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Original Research Article

Unleashing the determinants of adoption of ChatGPT in medical education: A student perspective

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Abstract

Background: ChatGPT is a powerful AI tool with conversational capabilities, in the setting of writing, learning, and assessment solving.
Objective: The crux of the proposed study is to develop a predictive model based on an established theory of technology adoption to understand the determinants leading to medical students' acceptance and use of ChatGPT.
Materials and Methods: The study selected seven key predictors to construct the model, which focused on students' behavioral intentions and actual usage of ChatGPT. Data analysis employed the partial-least squares method of structural equation modeling, demonstrating the reliability and validity of the proposed model.
Results: The findings are based on self-reported data from 353 students from a government medical college of Uttarakhand. Remarkably, nine out of ten hypotheses were confirmed, revealing significant insights into the factors driving students' intentions to use ChatGPT. Habit emerged as the most dominant determinant of behavioral intention, afterward performance expectancy and hedonic motivation. Moreover, the influencing determinant of actual usage behavior was behavioral intention, complemented by personal innovativeness.
Conclusion: The research underlines the urgency for further investigation into the integration of AI tools in learning, signifying the potential transformative impact of AI in education.

Keywords: ChatGPT, UTAUT2, Medical education, Technology acceptance, SmartPLS.

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1. Introduction

OpenAI launched ChatGPT, an AI-powered chatbot, in November last year, which features a large language model that allows it to generate original text based on prompts given by users. It can be accessed for free through an OpenAI account.[1] However, the emergence of generative AI, an example of which is ChatGPT, has sparked concerns about its possible effects on a number of organizations and entities. The potential application of ChatGPT lies in the realm of higher education, where it allows us to reconsider assessment and how it can boost learning. By using ChatGPT, institutions can teach critical thinking, writing, and how AI plays a role in today's society, rather than turning solely to software for assessments. By aligning with a transformative way of relating to knowledge, ChatGPT is considered an important teaching, learning, and assessment tool.

In order to explore ChatGPT's potential applications in health education, the software can be used to manufacture fake citations,[2,3] develop assignments,[4] support essay writing and encourage critical thinking about the application of artificial intelligence in society.[5,6] Currently, universities are weighing the implications of AI chats, and some academic teachers are already incorporating them into their

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assignments to expose their limitations. Due to this technology's broad range of possibilities and potential game-changing effects, higher education institutes are considering its impact on higher education learning and teaching in the future.[7] Several research has conducted research on acceptance and use of ChatGPT among medical students.[8-12] However, minimal research is available on adoption of ChatGPT among medical students, even though they do not use any technology acceptance theory to conduct the research. One study concluded that ChatGPT is an increasingly popular resource among medical students, with many preferring ChatGPT over other traditional resources such as professors, textbooks, and lectures.[13] Its impact on medical education will only continue to grow as its capabilities improve. Another study summarizes that ChatGPT can be used as a potential tool in medical research, there is a need for further evidence to generalize its impact on the different research activities.[14] To our knowledge, no investigation into ChatGPT's adoption among medical students in the India has been done. Therefore, this study aims to investigate the adoption of ChatGPT use among medical students.

2. Conceptual Framework

The study extends the well-known "Unified Theory of Acceptance and Use of Technology (UTAUT2)" model,[15] to explore the factors influencing the adoption of technology and the intention to use ChatGPT in medical procedures. UTAUT2 incorporates seven key predictors of behavioral intention. However, since ChatGPT is available for free (for basic content), we propose removing "Price Value" from the UTAUT2 model. Additionally, we introduce "Personal Innovativeness" as a new predictor, based on the model developed by Agarwal and Prasad.[16] "Personal Innovativeness" refers to an individual's willingness to embrace and experiment with new technologies like ChatGPT. It reflects a proactive approach to adopting change, often involving an element of risk, with the potential for gaining new knowledge and experiencing a sense of accomplishment. By integrating the UTAUT2 model with "Personal Innovativeness," this study provides a comprehensive analysis of the factors influencing the acceptance and use of ChatGPT by medical students. The findings will help determine how this innovative application is perceived and utilized in their education. The proposed model is given in the **Figure 1**.

3. Materials and Methods

The study used established measurements in the literature to ensure the face and content validity of the variables. The items of various constructs are originally taken from studies.[15-18] All the items were modified in the context of ChatGPT (**Annexure 1**). Before starting the data collection with the questionnaire from the targeted audience, a pilot study was led with 10 students (05 boys and 05 girls) from the MBBS program. Each construct met the reliability and validity criteria, and discriminant validity was confirmed.[19] Only one item was used to measure use behavior on a 5-point scale ranging from never to several times a day while 3-4 items were used to measure the remaining constructs using a Likert scale ranging from 1, "Strongly Disagree," to 5, "Strongly Agree." Five academicians and ChatGPT experts from the industry pre-tested the questionnaire to assess its face and content validity. Based on their comments, we revised some of the items. The revised version of the questionnaire was pilot-tested with 34 students (21 boys and 13 girls). The Cronbach's alpha values of all constructs exceeded 0.7, indicating that the measurement is reliable.

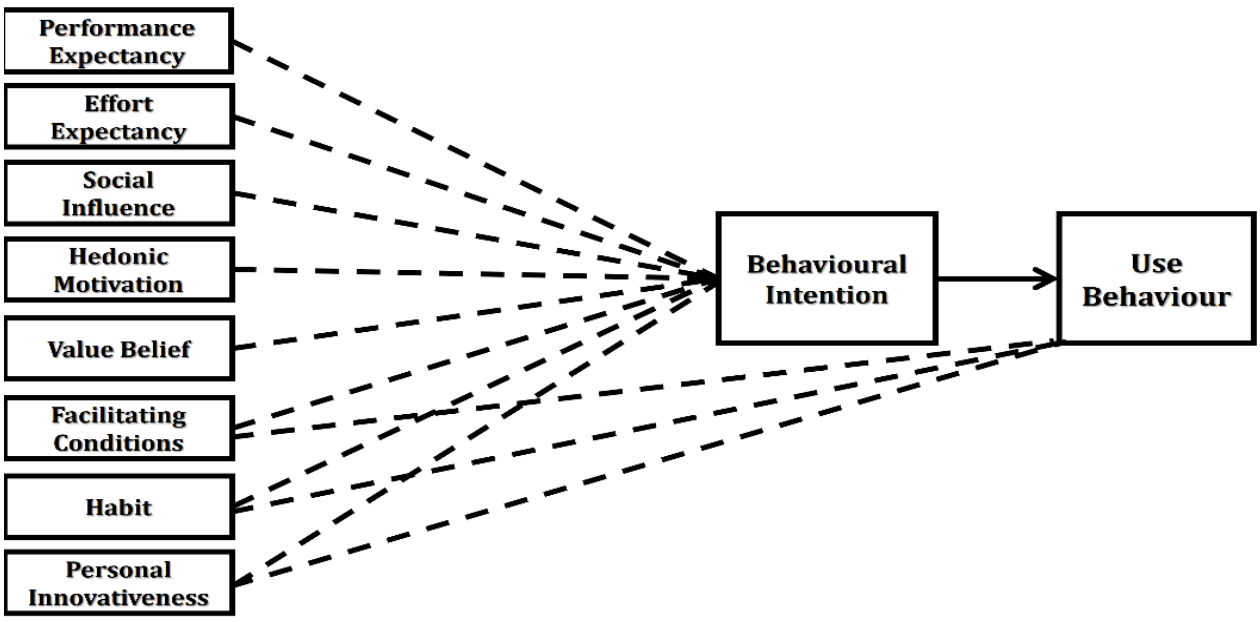

Figure 1: Proposed research framework for examining factors influencing ChatGPT adoption among medical students

For this study, a prominent sample size of 300 participants was required, given the use of 30 indicators (the total number of statements used for all constructs). The survey questionnaire was distributed via Google Forms and emailed directly to MBBS students at Government medical college in Uttarakhand in the mid-June 2024. The survey remained open for one week and 353 responses were collected.

4. Results

Out of 353 complete responses collected from the survey, 78.75% were boys and the rest were girls (21.25%). 44.2% of the participants belong to the age group of 20-22, following 41.3% in the age group of 22-24, whereas 14.5% are above the age of 25. The reliability of the constructs was assessed using internal consistency measure i.e. Cronbach's alpha values and composite reliability (CR) values. **Table 1** shows that the alpha values range from 0.709 to 0.901 (excluding 1.00 for single item construct), which indicates that all values are then the cut-off value of 0.701. The findings are also supported by the values of CR as all the values are higher than the critical value of 0.7. Further, the validity of the measurement model was assessed using HTMT ratio. Discriminant validity may exist among different constructs if the value of HTMT ratio is beyond the critical value of 0.85.[20,21] It was observed that there are no problematic values with regards to Discriminant Validity, as all HTMT values are below the 0.85 (**Table 2**).

The complete details of findings derived from SmartPLS on the proposed theoretical model is presented in **Figure 2**. As illustrated in **Figure 2**, the eight constructs (PE, EE, SI, HM, VB, FC, H, and PI) account for 73% of the variance in Behavioral Intention (BI) towards the use of educational technology ($R^2 = 0.73$). Additionally, BI, FC, H, and PI collectively explain 57.7% of the variance in Use Behaviour (UB) of educational technology ($R^2 = 0.577$). The overall R^2 values indicate that the proposed model explains 62.4% of the total variance. The models are considered weak, moderate, or substantial if they exhibit R^2 values of 0.19, 0.33, or 0.67, respectively.[20,21] Based on these criteria, the modified model proposed in this study demonstrates approximately substantial explanatory power ($R^2 = 0.624$) in predicting technology acceptance and UB among medical students in Uttarakhand.

The path coefficient values and t-values provided consistent support for the hypothesized relationships in the structural model of this study. All hypothesized relationships, except H2 (EE-PI), were found to be significant at $p < 0.01$, with H2 being significant at $p < 0.05$. The beta values, t-values, and the decisions for each hypothesis are detailed in **Table 3**. These findings align with those reported by Farooq et al.[22]

Table 1: Reliability (Cronbach's Alpha, CR) and validity (AVE) of the measurement model

Construct	Items	Loading	Cronbach's alpha	CR	AVE
Performance expectancy	PE1	0.722	0.761	0.767	0.624
	PE2	0.712			
	PE3	0.841			
	PE4	0.809			
Effort expectancy	EE1	0.861	0.826	0.898	0.766
	EE2	0.889			
	EE3	0.893			
	EE4	0.880			
Social influence	SI1	0.891	0.831	0.851	0.769
	SI2	0.879			
	SI3	0.869			
Hedonic motivation	HM1	0.924	0.709	0.875	0.809
	HM2	0.813			
	HM3	0.813			
Value Belief	VB1	0.831	0.825	0.843	0.662
	VB2	0.732			
	VB3	0.861			
	VB3	0.825			
Facilitating conditions	FC1	0.831	0.819	0.822	0.643
	FC2	0.749			
	FC3	0.816			
	FC4	0.812			

Table 1 Continued…					
Habit	HT1	0.845	0.732	0.866	0.733
	HT2	0.864			
	HT3	0.849			
Personal innovativeness	PI1	0.921	0.901	0.887	0.813
	PI2	0.912			
	PI3	0.881			
Behavioural Intention	BI1	0.911	0.854	0.912	0.842
	BI2	0.921			
	BI3	0.887			
Use Behaviour	UB1	1.000	1.000	1.000	1.000

Table 2: Heterotrait–monotrait (HTMT) ratio for discriminant validity assessment

	BI	EE	FC	HM	HT	PE	PI	SI	UB	VB
BI										
EE	0.434									
FC	0.511	0.427								
HM	0.591	0.532	0.461							
HT	0.612	0.501	0.423	0.781						
PE	0.399	0.794	0.699	0.462	0.482					
PI	0.799	0.542	0.445	0.543	0.781	0.462				
SI	0.471	0.361	0.444	0.505	0.592	0.453	0.511			
UB	0.513	0.545	0.765	0.605	0.592	0.583	0.622	0.652		
VB	0.334	0.823	0.512	0.461	0.444	0.581	0.444	0.446	0.069	

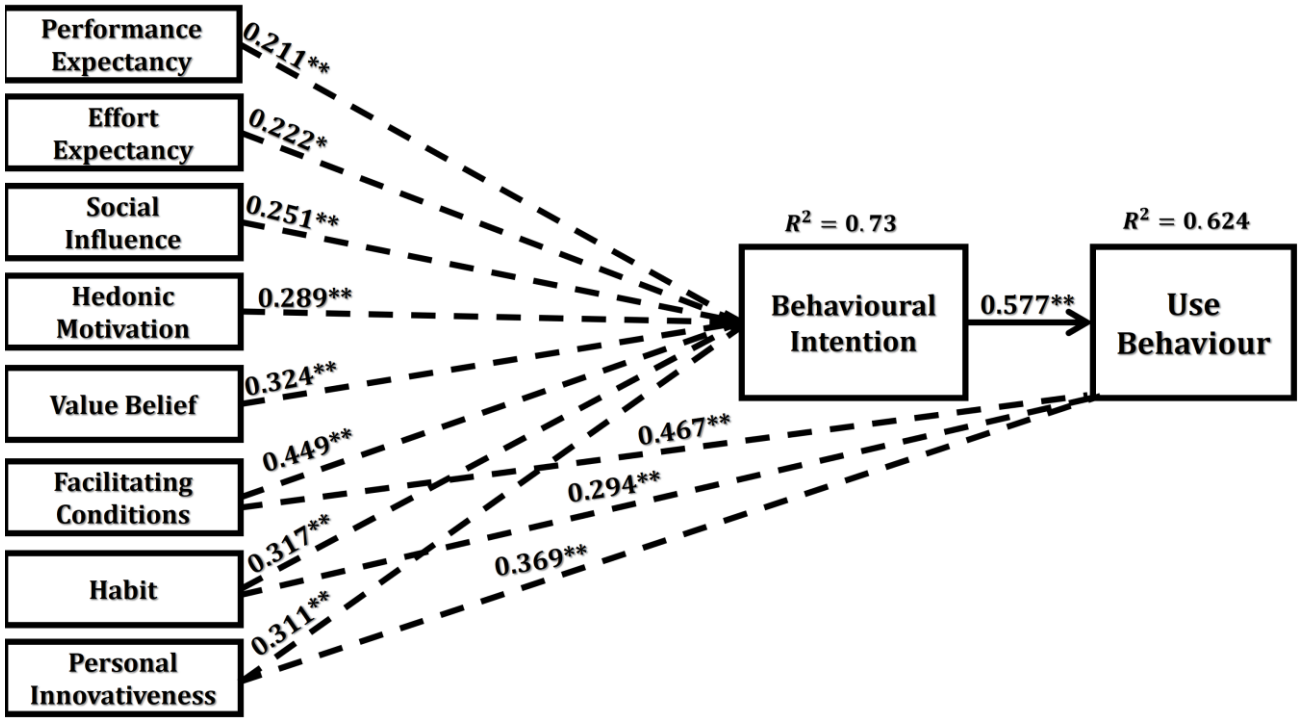

Figure 2: Findings of the structural model (Beta value and R^2)

Though, Goodness of Fit (GoF) is primarily an investigative tool used to assess how well the collected data aligns with the proposed theoretical model.[23] As an alternative. As an alternative, a study recommends using the Standardized Root Mean Square Residual (SRMR) as a criterion for assessing model fit.[23] An SRMR value close to 0 indicates a perfect fit, though Henseler et al. suggest that an SRMR value below 0.08 is considered an adequate fit for PLS-SEM models. In this study, the proposed model achieved an SRMR of 0.0421, indicating an adequate fit.[23] Based on a thorough analysis of both the measurement and structural models, it can be concluded that both models are validated.

Table 3: Structural model assessment: Path coefficients, t-values, and p-values

Hypothesis	Relation	Beta	t-value	Decision
H1	PE-BI	0.211	2.769**	Supported
H2	EE-BI	0.222	2.137*	Supported
H3	SI-BI	0.251	3.592**	Supported
H4	HM-BI	0.289	3.851**	Supported
H5	VB-BI	0.324	4.211**	Supported
H6a	FC-BI	0.449	4.895**	Supported
H6b	FC-UB	0.467	5.109**	Supported
H7a	HB-BI	0.317	4.497**	Supported
H7b	HB-UB	0.294	3.891**	Supported
H8a	PI-BI	0.311	4.412**	Supported
H8b	PI-UB	0.369	4.809*	Supported
H9	BI-UB	0.577	6.872*	Supported
Behavioural Intention: R^2=0.73, Adjusted R^2=0.721				
Use Behaviour: R^2=0.624, Adjusted R^2=0.609				
SRMR: Saturated 0.0421, Estimated Model 0.053				

These results further demonstrate that the modified model proposed in this study possesses significant predictive relevance and explanatory power. The following discussion will address the implications derived from this study, followed by its conclusion and limitations.

5. Discussion

This study expands the existing knowledge by introducing and validating a new construct, Value Belief (VB) & Personal Innovativeness, within the UTAUT2 framework. Using rigorous PLS-SEM analysis, the research shows that VB, along with the other eight constructs (PE, EE, FC, SI, HM, H, and PI), significantly influences the acceptance and use of ChatGPT among students of Govt. Doon Medical College, Uttarakhand. The findings contribute not only to the theoretical and methodological understanding of technology adoption but also offer practical insights to improve the integration of various educational technology tolls like ChatGPT etc. in academic institutions.

The majority of the participants were boys in the age group 20-22. The demographic results findings are similar to the Rao & Rajkumar[24] & Tiwari et al.[11]**Error! Reference source not found.** The results align with previous studies by Farooq et al.[22] and Venkatesh et al.,[15] which employed similar measurement scales. In our study, all the constructs considered in the model were found significant (**Table 3**). However, they diverge from Rao & Rajkumar,[24] who found that only "Habit" and "Value Belief" directly impacted the "Behavioural Intention" to use educational technology among higher education faculty, while other constructs did not. Further, Strzelecki[25] also finds the similar for the constructs which are considered in our study except facilitating conditions which was insignificant (p value =0.906) in his findings.

The study achieved a 73% explanatory power for behavioural intention and 62.4% for use behaviour which is higher than the power achieved in the study by Rao & Rajkumar[24] and Tiwari et al.[11] However, Tiwari et al. use the different framework to measure student acceptance and use of technology.[11] They find that the usefulness, social presence and legitimacy of the tool, as well as enjoyment and motivation, lead to the positive attitude toward using ChatGPT in for learning purposes. However, perceived ease of use was not found to be a significant construct in the adoption of ChatGPT by the students.[11]

6. Conclusion

This study provides valuable guidelines for universities in Uttarakhand and beyond. By validating the UTAUT2 constructs alongside VB and PI, it offers a framework for effectively implementing emerging educational technologies, such as virtual reality and the Metaverse. These insights can help educational institutions and policymakers enhance university teachers' behavioral intentions toward adopting these technologies, fostering a more tech-savvy educational environment.

7. Recommendation

It is recommended that various stakeholders should pay more attention to the factors like value belief and personal innovativeness while assessing the acceptance of use of chatbots like ChatGPT etc. Additionally, institutions should look into the various strategies to enhance faculty and student engagement with such emerging technologies, which definitely will foster a culture of a more innovative and tech-driven learning environment.

8. Limitations and Scope for Future Research

While this study contributes to medical education literature, it has some limitations. The lack of a cross-cultural comparison limits the findings to the cultural context of Uttarakhand, making them less generalizable to other regions. Additionally, the focus on medical students from

Uttarakhand and the small sample size of 300 responses may restrict broader applicability.

Future research could address these limitations by conducting cross-cultural and longitudinal studies, comparing students across different regions or countries. Expanding the sample and exploring moderating factors within the model would provide a deeper understanding of technology adoption in medical education.

9. Relevance of the Study

The relevance of the study exists in extending the UTAUT2 framework by adding two constructs i.e. value belief and personal innovativeness which provides a comprehensive understanding of students towards acceptance and use of ChatGPT.

10. Author's Contribution

All authors contributed equally.

11. Source of Funding

None.

12. Conflict of Interest

There are no conflicts of interest.

13. Ethical Approval

Approval was obtained from the Institutional Ethics Committee before the commencement of the study.

14. Declaration of Generative AI and AI Assisted Technologies in the Writing Process

The authors haven't used any generative AI/AI assisted technologies in the writing process.

15. Acknowledgement

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Annexure 1: Measurement items

Construct	Item	Items	Adapted from
Performance expectancy	PE1	"I believe that ChatGPT improves my performance in learning"	Venkatesh et al. (2003, 2012), Abdullah et al. (2016)
	PE2	"I believe that ChatGPT helps me in performing the task quickly"	
	PE3	"I believe that ChatGPT enhances my productivity in learning"	
	PE4	"I believe that ChatGPT enhances my effectiveness in learning"	
Effort expectancy	EE1	"I find ChatGPT easy to use"	Venkatesh et al. (2003, 2012)
	EE2	"My interaction with ChatGPT is clear and understandable"	
	EE3	"I find ChatGPT easy to use for my learning"	
	EE4	"It is easy for me to become skillful at using ChatGPT"	
Social influence	SI1	"People who are important to me think I should ChatGPT in my learning"	(Venkatesh & Xu, 2012)
	SI2	"People who influence my behavior believe that I should use ChatGPT for my learning"	
	SI3	"People whose opinions I value prefer me to use ChatGPT in my learning"	
Facilitating conditions	FC1	"I have the resources necessary to use ChatGPT"	Venkatesh et al. (2003, 2012)
	FC2	"I have the knowledge necessary to use ChatGPT"	
	FC3	"ChatGPT is compatible with ICT tools I use"	
	FC4	"I can get help from others when I have difficulties using ChatGPT" (dropped)	
Hedonic motivation	HM1	"Using ChatGPT for my learning is fun"	(Venkatesh & Xu, 2012)
	HM2	"Using ChatGPT for my learning enjoyable"	
	HM3	"Using ChatGPT for my learning is entertaining"	
Habit	HT1	"I often use ChatGPT for my learning"	(Venkatesh & Xu,2012)
	HT2	"I am addicted to using ChatGPT for my learning"	
	HT3	"I must use ChatGPT for my learning"	
	HT4	"Using ChatGPT for my learning has become a habit for me"	
Behavioral Intention	BI1	"I intend to continue using ChatGPT for my learning in the future"	(Venkatesh & Xu, 2012)
	BI2	"I will always try to use ChatGPT in my learning"	
	BI3	"I plan to continue to use ChatGPT frequently for my learning"	
Personal innovativeness	PI1	"I like experimenting with new technologies"	(Agarwal & Prasad, 1998)
	PI2	"If I heard about a new information technology, I would like to experiment with it"	
	PI3	"I am usually the first to try out new information technologies"	
	PI4	"In general, I do not hesitate to try out new information technologies"	
Use Behavior	UB1	"Please choose your usage frequency for ChatGPT: Never; Once a month; Several times a month; Once a week; Several times a week; Once a day; Several times a day"	(Venkatesh & Xu, 2012)