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Understanding pre-service teachers' intention to adopt and use artificial intelligence in Nigerian inclusive classrooms

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Introduction: This study applied the Unified Theory of Acceptance and Use of Technology (UTAUT) to provide an understanding of the behavioral intentions of pre-service teachers in the adoption and utilization of artificial intelligence (AI) tools for educational engagement in the inclusive classroom.

Methods: The cross-sectional study collected data through a validated questionnaire from 411 pre-service teachers were analyzed with descriptive statistics such as frequency counts and simple percentage calculation, as well as inferential statistics which involved correlational analysis and Structural Equation Modeling (SEM).

Results: The study established that effort expectancy had a positive and direct significant contribution to the perceived behavioral intention of pre-service teachers to adopt and use AI for inclusive education teaching. Technological self-efficacy had no direct contributory effect on these teachers' behavioral intention to adopt and use AI for inclusive education teaching. Technological self-efficacy did, however, have a significant positive and indirect contribution to the effect of performance expectancy and social influence on the pre-service teachers' behavioral intention to adopt and use AI for inclusive education teaching, based on their technological self-efficacy.

Discussion: The implication of findings of this study points to the exigency of a need to strengthen institutional policies and teacher preparation curricula in a manner that would advance the infusion of the use of artificial intelligence for teaching of learners with special needs.

KEYWORDS

inclusive education, pre-service teachers, unified theory of acceptance and use of technology, technological self-efficacy, artificial intelligence, teaching in inclusive classrooms

Background to the study

The 1994 Salamanca declaration and the Convention on the Rights of Persons with Disabilities and its Optional Protocol (UNESCO, 1994; United Nations, 2007) have significantly shaped the landscape of education for persons with disabilities. Specifically, the declaration and operational protocols have contributed to the global acceptance of inclusive education and commitments being observed regarding the dynamic growth of inclusive education across the globe. Nigeria has also witnessed a significant shift in inclusive educational policies, principles, and practices over the last two decades (Adigun, 2021; Adaka et al., 2022; Omede, 2016). According to Adaka et al. (2022) and Omede (2016) the dynamic shift in inclusive education in Nigeria have not only led to the realization of the National policy on education by the Federal Republic of Nigeria (2008) and

the enactment of the Discrimination Against Persons with Disabilities (Prohibition) Act of 2018 (Federal Republic of Nigeria, 2019). In line with the dictates of UNESCO's protocol on inclusive education, the enactment of the National Policy on Inclusive Education in Nigeria (Federal Ministry of Education, 2016) has motivated and strengthened the interest of inclusive education stakeholders in Nigeria. Inclusive education is based on a philosophy that promotes holistic consideration and support strategies that minimize or abolish barriers to learning engagement that may negatively limit a person's capacity to achieve his/her full potential. According to Adaka et al. (2022) and Adigun (2021), the overall goal of inclusive education is to ensure that learners with disabilities have access to the same learning opportunities and privileges available to all learners without being marginalized, regardless of their disabilities, thereby creating a platform for equality and epistemic and social justice.

While students with disabilities and their teachers remain the main stakeholders in inclusive education, it is pertinent to note that while the philosophy of inclusive education remains unchanged, the practices and requirements of inclusive education are constantly evolving based on academic, social, and technological dynamics (Adigun et al., 2022). The current trends and need for inclusive education have moved beyond the use of manually operated (low tech) assistive technologies for educational use by learners with disabilities to the use of advanced technologies in response to the changes needed in the era of the fourth industrial revolution (Adigun and Nzima, 2021). Recent evidence in literature has shown increasing applications and use of technological advances, particularly artificial intelligence (AI) in inclusive educational classrooms (Hopcan et al., 2023). AI can be described as a disruptive technology developed with the capability of logical reasoning to take definite actions that can increase possibilities of success and work efficiencies. AI is a computer-enabled application or machine designed to simulate, collect, process, and interpret knowledge and information and disseminate the same into actionable intelligence (Hopcan et al., 2023). AI is designed to mirror logical human cognition to interact and deal with complex human actions involving adaptations, analysis, learning, and idea synthesis.

In recent times, the adoption and use of AI in education have gained global attention, largely because of the capacity of AI not only to increase teaching and learning efficacies but also to foster self-directed learning and guide learning engagements and enhanced interactive learning experiences (Adigun et al., 2024; Salas-Pilco et al., 2022). While it is evident that the influx of AI in educational processes has altered and transformed pedagogical deliveries and processes leading to sustainable learning outcomes, the understanding of the complexities of AI, particularly in inclusive education in developing countries, is still not yet fully understood (Yakubu, 2024). Research studies in the past have queried teachers' perceptions and dispositions toward the adoption and use of technology in special education and/or inclusive classrooms (Sukubo and Atteng, 2023), with divergent results (Chukwuemeka and Samaila, 2020). Developing countries like Nigeria are still in the perceived formative stages of adoption and use of AI for inclusive education, so research is required regarding in-service and pre-service teachers' intentions to adopt and use AI for inclusive education in their classrooms. The broad objective of this study was to bridge the foregoing research gap by applying the Unified Theory of Acceptance and Use of Technology (UTAUT) model to determine pre-service teachers' behavioral intention toward the adoption and use of artificial intelligence in Nigerian inclusive classrooms. The study specifically aimed to:

- Ascertain the relationship between the independent variable (pre-service teachers' perceived behavioral intention) and the dependent variables (performance expectancy, effort expectancy, social influence, facilitating conditions, and technological self-efficacy) in terms of their adoption and use of AI for inclusive education in their classrooms.
- Determine the contributions and direction of the effects of the observed variables (performance expectancy, effort expectancy, social influence, facilitating conditions, and technological self-efficacy) on the outcome variable [pre-service teachers' perceived behavioral intention (to adopt and use AI for inclusive education in their classrooms)], with or without the mediating role of the technological self-efficacy of the respondents.

Theoretical underpinning

Since 2003, the Unified Theory of Acceptance and Use of Technology (UTAUT) formulated by Venkatesh et al. (2003) has been used extensively in research to theorize human behavior in relation to the perceived attitudes, behaviors, and perceptions toward technology and technological application. This theory has been applied in all sectors, but particularly in the educational sector (Maphalala and Adigun, 2021). The UTAUT model (see Figure 1) is constructed based on four factors, which are performance expectancy, effort expectancy, social influence, and the facilitating conditions, and on four moderators (age, experience, gender, and voluntariness of use). In their study, Maphalala and Adigun (2021) note that the UTAUT assumes that:

- Effort expectancy, performance expectancy, social influence, and facilitating conditions are essential components that influence users' intentions to adopt and use a technology.
- Effort expectancy, social influence, and perceived trust have a direct influence on users' intentions to adopt and use technology.
- Performance expectancy, social influence, and trust have an indirect influence on users' intentions to adopt and use technology through their influence on the users' attitudes toward using the technology. And
- The UTAUT does not assume that performance expectancy and facilitating conditions have a direct impact on users' intentions to adopt and use a technology.

Although existing studies have tested the UTUAT model based on its components (Yee and Abdullah, 2021), there is yet to be a study that examines pre-service teachers' intentions to adopt and use AI for teaching in their inclusive classrooms using their technological self-efficacy (TSE) as

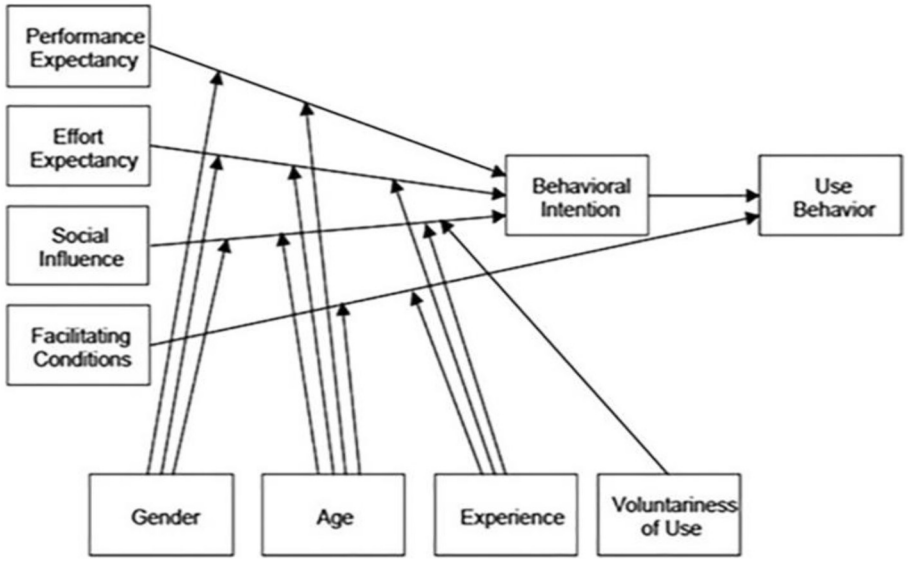

FIGURE 1
Unified theory of acceptance and use of technology (UTAUT).

a moderator variable. Therefore, using the four moderator variables (age, experience, gender, and voluntariness of use) of the UTAUT model (Figure 1) and the conceptual model (Figure 2), this study will answer the following research questions:

- Is there a significant relationship between pre-service teachers' perceived behavioral intentions, performance expectancy, effort expectancy, social influence, facilitating conditions, and technological self-efficacy?
- What is the direction of the effects on and the contribution of the observed variables to the outcome variables, with or without the role of the technological self-efficacy of the respondents?

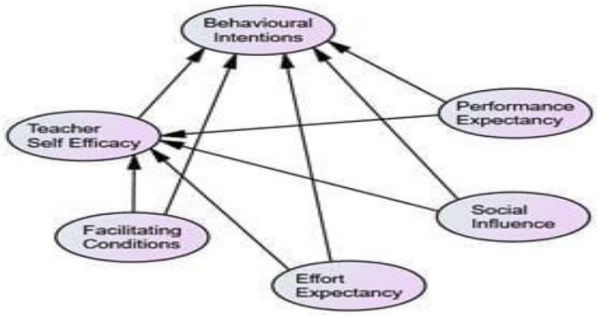

FIGURE 2
The conceptual model of the study.

Literature review

Behavior is a multidimensional construct that depicts a range of actions and mannerisms exhibited by persons or individuals in relation to the dynamics of the cognitive, physical, and/or social environment. Human behavior is motivated by environmental circumstances, so there is therefore the possibility of having the intention to engage with and/or react to environmental stimuli (Adigun et al., 2024). In other words, behavioral intention may be described as the measure of an individual's relative strength of intention to perform a behavior. In this study, behavioral intention is conceptualized as pre-service teachers' intention to adopt and use AI (technologies) for inclusive education teaching. The past two decades have witnessed a surge in research into human behavior with respect to education (Funmilola et al., 2019) and inclusive education spaces (Adigun, 2021). Ultimately, though, while inclusive education has gained some attention, the implication of the application of technologies, artificial intelligence (AI) in particular, is understudied in existing literature. Using the UTAUT model (Venkatesh et al., 2003), studies have shown a direct effect, an indirect effect, and no effect at all between the components of performance expectancy, effort expectancy, social influence, and the facilitating conditions, respectively, on the behavioral intention to use technology (Abbad, 2021; Bayaga and du Plessis, 2024; Zacharis and Nikolopoulou, 2022).

Performance expectancy and behavioral intention toward the adoption and use of technologies

Performance expectancy describes people's belief and trust in their potential efficacy to use technology in relation to

how such technology is valued for enhanced performance (Md Yunus et al., 2021; Venkatesh et al., 2003). According to Md Yunus et al. (2021), performance expectancy is theorized through the lens of extrinsic motivation, comparative benefit, and the result expectancies of the application and use of technology. Interestingly, a plethora of existing studies have shown the viable correlation between performance expectancy and behavioral intention among diverse groups of research participants (Funmilola et al., 2019; Ogegbo et al., 2024). However, Lin (2019) confirmed an insignificant correlation between performance expectancy and the intention to use e-books among 320 participants sampled in Fujian, China. Similarly, Alotumi (2022) reported that there was no significant relationship between performance expectancy and graduate students' behavioral intention to use the Google Classroom platform. The finding reported by Alotumi (2022) supported the earlier findings of Attuquayefo and Addo (2014) and Bervell et al. (2021). In addition, Rawashdeh and Rawashdeh (2021) reported the absence of a significant correlation between performance expectancy and the intention of users to use XBRL tools.

Effort expectancy and behavioral intention toward the adoption and use of technologies

Effort expectancy has been described as the level of belief about the comfort or convenience that people derive from the adoption and use of technology (Rizkalla et al., 2024; Venkatesh et al., 2003). In other words, people's perceptions about the easiness of use may heighten the likelihood of their increased adoption and usage of such technology. Past studies that adopted a correlation technique to examine the relationship between effort expectancy and behavioral intention have shown diverse results. For instance, Akbar (2021), Ogegbo et al. (2024), and Yu et al. (2021) found and recorded a positive correlation between effort expectancy and behavioral intention that was significant in their studies. They also ascertained that there were variations in the extent of the relationships between effort expectancy and behavioral intention. For example, Ogegbo et al. (2024) and Yu et al. (2021) both reported moderate relationships between effort expectancy and behavioral intention among their study participants. On the other hand, a few studies reported an insignificant relationship between effort expectancy and behavioral intention (Bervell et al., 2021; Zacharis and Nikolopoulou, 2022). In terms of the direction of the effect of effort expectancy on behavioral intention, Bandoh et al. (2024) and Xue et al. (2024) observed that the direction was positive. These aforementioned studies therefore reported on the direct effects of effort expectancy on behavioral intention. Conversely, Abbad (2021) and Zacharis and Nikolopoulou (2022) reported an indirect effect of effort expectancy on behavioral intention, and the study by Bayaga and du Plessis (2024) established that there was no direct effect of effort expectancy on the behavioral intention to use learning management systems.

Social influence and behavioral intention toward the adoption and use of technologies

Within the framework of the UTAUT, social influence has been used as a phenomenon that describes the degree to which an individual's perception and expectation about the norm that informs their adoption and use of technology is based on socio-environmental influences. In other words, based on the UTAUT model, social influence reflects an individual's behavior toward technology, which is informed by compliance, identification, and internalization (Bandoh et al., 2024; Venkatesh et al., 2003). According to Amadin et al. (2018) and Md Yunus et al. (2021) social influence seems to have a strong and positive connection to an individual's perception of and behavior toward the adoption, application, and use of technological devices.

Contrary to the foregoing findings, Suki and Suki (2017) offer an insignificant relationship between social influence and the behavioral intention to use technology. Some other research evidence revealed that social influence may have different directional effects and contribute to the behavioral intention to use technologies to different extents. This was evident in the studies of Bayaga and du Plessis (2024) and Zacharis and Nikolopoulou (2022). These researchers all recorded a positive and significant direct effect of social influence on behavioral intention among the participants of their studies. For example, Ogegbo et al. (2024) conducted a study among 83 pre-service science teachers from a large metropolitan university in Gauteng Province, South Africa, and noted a direct and positive effect by social influence on pre-service teachers' intention and willingness to adopt and use virtual reality (VR) classrooms for their microteaching and future classroom practice. On the other hand, a negative but significant effect of social influence on behavioral intention toward adoption and use of relevant technologies for teaching has also been reported in previous studies (Bandoh et al., 2024; Cimperman et al., 2016). Contrary to the finding of a direct effect of social influence on behavioral intention, Abbad (2021) found and reported an indirect effect by social influence on behavioral intention, whereas Alotumi (2022) and Lin's (2019) studies found no direct effect by social influence on behavioral intention.

Facilitating conditions and behavioral intention toward the adoption and use of technologies

Facilitating conditions is a term that is used to describe the degree or extent to which a person believes that an organization and technical infrastructure exist to support the adoption and continual use of a technology or system (Keller and Ercsey, 2024). The conditions may include stakeholders' support, infrastructure, the availability of resources, and ease of use. Keller and Ercsey (2024) believe that facilitating conditions have a strong influence on the behavioral intention toward the adoption and use of technology for efficient output. Further,

while some studies have established a positive correlation between facilitating conditions and behavioral intention (Amadin et al., 2018; Riady et al. (2022) found and reported an insignificant correlation between facilitating conditions and behavioral intention among 1249 teachers from three Indonesian provinces. With regards to the direction of the effect of the implication of facilitating conditions on behavioral intention, Abbad (2021), Lin (2019), and Zacharis and Nikolopoulou (2022) found a direct effect in their various studies. Contrary to this, Attuquayefo and Addo (2014) and Bervell et al. (2021) recorded an insignificant direct effect of facilitating conditions on behavioral intention in their respective studies, and Alotumi (2022) found no directional effect of facilitating conditions on behavioral intention.

Technological self-efficacy and behavioral intention toward the adoption and use of technologies

Self-efficacy is a long-term construct that has been widely interrogated in published research results. The term "self-efficacy" (Bandura, 1977) is used to describe individuals' personal beliefs, judgments, perceptions, and behaviors regarding their capability toward the achievement of a task. As noted by Adigun and Nzima (2021), self-efficacy has the potential to influence behavioral change. Hence, the dynamics and recurrent development in technology vis-à-vis people's views and actions have led to the emergence of technological self-efficacy, among others. Thus, technological self-efficacy is characterized by individuals' abilities, beliefs, capabilities, perceptions, and skills to adopt and utilize technology-related tools to execute related tasks, which in this study, mean using AI to teach in inclusive classrooms. Over the years, the potential effect and influence of technological self-efficacy or even self-efficacy on the acceptance and utilization of technology (Laver et al., 2012) and/or perhaps behavioral intention to adopt and use technology and AI for educational purposes have generated diverse results (Huffman et al., 2013; Pan and Chen, 2021). In line with the submission by Kent and Giles (2017) who affirmed that technological self-efficacy is a viable indicator of teacher education programs' effectiveness in preparing graduates to use instructional technology, Khalilzadeh et al. (2017) assert that efficacy has a significant association with the UTAUT model. In a study by Tarhini et al. (2017), technological self-efficacy was attested as having a direct, positive, and significant effect on students' behavioral intention to use technology. Similarly, Ogegbo et al. (2024) recently confirmed in their study among 83 pre-service teachers from a large metropolitan university in South Africa that perceived self-efficacy has a direct connection with the adoption and use of VR technology in microteaching practice and classroom teaching. However, Bayaga and du Plessis (2024) were not able to confirm the findings of Ogegbo et al. (2024) and Tarhini et al. (2017) because they did not observe any direct effects of self-efficacy. Instead, the findings of Bayaga and du Plessis (2024) support those of Jaradat and Faqih (2014).

Methods

Design and participants

This cross-sectional study employed the descriptive research design. A total of 411 pre-service teachers who had registered for special needs/inclusive education programs in three post-secondary institutions in Nigeria participated in the study. The study participants were identified through a multi-stage sampling procedure that included purposive and simple random sampling approaches. The simple random sampling techniques was adopted in this study because it helped to reduce potential for bias in the process of sample selection. More so, the simple random sampling technique ensure a representative sample of the population of pre-service teachers from the purposively selected post-secondary institutions (Noor et al., 2022). The three post-secondary institutions were purposively selected: Two institutions that train teachers for inclusive educational teaching were purposively selected from Oyo State in the Southwest of Nigeria, while the other institution in Cross Rivers State was purposively selected from among the states of the South-South geopolitical zone of Nigeria. A total of 411 pre-service teachers responded accurately to the research instrument. This represented 82.2% of the 500 potential respondents approached. Of the sampled population, only 21.4% or 88 respondents from Cross Rivers State participated in the study. Overall, as shown in Figure 3, the percentage of female pre-service teachers (84.67%) who responded to the research instrument was higher than that of the males. About 49.21% or 63 respondents who identified as having a disability were either Deaf or Hard of hearing, while a further 4.76% (3) of the respondents indicated that they had learning disabilities. It is interesting to note that the pre-service teachers in their final year (year four) were more readily available and committed to responding to the research instrument. The majority of the respondents (55.72%) were thus pre-service teachers who were in their final year of study, while 12.17% of those sampled were in year one of their studies.

Measures

In addition to the demographics shown in Figure 3, this study also collected some other relevant data from the respondents. The instruments used for further data collection are described below:

The unified theory of acceptance and use of technology (UTAUT) questionnaire

This questionnaire was adapted from two previous studies by Attuquayefo and Addo (2014) and Marchewka and Kostiwa (2007). The adapted UTAUT questionnaire borrowed some statements from the questionnaires used in the studies of Attuquayefo and Addo (2014) and Marchewka and Kostiwa (2007). For instance, the statement "using computational thinking will make it easier to do my job" in the study of Attuquayefo and Addo (2014) was reconstructed to read as "AI can offer convenience and save teaching time in inclusive classrooms" in this current study. Overall, the adapted UTAUT questionnaire contains 27 items,

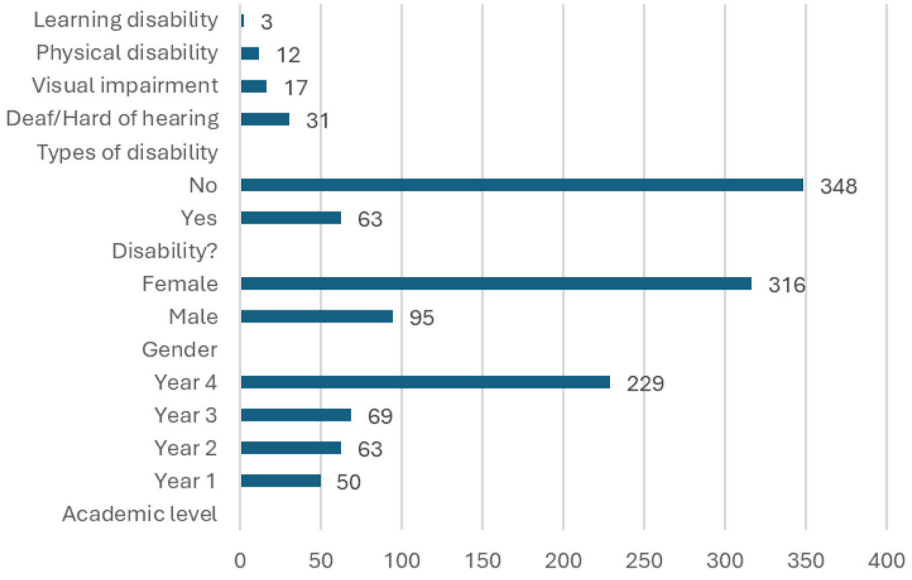

FIGURE 3
Bar chart showing the demographics of the study respondents.

which are divided into five sub-sections. The sub-sections of performance expectancy and social influence have six items each, and effort expectancy and facilitating conditions have four items each. Finally, the sub-section of behavioral intention has seven items. The adapted UTAUT questionnaire was designed in a five-point Likert scale format of "5 = Strongly Agree to 1 = Strongly disagree." The adapted UTAUT questionnaire was subjected to revalidation to ascertain its reliability coefficient. The revalidation of the UTAUT questionnaire among 30 non-inclusive education pre-service teachers from a college of education in one of the states in the Southwest region of Nigeria gave a Cronbach's alpha of 0.87.

Technological self-efficacy scale

The technological self-efficacy scale used in this study was a modified version of the computer self-efficacy scale (Laver et al., 2012). The scale (Laver et al., 2012) was originally designed on a 10-point Likert scale of "1 = Not at all confident to 10 = Completely confident." This scale with 10 items was adapted or redesigned for this current study to create a five-point Likert scale format of "5 = Strongly Agree to 1 = Strongly disagree." The scale was revalidated after being redesigned, and the revalidation was conducted among 30 non-inclusive education pre-service teachers from a college of education in one of the states in the Southwest region of Nigeria to ascertain its reliability coefficient. The revalidation process yielded a reliability coefficient of 0.79.

Process and procedure of data collection

The researcher/author obtained permission from the relevant authorities before approaching the pre-service teachers who were randomly selected to respond to the research. The author ensured that the respondents received adequate briefing about the objectives of the study. Nigerian sign language was used as the means of communication to also inform the pre-service teachers who identified as Deaf/Hard about the purpose of the study. The respondents were assured of the confidentiality of their responses to the research instrument prior to the distribution of the 500 questionnaires, and they responded to the questions on the instrument in venues conducive to their participation. The services of two research assistants were utilized, and they were properly prepared for the data collection process. Their assistance was very helpful. Each respondent took an average of 15 min to complete the three sections of the questionnaire properly.

Ethical consideration

Appropriate permission was obtained from the relevant authorities before conducting the study. Specifically, approval for the study was sought from the Head of the Department of Special/Inclusive Education at the three universities selected for the study. Both written and oral consent were obtained from the respondents before they were handed the paper-pencil questionnaire. Basically, the conducting of this study adhered strictly to the ethics of social sciences and humanities research involving human subjects, as advanced by the Declaration of Helsinki.

Analysis process and technique

Of the 500 questionnaires filled out, only 411 (82.2%) were adequately filled out and returned. The 411 valid questionnaires were coded using the SPSS version 23 software package. The coded data were then analyzed using descriptive (frequency count, simple percentages, and bar charts) and inferential statistics

[Pearson's product moment correlation coefficient (PPMC)] using the IBM SPSS statistical software version 23.0. While the PPMC was used to establish the relationships between the independent variable (behavioral intention) and the independent variables (performance expectancy, effort expectancy, social influence, facilitating conditions, and technological self-efficacy) of the study, the IBM AMOS version 26 statistical package was used to develop the theoretical model and to perform the structural equation analyses.

Results

Research question one

Is there a significant relationship between pre-service teachers' perceived behavioral intentions, performance expectancy, effort expectancy, social influence, facilitating conditions, and technological self-efficacy?

The matrix shown on Table 1 revealed an inverse but significant relationship between performance expectancy ($r = -0.233$, $p < 0.01$), SI ($r = -0.158$, $p < 0.01$), facilitating conditions ($r = -0.104$, $p < 0.05$), and the behavioral intention of the pre-service teachers to adopt and use AI tools for inclusive education teaching. Whereas effort expectancy ($r = 0.566$, $p < 0.01$) had a positive and significant relationship with the pre-service teachers' behavioral intention to adopt and use AI tools for inclusive education teaching, no significant relationship was established between technological self-efficacy and the pre-service teachers' behavioral intention to adopt and use AI tools for inclusive education teaching. The foregoing therefore implies that when the indicators of performance expectancy, social influence, and facilitating conditions that should foster the application and use of AI for inclusive education teaching are low, the intention and morale of the pre-service teachers toward the adoption and use of AI for inclusive education teaching will also be low. The positive relationship between effort expectancy and behavioral intention among the pre-service teachers implies a higher level of perceived behavioral intention of the study respondents to adopt and use AI for inclusive education teaching. On the other hand, the findings regarding technological self-efficacy shown in Table 1 imply that behavioral intention toward the adoption and use of AI for inclusive education teaching is not influenced by these pre-service teachers' technological self-efficacy.

Research question two

What is the direction of the effects on and the contribution of the observed variables to the outcome variables, with or without the role of the technological self-efficacy of the respondents?

The Structural Equation Model (SEM) depicted in Figure 4 was used to respond to research question two and particularly to determine the fitness of the model to provide a vivid explanation for the contributory roles of performance expectancy, effort expectancy, social influence, facilitating conditions, and technological self-efficacy on the behavioral intention of pre-service teachers to adopt and use AI for inclusive education teaching. This study adopted the recommendations of Bentler (1990), Hu and Bentler (1999), Kline (2005), and Senol-Durak and Durak (2011) to determine the fitness of the model. These authors provided recommendations regarding the implications of the comparative fit index (CFI), the normalized fit index (NFI), the goodness of fit indices (GIFs), and the Tucker-Lewis index (TLI). The GIFs, NFI, IFI, TLI, and CFI were determined to validate the empirical data obtained. According to Bentler (1990) and Byrne (1994), large values of $\geq$0.90 for the CFI, GFI, IFI, and TLI suggest the good fit of a model. In terms of the root-mean-square error of approximation (RMSEA), the existing study by Awang et al. (2016) states that the value of the RMSEA should be <0.08. Other studies state that the RMSEA value should be $\leq$ to 0.05 (Senol-Durak and Durak, 2011). According to Senol-Durak and Durak (2011), an RMSEA value of >0.05 indicates a closely fitting model, and a value of 0.10 indicates a marginally fit for purpose model (Hu and Bentler, 1999). In furtherance of the determination of the fitness of the SEM model, this current study accepts the submission of Kline (2010), who advances that the Chi-square (χ^2) ratio to the degree of freedom (df) should be <3 when determining the fitness of a SEM model.

The model was found to be adequate based on the output of the model using the AMOS statistical package. The model (see Table 2) showed that besides technological self-efficacy that had no direct contribution to the behavioral intention of pre-service teachers to adopt and use AI for inclusive education teaching, all of the other variables, namely, performance expectancy, effort expectancy, social influence, and facilitating conditions, contributed to the behavioral intention of pre-service teachers to adopt and use AI for inclusive education teaching. This is because the fit indices for these variables were all within the acceptable ranges ($\chi^2 = 956.52$, df = 314, χ^2/df = 3.05, CFI = 0.92, GFI = 0.90, IFI = 0.91, NFI = 0.92, and RMSEA = 0.65).

As shown in the model (Figure 4), performance expectancy ($\beta = -0.35$, $p < 0.001$), social influence ($\beta = -0.16$, $p < 0.05$), and facilitating conditions ($\beta = -0.13$, $p < 0.05$) had a negative but direct and significant contribution to the behavioral intention of pre-service teachers to adopt and use AI for inclusive education teaching. According to the findings presented in Figure 2, effort expectancy ($\beta = 0.67$, $p < 0.001$) had a positive direct and significant contribution to the perceived behavioral intention of pre-service teachers to adopt and use AI for inclusive education teaching, while technological self-efficacy ($\beta = 0.02$, $p > 0.001$) had no direct contributory effect on pre-service teachers' behavioral intention to adopt and use AI for inclusive education teaching. This implied that performance expectancy, social influence, and facilitating conditions had respective inverse contributions of 35%, 16%, and 13% to the perceived behavioral intention of the pre-service teachers to adopt and use AI for inclusive education teaching. In other words, the lowered degree of performance expectancy, social influence, and facilitating conditions of the respective magnitudes of 35%, 16%, and 13% reduced the intention and ambition of pre-service teachers to adopt appropriate AI tools with which to engage learners with disabilities. Meanwhile, with a magnitude of 67%, effort expectancy was found to contribute positively to the potential adoption and usage of AI tools for inclusive education by the Nigerian

TABLE 1 Correlational matrix of the dependent and independent variables of the study.

	Mean	Std	BI	PE	EE	SI	FC	TSE
Behavioral intentions (BI)	25.60	4.32	1	−0.233**	0.566**	−0.158**	−0.104*	−0.009
Performance expectancy (PE)	21.46	5.75		1	0.040	−0.139**	−0.039	0.130**
Effort expectancy (EE)	14.29	3.99			1	−0.196**	−0.059	−0.038
Social influence (SI)	21.94	5.59				1	0.106*	0.082
Facilitating conditions (FC)	16.94	4.54					1	−0.076
Technology self-efficacy (TSE)	35.90	8.00						1

*Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed).

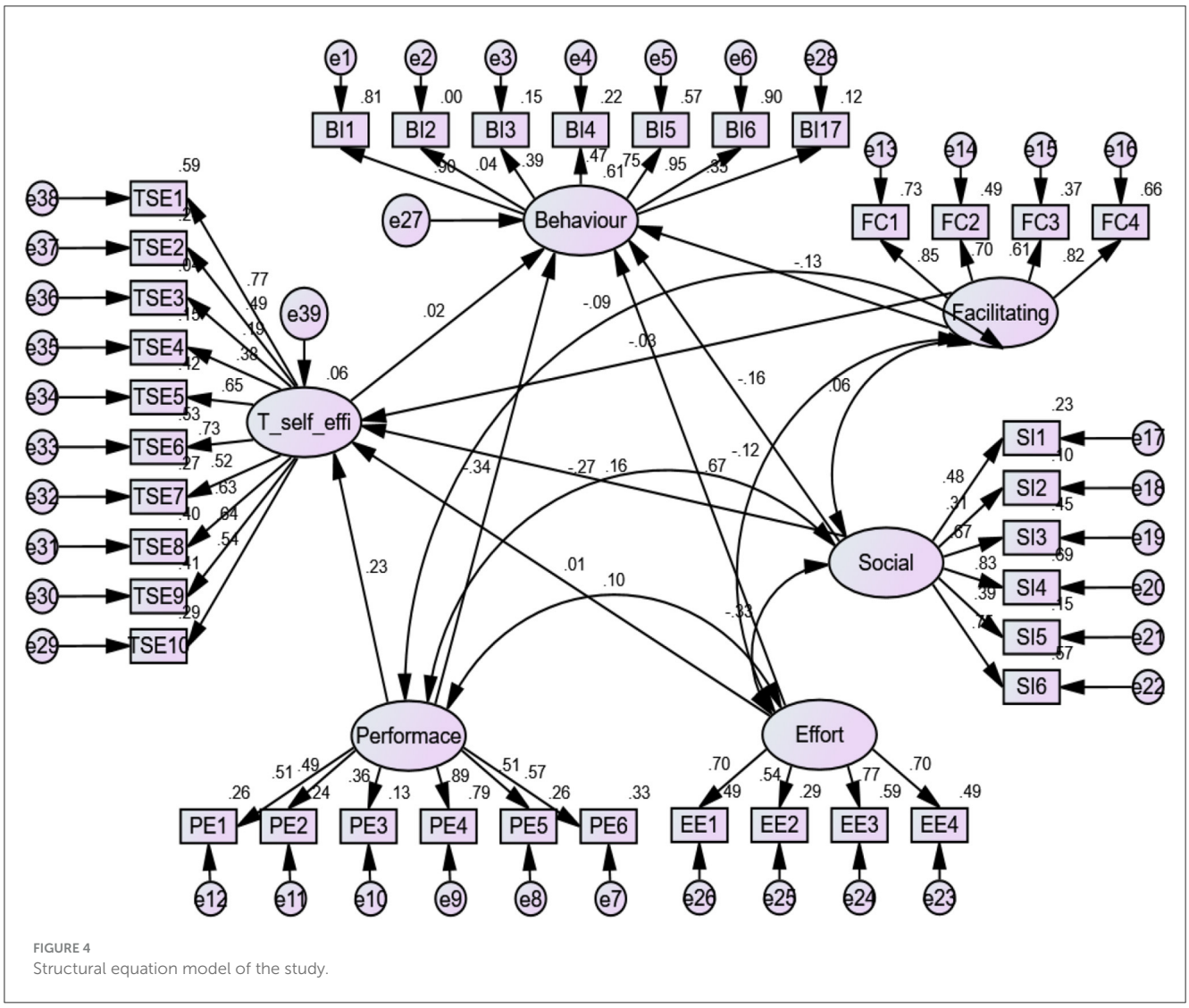

FIGURE 4
Structural equation model of the study.

pre-service teachers who participated in the study. In addition, this model found that performance expectancy ($\beta = 0.23$, $p < 0.001$) and social influence ($\beta = 0.27$, $p < 0.05$) had a significant positive and indirect contribution to the perceived behavioral intention of the pre-service teachers to adopt and use AI for inclusive education teaching due to their technological self-efficacy. Non-significant indirect contributions were also noted by effort expectancy and facilitating conditions. The results relating to the indirect contributions by performance expectancy and social influence, based on the perceived technological self-efficacy of the respondents, to the perceived behavioral intention of the pre-service teachers to adopt and use AI for inclusive education teaching could be influenced, as the model showed that technological self-efficacy could boost the contributions by performance expectancy and social influence by 23% and 27%, respectively.

TABLE 2 Associated values of the structural model.

Relationship between variables			Estimate	S.E.	C.R.	*P*	Decision
TSE	<–	PE	0.25	0.072	3.455	***	Supported
TSE	<–	EE	0.005	0.059	0.082	0.934	Not supported
TSE	<–	SI	0.208	0.087	2.4	0.016*	Supported
TSE	<–	FC	−0.017	0.034	−0.5	0.617	Not supported
BI	<–	PE	−0.451	0.07	−6.395	***	Supported
BI	<–	FC	−0.093	0.03	−3.101	0.002*	Supported
BI	<–	SI	−0.238	0.078	−3.056	0.002*	Supported
BI	<–	EE	0.74	0.068	10.926	***	Supported
BI	<–	TSE	0.021	0.052	0.409	0.682	Not supported

***Significant at 0.001. *Significant at 0.05.

Discussion of the findings

Inclusive education is widely acknowledged in Nigeria and implemented across all 36 states of the federation (Adigun, 2021; Adaka et al., 2022). However, the nature of the inclusive education implemented in the country is such that it incorporates little or no technology. Technology tends to be disruptive, and the recently enacted National Policy on Inclusive Education in Nigeria (Federal Ministry of Education, 2016) recognizes the plausible implications of technology in the holistic achievement of the goals of inclusive education. There are ongoing research activities investigating the influence of technology on inclusive teaching and learning activities in Nigeria. The implications of the UTAUT model (Venkatesh et al., 2003) on Nigerian pre-service teachers' intention to adopt and use AI in inclusive classrooms are yet to be established. This study has found a positive and significant relationship between effort expectancy (EE) and pre-service teachers' behavioral intention (BI) to adopt and use AI tools for inclusive education teaching. The finding implies that because of the perceived convenience associated with AI, pre-service teachers are likely to be positively disposed toward the adoption and utilization of AI tools for inclusive education teaching. This finding is consistent with those from several earlier studies, which also ascertained a positive relationship between EE and pre- and in-service teachers' BI to embrace technology to enhance teaching and learning for all learners, regardless of whether or not they have disabilities (Akbar, 2021; Yu et al., 2021). On the other hand, this finding does not support the reports by Bervell et al. (2021) and Zacharis and Nikolopoulou (2022), who found an insignificant correlation between EE and BI.

This study has found a negative but significant relationship between performance expectancy, social influence, facilitating conditions, and the behavioral intention of pre-service teachers to adopt and use AI tools for inclusive education teaching. This finding seems to have been influenced by the state of the technology within the university system in Nigeria. Several studies have decried the issues regarding the lack of funding and stakeholders' and the government's poor dispositions toward equipping the university laboratories to furnish the students with the required technological acumen and skills needed for teaching in the twenty-first century classroom. This finding implies that despite the potent effects of performance expectancy (PE), social influence (SI), and facilitating conditions (FC) on behavioral intention demonstrated by Amadin et al. (2018), and Venkatesh et al. (2003), an inverse relationship is also possible. The inverse relationship between these variables (PE, SI, and FC) on the behavioral intention of pre-service teachers to adopt and use AI tools for inclusive education teaching is a testament to the deficiency of these variables as factors that could positively influence the behavioral intention of the study participants to adopt and utilize AI tools for inclusive education teaching. This current finding also does not correspond to the findings of the studies of Amadin et al. (2018) and Riady et al. (2022) on the relationship between facilitating conditions and behavioral intention. The findings in the studies of Bandoh et al. (2024), Ogegbo et al. (2024), Suki and Suki (2017), and Venkatesh et al. (2003) on the positive correlation between social influence and behavioral intention were also not confirmed by this current study.

In addition, Lin (2019) confirmed an insignificant correlation between performance expectancy and the behavioral intention to use e-books among 320 respondents sampled in Fujian, China, and Alotumi (2022) found no significant relationship between performance expectancy and graduate students' behavioral intention to use the Google Classroom platform. This current study's finding deviates from those of Alotumi (2022) and Lin (2019), as it has established an inversely significant relationship between performance expectancy and behavioral intention among the pre-service teachers who participated in this study.

In terms of correlation between technological self-efficacy and behavioral intention, this study has not ascertained any relationship between these constructs. In other words, the relationship between technological self-efficacy and the behavioral intention of pre-service teachers toward the adoption and use of AI tools for inclusive education teaching cannot be verified. Hence, the finding cannot confirm the evidence reported in the studies by Huffman et al. (2013) and Laver et al. (2012). This can probably be attributed to the state of the technologies available for pedagogical activities in the teacher training institutions sampled in Nigeria. Adigun et al. (2022) posited that the teachers of learners with special needs were not able to engage comprehensively with learners with disabilities during the COVID-19 lockdown. This was largely because they were not adequately prepared to do so by the various teacher preparation institutions and thus lacked the technological

capacity for e-teaching. Their inability to teach via the digital space widened the epistemological inequalities and the epistemic injustice experienced by learners with special needs during the ravaging pandemic.

The study has established an inverse relationship between performance expectancy (PE), social influence (SI), facilitating conditions (FC), and the behavioral intention (BI) of pre-service teachers to adopt and use AI for inclusive education teaching. The model (Figure 3) expands further on the direction of the effect of the PE, SI, and FC on BI and shows that despite the inverse relationship, PE, SI, and FC have a direct effect on the BI of pre-service teachers to adopt and use AI for inclusive education teaching. The findings have shown that performance expectancy has the highest direct significant effect on the behavioral intention of the participants. This means that performance expectancy is a significant burden that suppresses the participants' behavioral intention to adopt and use AI for inclusive education teaching in Nigeria. Based on the description of performance expectancy advanced by Md Yunus et al. (2021) and Venkatesh et al. (2003), this finding reveals that the participants in this study do not have sufficient belief and/or trust in technology as an instrument that can enhance inclusive teaching. This finding supports the idea put forward by Md Yunus et al. (2021) that belief in the application of technology is a factor that enhances the behavioral intention to use technology. This belief is based on the perceived potential benefits or result expectancies of the utilization of technology, and these are a motivating factor. Although this study has found performance expectancy to have a direct effect on behavioral intention (Venkatesh et al., 2003), this finding is not in line with the results obtained by Abbad (2021), Bandoh et al. (2024), Bayaga and du Plessis (2024), and Zacharis and Nikolopoulou (2022). Their studies observed and reported the existence of a positive, significant, and direct effect of performance expectancy on the behavioral intention among the various research participants and constructs. The current finding deviates significantly from the findings of Abdekhoda et al. (2016), Alrawashdeh et al. (2012), Kim and Lee (2020), Moghavvemi et al. (2015), and Rawashdeh and Rawashdeh (2021), who found an indirect effect by performance expectancy on the behavioral intention regarding the adoption and utilization of technology for educational purposes among various study participants.

The study has also found social influence (SI) and facilitating conditions (FC) to have an inverse direct effect on the behavioral intention (BI) of pre-service teachers to adopt and use AI for inclusive education teaching. The current finding about the direction of the effect of SI on BI corresponds to the findings reported by Bandoh et al. (2024) and Cimperman et al. (2016), who also reported a negative but significant effect of SI on the BI to adopt and use relevant technologies for teaching. Contrarily, there are no similarities between the direction of the effect found in the current study and the results in the studies by Bayaga and du Plessis (2024), Ogegbo et al. (2024), Xue et al. (2024), and Zacharis and Nikolopoulou (2022). These researchers all recorded a positive, significant, and direct effect on behavioral intention by social influence among the participants of their studies. In addition, while a negative but direct effect by facilitating conditions (FC) on behavioral intention (BI) has been recorded in this current study, the only difference between this current study and others is that the studies of Abbad (2021), Lin (2019), Ogegbo et al. (2024), Xue et al. (2024), and Zacharis and Nikolopoulou (2022) found and recorded a positive and significant direct effect by FC on the BI of people toward the adoption and utilization of advanced technologies for teaching.

This current study reports on four components that positively predict behavioral intention, as did Venkatesh et al. (2003). This study has found effort expectancy (EE) to have a strong, positive, and direct effect on the behavioral intention (BI) of the participants to adopt and use AI for inclusive education teaching. Among the same four components examined by Venkatesh et al. (2003), they only confirmed EE as having a direct, positive, and significant effect on the BI of pre-service teachers to adopt and use AI for inclusive education teaching. This study's finding about the effect of EE attests to the fact that the pre-service teachers who participated in this study have great confidence in the potential convenience that the application of AI tools in inclusive education classrooms can provide. Rizkalla et al. (2024) have earlier stated that people's confidence in technology enhances their intention and capacity to adopt and use it to enhance their educational performance. This current finding about EE and its effect on the participants' BI is consistent with those of Bandoh et al. (2024), Ogegbo et al. (2024), Rawashdeh and Rawashdeh (2021), Venkatesh et al. (2003), and Xue et al. (2024), but it does not support the findings obtained in the studies of Abbad (2021), Bayaga and du Plessis (2024), or Zacharis and Nikolopoulou (2022).

While it can be confirmed in this study that technological self-efficacy (TSE) had no direct contributory effect on the behavioral intention (BI) of the pre-service teachers to adopt and use AI for inclusive education teaching, it did have an indirect effect by influencing other constructs that also impacted on these participants. This study has found a significant, positive, but indirect contribution made by performance expectancy (PE) and social influence (SI) on the perceived BI of the pre-service teachers to adopt and use AI for their inclusive education teaching because of their TSE. This finding confirms that technological self-efficacy is an independent construct. TSE is essentially a person's belief that they have the ability to perform complex tasks successfully using new technology (Bandura, 1977), in this instance, AI.

Given this definition of TSE and the current state of the technological facilities in the teacher education programs in Nigeria and the lack of infusion of technology in these programs (Adigun et al., 2022) has most likely significantly deflated the participants' perceived level of technological self-efficacy. Pre-service teachers need strong TSE to influence their behavioral intention to adopt and utilize AI tools for inclusive education teaching. The result obtained in this study does provide support for the works of Bayaga and du Plessis (2024), Jaradat and Faqih (2014), Ogegbo et al. (2024), and Tarhini et al. (2017).

Thus, the significantly positive indirect effect of performance expectancy (PE) and social influence (SI) on the behavioral intention of the study participants has been established because these participants have good technological self-efficacy (TSE). This implies that improved belief in their technological abilities (TSE) can improve the participants' perceptions that using AI will help them to perform better at their jobs (PE) and that others (e.g., other teachers) believe that they should use the new technology (SI) (Venkatesh et al., 2003). The finding therefore

did not support the findings of Alotumi (2022), Bandoh et al. (2024), Bayaga and du Plessis (2024), Ogegbo et al. (2024), and Zacharis and Nikolopoulou (2022), whose studies failed to find an indirect effect by performance expectancy and social influence on behavioral intention. In addition, none of these studies even examined the implications of performance expectancy, effort expectancy, social influence, and facilitating conditions on behavioral intention because of the technological self-efficacy of their respective participants.

Conclusion and recommendations

Inclusive education in Nigeria is still in the development phase, and teacher preparation for inclusive teaching in the era of technology and AI is still developing as well. However, the application and infusion of technology in the teacher preparation programs in Nigeria is far below expectations. The introduction and application of advanced technologies (AI tools) is inevitable in education in the current age, and this study using the UTAU model has provided an understanding of the behavioral intention of pre-service teachers to adopt and use AI in their inclusive classrooms in Nigeria.

This study concluded that performance expectancy, social influence, and facilitating conditions had a negative but direct and significant contribution to the behavioral intention of pre-service teachers to adopt and use AI for inclusive education (IE) teaching. Effort expectancy had a positive, direct, and significant contribution to the perceived behavioral intention of pre-service teachers to adopt and use AI for IE teaching. Technological self-efficacy had no direct effect on the pre-service teachers' behavioral intention to adopt and use AI for IE teaching, but it did have a significant, positive, and indirect contributory effect on performance expectancy and social influence and their impact on the behavioral intention of these teachers to adopt and use AI for IE teaching.

Based on the findings of this study, it is expedient for educational administrators and the other relevant stakeholders in inclusive education in Nigeria to continue putting pressure on the government to give priority to improving the technological facilities in all teacher preparation institutions across the country. It is important that the use and application of technology be included as a compulsory course in the teacher education curriculum. Deliberate inclusion of such a course will enhance the pre-service teachers' efficacy to apply and use technology in their inclusive classrooms. The study thus recommends an improvement of the conditions that will improve the overall performance expectancy, social influence, and facilitating conditions in a manner that will contribute to the digital dexterities of teachers in training for inclusive education and teaching.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

OA: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. FT: Conceptualization, Data curation, Project administration, Writing – original draft, Writing – review & editing. CH: Conceptualization, Data curation, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. SE: Data curation, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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