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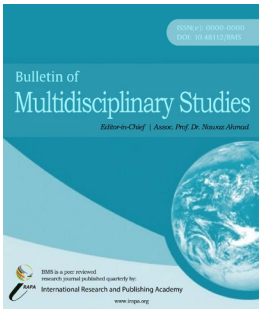

Original Article

Exploring the Impact of ChatGPT on Students' Engagement and Motivation: A Demographic Perspective

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ABSTRACT

AI-powered education is becoming increasingly prevalent in the global educational system. ChatGPT, an AI tool, significantly improves the dynamics of schooling by accelerating students' academic achievement to new heights using their various demographic information while engaging learners' thinking attributes. Thus, the study sought to explore the impact of ChatGPT on students' academic engagement and motivation using student demographics as a lens. The study used a quantitative research technique. The descriptive survey included all undergraduate students from public and private universities in Karachi. The researcher applied purposive and snowball sampling techniques to choose a sample of 400 undergraduate students. The study collected data using a questionnaire and analyzed it using SPSS. The findings indicated that male and female undergraduate students enrolled in any semester of any degree program at any department of Karachi's public and private-sector universities had the same level of academic engagement and motivation while utilizing ChatGPT in online learning settings. Therefore, the study offered useful information for policymakers, educators, and practitioners to develop more successful ways for incorporating current AI techniques into Karachi's higher education system.

Keywords: *ChatGPT, Demographic factors, Students' academic engagement, Students' motivation*

INTRODUCTION

The AI-based advanced technologies have greatly impacted the whole world. Therefore, its application in different fields has accelerated. Especially in the field of education, the majority of students use AI technologies, particularly ChatGPT for tailored online learning information along with immediate feedback. Thus, ChatGPT presents novel opportunities for making inaccessible education available to all students, regardless of demographics (Bagunaid et al., 2022). Furthermore, Saqlain (2023) stated that the advancement of AI technology over the last several decades has revolutionized the higher education system in Karachi, Sindh, Pakistan. As a result, Shah et al., (2021) investigated whether male and female undergraduate students of various ages in Karachi's higher education are more drawn to the AI-powered tool ChatGPT for hybrid learning. It aims to improve self-regulated and self-directed face-to-face classroom participation with peers and professors through digital or real-time lectures.

ChatGPT is a chatbot designed to influence the educational field specifically. Moreover, it provides personalized feedback, more readily available information, interactive discussions, lesson planning, assessment, and novel ways to teach and learn (Fitria, 2023). Therefore, the implementation of artificial intelligence tool, ChatGPT, has heightened self-reported learning through improving cognitive and social abilities. ChatGPT's ability to keep students engaged and motivated in online learning environments has led to an increase in learners' interest in their learning experience (Ahmad et al., 2022). In short, ChatGPT creates a vibrant and collaborative learning environment that can foster a thorough comprehension and emotional connection to a subject (Leiter et al., 2024).

The ChatGPT's quick generation of more queries and ideas depending on course content may help students enhance their problem-solving and critical-thinking skills. According to Baidoo-Anu and Ansah (2023), these two factors have a crucial role in students' learning engagement. ChatGPT is a potential tool for increasing students' behavioral, emotional, and cognitive engagement in online learning environments. It may encourage students' critical thinking to examine their comprehensive understanding of their learning activities, leading to self-regulated behavior (Kuraku et al., 2023). In the context of learning, motivation is described as an internal condition that motivates and increases people's learning actions (Lo et al., 2022). Deci and Ryan (2000) defined two types of student incentives for ChatGPT i.e. extrinsic and intrinsic.

Elishaer et al., (2024) revealed that ChatGPT had an important role in bridging the technical gap between male and female students studying in different semesters across several departments in the higher education system. The study also looks at how students organize themselves into groups based on gender, academic level, and activity to engage and utilize ChatGPT in higher education online learning settings. The influence of students' demographic traits on their understanding and attitudes toward AI-tool, is an increasingly popular field of research. Age, gender, semester system, degree programs, and departments have all been, therefore, identified as significant influences on undergraduate students' comprehension and views concerning AI, particularly ChatGPT (Tin et al., 2024).

Several research projects have been undertaken to better understand the role of ChatGPT in the realm of education. These studies analyze different aspects of ChatGPT that impact students' academic engagement and motivation at the higher education level. However,

previous research has not studied in detail the impact of students' demographic characteristics on their educational enthusiasm and readiness to utilize ChatGPT. This study fills this space by looking at how age, gender, semesters, degree programs, departments, and university types influence students' involvement and motivation to utilize ChatGPT at the higher education level.

Significance of the Study

The increasing engagement of students with AI in their online learning process provides valuable insights for policymakers, educators, and practitioners, allowing them to develop more effective plans for implementing AI-powered technologies to promote equal access to education, particularly for underprivileged students. Delivering AI-technology-based education helps to overcome the socioeconomic divide. Hence, students from underprivileged neighborhoods may complete their academic assignments regardless of their demographics.

Research Questions

- Do students of different ages demonstrate variable degrees of engagement and motivation when utilizing ChatGPT?
- How does gender influence students' motivation and engagement with ChatGPT?
- Are there significant differences in the impact of ChatGPT on students from various semesters, degree programs, and departments in Karachi's higher education?

Objectives of the Study

- To assess the difference in the means of academic engagement and motivation toward ChatGPT among male and female undergraduate students.
- To evaluate the difference in undergraduate students' academic engagement and motivation towards ChatGPT between private and public-sector universities in Karachi.
- To assess the difference in the undergraduate student's academic engagement and motivation scores among different departments' undergraduate students.
- To examine the difference in academic engagement and motivation scores among different degree programs' undergraduate students.
- To measure the combined impact of age and semesters on undergraduate students' educational engagement and motivation towards the learning process through ChatGPT.

Hypotheses

There is no significant difference in the means of academic engagement and motivation towards ChatGPT between male and female undergraduate students.

There is no significant difference in undergraduate students' academic engagement and motivation towards ChatGPT between private and public-sector universities in Karachi.

There is no significant difference in the undergraduate students' academic engagement and motivation scores among different departments' undergraduate students.

There is no significant difference in undergraduate students' academic engagement and motivation scores among different degree programs' undergraduate students.

There is no significant combined impact of age and semesters on undergraduate students' educational engagement and motivation towards the learning process through ChatGPT.

LITERATURE REVIEW

Recent advancements in artificial intelligence technologies have profoundly influenced several fields, most notably education. On November 30, 2022, OpenAI developed a sophisticated big language model called ChatGPT (Fitria, 2023). It is noticed that ChatGPT technology has the prodigious potential to increase student collaboration, academic performance, and learning opportunities in the higher education system. Thus, the application of ChatGPT progresses students' academic performance and retention of educational content through informal online learning (Firat, 2023). Therefore, ChatGPT was adapted as an educational assistant to give personalized support and feedback to online students. Hence, the integration of Chatbots, particularly ChatGPT, into a broad spectrum of education has the potential to greatly enhance student educational engagement and motivation (Azadnia, 2024).

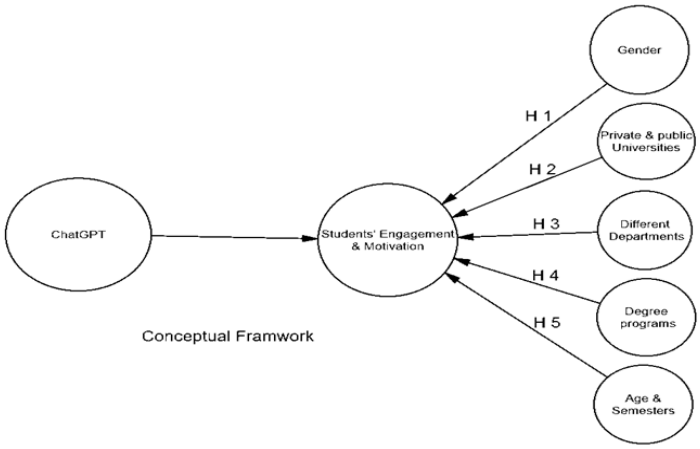
Students' engagement is a psychological process that includes focused attention, curiosity, devotion, and effort invested in learning. It also describes a student's motivation, ambition, passion, and vigor to actively engage and thrive academically. Consequently, it is a four-fold construct that includes three critical components: behavior, emotions, and cognition (Lo et al., 2022). In recent years, engaged learning has received great attention in educational circles as an important

component of effective classroom instruction. Furthermore, engaged students consistently exhibit behavioral, emotional, and cognitive physiognomies that allow them to replicate their ideas, attitudes, and behaviors during the learning process. In short, AI-powered learning, particularly through ChatGPT, is a promising technique for enhancing students' behavioral, emotional, and cognitive engagement in online learning settings. It may motivate students to think critically to assess their comprehensive understanding of their learning activities, resulting in self-regulated behavior (Kuraku et al., 2023).

In the context of learning, motivation is defined as an internal condition that motivates and enhances students' learning activities. Thus, extrinsically motivated students struggle to finish academic assignments, feel pressured to study, and regularly do less work to receive maximum praise. On the other side, intrinsically driven students are more active, self-directed, demanding, and enthusiastic about their studies. Therefore, Deci and Ryan (2000) identified two types of educational motives for ChatGPT: extrinsic and intrinsic. Intrinsically motivated pupils finish academic tasks without the need for incentives or stress. Extrinsically driven educational activities, on the other hand, are impacted by causes other than internal necessities. As a result, learners who acquire intrinsic motivation will not need an incentive or reward to start or accomplish a job. This type of learner is motivated by challenges and is more likely to complete the assignments at hand. Extrinsic motivation refers to the desire for incentives or punishments that are unrelated to the circumstance at hand, such as grades, instructor approval, etc. Hence, according to Caratiquit and Caratiquit, (2023), students who utilized ChatGPT in an online learning environment reported being more engaged in their studies, with the majority saying they enjoyed interacting with the programs. Das and Madhusudan (2024) discovered the importance of ChatGPT in online learning settings because it addresses four motives for students who have access to it. They include instructional material creation, information search, innovation, and accessibility.

Keengwe and Kidd (2010) created the intended objectives for an online education program to give a framework for instructors and students to select the most desired educational significances. There are three main types of online learning environments. Formal online learning occurs when the goals and objectives have been defined well before the start of the course. According to Nakayama et al., (2017), informal online learning is more beneficial than formal education. During informal online learning, learners identify what they expect to accomplish or fulfill the set of objectives, regardless of the curriculum designer's assessment of the students' proficiency or lack thereof. Seo et al., (2021), therefore, underlined the importance of learner-instructor interaction by incorporating hybrid learning into the classroom through the use of AI technology in the educational system. It caters to pupils' diverse learning methods. Sánchez-Ruiz et al., (2023) evaluated the use of ChatGPT with hybrid online learning methodologies to demonstrate several advantages for welfare in education. These include improved learning outcomes, increased student engagement and satisfaction, improved self-regulated learning and time management, increased access and adaptability, and cost-effectiveness.

Similarly, researchers have long been interested in the association between demographic traits and academic achievement. Thus, demographic information about undergraduate students, such as age, gender, public and private sector universities, semesters, degree programs, departments, and study hours, has been shown to have a significant impact on students' enthusiasm and motivation to continue using AI in academic learning, specifically ChatGPT (Sallam et al., 2024).



Conceptual Framwork

METHODOLOGY

The major goal of the study was to investigate the influence of ChatGPT on students' academic engagement and motivation by utilizing student demographics as a monocle. The researcher used descriptive research design, using quantitative research approach. The adopted quantitative design methodology for this study aimed to systematically measure and analyze the relationship between ChatGPT usage and students' levels of engagement and motivation across different demographic groups. The study's population consisted of undergraduate students from public and private-sectors universities in Karachi. The sample of 400 undergraduate students was selected through snowball and purposive sampling design. The research questionnaire contained three parts. Part A consisted of demographic information, including name, age, gender, university name, university type (Public and private), departments (Business Administration, Social Sciences, Media Sciences, Chemistry, Physics, Mathematics, Computer Science, Fashion Designing, and psychology), degree programs (B.Ed., M.Sc., B.Sc., B.S, and B.Cs), and semesters (1st, 2nd, 3rd, 4th, 5th, 6th, and 7th). Section B contained observational questions. Section C included 29 research attitude measuring items utilizing a five-point Likert scale.

Research Paradigm

The study employed a quantitative research approach, adhering to the positivist research paradigm. For positivism, hypotheses were supported if the information was congruent with reality and accurate. Furthermore, statistical data analysis is used to reject information that has no relationship to reality (Park et al., 2020). Thus, the study used the research paradigm called positivism, which was quantitatively compatible with its purpose by measuring and analyzing data to discover the cause-and-effect link between variables.

Data Collection

The survey method was used to gather data form the sample for the research study. The researcher personally assembled the data from private and public-sector universities in Karachi. The pilot testing findings on twenty-nine items indicated Cronbach's alpha value (α = 0.923), and showed a strong index of reliability. No missing values, miscoding, unengaged responses, or outliers mentioned the cleanliness of data. The Shapiro-Wilk test was executed to determine that the data was normally distributed by showing p >.01. Data was examined through IBM SPSS software.

Confirmatory Factor Analysis

Confirmatory Factor Analysis (CFA) is a statistical procedure that evaluates the factor structure of a set of observed data. CFA enables researchers to test the notion of a relationship between observable variables and their underlying latent components (Williams, 2023). For covariance-based structural modeling (CB-SEM), the researchers employed the CFA approach. The CFA was used to assess the validity and reliability of each component using the average variance extracted (AVE). The results of the analysis, which indicated that all of the scales' AVE values were more than 0.500. As a result, the measurement qualities satisfied all three necessary convergent validity requirements.

Ethical Considerations

Ethical considerations are important elements of conducting research studies to safeguard respondents from any ethical issues. Hence, the researcher conducted the following measures.

- The HODs of all departments signed a consent letter detailing the research project's purpose and respondents' roles.
- Participants' identities and addresses were kept secret.
- The data from this study was secret. The researcher had only the access to the research data and followed university procedures to minimize any potential humiliation for students.

Descriptive Statistics

The descriptive statistics for the research data set contained 400 undergraduate students to highlight their socioeconomic characteristics. The respondents' ages spanned between 17 and 46 years. The difference between students' minimum and maximum ages is 29 years. An average age was 23 years. There were 400 undergraduate students, with 212 male and 188 female undergraduate pupils. Furthermore, data were gathered from 68 students from Business Administration, 118 from Social Sciences, 37 from Media Studies, 35 from English, 33 from Computer Science, 27 from Mathematics, 24 from Chemistry, 27 from Physics, 09 from Fashion Designing, and 22 from Psychology departments. The 118 undergraduate students studied B.Ed., 168 BS, 27 B.Sc., 52 M.Sc., and 35 B.Cs.

Data Analysis

Table 1

Two-Sample T-Test for Male & Female Students' Academic Engagement & Motivation towards ChatGPT

	Gender	SD	T	df	p-value
Students' Engagement in ChatGPT	Male	6.050	0.405	397	0.687
	Female	5.898			
Students' Motivation towards ChatGPT	Male	5.964	0.437	397	0.672
	Female	6.282			

Note: N = 400, p = 0.01

Table 1 illustrated the two sample t-test, which was used to compare the levels of academic engagement and motivation of undergraduate students toward ChatGPT. Accepting the assumption of equal variances, the results showed no significant difference in male and female university students' academic engagement (F (400, 398) =.977, p =.686) and motivation (F (400, 398) =.368, p =.671) for ChatGPT. The results of the two-sample t-test indicated no significant difference in the means of male and female students' academic involvement and motivation for ChatGPT at Karachi's private and public institutions.

Table 2

Two-Sample T-Test for Students' Engagement & Motivation of Private & Public General Universities of Karachi towards ChatGPT

	Types	N	Mean	SD	t	df	p-value
Students' Engagement in ChatGPT	Private	188	26.22	5.789	.616	378	.548
	public	212	25.58	6.128			
Students' Motivation towards ChatGPT	Private	188	24.37	5.825	.284	399	.779
	Public	212	24.19	6.329			

Note: N = 400, p = 0.01

Table 2 showed the results of two sample t-tests to compare the levels of academic engagement and motivation of students at private and public-sector universities in Karachi towards ChatGPT. The findings confirmed no significant difference between private and public university students' academic engagement (F (400, 398) = 1.607, p =.545) and motivation (F (400, 398) = 1.477, p =.778) for ChatGPT. The two sample t-test findings show that there is no significant difference in students' academic engagement and motivation for ChatGPT between private and public sector universities in Karachi.

Table 3

Results of One-Way ANOVA on Students' Engagement & Motivation towards ChatGPT among Different Departments

Source of Variation	Sum of Squares	df	Mean squares	F	p- value
Between groups	625.217	9	68.257	1.414	.187
Within groups	18861.794	393	49.364		
Total	19476.012	389			

Note: N = 400, p = 0.01

To determine the impact of ChatGPT on pupils' academic involvement and drive, a one-way ANOVA was performed on undergraduate students from various departments at Hamdard University, Iqra University, Karachi University, and Sindh Madrassah tul Islam. They were BBA, social sciences, media studies, English, computer science, mathematics, chemistry, physics, fashion designing, and psychology. The study found no significant variations in students' academic engagement and motivation levels among different

departments (F (9,390) = 1.411, p > .001).

Table 4

Results of One- Way ANOVA on Engagement & Motivation of Students of Different Degree Programs towards ChatGPT

Source of variation	Sum of Squares	df	Mean Squares	F	p-Value
Between groups	77.184	4	19.297	.395	.815
Within Groups	19488.817	394	49.112		
Total	19497.000	398			

Note: N = 400, p = 0.01

To determine the influence of ChatGPT on academic engagement and motivation, a one-way ANOVA was done on undergraduate students from private and public sector higher education institutions in Karachi pursuing various degree programs such as B.Ed., BS, B.Sc., M.Sc., and B.Cs. The findings revealed that there is no significant variation in students' academic engagement and motivation scores across various degree programs, F (4, 399) = .393, p > .001.

Table 5

Two-Way ANOVA for the Effect of Age & Semesters on the Students' Engagement & Motivation for the Use of ChatGPT

Source of Variation	Sum of squares	df	Mean Squares	F	p-value
Age	1548.334	25	63.857	1.318	.157
Semesters	269.215	7	42.887	.977	.514
Interaction	1841.673	53	37.248	.772	.895
Within	15485.189	318	48.848		
Total	324350.000	410			

Note: N = 400, p = 0.01

Table 5 mentioned the results of a two-way ANOVA to determine the major impact of age and semesters at universities on the academic engagement and motivation of students towards ChatGPT. Additionally, it mentioned the interaction consequences between these two independent variables. The results highlighted no significant impact of students' age, F (24,400) = 1.308, p = .155, and semesters, F (6,317) = .878, p = .511, of private and public sector universities in Karachi, on students' academic engagement and motivation to use ChatGPT for their academic personalized learning. Therefore, the significant interactive impact of age and semesters was not found on the engagement and motivation of students towards the learning process through ChatGPT.

RESULTS & FINDINGS

Table 6

Summary of the Hypotheses

Statistical Tests	Null Hypotheses	P values	Decisions Taken
Two sample t-test	H_1	0.687	Upheld
Two sample t-test	H_2	.548	Upheld
One way ANOVA	H_3	.187	Upheld
One way ANOVA	H_4	.185	Upheld
Two way ANOVA	H_5	.895	Upheld

Note: p = .01

Table 6 suggested that both male and female university students are equally interested in adopting ChatGPT for their academic study. It also became evident that students from both private and public higher education institutions in Karachi were equally interested in utilizing ChatGPT for academic learning and success. Furthermore, the students from many departments have an interest in adopting ChatGPT to tailor their academic instruction for professional success. Additionally, students from various degree programs shared the same motivation and attitude toward using ChatGPT to obtain academic individualized information for professional development and accomplishment. The findings also indicated the same educational interest and involvement in ChatGPT by learners of all age groups studying in different semesters at private and public general universities in Karachi.

Discussion

The study identified no significant differences in students' attitudes toward academic engagement and motivation between male and female undergraduate students. Das and Madhusudan (2024) found that male and female undergraduate students showed similar levels of educational engagement and motivation for AI-powered educational learning.

Likewise, the multiple groups of undergraduate students enrolled in various degree programs in different departments of Karachi's universities shared the same level of enthusiasm and excitement for ChatGPT. Furthermore, the study found that undergraduate students' age and semesters had no significant impact on their academic involvement and desire to utilize ChatGPT. Mohamed Mohamed Bayoumy and Alsayed (2021) confirmed these facts by emphasizing that undergraduate students' demographics, such as gender, age, degree programs, academic semester, religion, and caste, had no influence on their involvement and motivation for ChatGPT. As a result, ChatGPT has the potential to increase student motivation and academic engagement, which benefits all students, independent of demographics. This suggests that ChatGPT is an adaptable tool that can enhance learning experiences across diverse student populations in higher education.

The study effectively predicted the possibility of students' didactic involvement and motivation through the usage of ChatGPT. Similarly, the learners' online learning environments and undergraduates' level of engagement predicted ChatGPT's adoption in the context of education. Alseddiqi et al., (2023) substantiated these findings through an investigation at the ChatGPT's ability to deliver individualized feedback and assistance in online learning situations, resulting in greater educational engagement. Accordingly, the study found that students' online learning habits and academic participation predict ChatGPT.

The results of earlier research studies clearly supported the conclusions of the current investigation on the relationship of demographic factors of undergraduate students and their academic involvement and motivation with ChatGPT. However, there were some disagreements between the existing research literature and the current study's findings. There were no significant differences in views toward academic involvement and motivation between male and female undergraduate students. Furthermore, undergraduate students' age and semesters had no significant impact on their academic involvement and excitement for using ChatGPT. These findings contradict the study conducted by Siregar et al., (2023), which found that male students were more likely to use ChatGPT than female students. While it also appeared important to the age of the students, younger students were more motivated to adopt ChatGPT than older students. As a result, students in lower grades are more engaged and involved in utilizing ChatGPT for learning purposes than students in higher grades. The fact that undergraduate students' ages had no substantial impact on their educational engagement and motivation is further demonstrated by Siregar et al., (2023). It explicitly indicated that at the university level, all undergraduate students are around the same age. As a consequence, students expressed similar levels of interest and enthusiasm for incorporating AI, namely ChatGPT, into their learning process.

Furthermore, the current study found that private and public sector universities in Karachi, based on the frequency of similarities in students' educational engagement and inspiration to use ChatGPT, follow the distribution of the population's estimated frequencies based on their regular, occasional, and frequent use of ChatGPT. These findings contradict the study conducted by Alam et al., (2021), which focused on the development of students' personalities via education in both private and public educational institutions. This study, however, found that many students in higher education choose to attend private educational institutions over public universities due to more sophisticated arrangements of adaptive information technology. These findings also contradict the study conducted by Nazeer and Gil (2023), which found that public sector higher education institutions are using AI to boost efficiency, improve facility quality, and improve policy-making academic dimensions.

However, technology adoption in public sector universities is slow.

Despite discrepancies in educational quality between private and public higher education institutions in Karachi, the current study discovered no difference in undergraduate students' engagement and desire to use ChatGPT. This might be linked to the choosing of university students with access to AI technologies.

CONCLUSION

The study was conducted to assess its impact on undergraduate students at public and private institutions in Karachi. The study's findings revealed that both male and female students at private and public institutions shown the same level of academic dedication and encouragement for using ChatGPT in their learning processes. The survey also found that university students rely heavily on ChatGPT to modify their educational learning routines. As a result, undergraduate students studying in various departments to complete different degree programs had no influence on their opinions regarding the employment of ChatGPT. Furthermore, the increasing prevalence of ChatGPT allows for a better understanding of university students' academic involvement and motivation. The study emphasized that it makes no difference whether male and female students of different ages, studying in any semester and department of a private or public university in Karachi, have the same level of educational engagement and motivation to use ChatGPT for tailored learning. In brief, according to the study's summarized statistical results, both male and female undergraduate students from public and private general universities in Karachi revealed the same interest and attitude toward the use of ChatGPT for advanced and modified educational learning. These findings were unaffected by differences in undergraduate student age groups, degree programs, departments, or semesters of enrollment.

Recommendations

The government should promote fairness in higher education by ensuring that all students, regardless of socio-economic position, have access to digital literacy. As a result, the government's proposal to supply graduates with computers and other related equipment will be beneficial in completing their educational obligations.

The research explored the impact of artificial intelligence (AI) technology on education. The advantage is that it removes all barriers due to their demographic elements and allows students at Karachi universities to participate in collaborative online educational learning with students from all over the world.

This study encourages more research and improvement in educational technology. It enables researchers and innovators to learn about the expanding trend of AI-powered tools in higher education institutions, as well as the impact of demographic factors on their development of new techniques.

Competing Interest

The authors had no competing interests.

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