

Adoption of Chatbots for Learning among University Students: Role of Perceived Convenience and Enhanced Performance

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Abstract—with the advent of internet and exponentially growing smartphone market, chatbots are becoming popular and are being widely used for interactions in varied fields. This study investigated the usage of chatbots for educational/learning purpose by university students. Wide research has been done exploring usage of chatbots in service industry; still there is vacuum regarding usage of chatbots in education for effective learning. Using path analysis, the study demonstrates validation of two newly added constructs as an extension in Technology Adoption Model and tries to understand the antecedents for intention to adopt chatbots. This study is of utmost importance to researchers, policy makers, system designers for e- learning platforms, teachers, and students in order to make learning effective.

Keywords—Chatbot, e-learning, TAM model, artificial intelligence, learning

1 Introduction

Machine algorithms and AI employing computational methods for better understanding, learning and delivering content in human language for developing online applications which are user interactive will rule the market demand. A chatbot is a computer program to which one can talk in natural (human) language and it will reply having a back and forth conversation. Though, the topic of chatbots seems to be novel but they have their existence with the first ever program, ELIZA in 1966 [1]. Initially being developed to mimic human conversations chatbots are used widely now-a-days in different areas like health, education, forecasting, service, personal assistance etc., being particularly designed for mobile messaging applications [2]. Chatbots are now becoming part and parcel of one's digital life. Big names like Apple, Microsoft, Google, Facebook, Amazon etc. are investing heavily developing digital assistants. Users can have interactions on private messaging platforms [3] making it an enjoyable and efficient platform for acquiring information and availing services [2]. Dynamic needs of user are still a big challenge in realizing the full potential of chatbots [4, 2]. Leveraging popularity of chatbots needs to provide user friendly pleasing experi-

ence to create loyal users [5]. Young tech savvy generation is more inclined towards using chatbots for availing different services and companies are targeting the millennials' for the same. According to Cinteractive Report 2020, 40% of the millennials' interacts with a chatbot daily, being younger generation more familiar with technology. Prior research suggests that chatbots creating a sense of social presence impacts human behavior positively in terms of perception and adoption [6, 7]. Integration of artificial intelligence can be noticed in learner centric education system in 'Education 4.0' [8]. Like scarcity of teachers, changing lifestyle, technology, dynamic needs of students etc. Chatbot is AI based software which stimulates conversation with user in natural language through mobile applications and messaging platform [10], users need not to download any applications on their devices [11]. It is argued in previous studies that adoption of new technology can be different from country to country [12,13]. India with a large younger population base possess much potential in adopting new technology and thus providing reason for conducting this study taking Indian university students and understanding their intention using chatbots for educational purposes. An extended TAM model is proposed to address this objective with two added constructs perceived convenience and enhanced learning performance. The different categories of educational chatbots available are - English (79), French (8), Arabic (7), Italian (3), Russian (3), Spanish (2), Korean (2), Bengali (1), German (1), Hindi (1), Japanese (1). For different subjects; Information (42), Language (16), Economics (6), Multiple subject matter (5), Math (4), Religion (4), Literature (3), History (2), Nature (2), Programming (2), Psychology (2), Design (1) [14].

2 Theoretical framework

TAM-Technology Adoption Model developed by Davis in the year 1986 is key theory applicable in predicting technology adoption [15]. Various factors that influence user's decision for adopting new technology when they exposed to it are being assumed by this model [16, 17, 18]. The primary theory of TAM is the foundation of this model, although extended constructs have been added to have a better understanding of chatbots adoption for e- learning by university students. The TAM model consists of two major predictors of user attitude i.e perceived usefulness and perceived ease of use [16]. This research includes exploring TAM model by extending two more constructs and enhanced performance adapted from [19] and perceived convenience adapted from [20].

3 Research model and hypothesis

Chatbots are relatively new and widely used in different areas embedded with various features offered to users in order to fulfill the objective in different areas. Perceived usefulness here can be explained as the benefits accrued from using technology or the degree to which students perceive use of chatbots will improve their academic performance. Perceived ease of use signifies ease in using the technology and students belief of using chatbots effortlessly. Perceived usefulness and ease of use are

the crucial constructs determining user adoption intention [16] and intention of actual use [21] when being exposed to new technology. Previous studies have shown the direct and positive effect of perceived ease of use on perceived usefulness [17, 22].

H1: Perceived usefulness positively effects students' adoption intension.

H2: Perceived ease of use positively effects perceived usefulness of students' adoption intention.

Attitude in context of technology can be described as users' positive or negative outcomes in accomplishing a goal [15]. Attitude can be considered as crucial construct for predicting behavior [14]. There are evidences of behavioral intension influencing usage of information technology further affected by attitude. These earlier studies have shown that perceived usefulness and perceived ease of use has positive effect on users' attitude [23, 24, 25].

H3: Perceived ease of use positively effects students' attitude towards adoption of chatbots.

H4: Perceived usefulness positively effects students' attitude towards adoption of chatbots.

H5: Students attitude positively effects students' adoption intention regarding chatbots.

Perceived convenience indicates individual preference for convenient product and service. Two key elements time and effort can easily define the convenient factor of a product/ service [26]. Time, place and execution are the three crucial elements of perceived convenience [20]. It is evident in earlier studies that perceived ease of use positively effects perceived convenience [27, 28]. Intension to adopt any service is positively affected by perceived convenience [29]. Study conducted [30] on learning through PDA's showed perceived convenience positively effecting perceived usefulness. The following hypothesis has been framed from above literature.

H6: Perceived convenience positively effects student's attitude towards chatbots adoption.

H7: Perceived convenience positively effects students' intension to adopt chatbots

H8: Perceived convenience positively effects perceived usefulness of chatbots.

H9: Perceived convenience positively effects perceived ease of use regarding chatbots.

Using technology for accomplishing a task is adoption (Davis 1989). Main factors determining e- learning are users' attitude, perceived ease of use, perceived usefulness and users' attitude (Sim, 2014). In the present study, e-learning technology adoption refers to utilization. This particular study assumed that utilization of chatbots for education purpose may lead to enhanced students' performance. H10 is being framed on this assumption.

H10: Adoption of chatbots for learning positively affects the enhancement of academic performance

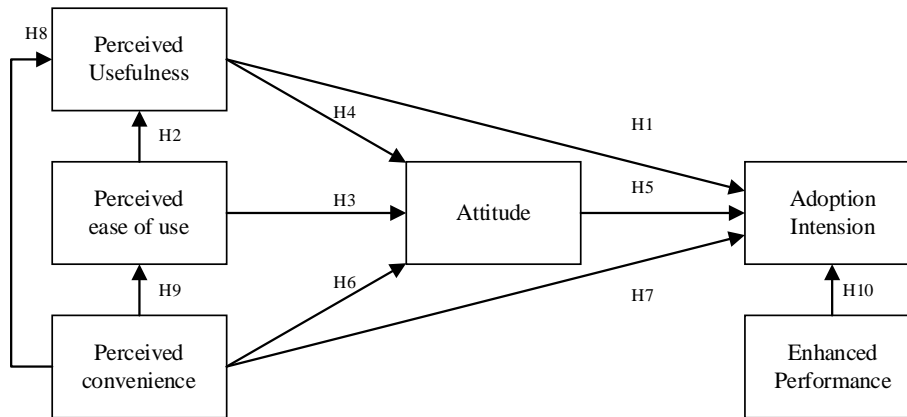


Fig. 1. Conceptual model

4 Methods

4.1 Data collection

University students constitute important demographic to be studied for using chatbots for educational purposes. However, due to newness of chatbots it was likely that most students may not be having an idea of chatbots. Hence recruiting respondents was very difficult. So, it was decided to float questionnaire on social media, Facebook to avail responses of students worldwide. A questionnaire consisting of demographic information and constructs related to perceived usefulness, perceived convenience, perceived ease of use, adoption intension and enhanced performance were included. The age of the respondents was duly taken care of as the study is focusing on only university students. The data was received from 768 respondents but pertaining to age (18-30) and complete information only 372 responses qualified for further analysis. The motive behind choosing university students, as they expect to have better understanding of e-learning and the constructs asked for, moreover being millennial generation they are more exposed to internet and e-learning content.

4.2 Respondents profile

The sample consisted of 245 males and 127 females out of which 112 were undergraduates, 233 pursuing postgraduates, 27 doctoral whereby, 89 belongs to science stream, 111 from arts and 172 from others. Respondents were using chatbots on different platforms and it was found that Facebook messenger is widely used by the students. Google Assistant is the most frequently used chatbot among students may be because of its availability on mobile phones.

4.3 Measures

The construct perceived usefulness adapted from [31, 32] and perceived ease of use and attitude from [32, 33], perceived convenience from [20], Adoption intension from [16], performance enhancement from [34].

5 Data Analysis

University SEM and structural relations being used for checking reliability and validity of this model with the help of Confirmatory Factor Analysis (CFA). Before proceeding further with the analysis a model fit test was conducted and the values for model fit were found to be significant indicating following values values. The value for model fit are ($\chi^2/df = 2.406$, $p = .000$; GFI = .902, RMR = .061, AGFI = .886, CFI = .955; RMSEA = .056, NFI = .806) [35]. In order to check adequacy discriminant and convergent validity of the constructs were tested. Scores of constructs for composite reliability were more than the standard value which is 0.70 [36, 37] which indicates reliability of the constructs.

Table 1. indicates that all the factor loading for the statements of the constructs are more than the standard value that is 0.70 [38] and the values of average variance explained are also above the standard value of 0.50 [36], thus validating convergent validity. In order to have divergent validity all the constructs are tested for the same and it was found that correlation between two constructs was not more than AVE square root [38]. Mentioned condition was checked and duly fulfilled by all the constructs, thus establishing discriminant validity for the model. A two-step procedure [39] was followed to check convergent validity and results revealed factor loadings and AVE of each construct were more than standard value of 0.70 and 0.50 respectively [30].

Multicollinearity for the constructs checked by applying regression whereby adoption intension entered as dependent variable and other constructs perceived ease of use, perceived usefulness, perceived convenience and enhanced performance entered as dependent variables. The values for variance inflation factor were in range of 1.0 and 3.0 [40], which indicates there is no collinearity present and one can proceed further with the analysis. The values of R^2 for perceived ease of use, perceived usefulness, attitude towards use, adoption intension, perceived convenience and enhanced performance explained 42.8, 49.8, 55.7, 47.7, 50.2 and 46.8 percent respectively indicating significant constructs.

Table 3 indicates perceived usefulness positively and significantly effects students adoption intention regarding chatbots for learning with the values depicting β is 0.142 and the value of $t = 3.901$ and $p < 0.05$, H1 supported. For second relation it is found that perceived ease of use positively effects perceived usefulness with the values of β is 0.237, $t = 3.742$, and $p < 0.05$, hence second hypothesis was supported. The third relation between PEOU and students attitude to adopt chatbots also found to be supported with following values, where β is 0.196, $t = 3.554$, and $p < 0.05$. So, H3 was supported. Further it was found that perceived usefulness significantly and positively effects students' attitude adoption for chatbots and hence H4 was found supported

with following values of β is 0.133, $t= 4.092$ and $p < 0.05$. Further, with the analysis it is revealed that students attitude is positively related and having an significant impact on intension to adopt for chatbots for educational purposes with the figures of β is 0.105, $t= 3.244$ and p is less than 0.05, H_5 was supported. Moreover with the new construct which is being introduced to understand the impact of perceived convenience on the student's attitude and it was found to be significantly impacted students attitude.

Table 1. Factor Loadings and Convergent Validity

Statements	Factor Loading	AVE	CR
Perceived usefulness			
Using chatbots for learning enables me achieving learning objectives effectively	.78	.634	.809
learning from chatbots improves my performance	.80		
Using chatbots are useful to provide access to information	.84		
Perceived ease of use			
Using chatbots learning becomes easy	.72	.567	.767.
Using chatbots for learning require less mental effort	.77		
learning is easy and understandable with chatbots	.74		
I can easily become skilful at using chatbots for learning	.72		
Perceived convenience			
I can access chatbots at anytime suitable to me	.76	.503	.740
I can learn at any place using chatbots	.81		
The execution of chatbots is effective and simple	.79		
Attitude			
It would be very desirable to use chatbots for learning	.84	.551	.791
Using chatbot is better than using any other e-learning applications	.75		
I like to use chatbot learning for academic purpose	.79		
It is desirable using chatbot compared to any other applications	.70		
Adoption Intension			
I use chatbots for learning	.86	.664	.810
Using chatbot is invaluable	.73		
I will continue using chatbots	.78		
Enhanced Performance			
Using chatbot for academic purpose reduces my study time	.75	.781	.883
Academic usage of chatbots makes it easier to execute learning tasks	.82		
Usage of chatbots for academic purpose improves my capability to execute learning tasks	.82		
Overall using chatbots enhances my learning performance	.89		

Source: primary data

Table 2. Check for discriminant validity

Constructs	1	2	3	4	5	6
EP	.883					
Attitude	.362	.742				
Adoption Intention	.423	.428	.815			
PC	.278	.345	.440	.709		
P. ease of use	.322	.524	.465	.599	.752	
PU	.520	.409	.681	.301	.542	.796

Source: primary data

Table 3. Structural analysis

Hypothesis	Path	Std β	t-value	Decision
H1	PU → Intension to Adopt	.142	3.901***	Supported
H2	PEOU → Perceived Usefulness	.237	3.742***	Supported
H3	PEOU → Students' Attitude	.196	3.554***	Supported
H4	PU → Students' Attitude	.133	4.092***	Supported
H5	Students' attitude → Intension to Adopt	.105	3.244***	Supported
H6	Perceived Convenience → Students Attitude	.201	4.065***	Supported
H7	Perceived Convenience → Intension to Adopt	.193	5.921***	Supported
H8	Perceived Convenience → Perceived Usefulness	.327	4.662***	Supported
H9	Perceived Convenience → PEOU	.220	3.609***	Supported
H10	Intension to Adopt → Enhanced Performance	.291	4.887***	Supported

Source: Primary data, *** $p < 0.01$

Hence, H6 was supported with the figures (β is 0.201, $t = 4.065$, $p < 0.05$). Moreover, for H7, we also find it supported as perceived convenience found to be positively impacted intension to adopt with β is 0.193, $t = 5.921$ and $p < 0.05$. Further, it was revealed with the analysis that perceived convenience positively effects perceived usefulness and PEOU with β is 0.327, $t = 4.662$ and $p < 0.05$ and β is 0.220, $t = 3.609$, $p < 0.05$ respectively, hence H8 and H9 both were supported. For the last relation the results indicated was supported H10, that adoption intension has positive effect on enhanced performance with the value of β is 0.291, $t = 4.887$ and the value of $p < 0.05$.

6 Discussion and Implications

When it comes to adopting new technology the behavior of young generation is difficult to predict [41]. Considering paucity of research in utilizing chatbots for educational purposes [38], present study tries to observe the antecedents influencing regarding adoption of chatbots for educational purposes by applying and extending TAM model with two more constructs i.e perceived convenience and enhanced performance. As we are living in the digital era the content effects the user experience which is dynamic, so extending TAM model for understanding user experience is justified [42]. Adoption of artificial intelligence is still at infancy stage, especially

developing countries and advancement in adoption rate is expected. Teaching learning transformation can be witnessed especially in higher education by technology adoption [43, 44,45]. Keller [46] in his study revealed that exposing students with pictures, text, images, audio and video, interactive activity ignites the arousal of academic interest which leads to enhanced academic performance. Infact, India has embraced usage of chatbots in various fields like banking, transport, education mostly for frequently asked questions and other services [57, 60]. Development and usage of chatbots in education field proved to reduce ambiguity, improve learning and productivity [53]. Prior studies [47] highlighted the capability of e-learning contribution in enhanced academic performance and learning adaptability. The results of present study regarding effect of perceived ease of use on perceived usefulness and attitude are in line with various earlier studies [48, 49,50] witnessed perceived ease of use impacts positively on perceived convenience [20,30] and attitude regarding users adopting any e-learning platform. Perceived usefulness had been regarded as a crucial factor responsible for shaping user attitude [49, 58]. The result of this study are consistent with earlier studies which found PEOU positively affects perceived usefulness and further perceived usefulness impacts users' attitude [32,51,52]. It is also argued that easiness in operating leads user to perceive that technology useful, thus forming positive attitude towards its adoption. Contribution towards validation and confirming the positive effect of perceived convenience on attitude and influence of enhanced performance adoption intension for chatbots is being explored in this study by extended TAM model.

7 Recommendations

Learning through chatbots indicates that students will interact with chatbots more in future and research exploring the negative effects of chatbots in learning is imperative to conduct. This study used TAM, other models can be undertaken by future researchers to facilitate better understanding of technology in education. Further, various other variables can also be explored in future studies with larger sample across countries/regions to enhance representativeness. This study is conducted in India only, comparative studies can be conducted between developing and developed countries in order to explore e-learning on chatbots.

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