20*(85), 45-64. https://doi.org/10.14689/ejer.2020.85.3

Gammelgaard, B. (2004). Schools in logistics research? A methodological framework for analysis of the discipline. *International Journal of Physical Distribution & Logistics Management*, *34*(6), 479-491. https://doi.org/10.1108/09600030410548541

Gao, Y., & Tang, Y. (2023). A Study on the Mechanism of Digital Technology's Impact on the Green Transformation of Enterprises: Based on the Theory of Planned Behavior Approach. *Sustainability*, *15*(15), 11854. https://doi.org/10.3390/su151511854

Garson, G. D. (2016). Partial least squares. Regression and structural equation models. In: Statistical Publishing Associates.

Gfrerer, A., Hutter, K., Füller, J., & Ströhle, T. (2021). Ready or not: Managers' and employees' different perceptions of digital readiness. *California Management Review*, *63*(2), 23-48. https://doi.org/10.1177/0008125620977487

Gigerenzer, G. (2004). Fast and frugal heuristics: The tools of bounded rationality. *Blackwell handbook of judgment and decision making*, *62*, 88. https://doi.org/10.1002/9780470752937.ch4

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis 6th Edition*. Pearson Prentice Hall. New Jersey. humans: Critique and reformulation ….

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing theory and Practice*, *19*(2), 139-152. https://doi.org/10.2753/MTP1069-6679190202

Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook*. Springer Nature. https://doi.org/10.1007/978-3-030-80519-7

He, Q., Borgonovi, F., & Paccagnella, M. (2021). Leveraging process data to assess adults' problem-solving skills: Using sequence mining to identify behavioral patterns across digital tasks. *Computers & Education*, *166*, 104170. https://doi.org/10.1016/j.compedu.2021.104170

Janis, I. L., & Mann, L. (1977). *Decision making: A psychological analysis of conflict, choice, and commitment*. Free press.

Jardim, J. (2021). Entrepreneurial skills to be successful in the global and digital world: Proposal for a frame of reference for entrepreneurial education. *Education Sciences*, *11*(7), 356. https://doi.org/10.3390/educsci11070356

Kock, N., & Lynn, G. (2012). Lateral collinearity and misleading results in variance-based SEM: An illustration and recommendations. *Journal of the Association for information Systems*, *13*(7). https://doi.org/10.17705/1jais.00302

Latané, B. (1981). The psychology of social impact. *American psychologist*, *36*(4), 343. https://doi.org/10.1037/0003-066X.36.4.343

Latané, B. (1996). Dynamic social impact: The creation of culture by communication. *Journal of communication*, *46*(4), 13-25. https://doi.org/10.1111/j.1460-2466.1996.tb01501.x

Liu, Y., Cai, L., Ma, F., & Wang, X. (2023). Revenge buying after the lockdown: Based on the SOR framework and TPB model. *Journal of Retailing and Consumer Services*, *72*, 103263. https://doi.org/10.1016/j.jretconser.2023.103263

Lu, J., Yao, J. E., & Yu, C.-S. (2005). Personal innovativeness, social influences and adoption of wireless Internet services via mobile technology. *The journal of strategic Information Systems*, *14*(3), 245-268. https://doi.org/10.1016/j.jsis.2005.07.003

Mangaroska, K., Sharma, K., Gašević, D., & Giannakos, M. (2022). Exploring students' cognitive and affective states during problem solving through multimodal data: Lessons learned from a programming activity. *Journal of Computer Assisted Learning*, *38*(1), 40-59. https://doi.org/10.1111/jcal.12590

Mehrabian, A., & Russell, J. A. (1974). *An approach to environmental psychology*. the MIT Press.

Mumford, M. D., Todd, E. M., Higgs, C., & McIntosh, T. (2017). Cognitive skills and leadership performance: The nine critical skills. *The Leadership Quarterly*, *28*(1), 24-39. https://doi.org/10.1016/j.leaqua.2016.10.012

Nguyen Thi, B., Tran, T. L. A., Tran, T. T. H., Le, T. T., Tran, P. N. H., & Nguyen, M. H. (2022). Factors influencing continuance intention of online shopping of generation Y and Z during the new normal in Vietnam. *Cogent Business & Management*, *9*(1), 2143016. https://doi.org/10.1080/23311975.2022.2143016

Noble, S. M., Mende, M., Grewal, D., & Parasuraman, A. (2022). The Fifth Industrial Revolution: How harmonious human–machine collaboration is triggering a retail and service [r] evolution. *Journal of Retailing*, *98*(2), 199-208. https://doi.org/10.1016/j.jretai.2022.04.003

O'Flaherty, J., & Costabile, M. (2020). Using a science simulation-based learning tool to develop students' active learning, self-confidence and critical thinking in academic writing. *Nurse Education in Practice*, *47*, 102839. https://doi.org/10.1016/j.nepr.2020.102839

Olszewski, B., & Crompton, H. (2020). Educational technology conditions to support the development of digital age skills. *Computers & Education*, *150*, 103849. https://doi.org/10.1016/j.compedu.2020.103849

Pachucki, M. A., Jacques, P. F., & Christakis, N. A. (2011). Social network concordance in food choice among spouses, friends, and siblings. *American journal of public health*, *101*(11), 2170-2177. https://doi.org/10.2105/AJPH.2011.300282

Paulus, P. B., & Dzindolet, M. (2008). Social influence, creativity and innovation. *Social Influence*, *3*(4), 228-247. https://doi.org/10.1080/15534510802341082

Peng, C., & Kim, Y. G. (2014). Application of the stimuli-organism-response (SOR) framework to online shopping behavior. *Journal of Internet Commerce*, *13*(3-4), 159-176. https://doi.org/10.1080/15332861.2014.944437

Pennebaker, J. W., Czajka, J. A., Cropanzano, R., Richards, B. C., Brumbelow, S., Ferrara, K., Thompson, R., & Thyssen, T. (1990). Levels of thinking. *Personality and Social Psychology Bulletin*, *16*(4), 743-757. https://doi.org/10.1177/0146167290164014

Perlmutter, M., Behrend, S. D., Kuo, F., & Muller, A. (1989). Social influences on children's problem solving. *Developmental psychology*, *25*(5), 744. https://doi.org/10.1037/0012-1649.25.5.744

Perna, L. W., & Titus, M. A. (2005). The relationship between parental involvement as social capital and college enrollment: An examination of racial/ethnic group differences. *The journal of higher education*, *76*(5), 485-518. https://doi.org/10.1080/00221546.2005.11772296

Pursitasari, I., Suhardi, E., Putra, A., & Rachman, I. (2020). Enhancement of studentâ€™s critical thinking skill through science context-based inquiry learning. *Jurnal Pendidikan IPA Indonesia*, *9*(1), 97-105. https://doi.org/10.15294/jpii.v9i1.21884

Rashotte, L. (2007). Social influence. *The Blackwell encyclopedia of sociology*. https://doi.org/10.1002/9781405165518.wbeoss154

Rosenquist, J. N., Murabito, J., Fowler, J. H., & Christakis, N. A. (2010). The spread of alcohol consumption behavior in a large social network. *Annals of internal medicine*, *152*(7), 426-433. https://doi.org/10.7326/0003-4819-152-7-201004060-00007

Runco, M. A. (2010). Divergent thinking, creativity, and ideation. *The Cambridge handbook of creativity*, *413*, 446.

Russell, K., O'Raghallaigh, P., McAvoy, J., & Hayes, J. (2020). A cognitive model of digital transformation and IS decision making. *Journal of Decision Systems*, *29*(sup1), 45-62. https://doi.org/10.1080/12460125.2020.1848388

Shanta, S., & Wells, J. G. (2022). T/E design based learning: assessing student critical thinking and problem solving abilities. *International Journal of Technology and Design Education*, *32*(1), 267-285. https://doi.org/10.1007/s10798-020-09608-8

Skagerlund, K., Forsblad, M., Tinghög, G., & Västfjäll, D. (2022). Decision-making competence and cognitive abilities: Which abilities matter? *Journal of Behavioral Decision Making*, *35*(1), e2242. https://doi.org/10.1016/j.jretai.2022.04.003

Tangkui, R. B., & Keong, T. C. (2023). The Effect of Minecraft on Learners' Higher-Order Thinking Skills in Fractional Problem-Solving. *Anatolian Journal of Education*, *8*(2), 1-20. https://doi.org/10.29333/aje.2023.821a

TRAN, T., TRUONG, T., PHAM, T., & & PHAM, D. H. (2024). Cognitive Competency, Problem-Solving Skills and Decision-Making: A Case Study of Students' Extracurricular Activities in The Distribution Chains Sector. *Journal of Distribution Science*, *22*(2), 71-82. https://doi.org/10.15722/jds.22.02.202402.71

Tran, T. D. (2023). Gen Z's Intention to Repurchase Food Online in The Context of a Crisis: A Case Study in Vietnam Under COVID-19. *Journal of Distribution Science*, *21*(12), 23-34. https://doi.org/10.15722/jds.21.12.202312.23

Tuan Mansor, T. M., Mohamad Ariff, A., Hashim, H. A., & Ngah, A. H. (2022). External whistleblowing intentions of auditors: a perspective based on stimulus–organism–response theory. *Corporate Governance: The International Journal of Business in Society*, *22*(4), 871-897. https://doi.org/10.1108/CG-03-2021-0116

Van Laar, E., Van Deursen, A. J., Van Dijk, J. A., & de Haan, J. (2020). Determinants of 21st-century skills and 21st-century digital skills for workers: A systematic literature review. *Sage Open*, *10*(1), 2158244019900176. https://doi.org/10.1177/2158244019900176

Volberda, H. W., Khanagha, S., Baden-Fuller, C., Mihalache, O. R., & Birkinshaw, J. (2021). Strategizing in a digital world: Overcoming cognitive barriers, reconfiguring routines and introducing new organizational forms. *Long Range Planning*, *54*(5), 102110. https://doi.org/10.1016/j.lrp.2021.102110

Wang, M., Yu, R., & Hu, J. (2023). The relationship between social media-related factors and student collaborative problem-solving achievement: an HLM analysis of 37 countries. *Education and Information Technologies*, 1-19. https://doi.org/10.1007/s10639-023-11763-z

Ward, T. B. (2004). Cognition, creativity, and entrepreneurship. *Journal of business venturing*, *19*(2), 173-188. https://doi.org/10.1016/S0883-9026(03)00005-3

Zhao, S., & Liu, Y. (2023). Revenge tourism after the lockdown: Based on the SOR framework and extended TPB model. *Journal of Travel & Tourism Marketing*, *40*(5), 416-433. https://doi.org/10.1080/10548408.2023.2256777