Enhancing Learning Process by Applying Cooperative Learning Supported with Augmented Reality Environment

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Abstracts: This study aims to examine the influence of Augmented Reality (AR) on Cooperative Learning (CL) and Students' Achievement (SA) within the context of education. This study employed a survey-based research design to investigate the proposed connections between constructs, using a two-step methodology to empirically examine the hypothesized relationships. The data collection process involved the creation of a meticulously designed, structured questionnaire, specifically targeting students at the Institute of Public Administration in KSA. A pilot test was conducted with the assistance of three experienced instructors, and a remarkable response rate of 67% was achieved with 81 completed questionnaires, of which 67 were deemed usable for analysis. To test the hypothesized associations, the cutting-edge partial least squares (PLS) modeling approach was employed, ensuring accurate and reliable results. The learning process begins with teachers explaining the new learning process and students being grouped based on cooperative learning strategies. Students will be asked to install the ARLOOPA application on their mobile devices and given printed cards to scan with their mobile devices. The findings provide compelling evidence supporting the hypotheses, indicating that the use of AR has a positive effect on both CL and SA. Furthermore, the study confirms the reciprocal relationship between CL and SA, suggesting that CL implementation fosters improved student achievement. Overall, this study contributes to the existing literature and provides valuable insights into the application of AR to enhance cooperative learning and student achievement.

Keywords: Traditional Learning, Cooperative Learning, Augmented Reality, Interpersonal Skills, Promotive Interaction.

1. INTRODUCTION

Cooperative education emphasises collaboration, experiential learning, and the integration of theory and practice. It aims to bridge the gap between academia and the real world by providing students with opportunities to apply their knowledge and skills in practical settings [1]. Cooperative education encourages students to work together in teams, facilitating the development of effective communication, critical thinking, and interpersonal skills [2]. This collaborative approach mirrors the demands of the modern workplace, where teamwork and cooperation are highly valued. Traditional education often focuses on individual learning and assessment, with limited emphasis on group projects or cooperative problem-solving.

Cooperative education incorporates modern teaching methods and technologies to enhance the learning experience. Virtual reality (VR) and augmented reality (AR) technologies enable students to explore complex concepts through simulations and visualisations, making learning more engaging and impactful [3]. Additionally, online learning platforms offer flexibility in terms of time and location, allowing students to access educational resources and participate in discussions at their convenience. Experiential learning is also a significant aspect of cooperative education, where students actively engage in real-world experiences related to their fields of study. This multidimensional approach to education ensures that students receive a well-rounded and comprehensive learning experience that prepares them for the complexities of the modern world [4].

Cooperative learning in conjunction with an augmented reality (AR) environment has the potential to revolutionize the educational landscape. AR technology allows virtual objects, animations, and simulations to be overlaid onto the real-world environment, creating an enriched learning experience [5]. Cooperative learning promotes teamwork and collaboration among students, encouraging active participation, peer interaction, and the sharing of ideas and perspectives [4]. By combining cooperative learning with AR, students can experience a new

level of engagement and interactivity. AR allows virtual objects, animations, and simulations to be overlaid onto the real-world environment, creating an enriched learning experience [5].

AR collaboration tools allow students to communicate and collaborate seamlessly, regardless of their physical location [5]. This virtual collaboration fosters teamwork and exposes students to diverse perspectives. The AR environment allows for instant feedback and assessment, enabling educators to monitor student progress and provide timely guidance [6]. Additionally, AR- based cooperative learning can create personalized and adaptive learning experiences, providing customized content and challenges [6]. It can also bridge the gap between abstract concepts and real-world applications, allowing students to interact with virtual objects and conduct experiments in a hands-on manner.

However, the integration of cooperative learning with AR should be implemented thoughtfully and with pedagogical considerations. Educators need to carefully design AR experiences that align with learning objectives, promote critical thinking, and provide appropriate scaffolding [7]. Additionally, accessibility and equity must be addressed to ensure that all students have equal opportunities to engage with AR technologies [8].

The primary aim of this study is to investigate and analyze the potential effects of Augmented Reality (AR) on Cooperative Learning (CL) and Students' Achievement (SA). By exploring the relationship between AR, CL, and SA, the study seeks to contribute to the existing body of knowledge and provide valuable insights into the educational landscape. The study aims to examine the impact of AR on CL and SA, validate relevant hypotheses, and shed light on the interplay between these constructs. Through rigorous research methods, the study strives to uncover empirical evidence that can inform educational practices and enhance student learning outcomes.

2. LITERATURE REVIEW

Cooperative learning is being applied in learning environments for many years, and many researches have been done to examine and enhance learning environments more engaging, and contributes in improving students' relationship, trust and understanding of their learning materials. Recent studies showed that supporting cooperative learning with new technologies could make learning process more successful than relying on traditional learning or using native digital learning environments. Augmented reality is a good example of these technologies, since it uses mobile devices that became a primary tool for this era, and being used by most of students' ages. In this research, a suggested augmented reality cooperative learning environment will examine the effect of supporting cooperative learning with augmented reality to create an improved learning environment.

2.1. Cooperative Learning

Cooperative learning has been characterized as a set of pedagogical approaches that students can employ in order to achieve an academic goal [9, 10]. [11] defines cooperative learning as a learning strategy in which students collaborate in groups to maintain an activity in order to enhance their learning and attain certain goals. [12] further described cooperative learning as a learning strategy that employs face-to-face communication and collaborative work in a particular learning opportunity in created groups.

[13] defined cooperative learning as a "group learning activity organized so that learning is dependent on the socially structured exchange of information between learners in groups and in which each learner is accountable for his or her own learning and motivated to increase the learning of others".

Although there are numerous definitions for cooperative learning, there is one thing that they all have in common: it is a teaching approach in which students collaborate to achieve a successful learning experience. In cooperative learning, Group members work jointly to fulfil their learning assignment [15] and learn their course topic [14]. A learner-centered model that employs cooperative learning strategies has gained appeal over a lecture-based model. According to current research [11], cooperative learning has a good impact on a variety of outcomes.

When utilizing cooperative learning in the classroom, the teacher's function shifts from knowledge transmitter to learning mediator [8], where the learning mediator helps and coaches. This creates a safe learning atmosphere that assists teachers in managing their classrooms [8]. Thus, when professors assign assignments to be completed, this environment can help students participate positively [10], and group members will be responsible for their learning and encourage group members to enhance learning in a knowledge sharing process [113]. As a result, the learning objective is met.

Classroom structure in cooperative learning may promote the education process and can improve relationships between team members, resulting in a more positive attitude toward classes. Teachers in addition to group members are active in the classroom; teachers must also actively participate in group formation, designing activities and creating rich learning environments. Additionally. Teachers are responsible to help students to improve their social skills so they can study efficiently with other group members [10]. In cooperative learning, group members consistently contribute to the success of other team members and the group as a whole. Individual assignments are frequently used in conventional learning, in contrast, students who use cooperative learning can converse face-to-face, assist other group members, and receive support from other group members. As a result, student relationships will be more trustworthy, and competition can take place at the group level instead of individual student level [16].

Majority of studies on cooperative learning demonstrated that it provides benefits like positive relationships, encouragement, and trust between students. When cooperative learning is used instead of standard instruction, students perform better academically. More than traditional learning, cooperative learning promotes relationships between students as well as their interest in learning [16]. It also improves academic performance and fosters analytical thinking. So, it delivers an excellent solution for learning issues. To have real cooperative learning, team members need to focus on all components of cooperative learning [17].

2.1.1. Cooperative Learning Components

Putting students in group doesn’t mean true cooperative learning, the followings are five elements of cooperative learning [1].

A. Positive Interdependence: in which students are required to work together to in order to fulfil mutual objectives. Students must feel the responsibility that they work together and one cannot succeed without other group members. They have to assist each other by guidance and Students need each other for support, clarifications to achieve their learning goal.

B. Individual Accountability: where each member is responsible to do his/her best work and share ideas and help group work efficiently. And team members can know who need support and help. Thus, team members fell the responsibility to learn and support other group members to learn and assure that no one in the group can get promoted on others’ work [11]. It is a motivating step for group members, since they cooperate and share information among others.

C. Promotive Interaction: in which team members interact and help each other, provide assistance and encouragement to accomplish a shared goal. This interaction needs to be done verbally to accomplish learning tasks [14]. And the more face-to-face communication between members, the clearer thinking process between members [12].

D. Interpersonal & Social Skills: where group members give each other feedback and communicate perfectly with all members. Interpersonal & social skills are important to be taught to students by their teachers. Examples of these skills are communication, leadership, trust building, and leadership [12] to perform the learning task. Thus, teacher’s role is not only to measure the final project, but to deal with students as friend, mentor, director, facilitator, and guide [10].

E. Group Processing: group members need to take a look at their achievements and learning progress. Then, teacher may focus on specific skill to be improved within the members.

2.2. Augmented Reality

Is a 3D technology that, in real time, merges digital and physical worlds [12], and adding virtual objects to the real world in a specific period of time. AR technology needs three key components to work: virtual and physical objects must be combined, arranged, and supported with real-time interaction [3]. Three main pillars are needed when creating AR tools, an information tracking tool, software and hardware to process information, and a device that displays digital information lively [12]. Since AR is a growing technology, many studies on education that concentrate on it, because of augmented reality still in early stages, there is a need for more researches to be done [3].

2.2.1. Advantages of Using Augmented Reality in Education

Augmented reality can introduce innovative ways that allows us to interact with real world by creating new experiences that are difficult to be created in unmixed real or virtual environments. AR can create hybrid learning environment and combines virtual and real elements [3], and help users experiment scenarios which cannot be done in real world, for example, chemical reactions that not safe to be done with students [6, 4].

Researches argue that interaction, cooperating, and learning gaining are advantages of using AR, on the other hand, its restrictions are because of usability problems [12].

2.2.2. Augmented reality in cooperative learning

Many researches have been done on augmented reality and applying it in study, but still in the beginning for cooperative learning. Cooperative learning can be interesting when group members can interact with the same object [13]. Thus, they can share their experiences to help group members learn new things as well as understand a specific problem clearer, or get new knowledge after sharing knowledge between them.

Cooperative learning allows student to engage more educational material, which enhance their understanding and promote their motivation. Education is the most popular area to create augmented reality applications in cooperative learning. As mentioned in researches, augmented reality created a new opportunity to create an engaging learning environment [14]. In augmented reality applications, students can interact with the virtual objects, rotate or grab them, meanwhile, other students see how the interaction affects those virtual objects. And students can share and discuss their experience with others. Thus, they can learn from each other [3].

3. METHODOLOGY

3.1Design

This study employed a survey-based research design to investigate the proposed connections between the constructs. A two-step methodology was implemented to empirically examine the hypothesized relationships. In the first step, a preliminary analysis was conducted to assess the construct validity and scale reliability of each included construct. The second step involved testing the hypothesized relationships using the PLS modeling approach. This approach was well-suited for analyzing complex models with multiple variables, enabling the simultaneous examination of multiple relationships. The study generated valuable insights into the factors influencing the learning process and students' achievements.

3.2. Sample design and data collection

The research sample consisted of 100 participants, representing a diverse range of backgrounds. To ensure accurate estimates of proportions, a non- probability quota sampling method was employed with a confidence level of 95% and a narrow margin of error of less than 0.05 points. The data collection process involved the creation of a meticulously designed structured questionnaire, specifically targeting students at the Institute of Public Administration in KSA. A pilot test was conducted with the assistance of three experienced instructors, and a

remarkable response rate of 67% was achieved, with 81 completed questionnaires, of which 67 were deemed usable for analysis. To test the hypothesized associations, the cutting-edge partial least squares (PLS) modeling approach was employed, ensuring accurate and reliable results.

3.3. Learning Process

The learning process begins when explaining the new learning process to teachers and how it will take place. Then, students will be grouped based on cooperative learning strategies; each group consists of five students with different learning abilities. This could be done in cooperation with teachers. Students will be asked to install the ARLOOPA application on their mobile devices and will be given printed cards. They are going to scan these cards with their mobile devices using the ARLOOPA application.

4. DATA ANALYSIS

In our analysis, we employed the widely recognized Partial Least Squares (PLS) method, known for its accuracy and reliability in predicting experimental observations [18]. The decision to use PLS was motivated by its ability to handle correlated independent variables, resulting in more precise predictions compared to orthogonal methods [18, 19]. By leveraging the power of PLS, we were able to delve into the intricate relationships between the independent and dependent variables under investigation. The analysis was conducted using SPSS version 25 and SmartPLS 3.2.8, which are standard software packages for PLS analysis [19]. The analysis unfolded in two steps, adhering to the recommended guidelines outlined by [18]. First, a robust measurement model was constructed, followed by the development of a comprehensive structural model, enabling a comprehensive exploration of the research variables and their interconnections.

4.1. Assessment of measurement model

During the initial phase of the analysis, we conducted an evaluation of the outer model, and the findings are presented in Table 1. To ensure internal consistency reliability, we examined the Composite reliability values, which surpassed the suggested threshold of 0.70 [18]. Moreover, the factor loadings exceeding 0.50 indicated the dependability of the indicators. Convergent validity was confirmed by achieving average variance extracted (AVE) values above 0.5. To assess discriminant validity, we followed the guideline proposed by [20], which states that the square root of the AVE of each construct should be greater than the correlation with all other relevant constructs. Table 2 and 3 provide compelling evidence of discriminant validity for all constructs in the measurement model.

Table 1. Construct reliability and validity

Construct	Code	Loadings	CA	CR	AVE	VIF
Augmented Reality (AR)	AR.1	0.905	*0.877*	*0.905*	*0.743*	2.214
	AR.2	0.865				2.507
	AR.3	0.869				2.402
	AT.4	0.828				2.056
Cooperative Learning (CL)	CL.1	0.849	*0.821*	*0.895*	*0.657*	2.295
	CL.2	0.764				1.753
	CL.3	0.832				2.137
	CL.4	0.784				1.858
	CL.5	0.827				2.053
Students' Achievement(SA)	SA.1	0.902	*0.911*	*0.934*	*0.792*	2.040
	SA.2	0.893				2.004
	SA.3	0.879				2.513
	SA.4	0.902				2.997

Table 2. Discriminant validity test (Fornell-Larcker criterion)

Construct	1	2	3
Cooperative Learning (CL)	0.813		
Students' Achievement (SA)	0.499	0.894	
Augmented Reality (AR)	0.578	0.545	0.870

Table 3. Discriminant validity test (HTMT criterion)

Construct	1	2	3
Cooperative Learning (CL)			
Students' Achievement (SA)	0.554		
Augmented Reality (AR)	0.648	0.603	

4.2. Assessment Of Structural Model

In examining the structural model, this study ventured into the footsteps of [18], who provided an insightful approach. The Variance Inflation Factor (VIF) came under scrutiny, revealing its highest value to be a captivating 2.998 (refer to Table 1). Luckily, this value remained comfortably within the confines of the recommended threshold, a fact duly noted by [18]. Building upon the foundation laid by these esteemed scholars, this research delved into the intricate web of causal relationships that intertwine the endogenous and exogenous constructs. With a keen eye, the study not only assessed the explanatory strength (R2), but also the predictive relevance (Q2) and the path coefficient (β-values). To ensure the robustness of these path coefficients, the bootstrapping approach was deployed, cleverly sampling 5,000 subsets, as prescribed by [18].

The study's revelations present compelling evidence in favor of H1 and H2, which propose that the utilization of Augmented Reality (AR) brings forth a positive influence on Cooperative Learning (CL) and Students' Achievement (SA) ($\beta = 0.571, 0.384$, $\rho<0.001$, respectively). Likewise, H3 secures its rightful place as a validated theory, as the introduction of Cooperative Learning (CL) manifests a beneficial impact on Students' Achievement (SA) ($\beta = 0.273$, $\rho<0.001$). Expanding the horizon of understanding, the study explores the magnificent interplay between exogenous and endogenous constructs, gauging their contribution through the lens of R2. The measured results demonstrate the significant role played by exogenous components in shaping endogenous constructs, encapsulating 33.5% of the cooperative learning's variability and an astounding 34.6% of the students' achievement's variability [18].

In an effort to thoroughly assess the model's predictive power, the study employed blindfolded procedures to measure the Q2 values. The remarkable finding revealed that all Q2 values surpassed zero, signifying robust predictive relevance for the endogenous constructs [18]. Moreover, the suitability of the proposed research model was reaffirmed by the commendable standardized root mean square residual (SRMR) value of 0.053, both for the estimated and saturated models. This value comfortably fell below the recommended threshold of 0.08, as advocated by [18] showcasing the model's soundness and integrity.

Through rigorous evaluation methods such as VIF, R2, Q2, and path coefficient analysis, the study embarked on a robust exploration of the structural model. The remarkable outcomes obtained provide compelling evidence, affirming the hypotheses and establishing the positive influence of Augmented Reality (AR) on both Cooperative Learning (CL) and Students' Achievement (SA). Additionally, the implementation of Cooperative Learning (CL) is proven to be closely linked with enhanced Students' Achievement (SA). The study's dependable findings not only strengthen the existing body of knowledge but also shed new light on the intricate interplay between Augmented Reality (AR), Cooperative Learning (CL), and Students' Achievement (SA).

CONCLUSIONS

The primary aims of this study are to investigate and analyze the impact of Augmented Reality (AR) on Cooperative Learning (CL) and Students' Achievement (SA). The study aims to explore the relationships between these variables, examining the extent to which the use of AR enhances cooperative learning practices and

contributes to improved student achievement. Through rigorous research methods and data analysis, the study seeks to provide valuable insights into the potential benefits and implications of integrating AR technology in educational settings. The ultimate goal is to contribute to the existing knowledge base and inform educational practitioners and policymakers about the efficacy of AR in fostering cooperative learning and enhancing student outcomes.

Through meticulous analysis of the Variance Inflation Factor (VIF), the study ensures that all values fall within the recommended threshold. Drawing upon the foundations established by previous scholars, the research investigates the complex web of causal relationships between endogenous and exogenous constructs. By assessing factors such as explanatory strength (R2), predictive relevance (Q2), and path coefficients (β-values), the study unveils substantial evidence supporting the hypotheses, affirming the positive impact of Augmented Reality (AR) on Cooperative Learning (CL) and Students' Achievement (SA). Additionally, the implementation of Cooperative Learning (CL) emerges as a significant contributor to improved Students' Achievement (SA). By exploring the interplay between exogenous and endogenous constructs, the study demonstrates the substantial role played by external factors in shaping both Cooperative Learning (CL) and Students' Achievement (SA). Furthermore, the study employs blindfolded procedures and measures the Standardized Root Mean Square Residual (SRMR) to ascertain the model's predictive power, successfully confirming its reliability and integrity. Overall, the study's findings not only reinforce existing knowledge but also provide fresh insights into the intricate relationship between Augmented Reality (AR), Cooperative Learning (CL), and Students' Achievement (SA).

While this study strives to shed light on the relationship between Augmented Reality (AR), Cooperative Learning (CL), and Students' Achievement (SA), it is important to acknowledge certain limitations. Firstly, the study's scope is confined to a specific context or sample size, which may limit the generalizability of the findings to other educational settings. Additionally, the study relies on self-report measures and subjective assessments, which may introduce bias or measurement errors. Furthermore, the study's duration and resources may impose constraints on the depth and breadth of data collection and analysis. It is essential to consider these limitations when interpreting the results and to encourage further research that addresses these constraints to enhance the validity and applicability of the findings.

As this study opens new avenues of understanding regarding the relationship between Augmented Reality (AR), Cooperative Learning (CL), and Students' Achievement (SA), it also paves the way for future research in this field. Firstly, future studies could explore the long-term effects of AR implementation on cooperative learning and student achievement to determine the sustainability of the observed benefits. Additionally, it would be valuable to investigate the moderating factors that may influence the effectiveness of AR in different educational contexts or student populations. Furthermore, exploring the optimal strategies for integrating AR into cooperative learning environments could provide practical insights for educators and instructional designers. Moreover, investigating the potential drawbacks or challenges associated with AR implementation would enable a comprehensive understanding of its limitations and guide future improvements. Lastly, comparative studies examining then effectiveness of AR compared to other emerging technologies could contribute to the ongoing discourse on innovative pedagogical approaches. By addressing these future research directions, we can further advance our knowledge and application of AR in enhancing cooperative learning experiences and student outcomes.

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REFERENCES

[1] Laal, M., & Laal, M. (2012). Collaborative learning: what is it?. Procedia- Social and Behavioral Sciences, 31, 491-495.

[2] Miller, J. A., & Young, C. A. (2023). Cooperative Learning in Virtual High School English Language Arts: An Action Research Study. In Handbook of Research on Facilitating Collaborative Learning Through Digital Content and Learning Technologies (pp. 106-131). IGI Global.

[4] Trongtorsak, S., Saraubon, K., & Nilsook, P. (2021). Collaborative Experiential Learning Process for Enhancing Digital Entrepreneurship.

Higher Education Studies, 11(1), 137-147.

[5] Hernandez-de-Menendez, M., Escobar Díaz, C. A., & Morales-Menendez,

R. (2020). Educational experiences with Generation Z. International Journal on Interactive Design and Manufacturing (IJIDeM), 14, 847-859.

[6] Kazanidis, I., Pellas, N., & Christopoulos, A. (2021). A learning analytics conceptual framework for augmented reality-supported educational case studies. Multimodal Technologies and Interaction, 5(3), 9.

[7] Parmaxi, A., & Demetriou, A. A. (2020). Augmented reality in language learning: A state-of-the-art review of 2014–2019. Journal of Computer Assisted Learning, 36(6), 861-875.

[8] Jam, F. A., Singh, S. K. G., Ng, B., & Aziz, N. (2018). The interactive effect of uncertainty avoidance cultural values and leadership styles on open service innovation: A look at malaysian healthcare sector. International Journal of Business and Administrative Studies, 4(5), 208-223.

[9] Chaidi, I., Drigas, A., & Karagiannidis, C. (2021). ICT in special education. Technium Soc. Sci. J., 23, 187.

[10] Namaziandost Ehsan, Shatalebi Vida, & Nasri Mehdi (2019). The impact of cooperative learning on developing speaking ability and motivation Toward learning English. Journal of Language and Education, 5 (3 (19)), 83-101.

[11] Phon, D. N. E., Ali, M. B., & Abd Halim, N. D. (2014, April). Collaborative augmented reality in education: A review. In 2014 International Conference on Teaching and Learning in Computing and Engineering (pp. 78-83). IEEE.

[12] Namaziandost, E., Nasri, M., & Rahimi Esfahani, F. (2019). Pedagogical efficacy of experience-based learning strategies for improving the speaking fluency of upper-intermediate male and female Iranian EFL students. International Journal of Research in English Education, 4(2), 29-41.

[13] Nasri, M., & Biria, R. (2017). Integrating multiple and focused strategies for improving reading comprehension and l2 lexical development of Iranian intermediate EFL learners. International Journal of Applied Linguistics & English Literature, 6(1), 311-321. http://dx.doi.org/10.7575/aiac.ijalel.v.6n.1p.311

[14] Nguyen, C., Trinh, T., Le, D., & Nguyen, T. (2021). Cooperative Learning in English Language Classrooms: Teachers' Perceptions and Actions. Anatolian Journal of Education, 6(2), 89-108.

[15] Hsin-Kai W., Silvia L., Hsin-Yi C., & Jyh-Chong L. (2013). “Current status, opportunities and challenges of AR in education,” Computers and Education, vol. 62, pp. 41–49.

[16] Hanif, A. ., ., H., Mudinillah, A. ., & Rahmi , P. W. L. . (2023). Development of the QUIZIZZ Platform as an Interactive Quiz-Based Learning Media for Arabic Language Lessons at Madrasah IBTIDAIYAH. International Journal of Membrane Science and Technology, 10(2), 372-384. https://doi.org/10.15379/ijmst.v10i2.1207

[17] Slavin, R. E. (2015). Cooperative learning in elementary schools. Education 3-13,43(1), 5-14. https://doi.org/10.1080/03004279.2015.963370

[18] Berzener, A. (2021). The Effect of Cooperative Learning on EFL Learners' Success of Reading Comprehension: An Experimental Study Implementing Slavin's STAD Method. Turkish Online Journal of Educational Technology-TOJET, 20(4), 90-100.

[19] Phon, D. N. E., Ali, M. B., & Abd Halim, N. D. (2014, April). Collaborative augmented reality in education: A review. In 2014 International Conference on Teaching and Learning in Computing and Engineering (pp. 78-83). IEEE.

[20] Hair, J., F, Hult, G., Ringle, C., & Sarstedt, M. (2017). A primer on partial least squares structural equation modeling (PLS-SEM) (2nd ed): Thousand Oaks, CA: Sage.

[21] Jaradat, Z., Al Shbail, M., Alzubi, A., Al-Hazaima, H., & Al Shbail, A. (2022b). Towards sustainability in SMEs during unforeseen crises: Governmental support as a moderating factor. Int. J. of Business Innovation and Research, In press.

[22] Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. Journal of Marketing Research, 18(3), 382-388.

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