The impact of university students' communication characteristics on team performance through entrepreneurial competencies

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Abstract: This study investigates the impact of university students' communication characteristics on team performance through entrepreneurial competencies. The research categorizes communication characteristics into clarity, interactivity, empathy, timeliness, and digital affinity, and examines their influence on entrepreneurial competencies, namely problem-solving, collaboration, and managerial knowledge. The study further explores how these competencies contribute to team performance. The findings reveal that clarity, interactivity, and empathy significantly enhance problem-solving and collaboration, leading to improved team performance. Specifically, clarity reduces misunderstandings and facilitates efficient teamwork by conveying information accurately. Interactivity fosters active feedback and idea exchange among team members, enabling practical and creative solutions. Empathy strengthens trust and emotional bonds within the team, creating a collaborative and supportive environment. However, timeliness and digital affinity did not show a significant effect on problem-solving or collaboration, indicating that merely fast communication or technological tool usage may not directly influence these processes. This research highlights the importance of developing communication characteristics and entrepreneurial competencies among university students and provides practical implications for educational strategies to enhance these capabilities and maximize team performance.

Keywords: Communication characteristics, Entrepreneurial competencies, Team performance, University students.

1. Introduction

Modern society demands talented individuals with creative and innovative problem-solving skills, underscoring the importance of entrepreneurial competencies and team performance. In particular, college students are expected to collaborate and communicate effectively in their studies, team projects, and preparations for entering the workforce. Within this context, communication characteristics serve as crucial factors that influence both individual and team performance [1].

Moreover, understanding the impact of college students' communication characteristics on entrepreneurial competence is essential for establishing a theoretical and practical foundation for effective teamwork and performance enhancement [2]. These communication characteristics encompass various factors, including clarity, interactivity, empathy, timeliness, and digital affinity. Beyond mere information exchange, these elements facilitate interaction and collaboration, ultimately contributing to problem-solving and improved team performance.

Specifically, clarity and interactivity are vital for fostering cooperative solutions through the exchange of ideas and feedback among team members. Meanwhile, empathy and timeliness help build trust and strengthen team bonds, thereby accelerating and enhancing the quality of the decision-making process [3, 4]. Additionally, digital affinity has become an increasingly important competency for modern university students, as it enables efficient collaboration by overcoming time and space

constraints.

Entrepreneurial competence, on the other hand, is reflected in problem-solving skills, cooperation, and management knowledge each playing a critical role in driving team performance [3]. Problem-solving fosters the development of creative and effective solutions, while cooperation facilitates teamwork based on interaction and mutual trust. Furthermore, management knowledge supports strategic decision-making and resource utilization, enabling teams to achieve their goals systematically. This entrepreneurial competence equips college students with the necessary foundation to engage actively and innovatively in their academic and organizational endeavors.

This study aims to explore the effect of college students' communication characteristics on team performance through individual entrepreneurship competency. To this end, the relationship between communication characteristics and entrepreneurship competency is theoretically reviewed, and based on this, the mediating relationship with team performance is analyzed. Existing studies have dealt with the effects of communication characteristics or entrepreneurship competency on individual performance, but studies that comprehensively examine the interaction between the two factors and the resulting transition to team performance are insufficient. This study is an attempt to fill this academic gap.

Therefore, the purpose of this study is to analyze in-depth the relationship between college students' communication characteristics and individual entrepreneurship competency, and to investigate their mediating effect on team performance. Through this, educational and practical implications for strengthening university students' communication and entrepreneurship competencies are presented, and strategic directions are provided to maximize team performance. This study will provide useful basic data for future research and practice by systematically explaining the process in which individual communication characteristics and entrepreneurship competency are linked to team performance.

2. Theoretical Background

2.1. Communication Characteristics of College Students (Clarity, Interactivity, Empathy, Timeliness, Digital Affinity)

The communication characteristics of college students are attracting attention as an important factor determining individual and team performance in the modern complex and collaborative academic and organizational environment [3]. Dividing these into clarity, interactivity, empathy, timeliness, and digital affinity, it will be possible to systematically understand the various effects of each characteristic on the communication process and performance [5, 6]. First of all, clarity is the ability to convey messages concisely and clearly, and it contributes to reducing misunderstandings or information distortions that may occur in the communication process and promoting mutual understanding [7]. And clear communication plays an essential role in increasing the efficiency of collaboration within teams, setting goals systematically, and solving complex problems. In particular, clarity acts as a key communication characteristic for college students to draw practical results in the process of coordinating various opinions and drawing conclusions in academic and team projects.

Next, interactivity refers to the ability to exchange various opinions through interactive communication, and to achieve mutual feedback and cooperation based on this [8]. In order for college students to successfully solve problems in a learning environment or team activities, they must form trust and empathy among team members through interaction, and derive creative and practical solutions. Teams with high interactivity expand individual ideas into group insights through active exchange of opinions between members, through which more innovative and effective results can be derived. In particular, the importance of interactivity will be more emphasized in collaborative learning and problem-based learning environments.

In addition, empathy is the ability to understand other people's positions and emotions and to communicate effectively based on them, and is an important factor in strengthening human connectivity among college students' communication characteristics [9]. Such empathetic communication forms positive relationships within the learning community and helps solve problems based on mutual respect even in conflict situations, so it is recognized as an essential element for effective teamwork and

leadership in the field of organizational management. In particular, it creates an environment in which members can freely share their opinions by forming a sense of psychological safety among team members in performing team projects or collaborative tasks. This environment will contribute to producing better results in tasks that require creativity and innovation.

And timeliness and digital affinity will be communication characteristics that are more emphasized in the rapidly changing modern society [10]. First of all, timeliness is the ability to provide information and feedback appropriately when necessary, and plays an important role in communicating efficiently and solving problems for college students in their studies and team assignments. Timely information accelerates the decision-making process and clarifies the priority of work to increase productivity. On the other hand, digital affinity is the ability to effectively communicate using digital tools and technologies, and is an essential competency for college students in the digital native generation. Digital technology enables efficient cooperation and information sharing beyond the constraints of time and space, and plays a more important role in team projects and remote learning environments. These communication characteristics of college students will be of great academic and practical importance in that they provide the foundation for enhancing the performance of the team and organization as well as strengthening individual capabilities.

2.2. Individual Entrepreneurship Competencies (Problem-Solving, Cooperation, Management Knowledge)

An individual's entrepreneurial competency is a core capability for successfully embracing challenges and driving innovation in modern society and organizations. This competency is reflected in problem-solving skills, cooperation, and management knowledge [11].

First, problem-solving refers to the ability to define and resolve issues creatively and systematically in complex and uncertain situations. It is an essential component of entrepreneurship Park [12] enabling individuals to efficiently utilize resources to achieve their goals and develop innovative solutions under constrained conditions. In particular, problem-solving serves as a fundamental competency for securing a competitive advantage in today's rapidly changing environment and is often used as a key indicator to assess the entrepreneurial potential of college students and early-career professionals.

Next, cooperation is the ability to achieve common goals through effective interaction with team members, forming a crucial foundation for collaboration in entrepreneurial settings [11]. Individuals with strong cooperative skills foster positive team dynamics, integrate diverse ideas, and drive creative and innovative outcomes. Moreover, cooperation plays a pivotal role in resolving conflicts among team members, thereby ensuring sustained organizational performance. In modern project-based learning environments and multidisciplinary team activities, the impact of cooperation on both individual and team performance becomes even more pronounced.

Finally, management knowledge encompasses the understanding and application of business-related principles, including management strategies, finance, and marketing [12]. This knowledge enables individuals to make effective decisions in complex business environments, optimize organizational resources, and formulate strategies for sustainable growth. By providing a theoretical foundation for entrepreneurial success, management knowledge enhances the ability to translate ideas into concrete business models, increasing the likelihood of market success for college students and early-stage entrepreneurs.

In summary, problem-solving, cooperation, and management knowledge are key components of an individual's entrepreneurial competency. These elements complement one another, collectively enhancing individual and team performance [11]. Strengthening these competencies is essential for fostering creative problem-solving abilities, promoting teamwork and innovation within organizations, and driving sustainable growth through strategic thinking and execution. Thus, systematically developing and reinforcing entrepreneurial competencies is expected to have a significant impact not only on individual growth but also on organizational and societal advancement.

2.3. Team Performance

Team performance is the outcome of a team's process in achieving common goals, created through cooperation, interaction among team members, and the effective utilization of resources [13]. Accordingly, team performance can be evaluated using both quantitative and qualitative indicators, which reflect goal achievement, problem-solving ability, decision-making efficiency, creativity, and innovation. In today's complex problem-solving and project-based work environments, team performance is significantly influenced not only by individual capabilities but also by the team's cooperative efforts and interdependence. To effectively assess and manage team performance, goal setting, role allocation, and clear communication are essential.

One of the key factors determining team performance is cooperation and harmony among team members [3]. A highly cooperative team recognizes and leverages the diversity of its members as a strength, fostering positive interactions even in conflict situations. Furthermore, trust and mutual respect within the team create an environment where members feel comfortable sharing ideas and opinions, leading to creative and innovative outcomes. Additionally, when each team member clearly understands their role and responsibilities and performs them diligently, it becomes a crucial factor in maximizing overall team performance.

Beyond internal dynamics, organizational and environmental factors also influence team performance. For instance, the resources and skills available to the team, external support or constraints, and the leadership style of the team leader all play a significant role. In particular, in the modern digital era, the ability to utilize digital tools and technologies has become a major determinant of team performance. Furthermore, establishing a structured feedback and performance evaluation system within the team can enhance members' sense of accomplishment and encourage continuous development. These various factors interact comprehensively to shape team performance, ultimately contributing to organizational success and competitive advantage.

3. A Research Method

3.1. Sample Design and Measurement Tools

This study conducted a survey of college students to examine the effect of their communication characteristics on team performance, mediated by individual entrepreneurial competencies. Data collection was carried out through an online survey from December 1 to December 20, 2024. Prior to distribution, the researcher explained the purpose and content of the study to participants and obtained their consent before administering the questionnaire. A total of 280 responses were collected, and after excluding incomplete or unfaithful responses, 271 valid questionnaires were used for the final analysis.

In this study, measurement items were selected based on previous research related to college students' communication characteristics, individual entrepreneurial competency, and team performance. The evaluation items were adapted from existing scales, modified as necessary to fit the study's objectives and context. All items were measured using a 5-point Likert scale.

Table 1.
List of Measurement.

Variable	Measurement Item	References
Clarity	Our team tends to clearly understand the message delivered by the other party.	Kim [4] and Park and Oh [2]
	Our team tends to give additional explanations to reduce misunderstandings during communication.	
	Our team tends to deliver important information with a clear emphasis.	
	In our team, confusing or ambiguous expressions rarely appear in the other person's words or writings.	
Interactivity	Our team has enough time to exchange opinions with each other during communication.	Kim [4] and Park and Oh [2]
	In my team, the other person actively responds to my opinion or feedback.	
	Our team tends to actively ask and respond to questions in conversation.	
	Our team is able to develop ideas by exchanging opinions during conversation.	
Empathy	In my team, the other person understands my feelings, considers them, and talks to them.	Kim [4] and Park and Oh [2]
	Our team tends to feel the other person's empathy during communication.	
	In my team, the other side takes my position seriously.	
	In my team, the other person respects me during the conversation and tries to accept my opinion.	
Specification	Our team tends to be provided with the necessary information at the right time.	Kim [4] and Park and Oh [2]
	Our team tends to have necessary discussions in time during the conversation.	
	Our team tends to deliver important matters without delay.	
	Our team tends to discuss the problem or find a solution at the appropriate time.	
Digital Affinity	Our team efficiently shares information by leveraging digital tools (e.g., collaboration apps, cloud services).	Kim [4] and Park and Oh [2]
	Our team tends to feel more convenient when communicating through digital platforms.	
	Our team tends to get positive results from communication using social media or online chat tools.	
	Our team is used to learning and utilizing new digital communication tools or technologies quickly.	
Problem Solvability	I am good at understanding and analyzing problems or phenomena accurately.	Jung and Lee [11]
	I have the ability to solve problems creatively.	
	I am better at solving problems and creating improvement measures than others.	
	I am used to how to create new opportunities in ideas.	
Co-operation	I am used to inspiring, encouraging and cooperating with the other person.	Jung and Lee [11]
	I am evaluated as having a good relationship with the people around me.	
	I tend to solve problems with many people rather than alone.	
Management Knowledge	I can understand and write a business model.	Jung and Lee [11])
	I have a lot of knowledge about establishing and operating a company.	
	I can understand and write a business plan.	
	I have a lot of knowledge necessary for management such as personnel, marketing, and financial management.	
Team Performance	Our team tends to achieve the given goals effectively.	Choi [13]
	The team's work results tend to maintain high quality.	
	Efficient working methods are well implemented within the team.	
	Our team successfully meets external expectations and needs.	

3.2. Method of Analysis

The purpose of this study is to examine the relationships between various latent variables and their

effects on specific outcomes. To achieve this, Covariance Structure Analysis (CSA) was employed. This method is a powerful analytical tool that effectively examines complex causal relationships among latent variables, incorporating both measured values and the relationships between individual variables based on the proposed hypotheses.

SPSS and AMOS were used for data analysis. SPSS provides a wide range of statistical analysis functions, including descriptive and inferential statistics, while AMOS is specialized software designed for advanced structural equation modeling (SEM), including covariance structure analysis. AMOS was utilized in this study for in-depth analysis of the relationships between variables.

By leveraging these analytical methods and tools, this study comprehensively examined the relationships between latent variables and their impact on research outcomes. Based on these analyses, the research hypotheses were systematically tested, allowing for the identification of key insights into the complex causal relationships among latent variables.

3.3. Method of Analysis

3.3.1. The Relationship between the Communication Characteristics of College Students and Entrepreneurship Competency of Individuals

The relationship between college students' communication characteristics and individual entrepreneurial competency is complementary and serves as a key factor in determining both individual and team performance [2].

First, clarity reduces uncertainty in the problem-solving process by ensuring clear information delivery, while interactivity facilitates cooperative and creative solutions through the exchange of diverse opinions and feedback. Empathy strengthens trust and team cohesion, promoting effective collaboration, whereas timeliness enhances the speed and efficiency of problem-solving and decision-making.

Additionally, digital affinity improves communication and teamwork efficiency by leveraging modern digital tools and platforms. These communication characteristics are expected to positively influence the development of key entrepreneurial competencies, including problem-solving, cooperation, and management knowledge.

In other words, college students' communication characteristics serve as a foundation for entrepreneurial competency and contribute to generating creative and innovative outcomes. Based on this, the following hypothesis is proposed.

$Hypothesis_{1-1}$: Clarity among college students' communication characteristics will have a positive (+) effect on individual problem-solving ability in entrepreneurship competency.

$Hypothesis_{1-2}$: Interaction among the communication characteristics of college students will have a positive (+) effect on the problem-solving ability of an individual in entrepreneurship competency.

$Hypothesis_{1-3}$: Among the communication characteristics of college students, empathy will have a positive (+) effect on a person's problem-solving ability in entrepreneurship competency.

$Hypothesis_{1-4}$: Timeliness among college students' communication characteristics will have a positive (+) effect on individual problem-solving ability in entrepreneurship competency.

$Hypothesis_{1-5}$: Among the communication characteristics of college students, digital affinity will have a positive (+) effect on a person's problem-solving ability in entrepreneurship competency.

$Hypothesis_{2-1}$: Clarity among college students' communication characteristics will have a positive (+) effect on individual cooperation in entrepreneurship competency.

$Hypothesis_{2-2}$: Interaction among the communication characteristics of college students will have a positive (+) effect on the individual's cooperation in entrepreneurship competency.

$Hypothesis_{2-3}$: Among the communication characteristics of college students, empathy will have a positive (+) effect on the individual's cooperation in entrepreneurship competency.

$Hypothesis_{2-4}$: Timeliness among the communication characteristics of college students will have a positive (+) effect on the individual's cooperation in entrepreneurship competency.

$Hypothesis_{2-5}$: Among the communication characteristics of college students, digital affinity will have a positive

(+) effect on individual cooperation in entrepreneurship competency.

Hypothesis_{3-1:} Clarity among college students' communication characteristics will have a positive (+) effect on an individual's management knowledge in entrepreneurship competency.

Hypothesis_{3-2:} Interaction among college students' communication characteristics will have a positive (+) effect on an individual's management knowledge in entrepreneurship competency.

Hypothesis_{3-3:} Among the communication characteristics of college students, empathy will have a positive (+) effect on an individual's management knowledge in entrepreneurship competency.

Hypothesis_{3-4:} Timeliness among college students' communication characteristics will have a positive (+) effect on an individual's management knowledge in entrepreneurship competency.

Hypothesis_{3-5:} Among the communication characteristics of college students, digital affinity will have a positive (+) effect on an individual's management knowledge in entrepreneurship competency.

3.3.2. Relationship between Individual Entrepreneurship Competence and Team Performance

The relationship between individual entrepreneurial competency and team performance is interdependent and plays a crucial role in achieving team goals and enhancing overall performance [12].

First, problem-solving, a key component of entrepreneurial competency, enables individuals to creatively and effectively address complex challenges within the team, serving as a critical factor in improving team performance. Cooperation fosters teamwork by facilitating smooth communication and mutual trust among team members, generating a synergistic effect that drives the team toward its common goals.

Additionally, management knowledge provides a foundation for supporting the team's strategic decision-making and execution processes, ensuring that goals are pursued systematically and efficiently. These entrepreneurial competencies collectively enhance team productivity and innovation, ultimately maximizing team performance.

Based on these insights, the following hypothesis is proposed.

Hypothesis_{4-1:} Problem solving among individual entrepreneurship competencies will have a positive (+) effect on team performance.

Hypothesis_{4-2:} Cooperation among individual entrepreneurship competencies will have a positive (+) effect on team performance.

Hypothesis_{4-3:} Management knowledge among individual entrepreneurship competencies will have a positive (+) effect on team performance.

4. Analysis Results

4.1. Characteristics of the Sample

The demographic characteristics of the sample used in this study are as follows.

First, in terms of gender, the sample consisted of 88 men (32.5%) and 183 women (67.5%). Next, regarding entrepreneurship education experience, 82 participants (30.3%) had attended one session, 70 participants (25.8%) had attended two sessions, 76 participants (28.0%) had attended three sessions, and 43 participants (15.9%) had attended four or more sessions. Additionally, 210 students (77.5%) had no experience in entrepreneurship clubs, while 61 students (22.5%) had prior experience.

4.2. Reliability and Validity of Measurement Items

The validity of the measurement model was verified using the final collected data (n = 271). This verification process included reliability and validity tests, with validity assessed through convergent validity and discriminant validity.

For reliability verification, Cronbach's α coefficient—a widely used metric in social science research was applied, with a threshold of 0.7 or higher indicating acceptable reliability. To assess convergent validity, confirmatory factor analysis (CFA) was conducted using AMOS, where a factor loading value

of ±0.4 or higher was considered significant.

Discriminant validity, which ensures that similar constructs are distinguishable from one another, was evaluated using the average variance extracted (AVE) value proposed by Fornell and Larcker [14] along with Pearson correlation analysis. Discriminant validity was deemed satisfied when the square root of the AVE for each construct exceeded the correlation coefficients between that construct and others.

Table 2 presents the results of the reliability and validity verification of the variables used in this study. The analysis confirmed that no items compromised reliability, with Cronbach's α values ranging from 0.805 to 0.91, all exceeding the recommended threshold of 0.7 or higher, thereby ensuring the reliability of the measurement items. Additionally, the factor loading values met the standards suggested in previous research, indicating that the validity of the measurement items was also confirmed.

Furthermore, no issues were found in the discriminant validity verification using the AVE values, confirming that discriminant validity was secured. These results statistically demonstrate the internal consistency and validity of the questionnaire items.

Table 2 provides an overview of the reliability and validity verification results of the measurement model, while <Table 3> illustrates that the square root of the AVE values (shown on the diagonal) is greater than the correlation coefficients between constructs, thereby confirming discriminant validity among the study's variables.

Table 2.
Reliability and Validity of Measurement Items.

Variable	Measurement Item	Factor Loading	Measurement Error	Cronbach's α	C.R	AVE
Clarity	Clarity1	0.81	0.155	0.884	0.938	0.792
	Clarity2	0.828	0.169			
	Clarity3	0.807	0.183			
	Clarity4	0.799	0.184			
Interactivity	Interactivity 1	0.786	0.181	0.851	0.928	0.763
	Interactivity 2	0.79	0.173			
	Interactivity 3	0.746	0.156			
	Interactivity 4	0.76	0.226			
Empathy	Empathy1	0.881	0.121	0.902	0.941	0.801
	Empathy2	0.812	0.195			
	Empathy3	0.799	0.216			
	Empathy4	0.854	0.165			
Specification	Specification1	0.745	0.347	0.858	0.898	0.688
	Specification2	0.774	0.292			
	Specification3	0.779	0.261			
	Specification4	0.817	0.202			
Digital Affinity	Affinity1	0.792	0.342	0.86	0.858	0.603
	Affinity2	0.82	0.319			
	Affinity3	0.799	0.39			
	Affinity4	0.718	0.563			
Problem Solvability	Problem.S1	0.831	0.168	0.91	0.95	0.828
	Problem.S2	0.864	0.14			
	Problem.S3	0.808	0.182			
	Problem.S4	0.885	0.108			
Co-operation	Co-operation1	0.708	0.403	0.805	0.866	0.683
	Co-operation2	0.759	0.221			
	Co-operation3	0.826	0.192			
Management Knowledge	Management.K1	0.799	0.195	0.853	0.919	0.741
	Management.K2	0.781	0.192			
	Management.K3	0.737	0.208			
	Management.K4	0.757	0.233			
Team Performance	Team. P1	0.655	0.363	0.826	0.896	0.683
	Team. P2	0.769	0.214			
	Team. P3	0.786	0.196			
	Team. P4	0.742	0.242			

Table 3.
Correlation, Mean, Standard Deviation of Constituent Concepts.

Factor	Correlation Coefficients between Factors								
	1	2	3	4	5	6	7	8	9
Clarity	0.890								
Interactivity	0.578**	0.873							
Empathy	0.490**	0.582**	0.895						
Specification	0.624**	0.575**	0.500**	0.829					
Digital. A	0.335**	0.455**	0.541**	0.639**	0.777				
Problem. S	0.709**	0.654**	0.657**	0.598**	0.449**	0.910			
Co-operation	0.520**	0.637**	0.714**	0.608**	0.619**	0.660**	0.826		
Management.K	0.749**	0.614**	0.540**	0.578**	0.387**	0.734**	0.557**	0.861	
Team. P	0.466**	0.730**	0.712**	0.576**	0.552**	0.645**	0.710**	0.499**	0.826
Average	4.437	4.355	4.202	4.191	4.009	4.330	4.236	4.403	4.244
Std. Err.	0.613	0.562	0.671	0.699	0.855	0.647	0.681	0.595	0.604

Note: ** $p<0.01$, number at the diagonal line is average variance extracted (AVE).

4.3. Validation of the Fitness of the Measurement Model

After verifying the reliability and validity of the measurement model, a fitness test was performed using AMOS to evaluate whether the collected data were suitable for the research model. The fitness verification of the initial measurement model was conducted based on a total of 35 measurement items. As the fitness verification index, the Goodness-of-Fit Index (GFI, 0.9 or more), the Normal Fit Index (NFI, 0.9 or more), the Root Mean Square Residual (RMR, 0.05 or less), the Comprehensive Fit Index (CFI, 0.9 or more), and the p value (≥0.05) were used.

As a result of the verification, χ^2=1115.054 (df=524), p=0.000, CMIN/DF=2.128 RMR=0.031, NFI=0.85, CFI=0.914, GFI=0.814, AGFI=0.776, TLI=0.902, IFI(Delta2) =0.914, and it was confirmed that most of the indices met the recommended criteria and thus there was no problem with the model fit. This led to the conclusion that the data collected in this study were suitable for the research model.

4.4. Research Hypothesis Verification Results

After verifying the validity of the measurement model with a total of 271 data, a structural equation model (SEM) analysis using AMOS was performed to verify the influence between variables presented in the research model. Through this, two main results could be derived.

First, the fitness index of the structural model was χ^2 = 1156.746 (df=532), p=0.000, CMIN/DF=2.174, RMR=0.031, NFI=0.844, CFI=0.909, GFI=0.808, AGFI=0.773, and TLI=0.898 IFI(Delta2) =0.909. As a result of a review focusing on the model fitness criteria (CFI, TLI, and RMR) proposed by Cheung, et al. [15] the fitness of the research model was found to be generally good. These results suggest that it is suitable for verifying the relationship between variables presented by the research model and can give trust to the analysis and interpretation of research hypotheses. The results of hypothesis verification are as follows. First, among the communication characteristics of college students, clarity was found to be β=0.574 on the problem-solving ability of individual entrepreneurship competency, and hypothesis 1-1 was adopted as having a positive (+) effect. Likewise, interactivity and empathy were also found to have a positive (+) effect on problem-solving with β=0.267 and β=0.288, respectively, and both hypotheses 1-2 and 1-3 were adopted. However, timeliness and digital affinity appeared as β=-0.069 and β=0.029 respectively on problem-solving, and hypothesis 1-4 and hypothesis 1-5 were rejected as having no effect. Secondly, among the communication characteristics of college

students, clarity appears to be β=-0.002, which has no effect on the collaboration of individual entrepreneurship capabilities, and hypothesis 2-1 was rejected. However, as interactivity, empathy, and digital affinity were found to have a positive (+) effect on collaboration with β=0.412, β=0.428, and β=0.16 respectively, hypothesis 2-2 and hypothesis 2-3 and hypothesis 2-5 were all adopted. However, hypothesis 2-4 was rejected as timeliness had no effect on collaboration with β=0.077. Third, among the communication characteristics of college students, clarity appears to be β=0.717 on the management knowledge of an individual's entrepreneurship competency, and hypothesis 3-1 was adopted as having a positive (+) effect. In addition, interactivity appears to be β=0.197 on management knowledge, and hypothesis 3-2 was adopted as having a positive (+) effect. However, empathy, timeliness, and digital affinity were found to have no effect on management knowledge with β=0.09, β=-0.077, and β=0.048, respectively, and hypothesis 3-3, hypothesis 3-4, and hypothesis 3-5 were all rejected. Fourth, hypothesis 4-1 was adopted that the problem-solving ability of an individual's entrepreneurship competency was found to have a positive (+) effect by showing β=0.132 on team performance. And cooperation was found to have a positive (+) effect by showing β=0.844 on team performance, and hypothesis 4-2 was adopted. However, management knowledge was found to have a negative (-) effect by showing β=-0.181 on team performance, and hypothesis 4-3 was adopted.

Table 4.
Result of Research Model.

Path			Estimate	S.E.	C.R.	P	Results
Clarity	->	Problem Solvability	0.574***	0.093	6.139	***	Support
Interactivity	->	Problem Solvability	0.267***	0.081	3.32	***	Support
Empathy	->	Problem Solvability	0.288***	0.062	4.653	***	Support
Specification	->	Problem Solvability	-0.069	0.108	-0.643	0.52	Reject
Digital Affinity	->	Problem Solvability	0.029	0.068	0.432	0.666	Reject
Clarity	->	Co-operation	-0.002	0.08	-0.028	0.977	Reject
Interactivity	->	Co-operation	0.412***	0.073	5.682	***	Support
Empathy	->	Co-operation	0.428***	0.057	7.521	***	Support
Specification	->	Co-operation	0.077	0.09	0.855	0.393	Reject
Digital Affinity	->	Co-operation	0.16***	0.058	2.771	0.006	Support
Clarity	->	Management Knowledge	0.717***	0.101	7.078	***	Support
Interactivity	->	Management Knowledge	0.197**	0.079	2.494	0.013	Support
Empathy	->	Management Knowledge	0.09	0.06	1.487	0.137	Reject
Specification	->	Management Knowledge	-0.077	0.107	-0.72	0.472	Reject
Digital Affinity	->	Management Knowledge	0.048	0.067	0.715	0.475	Reject
Problem Solvability	->	Team Performance	0.132*	0.078	1.683	0.092	Support
Co-operation	->	Team Performance	0.844***	0.094	9.017	***	Support
Management Knowledge	->	Team Performance	-0.181**	0.082	-2.206	0.027	Reverse Adoption

Note: *** p<0.01, ** p<0.05, * p<0.01.

5. Conclusion

This study examined the impact of college students' communication characteristics on team performance through individual entrepreneurial competencies and explored the relationship between communication characteristics and entrepreneurial competencies in depth. According to the research findings, among the communication characteristics of college students, clarity, interactivity, and empathy positively influence the problem-solving component of entrepreneurial competency. These results suggest that college students' communication skills serve as a crucial foundation for

entrepreneurial competency, which requires creative and innovative problem-solving beyond merely enhancing efficiency in the communication process.

In particular, clarity ensures that ideas and information are conveyed accurately, reducing misunderstandings within the team and facilitating effective collaboration. Interactivity contributes to the development of creative and practical solutions through diverse exchanges of opinions and feedback. Additionally, the importance of empathy is highlighted in its role in strengthening trust and cooperation among team members, mitigating conflicts, and fostering more flexible thinking in the problem-solving process. Therefore, it is essential to develop and implement programs in university education that enhance these communication characteristics, enabling students to demonstrate competitive problem-solving skills in real-world corporate environments.

However, timeliness and digital affinity two other communication characteristics of college students were found to have no significant effect on the problem-solving component of entrepreneurial competency. These findings indicate that communication characteristics do not uniformly impact all elements of entrepreneurial competency. While timeliness reflects the speed of information delivery, a rapid response or quick communication does not necessarily translate into improved problem-solving quality. This suggests that timeliness may encourage a superficial approach when creative and in-depth thinking is required for problem-solving.

Similarly, digital affinity, which represents the ability to communicate using digital technology, does not appear to be an essential competency in the problem-solving process. This implies that an overreliance on digital tools may create limitations or misunderstandings in face-to-face communication. Additionally, communication on digital platforms may not always contribute to a fundamental understanding of problems or the generation of creative solutions.

Furthermore, it was found that clarity and timeliness had no significant effect on the cooperation component of entrepreneurial competency. These results suggest that different communication characteristics may be required to enhance cooperation, as clarity and timeliness do not directly influence cooperative behaviors. While clarity improves the accuracy and comprehension of information delivery, cooperative behaviors are likely to depend more on relational dynamics and emotional bonds between team members. This implies that clear communication alone may not be sufficient to establish mutual trust and a strong willingness to collaborate.

Likewise, although timeliness emphasizes the speed and immediacy of information exchange, cooperative behaviors may be more strongly influenced by consensus-building and mutual respect rather than the rapidity of communication. Even if information is exchanged promptly, a lack of emotional support or positive team relationships may limit the enhancement of cooperation.

Therefore, these findings underscore the importance of prioritizing emotional and relational aspects—such as empathy and interactivity over mere efficiency in information delivery when aiming to strengthen cooperation within teams.

In addition, among the communication characteristics of college students, interactivity, empathy, and digital friendliness were found to have a positive effect on the factor of cooperation in entrepreneurship competency. These results suggest that college students' interactivity, empathy, and digital friendliness play an important role in strengthening cooperation. Interaction contributes to strengthening teamwork through active exchange of opinions and feedback among members, and to effectively achieve common goals by coordinating various perspectives. This shows that interactive communication is an important facilitating factor in a cooperative environment. And empathy plays a key role in forming trust and emotional bonds among members. Communication based on empathy creates a cooperative culture in which team members can understand and support each other even in conflict situations, thereby simultaneously increasing efficiency and creativity in the problem-solving process.

On the other hand, digital affinity enhances the accessibility and efficiency of communication by leveraging digital platforms and tools, enabling cooperative communication beyond the constraints of physical distance and time. In particular, for college students—the digital-native generation—digital-

based communication is likely to naturally facilitate collaboration. These findings highlight the importance of education and training for college students to develop interactive and empathetic communication skills while effectively utilizing digital tools to enhance cooperation.

Third, among the communication characteristics of college students, clarity and interactivity were found to have a positive impact on the management knowledge component of entrepreneurial competency. These findings indicate that clarity and interactivity play a crucial role in the formation and reinforcement of management knowledge. Clarity enhances the acquisition and understanding of management knowledge by enabling the accurate and systematic transmission of information. This suggests that clear communication is essential for effectively conveying complex management concepts and strategic ideas, thereby maximizing learning outcomes and minimizing misunderstandings among team members.

Additionally, interactivity facilitates the exchange of diverse perspectives and enriches management knowledge through in-depth discussions. Management knowledge is not merely the accumulation of information; it also encompasses problem-solving skills and the ability to apply knowledge in decision-making processes. Interactive communication serves as a vital enabler in this regard, allowing students to share experiences and insights, thereby building a more comprehensive foundation for management knowledge. These findings underscore the necessity of designing a learning environment that prioritizes clear and interactive communication rather than relying solely on traditional methods focused on theoretical content delivery. In particular, learning approaches that emphasize practical communication, such as case-based learning and team projects, may be especially effective in fostering management knowledge.

However, among the communication characteristics of college students, empathy, timeliness, and digital affinity were found to have no significant effect on the management knowledge component of entrepreneurial competency. These findings suggest that empathy, timeliness, and digital affinity may not be essential factors in the development of management knowledge. While empathy plays a key role in strengthening emotional bonds and trust among members, it may have a relatively limited influence in the acquisition of specialized and logical knowledge, such as management concepts. This likely reflects the nature of management knowledge, which relies more on objective and analytical thinking.

Furthermore, although timeliness emphasizes the speed of information delivery, the mere rapid exchange of information may not necessarily contribute to a deeper understanding of management knowledge or enhance its practical application. This suggests that management knowledge requires systematic analysis and thoughtful judgment rather than a focus on speed.

Likewise, while digital affinity enhances accessibility to communication through digital tools, it may not directly influence the depth and quality of management knowledge formation. This indicates that digital tools serve merely as facilitators, while other factors play a more significant role in internalizing management knowledge.

Finally, within entrepreneurial competency, problem-solving and cooperation were found to have a positive effect on team performance, while management knowledge had a negative effect. These findings suggest that different components of entrepreneurial competency influence team performance in distinct ways and can have either positive or negative effects depending on the nature of each factor and the context of team activities.

The positive impact of problem-solving and cooperation on team performance highlights the critical role of effective problem-solving skills and smooth collaborative relationships in achieving team goals. Problem-solving enables individuals to generate creative and practical solutions even in complex situations, while cooperation fosters trust and communication among team members, ultimately enhancing team productivity and efficiency.

On the other hand, the negative impact of management knowledge on team performance may seem unexpected, but it offers valuable insights. While management knowledge represents an individual's expertise and knowledge base, an overly knowledge-centered approach in a team setting may impede cooperation and execution. For instance, excessive reliance on analysis and discussion based on

management knowledge can delay decision-making or hinder practical execution within the team. Additionally, the overt display of personal expertise may lead to conflicts among team members.

Therefore, these findings emphasize the need for a balanced approach to developing and applying entrepreneurial competencies to maximize team performance. While fostering problem-solving and cooperation, it is also essential to manage the application of management knowledge to ensure its effective use in a team environment. Future research should explore specific situations in which management knowledge negatively impacts team performance, as well as the role of communication and leadership in mitigating such effects. These insights could contribute to the development of more refined educational and managerial strategies aimed at improving team performance.

Transparency:
The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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