



# Adoption of mobile instant messaging tools among higher education students: Scale development

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## ABSTRACT

This study aimed to develop a valid and reliable scale to measure higher education students' adoption levels of mobile instant messaging (MIM) tools. Within the scope of the study, a comprehensive literature review was conducted, an item pool of 53 items was created and content validity was ensured by consulting expert opinions. A pilot study was conducted with 23 participants to evaluate the comprehensibility of the scale. Data were collected from 351 higher education students to evaluate the psychometric properties of the scale. As a result of the exploratory factor analysis, it was determined that the scale had a three-factor structure as "ease of use and usefulness," "flexible learning and collaboration" and "concerns." Confirmatory factor analysis supported this structure (CFI = 0.91, TLI = 0.902, SRMR = 0.049, RMSEA = 0.0734). The reliability coefficients of the scale were high (Cronbach's  $\alpha$  = 0.962, McDonald's  $\omega$  = 0.968). Latent profile analysis revealed that the students were divided into four different profiles: "passionate advocates," "positive pragmatic users," "balanced users," and "abstaining adopters." Analyses of demographic variables showed that younger students have a more positive view of MIM technologies and that women are more cautious about MIM use than men. The scale developed in this study is a valuable tool that can be used to evaluate the use of MIM technologies in higher education, identify different user profiles and plan the integration of MIM technologies into educational processes. Future studies are recommended to test the scale in different cultural contexts and examine the effects of MIM use on academic performance.

**Keywords:** mobile instant messaging, higher education, scale development, WhatsApp, Telegram, WeChat

## INTRODUCTION

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Applications for mobile instant messaging (MIM) have grown to be among the most ubiquitous forms of communication technologies available nowadays. Billions of people now live their lives surrounded by platforms like WhatsApp, Facebook Messenger, LINE, Telegram, and WeChat as essential components of everyday contact. According to Ceci (2024), the number of global mobile phone messaging app users is expected to reach 4.6 billion by 2026. These applications have spread rapidly since the 2010s, offering multiple versions for various operating systems and devices with cross-platform features (H. H. Huang & Lin, 2023).

In higher education, MIM applications are widely used as communication and learning tools (Enakrire & Kehinde, 2022; Lee et al., 2023; Masalimova et al., 2025). These applications have brought a new dimension to educational processes by facilitating communication between students and instructors. WhatsApp is one of the most widely used communication tools in higher education and is used by students several times a day (Baishya & Maheshwari, 2019; Motlhaka, 2021). Research shows that students use WhatsApp for group discussions (33.3%) and resource sharing (30.3%) (Baishya & Maheshwari, 2019).

MIM applications make the learning experience more interactive and motivating (Lee et al., 2023). Students who interacted in WhatsApp groups reported a stronger sense of belonging to the university community, and this increased sense of belonging reduced the likelihood of students dropping out and increased retention (Rabotapi & Matope, 2024). Language learners who used the Telegram app as an instructional tool reportedly had far more motivation and less foreign language fear (Zhao et al., 2022). Still, the application of MIM technologies in higher education raises other questions. Adoption of these technologies suffers a great obstacle from privacy issues (Aldalbahi & Albasher, 2023). It is also said to promote distraction and reduced intellectual attention (Aharony & Zion, 2019). M. Kim et al. (2021) claimed that MIM notifies distractors to pupils studying and causes poor academic achievement.

This study aims to develop a measurement tool to assess higher education students' adoption levels of MIM tools. When the studies in the literature are examined, it is seen that there are limited measurement tools that comprehensively evaluate the use and effects of MIM applications in higher education. Existing studies often focus on a specific MIM application (e.g., WhatsApp or WeChat) or assess only certain aspects of MIM use (Criollo-C et al., 2021; Tang & Hew, 2022). Moreover, there is a lack of studies that assess students' perceptions and attitudes towards MIM use according to different user profiles.

In this context, the study aims to answer the following research questions:

1. How are the valid and reliable measurements of the scale assessing higher education students' adoption levels of MIM tools?
2. What are higher education students' perceptions of MIM usage?
3. How can higher education students be grouped according to their MIM usage profiles?
4. What is the relationship between demographic variables (age, gender, duration of use, etc.) and MIM usage?

The results of this study will contribute to developing strategies for a more effective integration of MIM technologies in higher education. Moreover, knowing various student profiles would enable teachers and institutions to modify MIM technology to fit the requirements of various student groups. Furthermore helping to shape regulations on the application of MIM technologies in higher education will be the study findings.

## LITERATURE REVIEW

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### Use of Mobile Instant Messaging Tools in Higher Education and User Profiles

MIM applications have become the most prevalent method of communication among young individuals, surpassing email, SNSs, and voice interactions (Cao & Jia, 2024; Jia & Hew, 2022). Among the most frequently utilized smartphone applications worldwide are instant messaging applications (e.g., WhatsApp, Facebook Messenger, and LINE). The majority of these are cross-platform and offer multiple versions for various operating systems and devices (H. H. Huang & Lin, 2023). Since their ascent to prominence in the 2010s,

messaging applications have also expanded their selection of services. By 2026, it is anticipated that the global population of mobile phone messaging app consumers will reach 4.6 billion (Ceci, 2024).

In the last decade, MIM applications such as WhatsApp, Telegram, and WeChat have been widely used in higher education as tools for communication and learning (Enakrire & Kehinde, 2022; Lee et al., 2023). These applications have brought a new dimension to educational processes by facilitating communication between students and instructors. MIM applications are used for various pedagogical purposes in higher education. WhatsApp is one of the most widely used communication tools in higher education and is used several times daily by students (Baishya & Maheshwari, 2019; Motlhaka, 2021). Research shows that students use WhatsApp for group discussions (33.3%) and resource sharing (30.3%) (Baishya & Maheshwari, 2019). It is also an effective channel for announcements, campus news and Q&A activities (Lee et al., 2023).

Through the use of WhatsApp, students and faculty members can constantly interact outside the classroom and develop creative thinking, critical thinking and collaborative working skills (Lee et al., 2023; Motlhaka, 2021). Mobile messaging groups also create collaborative learning environments; students exchange information using group chats for common projects and assignments (Lee et al., 2023).

MIM tools have become important technological tools that support collaborative learning processes. Collaborative learning is a process in which students work together towards a common goal and support each other's learning. In this context, MIM applications enable students to communicate without time and space limitations (Chung & Choi, 2023). Especially in group work, students can share ideas, share resources and coordinate projects in groups they create on platforms such as WhatsApp or Telegram (Costa-Sánchez & Guerrero-Pico, 2020). Moreover, thanks to these tools, students can receive instant feedback from their peers and actively participate in the knowledge construction process.

Many studies (Chung & Choi, 2023; Tang & Hew, 2022) show how much MIM tools assist group learning. Students who actively used WhatsApp groups showed improved critical thinking and problem-solving ability (Hidayat et al., 2021; Pacholek et al., 2023). Comparably, Tang and Hew (2020) and L. Xia et al. (2024) found that MIM apps improved students' sense of social presence and group membership. MIM technologies democratize knowledge exchange among students and help to include those with various learning styles into group projects (Ahmad et al., 2023; Shirkhani & Poorhadian, 2024). By means of MIM technologies, peer teaching helps students to strengthen their social as well as their academic skills (Imanuela et al., 2023; Lee et al., 2023; Mabaso et al., 2023). Generally speaking, MIM technologies improve the higher education learning process by offering a flexible, easily available interactive forum for group projects.

These applications are also used in specialized areas such as language education and support the social and academic adaptation of new university students. WhatsApp groups, especially during the orientation process, allow students to ask questions about university life and connect with their peers, strengthening their sense of belonging (Rabotapi & Matope, 2024).

The use of mobile messaging applications in education has significant effects on students. These tools make the learning experience more interactive and motivating (Lee et al., 2023). Students who interacted in WhatsApp groups reported a stronger sense of belonging to the university community, and this increased sense of belonging decreased the likelihood of students dropping out and increased their retention (Rabotapi & Matope, 2024).

In an experimental study conducted with the Telegram application, it was found that the motivation of language learners who used the application as an educational tool increased significantly and their foreign language anxiety decreased (Zhao et al., 2022). Students feel more engaged by using messaging groups as a space for discussing course materials, receiving quick feedback on assignments, and peer learning (Lee et al., 2023; Rabotapi & Matope, 2024).

The impact of mobile messaging tools on academic achievement and student interaction has been widely studied in the literature. Many studies have found that when used appropriately, these applications can improve students' academic performance (Imamyartha et al., 2024; Lee et al., 2023; Motlhaka, 2021). An econometric study conducted at a university in Ghana showed that students who used WhatsApp mainly for studying significantly improved their GPA (Afful & Akrong, 2020). A large-scale review study reported that students using WhatsApp exhibited more organized study, time management, active learning and motivation (Lee et al., 2023; Suárez-Lantarón et al., 2022). The constant communication provided in messaging groups

can accelerate the learning process by allowing students to reinforce course topics and ask questions on the fly (Imamyartha et al., 2024; Lee et al., 2023; Zahra et al., 2022).

However, the impact on academic achievement is not always uniformly positive, with findings showing varying results depending on usage and context (Lee et al., 2023; Swartz et al., 2022). For example, a study examining a WeChat-supported blended classroom model in China found that students' engagement in pre-class activities increased, but there was no significant difference in final grades compared to the traditional method (L. Huang et al., 2023).

There is a more consistent picture regarding the role of mobile messaging apps in increasing student interaction and engagement. Online communities created through applications such as WhatsApp or WeChat create an active learning community by giving students the opportunity to share their thoughts, ask questions and learn from each other (L. Huang et al., 2023; le Roux & Parry, 2022). In large online courses where face-to-face communication is limited, messaging groups provide an important mechanism to reinforce students' social cohesion (L. Huang et al., 2023). Discussions conducted through instant messaging increase the overall level of interaction as it facilitates the participation of more timid students (Al Omar et al., 2024; Lee et al., 2023).

Today's students, who are defined as digital natives, have made WhatsApp and similar applications an integral part of their daily lives. As a matter of fact, WhatsApp is a universal communication tool for the younger generation. A study found that university students use WhatsApp for four main reasons (Lee et al., 2023):

- communication with family and friends,
- discussing thoughts and ideas with peers,
- start conversations with new acquaintances in a relaxed atmosphere, and
- developing their own social environment.

In terms of frequency of use and time spent (Baishya & Maheshwari, 2019):

- 97% of students use WhatsApp several times a day, 3% use it once a day and
- 42.4% spend 3-5 hours a day and 34.3% spend 1-2 hours a day on WhatsApp.

The COVID-19 pandemic has given a significant impetus to the use of mobile messaging tools in education. During the pandemic, many universities had to move away from face-to-face education and switched to emergency distance education. In this process, WhatsApp and its derivative applications have become critical communication platforms to ensure course continuity (Nyamupangedengu et al., 2023).

### **Adoption of Mobile Instant Messaging Technologies in Higher Education: Perceived Benefits and Concerns**

MIM technologies support educational processes by providing fast and easy communication between students and educators (Criollo-C et al., 2021; Tang & Hew, 2017). MIM applications are increasingly used in both formal and informal learning environments in higher education (So, 2016; Suárez-Lantarón et al., 2022). These technologies offer many benefits in higher education. These include instant communication between students and instructors, rapid sharing of course materials, and facilitating group work (Tang & Hew, 2017). MIM helped students save time and solve tasks, therefore enabling cooperation and communication (Afzal & Abdullah, 2022; Segal & Biton, 2024). Studies reveal that MIM technologies raise student participation and improve learning results (Alamer et al., 2023; Tang & Hew, 2022). Particularly when extra help is given, some studies have demonstrated that MIM improves academic performance, hence raising learning achievement (So, 2016). Moreover, MIM applications support distance education processes as they are accessible off-campus (Al-Mothana Gasaymeh & Gasaymeh, 2017; Maphosa et al., 2020).

The use of MIM technologies in education improves students' collaborative learning skills. Students can share ideas, discuss and work together through group chats (Kaysi, 2023; Molina, 2022; Naidoo & Kopung, 2016). The perceived benefits include facilitating information sharing, supporting group work and making the learning process more flexible (Baishya & Maheshwari, 2019). This contributes to the development of critical thinking and problem solving skills (Anitha & Kavitha, 2023; Pacholek et al., 2023). WhatsApp groups support peer learning by encouraging information sharing among students (Cetinkaya, 2017). In addition, increasing

social presence, especially through emotional expression and the use of inclusive language, is also stated among the benefits (Awada, 2016; Tang & Hew, 2020).

Still, the use of MIM technologies in higher education begs for several interesting issues. Privacy concerns provide a significant barrier to adoption of these technologies (Aldalbahi & Albeshir, 2023). Negative consequences have also been noted, like children becoming distracted and concentrating on extracurricular problems (Igbafe & Ngozi Anyanwu, 2018). It is also noted that MIM use can be distracting and reduce academic focus (Aharony & Zion, 2019). WhatsApp might disturb more serious intellectual debates even if it can help casual communication. This dichotomy can lead to a situation whereby important learning is undermined (Annamalai et al., 2024). Moreover, multitasking and more communication burden help pupils to be less productive overall. For certain students, the demand to engage and the requirement to react fast could cause stress (Tang & Hew, 2022). Another issue on the application of MIM technologies in higher education is the digital divide. Use of these technologies can result in disparities where not all pupils have access to cellphones or the internet (Tawiah, 2014).

Students may find it challenging to concentrate on their homework when mobile instant messengers are always online and always attentive. Recent studies reveal that MIM alerts cause students to become preoccupied when studying, therefore impairing their academic performance (M. Kim et al., 2021). According to Upshaw et al. (2022) and Kaminske et al. (2022), smartphone notifications confuse students and raise the error rate in cognitive activities. Students that actively utilize MIM apps during study have distraction and focus issues and cannot effectively spend the study time (Dou et al., 2025). Considered as technological stimulus overload, this situation can finally undermine students' academic self-discipline and time management skills (S. Y. Kim et al., 2022). Constant message checking behavior also can promote fear of missing out (FOMO) syndrome in students, hence increasing their stress and anxiety levels (Gul et al., 2021).

Institutional policies need to be established for the effective use of MIM technologies in education. These policies should include privacy, data security and appropriate usage rules (Cheng & Wang, 2022; Iqbal & Bhatti, 2020). Furthermore, it is important that educators have the necessary skills to integrate these technologies into their educational programs. Professional development programs for educators can support the effective use of MIM technologies (Andujar, 2016).

The application of MIM technologies in higher education has different effects depending on nation and society. For instance, whilst WhatsApp is more used in Western countries (Venturino & Hsu, 2022), WeChat is more common in China (M. Xia & Liu, 2023). Adoption and use patterns of these technologies depend on cultural variances. MIM technologies should thus be used in education according to the local situation (Klein et al., 2018; Soon et al., 2022; Swartz et al., 2022; Tang & Hew, 2022).

In essence, MIM technologies present possibilities as well as problems in higher education. Effective acceptance of new technologies depends on a fair evaluation of advantages and drawbacks. The long-term consequences of MIM technology use in higher education should be investigated in further studies (Aladsani, 2021; Kaliisa et al., 2019). Moreover, teachers and institutions ought to create plans for including these technologies into their courses (Merelo et al., 2024; Pimmer et al., 2019; Yang, 2024).

## METHOD

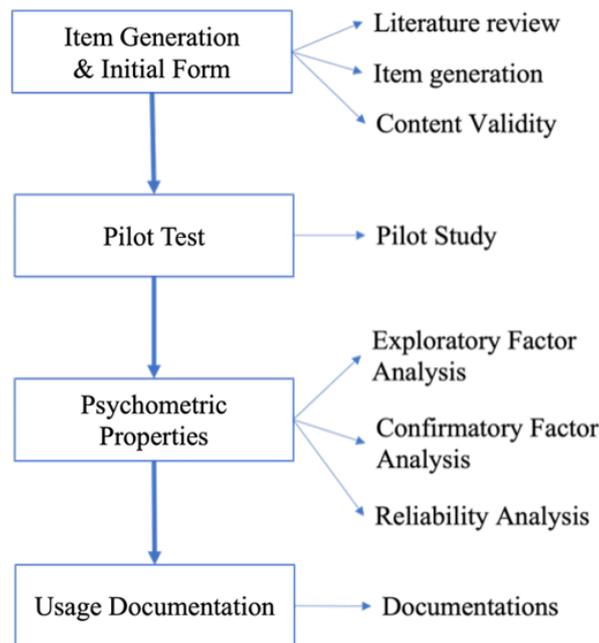
In the scale development process, the steps shown in [Figure 1](#) were followed.

### Development of Scale Items

#### Literature review

**Objective:** To investigate in the pertinent field existing studies and scales holistically.

**Process:** Hinkin (1998) stressed the importance of a careful review of the literature both to expose the advantages and disadvantages of present scales and to build a conceptual framework for a new scale. According to Snyder (2019), comprehending the several aspects of the construct and associated concepts depends much on a comprehensive literature review.



**Figure 1.** Scale development process (Figure created by the authors)

### **Creating the initial item pool**

**Objective:** To develop a broad set of items covering all dimensions of the construct to be measured.

**Process:** DeVellis and Thorpe (2021) emphasized the importance of developing a large set of items covering all aspects of the construct when creating an item pool. Clark and Watson (1995) emphasized the importance of using clear, understandable and appropriate language for the target audience in item writing.

### **Ensuring content validity**

**Objective:** To assess the extent to which the items cover the construct to be measured.

**Process:** Yusoff (2019) suggested using expert opinions and calculating the content validity ratio to assess content validity. Polit and Beck (2006) emphasized the importance of assessing content validity with qualitative and quantitative methods.

### **Pilot Study**

**Objective:** To test the operability of the scale before implementation.

**Process:** Van Teijlingen and Hundley (2001) stated that pilot studies play a critical role in testing the comprehensibility of scale items and identifying potential implementation problems. At this stage, the draft scale is administered to a small group to determine the comprehensibility of the items, the duration of administration and possible problems.

### **Evaluation of Psychometric Properties**

**Objective:** To statistically analyze the validity and reliability of the scale.

**Process:** As psychometric features, Mellinger and Hanson (2020) stressed validity and reliability studies. In this stage, also exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) should be done (Brown, 2015; Williams et al., 2010).

### **Preparation of the User Documentation**

**Objective:** To provide guidelines for the appropriate use of the scale.

**Process:** Gudmundsson (2009) emphasized the importance of preparing guidelines for the use of the scale, especially for its use in different contexts and cultures. This documentation includes information on how to administer, score and interpret the scale.

The systematic implementation of these steps forms the basis of a valid and reliable scale development process. Each step ensures that the scale conforms to scientific standards and provides researchers and practitioners with a measurement tool that they can use with confidence.

## Samples

This study was conducted with two different sample groups. The first sample was a group of 23 participants used in the pilot study phase to evaluate the comprehensibility of the scale. The second sample was used to examine the validity and reliability (psychometric properties) of the scale and consisted of 382 participants. Prior to data analysis, a data cleaning process was applied; in this context, participants who marked all items as "1" or "5" were excluded from the sample and it was assumed that these participants answered the questions without reading them. Reverse items were recorded. After this cleaning process, the sample size was reduced to 351 participants. 64% of the participants were female and 36% were male. In terms of age groups, 50.6% were between the ages of 18-19, 37.4% were between the ages of 20-21, and 12% were 22 years and older. In the process of evaluating the psychometric properties of the scale, in order to avoid conducting both EFA and CFA on the same sample, the sample of 351 participants was randomly divided into two groups and data analysis was carried out in this way.

## Data Analysis

The study performed data analysis using Jamovi (2.6.25). Data visualization was accomplished using Tableau tools. Content validity of the items was found in the scale construction process by means of item-content validity index (I-CVI) and content validity index average (CVI/Ave) computations. As suggested by Yusoff (2019), the minimum I-CVI value for 8 experts was determined as 0.83. Items below this value were removed from the scale. To evaluate the comprehensibility of the scale items, the mean scores of the pilot research were computed. At this point, the comprehensibility of the objects by the target audience was tested, as advised by DeVellis and Thorpe (2021).

EFA and CFA were used for construct validity. The factor structure of the scale was determined with EFA and this structure was tested with CFA. As suggested by Williams et al. (2010), Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett's test of sphericity were applied to determine the appropriateness of factor analysis. 'maximum likelihood' was used as the factor extraction method and 'varimax' as the rotation method. As suggested by Brown (2015), a factor loading limit of 0.6 was set to obtain stronger factor structures. In the evaluation of CFA results,  $\chi^2/df$ , CFI (comparative fit index), TLI (Tucker-Lewis index), SRMR (standardized root mean square residual), and RMSEA (root mean square error of approximation) indices were used. As stated by Kline (2016), the following criteria were considered for model fit indices:  $\chi^2/df < 3$ , CFI  $> 0.90$ , TLI  $> 0.90$ , SRMR  $< 0.08$ , and RMSEA  $< 0.08$ . Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients were calculated to determine the reliability of the scale. Mellinger and Hanson (2020) advised values of 0.70 and above as trustworthy.

Students' latent profile analysis helped them define their MIM profiles. The ideal number of classes was ascertained by looking at AIC (Kaike information criteria), BIC (Bayesian information criteria), SABIC (sample-size adjusted BIC) and entropy values as advised by Nylund et al. (2007).

Calculation of the descriptive statistics of the scale scores and analysis of scale variations depending on demographic factors were done. Tableau program visualized these analyses, therefore enabling the data interpretation process. Data visualization, according to Knaflc (2015), helps one to better convey complicated data and aids the grasp of it.

Every analysis was done with 95% confidence intervals and  $p = 0.05$  was statistically significant.

## FINDINGS

### Item Generation and Initial Form

Literature was reviewed and scale items were written to express students' thoughts and attitudes. There are 53 items in the first form. Then this form was presented for expert evaluation. The expert group comprised 2 specialists in communication and languages, 5 specialists in educational technologies, and 1 expert in measurement and assessment. A total of 8 professionals provided their comments. The experts were asked

**Table 1.** CVI for item and scale level

ID	I-CVI	S-CVI	S-CVI/UA	ID	I-CVI	S-CVI	S-CVI/UA	ID	I-CVI	S-CVI	S-CVI/UA
IS_01	1	1	1	IS_19	1	1	1	IS_37	0.500		
IS_02	1	1	1	IS_20	0.875	0.875		IS_38	1	1	1
IS_03	0.875	0.875		IS_21	1	1	1	IS_39	0.630		
IS_04	1	1	1	IS_22	1	1	1	IS_40	1	1	1
IS_05	1	1	1	IS_23	1	1	1	IS_41	1	1	1
IS_06	1	1	1	IS_24	0.500			IS_42	1	1	1
IS_07	1	1	1	IS_25	1	1	1	IS_43	1	1	1
IS_08	0.250			IS_26	0.875	0.875		IS_44	0.500		
IS_09	1	1	1	IS_27	0.380			IS_45	1	1	1
IS_10	1	1	1	IS_28	1	1	1	IS_46	1	1	1
IS_11	1	1	1	IS_29	1	1	1	IS_47	1	1	1
IS_12	1	1	1	IS_30	0.875	0.875		IS_48	1	1	1
IS_13	1	1	1	IS_31	0.875	0.875		IS_49	1	1	1
IS_14	1	1	1	IS_32	1	1	1	IS_50	1	1	1
IS_15	1	1	1	IS_33	0.875	0.875		IS_51	0.875	0.875	
IS_16	1	1	1	IS_34	1	1	1	IS_52	0.875	0.875	
IS_17	0.875	0.875		IS_35	1	1	1	IS_53	1	1	1
IS_18	1	1	1	IS_36	1	1	1				

to evaluate each item one by one. The evaluation is “1” (the item is suitable for the purpose of the scale) and “0” (the item is not suitable).

As a result of the experts’ evaluations, I-CVI was calculated for each item. I-CVI values vary between 0.25 and 1. According to Yusoff (2019), the minimum I-CVI value for 8 experts should be 0.83.

Three items that did not meet this criterion were removed from the scale:

- “I think using MIM in education will cause me social problems.”
- “It is troublesome to read instructional materials on mobile devices with MIM.”
- “Using MIM is more comfortable.”
- “The simple conversational structure of MIM is not well catered for structured discussion and learning.”
- “Receiving instructional materials and questions outside office hours can interfere with my private life.”
- “I find it easy to use MIM to chat or obtain entertainment.”

The CVI/Ave value calculated for the first form of the scale is 0.917. After the items were removed, the CVI/Ave value was calculated as 0.976. The CVI/UA (content validity index for universal agreement) value was found to be 0.809. As a result of the analysis, it was seen that the content validity of the new scale form consisting of 47 items was achieved (**Table 1**).

## Pilot Study

A small pilot group used the revised scale to assess comprehension among the target audience. Participants were asked to rate each item as either “0” (not completely understood) or “1” (totally understood). Based on these ratings, averages were calculated for each item. The means ranged between 0.91 and 1, with eight items scoring below 1:

- “MIM is effective for sharing learning materials and resources.”
- “MIM Messenger makes communication easier.”
- “Comparing myself to other students’ performance on MIM groups can create social pressure and stress for me.”
- “The large amount of information shared on MIM can lead to information overload.”
- “I think using MIM in my education would be fun.”
- “I use MIM to get advice from senior students about courses.”
- “MIM can provide new learning opportunities.”
- “MIM can improve communication between students and teachers.”

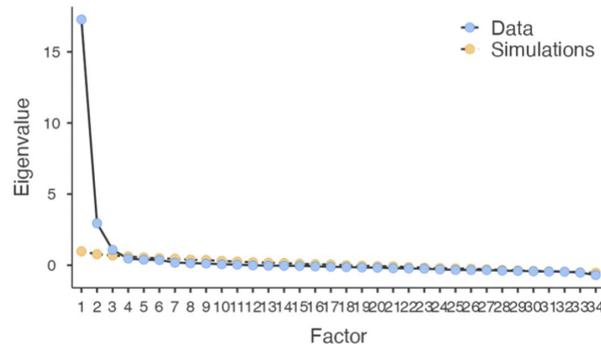


Figure 2. Scree plot for MIM scale (Figure created by the authors)

Table 2. Factor loading for MIMS sub-dimensions

Items	1	2	3	Uniqueness	Items	1	2	3	Uniqueness
I_37	0.852			0.155	I_13		0.809		0.220
I_41	0.850			0.232	I_20		0.786		0.280
I_45	0.836			0.196	I_22		0.749		0.331
I_47	0.831			0.158	I_17		0.740		0.392
I_43	0.809			0.216	I_11		0.715		0.396
I_35	0.800			0.223	I_18		0.712		0.373
I_34	0.791			0.325	I_06		0.698		0.436
I_46	0.791			0.225	I_04		0.694		0.413
I_44	0.787			0.271	I_16		0.693		0.457
I_27	0.744			0.312	I_14		0.687		0.413
I_36	0.742			0.373	I_21		0.682		0.405
I_38	0.733			0.373	I_12		0.681		0.474
I_26	0.726			0.391	I_03		0.664		0.463
I_28	0.725			0.349	I_02		0.652		0.530
I_42	0.694			0.406	I_30			0.821	0.320
I_31	0.660			0.412	I_32			0.738	0.443
I_40	0.660			0.445	I_25			0.616	0.542
Items		1				2		3	
Sum of squares loadings		11.36				8.94		1.76	
Percentage of variance (%)		33.40				26.28		5.18	
Cumulative percentage (%)		33.40				59.70		64.90	

Experts reviewed these lower-scoring items once more and decided to keep them in their current form. This pilot study served as an important initial step in determining the scale’s comprehensibility for the target group and making necessary adjustments. The scale became more logical and useful based on the feedback received.

### Exploratory Factor Analysis MIMS

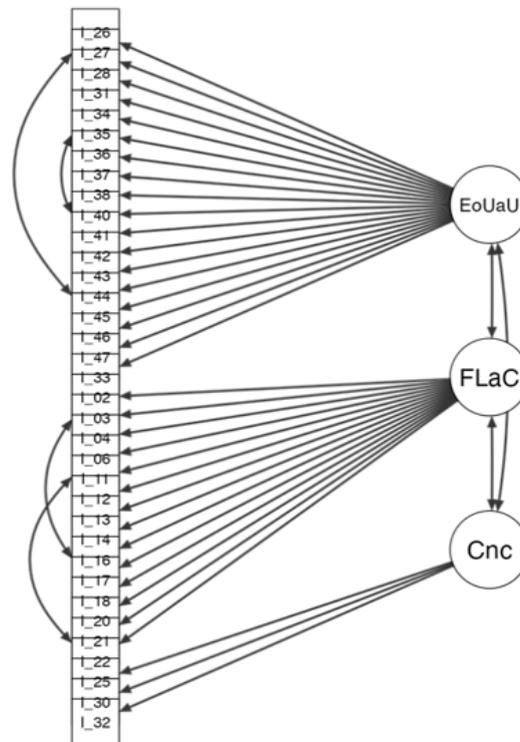
KMO measure of sampling adequacy and Bartlett’s test of sphericity were performed to determine whether the EFA data set was factorable. According to the test results,  $\chi^2 = 10,939$ ,  $df = 1,081$ , and  $p < .001$ , and KMO was calculated as 0.936. When no rotation was made in factor loadings, factor loadings ranged between -0.384 and 0.873 and a 4-factor structure emerged. ‘Maximum likelihood’ extraction method was used in combination with a ‘varimax’ rotation. To obtain stronger factor structures, a factor loading limit of 0.6 was set. Items with low factor loadings and overlapping items (1, 5, 7, 8, 9, 10, 15, 19, 23, 24, 29, 33, and 39) were removed from the scale. According to parallel analysis, a 3-factor structure was obtained (Figure 2).

After the items were removed, KMO was recalculated as 0.945 and Bartlett’s test of sphericity ( $\chi^2 = 17,968$ ,  $df = 561$ , and  $p < .001$ ). The factor loadings obtained for each sub-dimension are presented in Table 2.

When the factor analysis results are analyzed, three main dimensions emerge regarding the evaluation of MIM platforms in the context of education. The first factor, named as “perceived ease of use and usefulness of MIM in education,” is the most dominant factor explaining 33.4% of the total variance. With an eigenvalue of 11.36, this component is obviously different from the others and indicates that the participants find MIM tools simple to use in education, interesting and useful in terms of academic coordination. Particularly, the

**Table 3.** Model indices for MMS

Model	$\chi^2/df$	CFI	TLI	SRMR	RMSEA	RMSEA 90% confidence interval	
Criteria	< 3	> .90	> .90	< 0.08	< 0.08	Lower	Upper
Primitive model	1687/524=3.22	0.85	0.84	0.0531	0.0958	0.0907	0.101
Final model	1258/546=2.30	0.91	0.902	0.049	0.0734	0.0681	0.0787

**Figure 3.** Path diagram based on CFA (Figure created by the authors)

possibility to enhance student-teacher connection, offer instantaneous comments and support traditional teaching strategies calls for attention.

The second factor named as “MIM as a flexible learning and collaboration tool” contributes significantly to the total variance explained with a variance explanation rate of 26.28%. This factor focuses on the features of MIM applications that add flexibility to learning processes, eliminate time and space limitations, facilitate multimedia content sharing and support collaborative learning. With an eigenvalue of 8.94, this factor, which ranks second, emphasizes the role of MIM in supporting collaboration in educational processes.

The third factor named “concerns regarding MIM usage” has a lower effect compared to the other factors with a variance explanation rate of 5.18%. With an eigenvalue of 1.76%, this factor draws attention to the potential negative aspects of MIM use. Concerns such as excessive MIM use making time management difficult, the risk of addiction that may negatively affect learning motivation, and the distracting effect of notifications during studying are gathered under this factor. The fact that the three factors explained 64.9% of the total variance indicates that the scale adequately measures the perceptions about the use of MIM in education. As a result, it is understood that while the benefits and conveniences offered by MIM tools in educational processes are widely accepted by users, there is a certain level of concern about their potential negative effects.

### Confirmatory factor analysis MIMS

The MIMS structure obtained in the EFA was tested in the CFA data set for CFA (Table 3). The structure was tested without adding residual covariances. CFI and TLI values were below the critical values. Since  $\chi^2/df$  and RMSEA values were above the critical value, the scale structure could not be accepted. Modifications of the proposed model were added to the software side (shown in Figure 3). In the final model, since the model index values were between the critical values, the model was accepted.

**Table 4.** Factor loading MIMS based on CFA

Factor	Indicator	Estimate	Standard error	Z	p
Ease of use and usefulness	I_26	0.717	0.0496	14.43	< .001
	I_27	0.766	0.0483	15.84	< .001
	I_28	0.796	0.0478	16.65	< .001
	I_31	0.809	0.0577	14.01	< .001
	I_34	0.743	0.0531	14.00	< .001
	I_35	0.844	0.0484	17.45	< .001
	I_36	0.790	0.0530	14.92	< .001
	I_37	0.914	0.0524	17.45	< .001
	I_38	0.807	0.0552	14.64	< .001
	I_40	0.725	0.0647	11.20	< .001
	I_41	0.756	0.0515	14.67	< .001
	I_42	0.826	0.0601	13.76	< .001
	I_43	0.903	0.0485	18.61	< .001
	I_44	0.851	0.0503	16.93	< .001
	I_45	0.772	0.0474	16.29	< .001
I_46	0.880	0.0486	18.12	< .001	
I_47	0.839	0.0507	16.55	< .001	
I_33	0.660	0.0605	10.90	< .001	
Flexible learning and collaboration	I_02	0.611	0.0531	11.52	< .001
	I_03	0.626	0.0461	13.59	< .001
	I_04	0.535	0.0407	13.15	< .001
	I_06	0.639	0.0448	14.27	< .001
	I_11	0.771	0.0584	13.20	< .001
	I_12	0.713	0.0564	12.64	< .001
	I_13	0.711	0.0451	15.78	< .001
	I_14	0.590	0.0465	12.68	< .001
	I_16	0.666	0.0539	12.35	< .001
	I_17	0.696	0.0537	12.95	< .001
	I_18	0.740	0.0462	16.02	< .001
	I_20	0.715	0.0444	16.10	< .001
I_21	0.710	0.0520	13.64	< .001	
I_22	0.684	0.0444	15.41	< .001	
Concerns	I_25	0.644	0.0799	8.06	< .001
	I_30	1.198	0.0918	13.04	< .001
	I_32	0.757	0.0833	9.08	< .001

**Table 5.** Reliability coefficient

Dimension	Cronbach's α	McDonald's ω
Ease of use and usefulness	0.974	0.973
Flexible learning and collaboration	0.952	0.952
Concerns	0.772	0.741
Total	0.962	0.968

CFA results strongly support the three-factor structure of the MIM scale (Table 4). The factor loadings for the “ease of use and usefulness” factor ranged from 0.660 to 0.914. The highest load on this factor was found in item I\_37 (0.914), while the lowest load was found in item I\_33 (0.660). In the “flexible learning and collaboration” factor, the loadings range between 0.535 and 0.771. In this factor, item I\_11 has the highest load (0.771), while item I\_04 has the lowest load (0.535). In the “concerns” factor, the loadings are between 0.644 and 1.198. The striking point in this factor is that item I\_30 has a very high loading (1.198). The p values for all items were found to be <.001. This proves that all items show statistically significant relationships with the relevant factors. In general, factor loadings were mostly above 0.6, indicating that the three-factor structure of the scale is valid and reliable. The consistent loadings of the items in each factor confirm that the scale is effective in assessing the role of MIM in education.

### Reliability Analysis

Based on dimensions as well as a whole scale, reliability study findings suggest that the MIM scale is very reliable (Table 5). With a Cronbach's α value of 0.974 and McDonald's ω value of 0.973 the dimension “ease

of use and usefulness" shows outstanding reliability. With Cronbach's  $\alpha$  and McDonald's  $\omega$  values of 0.952, the "flexible learning and collaboration" dimension also exhibits rather great reliability. With a Cronbach's  $\alpha$  value of 0.772 and McDonald's  $\omega$  value of 0.741, the "concerns" dimension—though smaller than the other dimensions—has a reasonable degree of reliability. The limited number of objects in this dimension could be the reason for its less reliability. The scale's total reliability values (Cronbach's  $\alpha = 0.962$ , McDonald's  $\omega = 0.968$ ) demonstrate that internal consistency of the scale is strong overall. Finally, these results of reliability study show that the MIM scale is a useful measuring instrument for field of education.

## User Documentation

The scale developed in this study aims to assess students' level of adoption of MIM tools in higher education. The scale consists of 34 items in total and includes three sub-dimensions. These sub-dimensions are named as "ease of use and usefulness," "flexible learning and collaboration," and "concerns."

The "ease of use and usefulness" sub-dimension consists of items numbered 26, 27, 28, 31, 34, 35, 35, 36, 37, 38, 40, 41, 42, 43, 44, 45, 46, and 47. The "flexible learning and collaboration" subscale consists of items numbered 2, 3, 4, 6, 11, 12, 13, 14, 16, 17, 18, 20, 21, and 22. The "concerns" sub-dimension consists of items numbered 25, 30, and 32.

All items are evaluated using a 5-point Likert scale. The Likert scale options are as follows: 1—strongly disagree, 2—disagree, 3—undecided, 4—agree, and 5—strongly agree.

By taking the averages of the items in the "ease of use and usefulness" and "flexible learning and collaboration" sub-dimensions, comments can be made about the participants' positive perceptions of MIM tools. The increase in the mean value indicates that the participants have more positive thoughts about the use of MIM tools in education.

Items to be reverse coded: All items in the "concerns" sub-dimension (25, 30, and 32) should be reverse coded and scored. Reverse coding is as follows:

- 5-point answer → 1 point
- 4-point response → 2 points
- 3-point answer → 3 points
- 2-point answer → 4 points
- 1 point answer → 5 points

The list of reverse coded items is as follows:

- Item 25: "Notifications from mobile instant messaging apps can distract me while working or studying."
- Item 30: "Spending too much time on mobile IMs can make it difficult for me to effectively manage my time for studying and other academic responsibilities."
- Item 32: "I am worried about being overly dependent on mobile instant messaging apps, which can negatively affect my motivation to learn and my academic performance."

The increase in the mean of the items in the "concerns" sub-dimension (after reverse coding) indicates that the participants are less concerned about the use of MIM tools in education.

The total score that can be obtained from the scale can be obtained by summing up the averages of all sub-dimensions. A higher total score indicates that the participants are more likely to use MIM tools for educational purposes. The administration of the scale takes approximately 10-15 minutes and can be administered individually or as a group.

This scale can be used to assess the adoption of MIM tools in higher education, identify different user profiles and plan the integration of MIM technologies into educational processes.

## Perceptions of Students

Results come from descriptive statistics for the three MIM scale dimensions (**Table 6**). The median value of the "ease of use and usefulness" dimension is 4.03; its mean score is 4.06. On a 5-point system, these values show a great evaluation. With a skewness of -1.015 in this dimension, the scores are essentially focused on high values. With a mean of 4.18, the "flexible learning and cooperation" dimension stands top. For this

**Table 6.** Descriptive statistics for MIM dimension

Dimension	M	Median	SD	Skewness	Skewness SE	Kurtosis	Kurtosis SE
Ease of use and usefulness	4.06	4.03	0.777	-1.015	0.13	1.367	0.26
Flexible learning and collaboration	4.18	4.14	0.668	-0.999	0.13	2.026	0.26
Concerns	3.23	3.33	1.021	-0.203	0.13	-0.589	0.26

**Table 7.** Model indices based on latent profile analysis

Model	Classes	LogLik	AIC	AWE	BIC	CAIC	CLC	KIC	SABIC	ICL	Entropy
1	2	-1202	2423	2549	2462	2472	2405	2436	2430	-2567	0.619
1	3	-1133	2294	2470	2348	2362	2267	2311	2303	-2404	0.843
1	4	-1123	2282	2509	2352	2370	2248	2303	2294	-2439	0.800
1	5	-1121	2285	2564	2370	2392	2243	2310	2300	-2543	0.701
1	6	-1121	2294	2623	2394	2420	2243	2323	2311	-2658	0.637
2	2	-1072	2171	2334	2221	2234	2147	2187	2180	-2232	0.950
2	3	-988	2016	2269	2093	2113	1978	2039	2030	-2139	0.852
3	2	-1156	2338	2502	2388	2401	2313	2354	2346	-2510	0.530
3	3	-1071	2176	2390	2241	2258	2143	2196	2187	-2370	0.697
3	4	-1047	2136	2402	2217	2238	2096	2160	2151	-2349	0.745
3	5	-1038	2127	2443	2223	2248	2078	2155	2144	-2407	0.692
3	6	-1020	2097	2465	2209	2238	2041	2129	2117	-2397	0.707
6	2	-1010	2058	2298	2131	2150	2021	2080	2071	-2209	0.649
6	4	-864	1807	2301	1957	1996	1730	1849	1833	-2020	0.846

dimension the median is 4.14 and the SD is 0.668. The negative skewness (-0.999) and high kurtosis (2.026) values indicate that the participants' evaluations of this dimension are also quite high and close to each other. The "concerns" dimension has a lower mean (3.23) compared to the other dimensions. The SD of this dimension (1.021) is higher than the other dimensions. This shows that the responses related to concerns are spread over a wider range. In addition, the low skewness (-0.203) and negative kurtosis (-0.589) values in this dimension indicate that the responses show a flat distribution that is closer to a normal distribution. In conclusion, while participants had positive views on the ease of use, usefulness and contribution of MIM to flexible learning, they expressed more diverse views on concerns.

### Latent Profile Analysis

When the latent profile analysis results are analyzed, it is seen that the most appropriate model is model 6-4 (Table 7). This model is the 4-class version of model 6. There are several important reasons for choosing this model. The AIC value of model 6-4 is 1,807, the BIC value is 1,957, and the SABIC value is 1,833. These values are quite low compared to other models. Lower values indicate better model fit. In addition, the entropy value of this model is 0.846. This high entropy value indicates that individuals are clearly separated into classes. With a log-likelihood value of -864, this model fits the data well. Although model 2-2 has a higher entropy value (0.950), the information criteria of this model are higher than model 6-4. This indicates that model 2-2 has a poorer fit to the data. The four-class structure offers the possibility to distinguish different user profiles in MIM use in more detail. This may better reflect the different combinations between the three dimensions of the scale. In conclusion, model 6-4 is the best choice for describing latent profiles of MIM use in terms of both statistical fit indices and interpretability.

The 4-class structure resulting from the latent profile analysis clearly shows the different profiles of MIM users (Table 8). Class 2 (N = 41), despite being the smallest group, has the highest values with almost full points in the dimensions "ease of use and usefulness" (mean [M] = 4.99, standard deviation [SD] = 0.0241) and "flexible learning and collaboration" (M = 4.99, SD = 0.0281). This group also had the highest mean in the "concerns" dimension (M = 3.6). This indicates that they have few worries. This group was labeled as "passionate advocates."

Class 1 (N = 109) showed high values in the dimensions of "ease of use and usefulness" (M = 4.62) and "flexible learning and collaboration" (M = 4.64), while having a moderate level of concern (M = 3.25). This group was labeled as "positive pragmatic users."

**Table 8.** Descriptive statistics based on classes

Dimension	Class	N	M	Median	SD	Minimum	Maximum
Ease of use and usefulness	4	113	3.90	3.94	0.1757	3.47	4.29
	3	87	3.13	3.06	0.7684	1.00	5.00
	2	41	4.99	5.00	0.0241	4.94	5.00
	1	109	4.62	4.65	0.2862	3.94	5.00
Flexible learning and collaboration	4	113	3.93	3.93	0.1720	3.50	4.29
	3	87	3.56	3.43	0.7990	1.00	5.00
	2	41	4.99	5.00	0.0281	4.93	5.00
	1	109	4.64	4.71	0.2428	3.93	5.00
Concerns	4	113	3.12	3.00	0.8334	1.00	5.00
	3	87	3.16	3.00	1.0960	1.00	5.00
	2	41	3.60	4.00	1.1864	1.00	5.00
	1	109	3.25	3.33	1.0503	1.00	5.00

**Table 9.** Demographic distribution in each class

Variables	Passionate advocates	Positive pragmatic users	Balanced user	Abstaining adopters	
Age	18-19	44%	53%	55%	45%
	20-21	41%	37%	37%	37%
	22 and elder	15%	10%	8%	18%
Gender	Female	58%	66%	57%	74%
	Male	42%	34%	43%	26%
Time spent	Less than 1 hour	12%	21%	22%	18%
	1-3 hours	41%	50%	55%	46%
	4-6 hours	34%	20%	20%	24%
	7 and more hours	12%	8%	3%	11%

Class 4 (N = 113) was the largest group and showed medium-high values in both positive dimensions (M = 3.9 and M = 3.93) but had the lowest mean (M = 3.12). This means that his concern is the highest compared to his other friends. They were labeled as “balanced users.” Class 3 (N = 87) has the lowest values in the dimensions of “ease of use and usefulness” (M = 3.13) and “flexible learning and collaboration” (M = 3.56). They were labeled as “abstaining adopters.”

**Table 9** shows the demographic characteristics of the four user profiles. When the age distribution is analyzed, it is seen that the 18-19 age group is dominant in all profiles. This rate is highest among balanced users (55%). The 22 and above age group has the highest proportion of the abstaining adopters (18%). This indicates that younger consumers view MIM technologies in more favorable light. Regarding gender distribution, women make up the bulk in every profile. Among abstaining adopters, women make up the biggest proportion—74%. Men make more of a proportion in balanced users (43%), and passionate advocates (42%). These findings suggest that women may have a more reserved approach to MIM use. Balanced users and positive pragmatic users generally spend 1-3 hours (55% and 50%), on the MIM. More often among passionate advocates (34%), are 4-6 hours of usage. Among balanced users (3%), use of 7 hours or more is rather low; while, among passionate advocates (12%), and abstaining adopters (11%), it is rather high. This is an intriguing result since the most positive and the most abstaining groups show high usage time, implying that usage time could be related with various mindsets. One of the noteworthy points about **Figure 4** is that male in the 18-19 age group who use MIM for 4-6 hours show a high score (4.7) in the ease of use dimension. In addition, male in the 20-21 age group who use MIM for 7+ hours have a very low ease of use score (1.4), while their concerns score is quite high (4.7). Similarly, aged 22 and over who use 7+ hours have a significantly lower flexible learning score (1.6). Overall, the flexible learning and collaboration dimensions have the highest values for most groups, while the concerns dimension generally has the lowest scores.

## DISCUSSION

### Factor Structure and Validity of the Scale

The MIM scale developed in this study revealed a three-factor structure as a result of exploratory and confirmatory factor analyses (**Appendix A**). These three factors were named as “ease of use and usefulness,” “flexible learning and collaboration,” and “concerns.” The scale’s factor structure mostly conforms to the body

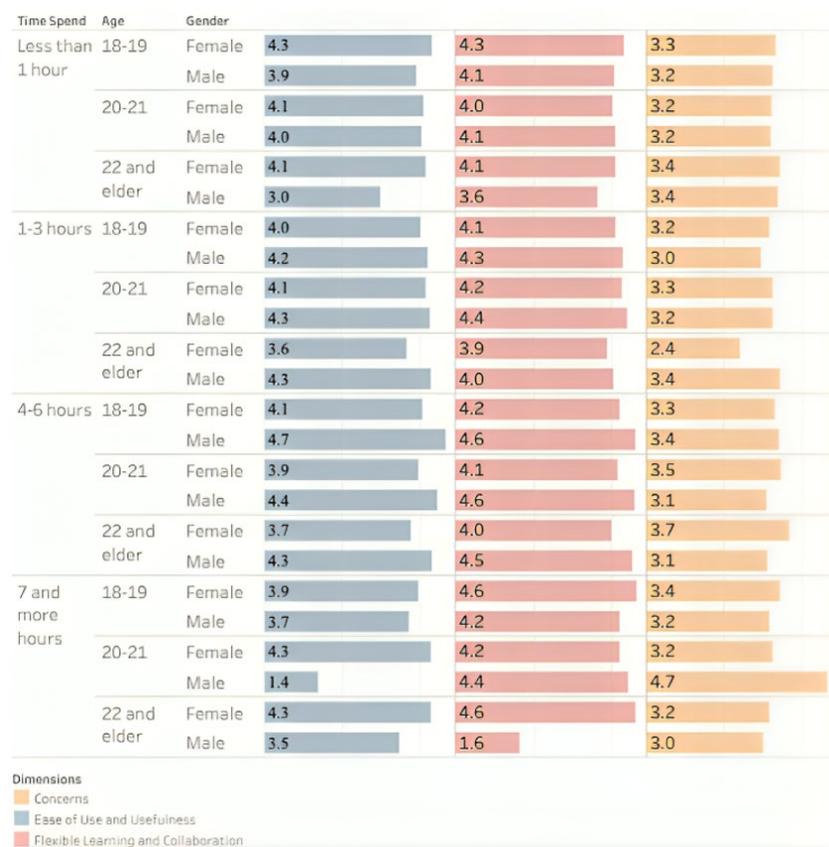


Figure 4. Demographic distribution of MIM utilization dimensions (Figure created by the authors)

of knowledge already in publication on the application of MIM technologies. For instance, Tang and Hew (2022) found that students in their research primarily appreciated ease of use and usefulness dimensions of MIM apps. Similarly, Lee et al. (2023) emphasized that MIM applications contain elements that support flexible learning and collaboration in higher education.

When the psychometric properties of the scale were examined, high reliability values (Cronbach’s  $\alpha = 0.962$ , McDonald’s  $\omega = 0.968$ ) were obtained. These values meet the reliability criteria specified by Mellinger and Hanson (2020). In addition, the content validity of the scale was ensured by expert opinions and high I-CVI values (0.976) were obtained. This value is above the values recommended by Yusoff (2019). CFA results also supported the construct validity of the scale (CFI = 0.91, TLI = 0.902, SRMR = 0.049, RMSEA = 0.0734). These values are in accordance with the model fit indices suggested by Brown (2015).

### Use of Mobile Instant Messaging Tools in Higher Education

The findings of our study show that MIM tools are widely used in higher education. This is in line with studies by Cao and Jia (2024) and Jia and Hew (2022). The researchers stated that MIM applications have become a more common method of communication among young individuals than e-mail, social networking sites and voice interactions. According to a study by Ceci (2024), the number of global mobile phone messaging app users is expected to reach 4.6 billion by 2026.

The MIM usage profiles that emerged in our study show that these technologies are being adopted in various ways in the educational context. According to Baishya and Maheshwari (2019) and Motlhaka (2021), students use WhatsApp many times a day; they choose this medium for group chats (33.3%) and resource sharing (30.3%). Lee et al. (2023) also stressed how well MIM apps support announcements, campus news, and Q&A events.

### Importance of Ease of Use and Usefulness Factor

The “ease of use and usefulness” factor (33.4%), which has the highest explained variance in our study, shows how important these features are in students’ use of MIM tools for educational purposes. This finding

is in line with the view stated by Tang and Hew (2017) that MIM technologies support educational processes by providing fast and easy communication. Similarly, Criollo-C et al. (2021) stated that the ease of use of MIM applications increases their use in both formal and informal learning environments in higher education.

Afzal and Abdullah (2022) and Segal and Biton (2024) stated that MIM applications help students save time and solve tasks, thus facilitating collaboration and communication. Alamer et al. (2023) and Tang and Hew (2022) also found that MIM technologies increase student engagement and improve learning outcomes.

### **Mobile Instant Messaging Applications as Flexible Learning and Collaboration Tools**

The “flexible learning and collaboration” factor explained 26.28% of the total variance. This finding emphasizes the features of MIM applications that add flexibility to learning processes, eliminate time and space limitations, facilitate multimedia content sharing, and support collaborative learning. MIM applications give students the chance to connect without time and space constraints, according to Chung and Choi (2023) and Costa-Sánchez and Guerrero-Pico (2020), especially in group projects when they help to distribute ideas and resources.

Tang and Hew (2020) and L. Xia et al. (2024) found that MIM applications improved students’ sense of social presence and group membership. Ahmad et al. (2023) and Shirkhani and Poorhadian (2024) emphasized that MIM technologies democratize information exchange among students and help to involve students with different learning styles in group projects.

Imanuela et al. (2023), Lee et al. (2023) and Mabaso et al. (2023) stated that peer teaching through MIM technologies helps students strengthen both social and academic skills. These findings support the results of our study.

### **Concerns and Limitations of Using Mobile Instant Messaging**

In our study, the “concerns” factor explained 5.18% of the total variance. This factor draws attention to the potential negative aspects of MIM use. Concerns such as excessive MIM use making time management difficult, the risk of addiction that may negatively affect motivation to learn, and the distracting effect of notifications during study were collected under this factor.

M. Kim et al. (2021) reported that MIM alerts distract students during studying and negatively affect their academic performance. Upshaw et al. (2022) and Kaminske et al. (2022) reported that smartphone notifications confuse students and increase the error rate in cognitive activities. According to Dou et al. (2025), students who actively used MIM applications throughout their studies experienced issues with distraction, focus, and inefficient use of study time.

S. Y. Kim et al. (2022) stress that this circumstance, which is considered to be an overflow of technological stimuli, may have a substantial impact on students’ academic self-discipline and time management abilities. According to Gul et al. (2021), students who constantly check their messages may have FOMO syndrome, which raises their stress and anxiety levels.

### **Mobile Instant Messaging Perception According to Student Profiles**

The latent profile analysis conducted in our study showed that MIM users fall into four different profiles: “passionate advocates,” “positive pragmatic users,” “balanced users,” and “hesitant adopters.” These profiles reflect students’ different perceptions and attitudes towards MIM technologies. The fact that the “passionate advocates” group received virtually full points in the “ease of use and usefulness” and “flexible learning and collaboration” criteria suggests that this group has a quite good attitude toward MIM technology. This result is consistent with the 2024 findings of Rabotapi and Matope that WhatsApp groups enhance students’ sense of belonging to the university community and that this enhanced sense of belonging lowers the possibility of students dropping out and raises retention.

The “positive pragmatic users” group’s moderate level of concern is in line with Aharony and Zion’s (2019) concerns that MIM use can be distracting and reduce academic focus. The “balanced users” group showed the lowest level of concern, which is in line with Tang and Hew’s (2022) concern that the demand for participation and the need to respond quickly may cause stress for some students.

The fact that the “abstainers” group had the lowest values in the “ease of use and usefulness” and “flexible learning and collaboration” dimensions may be associated with the concern expressed by Tawiah (2014) that the use of MIM technologies may lead to inequalities in situations where not all students have access to mobile phones or the Internet.

### Relationship between Demographic Variables and Mobile Instant Messaging Use

Our study also examined the impact of demographic variables on MIM usage profiles. The predominance of the 18-19 age group in all profiles indicates that young consumers have a more positive view of MIM technologies. This finding is consistent with the perspective of Lee et al. (2023), who describe today’s students–digital natives–as having made WhatsApp and related apps a daily habit.

With regard to gender distribution, women comprise the majority in all profiles and have the highest percentage in the “hesitant adopters” group, suggesting that women might approach MIM use more carefully. Although “passionate advocates” (34%), “balanced users,” and “positive pragmatic users” use MIM for 4-6 hours on average, they use it for 1-3 hours (55% and 50%, respectively). This result is consistent with research by Baishya and Maheshwari (2019), which shows that 42.4% of students used WhatsApp for three to five hours each day, compared to 34.3% who used it for one to two hours.

Men in the 20-21 age range who used MIM for 7+ hours had a very low ease of use score (1.4); hence, there is an interesting correlation between duration of use and perception of ease of use; men in the 18-19 age range who used MIM for 4-6 hours showed a high score (4.7). This finding can be explained by the concept of technological stimulus overload stated by S. Y. Kim et al. (2022)

### Contribution of the Scale to Educational Research and Suggestions for Implementation

The developed MIM scale makes important contributions to educational research and practice. The scale can be used as a reliable and valid measurement tool to assess the use and impact of MIM technologies in higher education. It can also be used to determine students’ perceptions and attitudes towards MIM technologies, identify different user profiles and develop educational strategies according to these profiles. According to Cheng and Wang (2022) and Iqbal and Bhatti (2020), institutional policies should be developed for the efficient use of MIM technologies in education and include privacy, data security and suitable use guidelines. Andujar (2016) underlined the need of teachers possessing the required tools to include these technologies into their courses. Klein et al. (2018), Soon et al. (2022), Swartz et al. (2022) and Tang and Hew (2022) stated that the adoption and usage patterns of MIM technologies depend on cultural differences. Therefore, MIM technologies should be used in education according to the local situation.

In conclusion, our study shows that MIM technologies present opportunities and problems in higher education. As suggested by Aladsani (2021), Kaliisa et al. (2019), Merelo et al. (2024), Pimmer et al. (2019) and Yang (2024), effective adoption of new technologies depends on a fair assessment of advantages and disadvantages, and educators and institutions should create plans to incorporate these technologies into their courses.

## CONCLUSION

In this study, a valid and reliable scale was developed to assess higher education students’ level of adoption of MIM tools. Exploratory and confirmatory factor analyses revealed that the scale has a three-factor structure, namely “ease of use and usefulness,” “flexible learning and collaboration,” and “concerns.” The overall reliability coefficient of the scale was high (Cronbach’s  $\alpha = 0.962$ , McDonald’s  $\omega = 0.968$ ). Latent profile analysis revealed that the students were divided into four different profiles: “passionate advocates,” “positive pragmatic users,” “balanced users,” and “abstaining adopters.” Analyses of demographic variables showed that younger students have a more positive view of MIM technologies and that women are more cautious about MIM use than men. In conclusion, the developed scale is a valuable tool that can be used to evaluate the use of MIM technologies in higher education, identify different user profiles and plan the integration of MIM technologies into educational processes.

## Limitations of the Study

This study has some limitations. Firstly, the study was conducted in higher education institutions in a specific geographical region, so caution should be exercised in generalizing the results. Also, the data collection process was cross-sectional, which makes it difficult to track changes in MIM use over time. The measurement precision of the “concerns” dimension of the scale may be affected by its lower reliability value (Cronbach’s  $\alpha = 0.772$ ) and a smaller number of items than the other dimensions. Finally, the study relied on self-reported data, which runs the danger of smaller responses not accurately reflecting the actual state of affairs because of variables like social favorability effects.

## Suggestions for Future Studies

Several suggestions can be made for future research. Testing the MIM scale in several cultural settings and educational levels will first help the scale to be more generally applicable. Second, one can investigate how MIM use affects academic performance by means of longitudinal studies. Especially, more products can be created to increase the dimension of “concerns” and thereby reinforce it. Planned to investigate the association between the intensity and frequency of MIM use and social presence, course engagement, and learning outcomes, mixed methodologies research incorporating quantitative and qualitative approaches can be executed. Finally, experimental studies can be planned to create tailored training plans for several MIM user profiles and assess their success.

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## APPENDIX A

**Table A1.** MIM scale

No	Item
1	MIM Messenger can enhance my effectiveness in communication with others.
2	The multimedia content storage in MIM helps me review course materials.
3	MIM facilitates project management and task completion.
4	MIM is effective for sharing learning materials and resources.
5	MIM Messenger makes communication easier.
6	Collaboration among team members is easy with MIM.
7	I use MIM to communicate with instructors about office hours and meetings.
8	I use MIM to get feedback from course instructors.
9	Comparing myself to other students' performance on MIM groups can create social pressure and stress for me.
10	I use MIM to arrange project meetings with my classmates.
11	I would like to use MIM in the educational process.
12	MIM Messenger improves my communication efficiency.
13	I feel comfortable using MIM for learning.
14	I can effectively handle technical problems when using MIM.
15	Discussions about academic topics on MIM may not be as effective as face-to-face communication.
16	MIM gives me time to think and formulate my responses in academic discussions.
17	I can easily access the academic resources I need through MIM.
18	MIM makes it easy to manage and discuss projects.
19	I use MIM to discuss ideas related to courses with instructors.
20	I can easily share and receive multimedia content for learning through MIM.
21	MIM can support collaborative learning by forming discussion groups.
22	MIM allows me to engage in learning activities anytime and anywhere.
23	I think the use of MIM in my education would be helpful.
24	The large amount of information shared on MIM can lead to information overload.
25	Notifications from MIM can distract me while studying or working.
26	MIM enables quick feedback in the learning process.
27	MIM's instant messaging feature supports my learning.
28	MIM can supplement conventional teaching methods and face-to-face classroom learning.
29	I use MIM to communicate with my instructor about matters related to course requirements.
30	Spending too much time on MIM may make it harder for me to manage my time effectively for studying and other academic responsibilities.
31	I use MIM to discuss ideas about courses with my classmates.
32	I'm concerned about becoming overly dependent on MIM, which might negatively impact my learning motivation and academic performance.
33	It is easy to learn to work as a team via MIM.
34	It is easy for me to become skillful at using MIM Messenger.
35	MIM facilitates coordination of academic activities.
36	I use MIM to get links to topics and resources related to courses.
37	I think using MIM in my education would be fun.
38	I use MIM to get course announcements.
39	I use MIM to maintain professional communication with instructors.
40	I use MIM to get advice from senior students about courses.
41	Learning how to use MIM Messenger is easy for me.
42	I use MIM to plan and organize my study schedule.
43	MIM can provide new learning opportunities.
44	MIM can improve communication between students and teachers.
45	MIM Messenger allows me to communicate with others more quickly.
46	I think it would be easy to use MIM in my education.
47	MIM is useful for my academic activities.

