Lecture Notes in Educational Technology

Jon-Chao Hong *Editor*

New Technology in Education and Training

Select Proceedings of the 5th International Conference on Advance in Education and Information Technology

Springer

Lecture Notes in Educational Technology

The series Lecture Notes in Educational Technology (LNET), has established itself as a medium for the publication of new developments in the research and practice of educational policy, pedagogy, learning science, learning environment, learning resources etc. in information and knowledge age, – quickly, informally, and at a high level.

Abstracted/Indexed in:

Scopus, ACM Digital Library, ERIC, INSPEC, Norwegian Register for Scientific Journals and Series, SCImago

Jon-Chao Hong
Editor

New Technology in Education and Training

Select Proceedings of the 5th International Conference on Advance in Education and Information Technology

Springer

Editor
Jon-Chao Hong
National Taiwan Normal University
Taipei, Taiwan

ISSN 2196-4963 ISSN 2196-4971 (electronic)
Lecture Notes in Educational Technology
ISBN 978-981-97-4217-2 ISBN 978-981-97-3883-0 (eBook)
https://doi.org/10.1007/978-981-97-3883-0

Organization

Conference Co-chairs

Prof. Rong Zhang, Nishinippon Institute of Technology, Japan
Prof. Philipp Gonon, University of Zurich, Switzerland

Program Chairs

Prof. Jon-Chao Hong, National Taiwan Normal University, Taipei, Taiwan
Assoc. Prof. Yutaka Watanobe, The University of Aizu, Japan

Publication Chairs

Prof. Emer. Jun Murakami, National Institute of Technology, Japan
Assoc. Prof. Inci Bilgin Tekin, Istanbul Bilgi University, Turkey

Technical Program Committees

Prof. Naoki Yamamoto, National Institute of Technology, Japan
Prof. Prachyanun Nilsook, King Mongkut's University of Technology North Bangkok, Thailand
Prof. Hi-Lian Jeng, National Taiwan University of Science and Technology, Taiwan
Prof. Zaidatun Tasir, Universiti Teknologi Malaysia, Malaysia
Prof. TaeIn Han, Open Cyber University of Korea (KOCU), Korea
Prof. Charalampos Karagiannidis, University of Thessaly, Greece

Prof. Min-Hsien Lee, National Taiwan Normal University, Taiwan
Prof. Nobuhiro Oishi, National Institute of Technology, Japan
Prof. Antonio-José Moreno-Guerrero, Universidad de Granada, Spain
Prof. Carlos D. Ciriza-Mendivil, Public University of Navarra, Spain
Prof. Ana Mafalda Portas Matias, Polytechnic Institute of Viseu, Portugal
Prof. Gabriel Gomes de Oliveira, University of Campinas (Unicamp), Brazil
Prof. Kuo-Liang Ou, National Tsing Hua University, Taiwan
Assoc. Prof. Li-Yi Wang, National Taiwan Normal University, Taiwan
Assoc. Prof. Thapanee Thammetar, Silpakorn University, Faculty of Education, Thailand
Assoc. Prof. Sebastien Jacques, University of Tours, France
Assoc. Prof. Kavita Chavali, Dhofar University, Oman
Assoc. Prof. Dr. Ruchi Gautam, Sharda University, India
Assoc. Prof. Huang Yu-Che, University of Technology, Taiwan
Assoc. Prof. Yu-Mei Wang, University of Alabama at Birmingham, USA
Asst. Prof. Shahid Anjum, Universiti Teknologi Brunei (UTB), Brunei Darussalam
Asst. Prof. Phongsak Phakamach, Rajamangala University of Technology Rattanakosin, Thailand
Asst. Prof. Carlos Rojas Bruna, Pontificia Universidad Católica de Chile, Chile
Asst. Prof. Mahsa Allahbakhshi, Pontificia Universidad Católica de Chile, Chile
Asst. Prof., Dr., Gayane Sedrakyan, University of Twente, The Netherlands
Asst. Prof. Kanitta Hinon, King Mongkut's University of Technology North Bangkok, Thailand
Asst. Prof. Dr. Pasapitch Chujai, King Mongkut's University of Technology Thonburi (KMUTT), Thailand
Asst. Prof. Dr. Bhumika Sharma, Sharda University, India
Asst. Prof. Dr. Arvind Shanker Shukla, Sharda University, India
Dr. Zaenal Abidin, Universitas Negeri Semarang, Indonesia
Dr. Edgar P. Aban, Camarines Norte State College, Philippines
Dr. Nuanphan Chaiyama, Thailand National Sports University Udon-Thani, Thailand
Dr. Murod Ismailov, University of Tsukuba, Japan
Dr. Francesca Maria Dagnino, Institute for Educational Technology, Italy
Dr. Alexander Mikroyannidis, The Open University, UK
Dr. Jose Alberto Lencastre, University of Minho, Portugal
Dr. Nicola Capuano, University of Basilicata, Italy
Dr. Adamantios Koumpis, RWTH Aachen, Germany
Dr. Arthur Tatnall, Victoria University, Melbourne, Australia
Dr. D. Pérez-Jorge, University of La Laguna, Spain
Dr. Yun Li, Texas A&M University, USA
Dr. Karen Ngeow, the University of Hong Kong, Hong Kong
Dr. Ngeow Yeok Meng, Universiti Tunku Abdul Rahman (UTAR), Malaysia

Preface

The International Conference Series Advances in Education and Information Technology (AEIT) has been bringing together researchers and scientists, both industrial and academic, developing novel Education and Information Technology outcomes. This volume is devoted to presenting selected papers from AEIT 2024. We hope this volume provides valuable academic insights and the future prospects of the conference topics for the readers.

The accepted papers published in these proceedings have been revised and approved by the technical committee of the 5th AEIT 2024. All of the papers exhibit clear, concise, and precise expositions that appeal to a broad international readership interested in Education and Information Technology fields.

The conference was held over two days on January 6 and 7, 2024, in both online and onsite modes. The conference included altogether four keynote speeches, two invited speeches, and four parallel sessions which were filled with presentations by authors from different countries and areas. We are glad that experts in the various fields of education and information technology have presented and discussed their ideas and the latest developments in the field. The keynote speakers include Prof. Philipp Gonon, University of Zurich, Switzerland; Prof. Jon-Chao Hong, National Taiwan Normal University, Taipei, Taiwan; Prof. Piet Kommers, University of Twente, The Netherlands; and Prof. Prachyanun Nilsook, King Mongkut's University of Technology North Bangkok (KMUTNB), Thailand. The invited speakers are Asst. Prof. Shahid Anjum, Universiti Teknologi Brunei (UTB), Brunei Darussalam, and Prof. Al Jupri, Universitas Pendidikan Indonesia, Indonesia.

The organizing committee of the conference would like to thank all the participants for their fruitful work and personal contribution to the development of these conference proceedings. We extend our very best wishes to you, and we are looking forward to your participation again in the next edition of AEIT.

Taipei, Taiwan

Prof. Jon-Chao Hong
Program Chair

Contents

Chapter 1
Design Implications for Next Generation Chatbots with Education 5.0

Gayane Sedrakyan, Simone Borsci, Stéphanie M. van den Berg, Jos van Hillegersberg, and Bernard P. Veldkamp

Abstract Prior research indicates that chatbots have the capacity to significantly enhance learning performance, student satisfaction, and engagement. Chatbots are employed in various educational contexts, serving as content delivery platforms, facilitating student interaction, fostering collaborative learning, and promoting question-and-answer practice, among other applications. Moreover, integrating chatbots into teaching practices empowers educators to analyze and assess students' learning abilities and comprehension levels. However, much of the existing research on educational instruments, including chatbots, lacks both theoretical support from recent advancements in the learning sciences and an evidence-informed foundation for selecting appropriate data and information models. As a consequence, educational chatbots run the risk of yielding unintended negative consequences instead of delivering the intended benefits. This study seeks to address this gap by grounding the design of educational chatbots in the principles of learning sciences. We argue that effective communication through educational chatbots necessitates formulating information in the form of feedback dialogues to enhance learners' comprehension. Additionally, we align the design of educational chatbots with learner-centric and mindful technology concepts, inline with Industry 5.0 digitization strategies.

G. Sedrakyan (✉) · J. van Hillegersberg
Department of High-tech Business and Entrepreneurship, Section Industrial Engineering and Business Information Systems, University of Twente, Enschede, The Netherlands
e-mail: g.sedrakyan@utwente.nl

J. van Hillegersberg
e-mail: j.vanhillegersberg@utwente.nl

S. Borsci · S. M. van den Berg · B. P. Veldkamp
Department of Learning, Data analytics and Technology, Section Cognition, Data, and Education, University of Twente, Enschede, The Netherlands
e-mail: s.borsci@utwente.nl

S. M. van den Berg
e-mail: stephanie.vandenberg@utwente.nl

B. P. Veldkamp
e-mail: b.p.veldkamp@utwente.nl

J.-C. Hong (ed.), *New Technology in Education and Training*, Lecture Notes in Educational Technology, https://doi.org/10.1007/978-981-97-3883-0_1

Keywords Education digitalization · Chatbots · Digital feedback · Education 5.0

1.1 Introduction

In the context of accelerated digitization processes in post-pandemic education, the potential of chatbots (e.g. ChatGPT) exploiting generative AI in education is promising. However, a critical gap exists in grounding these chatbots on learning theories. To bridge this gap, our research conducts a literature review to explore and link relevant concepts from learning theories and future trends in digitization that focus on design elements in the context of Industry 5.0 and Education 5.0 paradigms. We aim to conceptualize a map for information transmission and exchange that can serve as general guidelines for designing chatbot agents for educational chatbots, while also identifying relevant questions to guide research on designing next generation chatbots.

1.1.1 Future Trends in Digitalization with Industry 5.0 and Education 5.0 Concepts

With the advent of Industry 4.0, digitalization processes have increasingly focused on data-driven mechanisms, including Big Data, Artificial Intelligence (AI), and other technologies. Educational institutions and research have introduced numerous instruments to support technology-enhanced teaching and learning processes, such as automated assessment and feedback (Derick et al., 2017; Ruiz et al., 2015; Sedrakyan, 2016; Sedrakyan & Snoeck, 2015). This approach has brought about various benefits, including cost-effectiveness and the automation of simple tasks in larger classrooms, addressing issues related to the lack of resources.

Even before the outbreak of COVID-19, Big Data and AI were significantly reshaping modern education. However, the global pandemic accelerated the need for educational institutions to swiftly transition their teaching and learning processes and infrastructures to fully support digitalized education. Over the past few years, it has become evident that digitalization will play a pivotal role in the transition to post-pandemic educational environments, where hybrid classrooms/campuses, integrating physical and digital learning experiences, will likely define the new norms.

The widespread shift to digitalization also implies reducing human-to-human interactions, leading to an increasing shift in decision-making power from humans to technology. This transition has resulted in varying levels of success and quality implications, which have affected learners' performance, motivation, as well as their physical and social well-being. The lockdown measures that allowed for experiencing digitalized education at multiple levels have already highlighted the central value of human contact in the learning process. Educational research may need to look far

beyond technology and data-driven mechanisms to reposition humans at the core of learning processes as well as the design of instruments for future-proof education. For instance, generative AI conversation systems, like ChatGPT (Floridi & Chiriatti, 2020), could be disruptive of classic evaluation processes of education (Yeadon et al., 2212) by providing learners with ways to quickly generate essays or reports. These emerging systems can be seamlessly integrated into educational contexts and frameworks, with the underlying notion that in silico agents are not barriers or substitutes for educators. Instead, they are more likely to serve as collaborative teammates to learners (Seeber et al., 2020) who should be equipped with the knowledge to employ these novel tools ethically and effectively. The development and integration of AI conversational systems in education currently lack sufficient guidance for informed decision-making. Existing *research on educational instruments often lacks theoretical support from recent advancements in the learning sciences and fails to establish an evidence-informed foundation for selecting relevant data models to observe and assess learning processes and interventions* (Saywer, 2014). Consequently, these interventions may overlook the fundamental nature of learning, *resulting in instruments that may have a detrimental impact on the learning processes* (Sedrakyan et al., 2020). For instance, these systems may deliver information that inadequately aligns with the intended learning objectives.

The concept of Industry 5.0 necessitates a paradigm shift, requiring one to think and act differently (Broo et al., 2022), with a primary focus on leveraging research and innovation to drive the transition toward a sustainable, human-centric, and resilient industry (Seeling et al., 2022). Unlike Industry 4.0, which revolved around data and technology, Industry 5.0 embraces a value-driven perspective (Xu et al., 2021), emphasizing the provision of value for end-users, stakeholders, and the broader socio-technical and environmental system within which actors operate. Norman (Norman, 2023) recently proposed the adoption of humanity-centered design principles for future systems, underlining the importance of considering not only the value of new technology for humans but also its impact on the socio-technical and environmental contexts. In this context, a product that brings high value to people but consumes excessive resources (e.g. energy) or has negative effects on others cannot be deemed humanity-centered. This "re-humanized" approach to digitalization necessitates the eroding of boundaries between different disciplines, moving away from a solely data analytics-driven approach. In the field of education, the concept of Education 5.0 encompasses the future-proof digitalization process, requiring appropriate *methodological and pedagogical approaches to establish common guidelines* (Seeling et al., 2022) to design *mindful technology*. Technological mindfulness entails the active *involvement of key stakeholders*, including teachers, policy providers, education and industry organizations, and, most importantly, the *learners themselves*. This inclusive approach enables the consideration of various essential elements to deliver value, such as *accessibility*, *usability*, *trust*, *privacy*, *ethics*, *security*, and *transparency* for end-users. Trust and transparency are in addition closely related to the concept of *eXplainable AI* (XAI), which involves the adoption of emerging methods to increase trust in AI systems and *enable effective evaluation for continuous improvement* (refinement loops). The importance of usability in ensuring safety (ISO 9241–11)

and trust (Salanitri, 2015) within specific contexts, such as virtual reality and retail, should also be explored and tested, particularly concerning conversational agents. Moreover, the predictability (Daronnat et al., 2021) of digital agents significantly influences trust in such systems. Furthermore, the interplay between trust, understanding, and explainability appears to be strongly connected (Diprose et al., 2020) when it comes to interacting with AI systems in high-risk decision-making contexts, such as health care.

1.1.2 Chatbots in Education

In the context of Industry 4.0 and massive digitalization processes, technological interventions have become instrumental in supporting manufacturing and service operations. A similar trend has emerged in education, where digital technology has been harnessed through various software types, often referred to as technology-enhanced or computer-assisted learning. Given the prevalence of online platforms in today's technological landscape, communication and various activities increasingly rely on digital interfaces. Consequently, chatbots have gained prominence in the education domain for enhancing student interaction (Okonkwo & Ade-Ibijola, 2021). The integration of chatbots in education holds the promise of significantly improving learning outcomes and overall student satisfaction (Winkler & Söllner, 2018). Educational chatbots are defined as computer programs designed to emulate and process human communication, facilitating interactions with digital devices in a manner as if conversing with real individuals (Ciechanowski et al., 2019). Chatbots have been used for educational purposes in a variety of ways, e.g., via an online platform as a conversational agent capable of providing accurate information to deliver course content to students (Okonkwo & Ade-Ibijola, 2020). Its dialogue mechanism encourages collaborative learning (Ruan et al., 2019). Educators are seeing the value of utilizing chatbots in educational settings to provide students with an engaged experience (Wu et al., 2020). Students can use these bots to ask questions, get responses, i.e., practice questioning and answering (Hiremath et al., 2018), get individualized help (Sinha et al., 2020), and perform reflective learning tasks (Song et al., 2017). Additionally, AI-powered chatbots present the potential to establish automated and intelligent teaching systems, empowering teachers to analyze students' learning abilities. By recording and analyzing students' responses, these chatbots can also facilitate the assessment of subject comprehension levels (Durall & Kapros, 2020).

Overall, the integration of chatbots into education offers substantial potential to enrich the learning experience and enhance educational outcomes. However, it is essential to carefully explore the implications and optimal applications of this technology within the pedagogical landscape.

1.2 Next Generation Educational Chatbots in the Context of Education 5.0

In spite of the widespread popularity of chatbots, the design aspects of their application in the education context remain relatively underexplored. Recent systematic reviews concerning educational chatbots (Kuhail, 2022) have highlighted a notable lack of systematic consideration of usability aspects, and an overreliance on diverse educational principles, ranging from personalized to experiential learning, without a cohesive framework to underpin their design decisions. Furthermore, the *absence of theoretical foundations rooted in the learning sciences* is evident.

Although there are many ways to interact in education, such as email communication, student-to-student interaction, and student-to-lecturer interaction, none have proven capable of facilitating truly individualized learning experiences that are optimally convenient for students. Chatbot technology can provide students with a more personalized and engaging learning environment (Cunningham-Nelson et al., 2019) by providing *tailored information* to learners that can trigger effective learning process mechanisms. For instance, *reconceptualizing information dissemination as a feedback dialogue*, *rather than mere transmission of information*, has been shown to increase the likelihood of students' comprehension (Nicol & Macfarlane-Dick, 2006).

Empirical evidence shows the importance of grounding *effective feedback* in the *regulatory mechanisms underlying learning processes.* Central to the concept of feedback is the regulation of learning, a multifaceted construct encompassing goal-directed, intentional, and metacognitive activities wherein *learners take strategic control of their actions (behavior), thinking (cognitive), and beliefs (motivation, emotions) throughout the learning process* (Zimmerman, 2011; Derick et al., 2017). Notably, research has consistently revealed that successful learners use a repertoire of strategies to guide and enhance their learning process—cognitive, behavioral, and motivational—toward completing academic tasks (Sedrakyan et al., 2020).

In order to optimize the learning experience, the next generation of chatbots designed for educational purposes needs to be grounded in cognitive, socio-cognitive, and behavioral theories. These foundational theories will enable chatbots to deliver appropriate and tailored information (i.e., right content and amount of information), stimulating effective learning processes in learners. For instance, data analytics models should be equipped to discern the most suitable type of information to be conveyed and exchanged with learners, and the ability to distinguish if the information to be communicated needs to contain direct, elaborate, and comprehensive information or a succinct prompt. Moreover, these chatbots should be capable of providing cognitive feedback aimed at enhancing learners' understanding of specific concepts, encouraging thoughtful reflection, or reinforcing independent learning behaviors.

In the design process of educational chatbots, it is crucial to consider the concept of *learning goals and orientations* (Sedrakyan et al., 2020; Tuckey et al., 2002), which play a pivotal role in shaping learners' *feedback and information-seeking behavior*. Instructors typically define explicit learning goals to provide students with a clear

understanding of expectations, leading to a more efficient concentration of efforts toward achieving those objectives (Turkay, 2014). Such clear objectives operationalized by instructors also encourage students to actively seek information and feedback to bridge the gap between their current understanding or skills and the desired learning outcomes (Hattie & Timperley, 2007; Marzano et al., 2001). The process of self-goal setting can significantly enhance students' learning and motivation (Sedrakyan et al., 2020; Zimmerman, 2011). Therefore, instructors can empower students by encouraging them to set their *own learning goals*, and promoting *proactive and ownership-driven behavior* (Elliot & Fryer, 2008). Understanding the concept of goal orientation is vital as it reveals different approaches individuals may take when setting their learning goals (Sedrakyan et al., 2020). For instance, learners may align themselves with mastery- or performance-oriented goals (Gjerde et al., 2022). A *performance orientation* is evident when the focus is on obtaining good grades, whereas a *mastery orientation* is observed when the focus is on improving skills and knowledge in a particular area. Those with mastery goals are genuinely interested in learning for its intrinsic value, aiming to understand and grasp as much as possible. On the other hand, students with performance goals view learning as a means of showcasing their competence and abilities, e.g., by striving to outperform their peers or avoid failure. Thus, being aware of learners' goal orientations is crucial in designing effective information transmission dialogues. Consideration should be given to the extent and depth of information provided, tailoring responses to accommodate elaborate information or hints based on individual goal orientations.

1.3 Learner-Centric Design Elements and Research Questions: Linking Education 5.0 Digitization and Learning Science Concepts

In this research, we posit that for chatbots to be effectively used in the domain of education, in addition to grounding the information transmission dialogue onto learning theories, it is also important that these instruments are accessible (Smutny & Schreiberova, 2020), usable (Borsci et al., 2022a; 2022b), and that the information provided through these instruments is understood by students. As mentioned in the previous chapter, this requires that the *information in the first place needs to be conceptualized as feedback dialogue grounded on theories of regulatory mechanisms of learning processes* rather than as information transmission. Figure 1.1 depicts the conceptual map of the information transmission model based on regulatory mechanisms underlying learning processes (Zimmerman, 2011). Based on the implications of digitization concepts of Industry 5.0 technology, several questions need to be answered when designing next generation chatbots, among others including.

- What type of interaction and feedback models are most effective for chatbots in supporting ***cognitive processes of learning*** and at what level (e.g. what feedback elements are needed to contribute to the cognitive learning process, when should

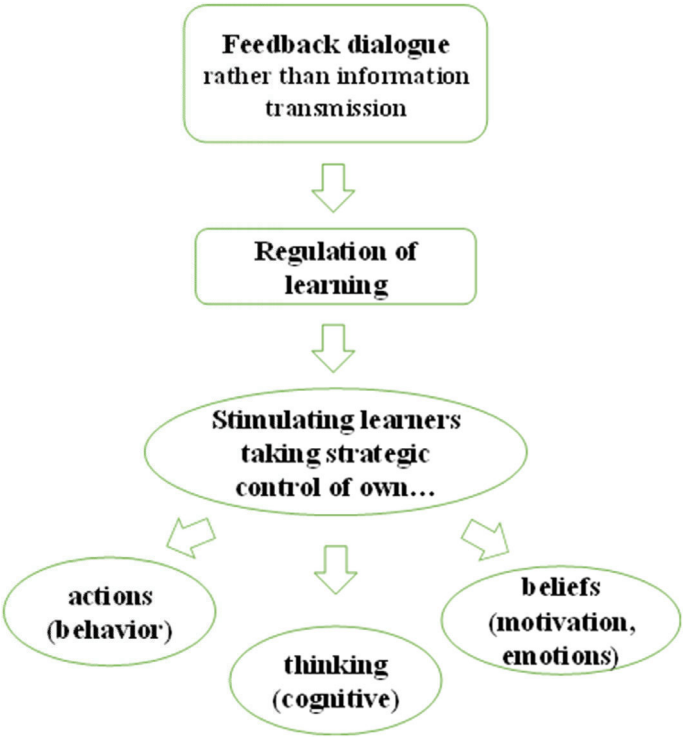

Fig. 1.1 Conceptual information transmission model for educational chatbots

prompts, scaffolding, or more elaborate feedback elements need to be employed to enhance effectiveness)? Can this differentiation be detectable from a conversation dialogue?

- Which interaction/feedback models are essential for ***reinforcing and supporting an effective learning behavior*** (e.g. guidance on how a certain goal/procedure can be achieved/completed)?
  - Should the information provided through a chatbot include elaborate feedforwarding or encourage a more ***independent learning*** behavior, e.g. by using prompts or hints (e.g. "did you check … ?")?
- What type of interaction/feedback elements are needed to support ***increased motivation and creativity*** when using chatbots as educational tools?
  - In what ways can chatbots contribute to emotion regulation and foster a positive emotional environment for enhanced learning outcomes?

In the context of transitioning to Education 5.0, the following research questions emerge as relevant when designing the new generation of educational chatbots:

- What are the essential ***stakeholders*** to be involved in the design, development, and implementation of educational chatbots?
  - To what extent and in what manner should these stakeholders be engaged in the process?
  - If and how do these stakeholders need to interact with and influence the data models governing information transmission within educational chatbots?
- How can ***learners*** be actively ***engaged as change agents*** and ***co-creators*** in the refinement process of educational chatbots?
  - How can learners be empowered to influence the underlying algorithms of chatbots, for example, by specifying preferences, determining data collection levels, providing feedback, etc.?
- What other design components are needed to ***ensure trust*** (e.g. privacy, ethics, and safety)?
  - Is being predictable an important determinant of being explainable and trustworthy in an educational context?
  - Specifically, what is the role of predictability in determining trust and XAI for educational chatbots?
- What data needs to be collected to ***enable evaluation*** and ***long-term maintainability*****?**
  - How can the collected learning-process data be ***effectively mapped*** to end-users to support evaluation and maintenance loops for the chatbots?
  - How can data on learner interaction, such as the number of times a specific concept has been queried, the frequency of usage by different students (e.g. if a question on a specific concept has been asked by a learner the first time or multiple times, by a limited number of students or many learners, students who were absent from class), be leveraged to identify potential difficulties in interacting with learning resources or interpreting concepts?
  - How can data enable assessing and improving the interaction process?

Figure 1.2 illustrates the conceptual design elements of a learner-centric chatbot, where explainability plays a pivotal role. Explainability refers to the capability of the chatbot system to offer transparency throughout the information transmission process and its resulting output. This aspect is closely related to the concepts of trust and reliability, encompassing considerations for privacy, ethics, and safety awareness. Moreover, explainability aligns with the learner-centric technology approach, which in addition seeks to empower learners and teachers to influence the chatbot's inner algorithms. This empowerment can be achieved through providing opportunities to give feedback on the chatbot's output, adjusting preferences to control the amount and depth of information received, and tailoring the output to meet individual learner needs, including learning goals and preferences regarding data collection during the interaction process. Consequently, explainability not only fosters trust and reliability

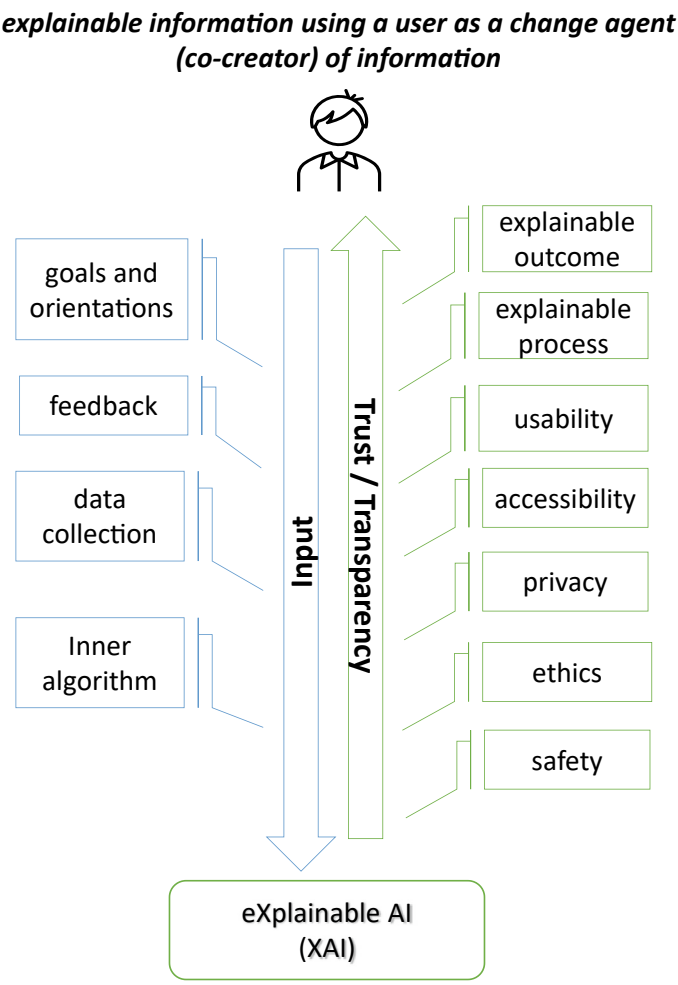

Fig. 1.2 Learner-centric design elements

in the system but also ensures that the information conveyed to users is meaningful to them by holding greater relevance to their unique requirements.

1.4 Conclusion

Chatbots have emerged as a promising tool in education, offering the potential to significantly enhance learning performance and satisfaction while providing engaging learning experiences (Kuhail, 2022; Smutny & Schreiberova, 2020). Their applications in education are diverse, encompassing the delivery of course content,

improved student interaction, collaborative learning, question-and-answer practice, and even assisting teachers in analyzing and assessing student learning abilities and comprehension. The existing research on educational chatbots however often lacks robust theoretical support from recent advancements in the learning sciences and evidence-informed foundations for data and information choices, leading to potential risks of delivering more harm than benefits to learners.

In our research, we endeavored to address this gap by anchoring the design of educational chatbots in the principles of learning sciences. We advocate that for effective educational outcomes, the information transmitted through educational chatbots should be formulated as a feedback dialogue, triggering regulatory mechanisms underlying the learning processes. In this context, specific learning goals and orientations of learners should be considered when designing the next generation of educational chatbots, allowing customization of the depth and content of information conveyed to learners by relevant stakeholders.

Additionally, we consider the implications of transitioning into Industry 5.0 and the corresponding digitization needs for educational technology (Education 5.0). This perspective incorporates concepts like learner-centric technology and technological mindfulness. Our research aims to provide a foundational platform linking the trends of Industry 5.0 and Education 5.0 within the domain of educational chatbots, by also outlining a set of research questions that necessitate attention during the design and prototyping phases of educational chatbots. It is important to note that the design implications presented in this work need to be interpreted with a certain level of caution. Prototype designs and empirical evaluations are further recommended to establish or reject the usability and effectiveness of particular design elements. As authors, we aspire to stimulate a wide-ranging discussion in the domain of integrating conversational agents in a learning/teaching context with the aim of establishing theoretical guidelines and standards for the educational community to adhere to the design and advancement of educational chatbots.

References

Borsci, S., et al. (2022a). A confirmatory factorial analysis of the Chatbot usability scale: a multilanguage validation. *Personal and Ubiquitous Computing,* 1–14.

Borsci, S., et al. (2022b). The Chatbot usability scale: The design and pilot of a usability scale for interaction with AI-based conversational agents. *Personal and Ubiquitous Computing, 26*(1), 95–119.

Broo, D. G., Kaynak, O., & Sait, S. M. (2022). Rethinking engineering education at the age of industry 5.0. *Journal of Industrial Information Integration, 25*, 100311.

Ciechanowski, L., et al. (2019). In the shades of the uncanny valley: An experimental study of human–chatbot interaction. *Future Generation Computer Systems, 92*, 539–548.

Cunningham-Nelson, S., et al. (2019). A review of chatbots in education: practical steps forward. In *30th Annual conference for the australasian association for engineering education (AAEE 2019): Educators becoming agents of change: Innovate, integrate, motivate.* Engineers Australia.

Daronnat, S., et al. (2021). Inferring trust from users' behaviours; agents' predictability positively affects trust, task performance and cognitive load in human-agent real-time collaboration. *Frontiers in Robotics and AI, 8*, 194.

Derick, L., et al. (2017). Evaluating emotion visualizations using AffectVis, an affect-aware dashboard for students. *Journal of Research in Innovative Teaching & Learning, 10*(2), 107–125.

Diprose, W. K., et al. (2020). Physician understanding, explainability, and trust in a hypothetical machine learning risk calculator. *Journal of the American Medical Informatics Association, 27*(4), 592–600.

Durall, E., & Kapros, E. (2020). Co-design for a competency self-assessment chatbot and survey in science education. In *International conference on human-computer interaction.* Springer.

Elliot, A. J., & Fryer, J. W. (2008). The goal construct in psychology. *Handbook of Motivation Science, 18*, 235–250.

Floridi, L., & Chiriatti, M. (2020). GPT-3: Its nature, scope, limits, and consequences. *Minds and Machines, 30*(4), 681–694.

Gjerde, K. P., Skinner, D., & Padgett, M. (2022). Importance of goal and feedback orientation in determining feedback effectiveness. *Journal of the Scholarship of Teaching and Learning, 22*(3), 55–75.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81–112.

Hiremath, G., et al. (2018). Chatbot for education system. *International Journal of Advance Research, Ideas and Innovations in Technology, 4*(3), 37–43.

Kuhail, M. A., et al. (2022). Interacting with educational chatbots: A systematic review. *Education and Information Technologies,* 1–46.

Marzano, R. J., Pickering, D., & Pollock, J. E. (2001). Classroom instruction that works: Research-based strategies for increasing student achievement. Ascd.

Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education, 31*(2), 199–218.

Norman, D. A. (2023). *Design for a better world: Meaningful, sustainable, humanity centered*. MIT Press.

Okonkwo, C. W., & Ade-Ibijola, A. (2021). Chatbots applications in education: A systematic review. *Computers and Education: Artificial Intelligence, 2*, 100033.

Okonkwo, C. W., Ade-Ibijola, A. (2020). Python-Bot: A chatbot for teaching python programming. *Engineering Letters, 29*(1)

Ruan, S., et al. (2019). Bookbuddy: Turning digital materials into interactive foreign language lessons through a voice chatbot. In *Proceedings of the sixth ACM conference on learning@ scale.*

Ruiz, J., Sedrakyan, G., & Snoeck, M. (2015). Generating user interface from conceptual, presentation and user models with JMermaid in a learning approach. In *Proceedings of the XVI international conference on human computer interaction.*

Salanitri, D., et al. (2015). Relationship between trust and usability in virtual environments: An ongoing study. In *International conference on human-computer interaction.* Springer.

Saywer, R. (2014). The future of learning: Grounding educational innovation in the learning science. In *The cambridge handbook of the learning sciences* (pp. 1–19).

Sedrakyan, G. (2016). Process-oriented feedback perspectives based on feedback-enabled simulation and learning process data analytics.

Sedrakyan, G., et al. (2020). Linking learning behavior analytics and learning science concepts: Designing a learning analytics dashboard for feedback to support learning regulation. *Computers in Human Behavior, 107*, 105512.

Sedrakyan, G., & Snoeck, M. (2015). *Effects of simulation on novices' understanding of the concept of inheritance in conceptual modeling*. Advances in Conceptual Modeling: ER 2015 Workshops AHA, CMS, EMoV, MoBID, MORE-BI, MReBA, QMMQ, and SCME, Stockholm, Sweden, October 19–22, 2015, Proceedings 34. 2015. Springer.

Seeber, I., et al. (2020). Machines as teammates: A research agenda on AI in team collaboration. *Information & Management, 57*(2), 103174.
Seeling, P., Roberts, S., & Weible, J. (2022). Towards education 5.0: instruction with learners in the loop. In *The 23rd annual conference on information technology education.*
Sinha, S., et al. (2020). An educational Chatbot for answering queries. *Emerging technology in modelling and graphics* (pp. 55–60). Springer.
Smutny, P., & Schreiberova, P. (2020). Chatbots for learning: A review of educational chatbots for the Facebook Messenger. *Computers & Education, 151*, 103862.
Song, D., Oh, E. Y., Rice, M. (2017). Interacting with a conversational agent system for educational purposes in online courses. In *2017 10th international conference on human system interactions (HSI)*. IEEE.
Tuckey, M., Brewer, N., & Williamson, P. (2002). The influence of motives and goal orientation on feedback seeking. *Journal of Occupational and Organizational Psychology, 75*(2), 195–216.
Turkay, S. (2014). Setting goals: Who, why, how?. http://vpal.harvard.edu/publications/setting-goals-who-why-how
Winkler, R., & Söllner, M. (2018). Unleashing the potential of chatbots in education: A state-of-the-art analysis. In Academy of management annual meeting (AOM).
Wu, E.H.-K., et al. (2020). Advantages and constraints of a hybrid model K-12 E-learning assistant chatbot. *IEEE Access, 8*, 77788–77801.
Xu, X., et al. (2021). Industry 4.0 and industry 5.0—inception, conception and perception. *Journal of Manufacturing Systems, 61*, 530–535.
Yeadon, W., et al. (2022). The death of the short-form physics essay in the coming AI revolution. arXiv preprint arXiv:2212.11661.
Zimmerman, B. J. (2011). Motivational sources and outcomes of self-regulated learning and performance: Graduate center of city university of new york. In *Handbook of self-regulation of learning and performance* (pp. 63–78). Routledge.

Chapter 2
Designing a GAI-Assisted Pedagogical Task for Teaching Negotiation Skills: A Design Thinking Approach

Thanh-Thao Luong and Minh-Tuan Tran

Abstract Generative Artificial Intelligence (GAI) has been claimed to be capable of transforming the entire strategy of delivering education. This study embraces the perspective that GAI offers numerous opportunities to transform teaching and learning toward more innovative and creative approaches. Accordingly, this study attempts to design a GAI-assisted pedagogical task for teaching negotiation skills to business students. The proposed task, called "Negotiate with ChatGPT", focuses on two areas: (1) to provide opportunities for practicing negotiation and (2) to help students reflect on their experience of negotiation. Specifically, we use ChatGPT, an AI-powered language model, to conduct a role-play activity for students. Our task design process is guided and underpinned by the Design Thinking for Teaching (DTT) Framework. This compelling student-centered model helps us ensure that our intention to integrate GAI in teaching negotiation skills places learners at the heart of the teaching process. Following the DTT process, the "Negotiate with ChatGPT" learning activity is designed and described in detail. Future research needs to provide empirical evidence to demonstrate the effectiveness of this proposed teaching task in teaching negotiation skills.

Keywords Design thinking for teaching · Negotiation pedagogy · Generative artificial intelligence · GAI-assisted pedagogy · AI

T.-T. Luong (✉)
The Business School, RMIT University Vietnam, 702 Nguyen Van Linh, Ho Chi Minh City, Vietnam
e-mail: thao.luong3@rmit.edu.vn

M.-T. Tran
School of Science, Engineering, and Technology, RMIT University Vietnam, 702 Nguyen Van Linh, Ho Chi Minh City, Vietnam

J.-C. Hong (ed.), *New Technology in Education and Training*, Lecture Notes in Educational Technology, https://doi.org/10.1007/978-981-97-3883-0_2

2.1 Introduction

As technology advances at an extraordinary rate, it's unsurprising that various industries are beginning to experience the effects of automation and artificial intelligence (AI). Among these industries, education has been claimed to be particularly vulnerable to potential disruption caused by generative AI (GAI) technology (Crawford et al., 2023; Farrokhnia et al., 2023). However, those who welcome this technology to enhance the overall educational landscape have the potential to turn this emerging challenge into a chance for growth. This study embraces this perspective and attempts to design a teaching task that focuses on training negotiation skills.

In our proposed pedagogical task, we use a role-play designed by Gomolka et al. (1993) as a scenario for students taking negotiation training courses. What sets our teaching approach apart from other negotiation training exercises is our utilization of ChatGPT (OpenAI: GPT Model, 2023) in facilitating role-play activities for students while incorporating the Design Thinking for Teaching (DTT) framework (Cai & Yang, 2023) in the task's design process. By adhering to this student-centered model in our pedagogical task, we ensure that our aim to integrate GAI into teaching negotiation skills keeps learners at the core of the instructional process, prioritizing their experience over the intricacies of the advanced technology employed. Furthermore, we employ the strategy of "collaborating with AI black boxes rather than attempting to unveil their inner workings" (Bearman & Ajjawi 2023) to encourage meaningful learner engagement with AI. Accordingly, our paper is divided into the following parts: Sect. 2.1 is the introduction, Sect. 2.2 provides the theoretical underpinnings of our proposed GAI-assisted teaching task, Sect. 2.3 briefly explains the way how we adopt the DTT framework to design the teaching task, Sect. 2.4 describe our proposed task which is called "Negotiate with ChatGPT", and Sect. 2.5 concludes our paper.

2.2 Theoretical Underpinnings

2.2.1 A Framework of Design Thinking for Teachers

Design thinking refers to a problem-solving approach employed across various industries and disciplines, such as business management, science, and education. This approach focuses on designing solutions that place understanding and fulfilling human needs at the heart of the problem-solving process (Cai & Yang, 2023). Researchers and practitioners have claimed that, with its human-centered approach, design thinking has had a significant impact on the ways how strategies, products, services, and work procedures are designed and enhanced (Brown, 2008; Kolko, 2015). For business managers, it has always been among the best methods for either managing projects (Pande & Bharathi, 2020) or achieving innovation and creativity in designing products and services (Johansson-Sköldberg et al., 2013).

Although it has a long-established history in design industries and business management, design thinking had not been adopted in education until the Stanford University d.school in California's Silicon Valley and the HPI D-School of the Hasso Plattner Institute of Design in Potsdam (Germany) used it in their collaborative business or design-related study projects (Sándorová et al., 2020). Since then, design thinking has become a powerful tool for teachers to enhance instructional effectiveness through their adoption of learner-centered pedagogy underpinned by the design thinking philosophy (Henriksen et al., 2020). Also, design thinking has been used as a pedagogical framework to teach creativity and innovation skills to MBA students as it trains students to address management problems in a way similar to how designers approach design problems (Pande & Bharathi, 2020).

One of the reasons why design thinking has been increasingly and widely applied in education is that, just like in business contexts where practitioners have to deal with ill-structured scenarios, educational settings also involve complex contextual factors that require teachers to develop their exploratory and creative problem-solving skills. Henriksen et al. (2020) stresses that, as educators need to seek solutions for problems in teaching contexts, such as the differences in learning goals, cognitive capacity, learning motivations, and teacher-student relationships, they need to consider themselves as designers to understand and address such challenges innovatively. For this reason, theoretical frameworks have been proposed to guide the process of practicing design thinking in teaching. A well-known model is the Stanford Design Thinking Model (Plattner, 2013), which has five phases: (1) *Empathizing* with students to understand their underlying needs, (2) *Defining* the problems based on the needs analysis results, (3) *Ideation* refers to the process of generating a range of teaching ideas or learning activities to address the identified problems, (4) *Prototyping* is related to building a preliminary teaching plan to be conducted in the next step, and (5) *Testing* is the last phase where teachers try out the designed teaching plan with the target learners in real classroom settings.

Although the Stanford Design Thinking Model has been widely applied, it was not specifically designed for guiding and measuring teachers' design thinking perceptions and practices. However, it has been a theoretical foundation for the Design Thinking for Teaching (DTT) framework, which has been proposed and validated by Cai and Yang (2023). The DTT offers specific guidelines and measures for teachers' design thinking and has been confirmed by Cai and Yang (2023) to positively influence teachers' perceived instruction quality. It proposes four factors of design thinking for teaching: (1) *Problematizing*, (2) *Ideating*, (3) *Prototyping,* and (4) *Testing*. Details of this scale are demonstrated in Fig. 2.1.

This study adopts the DTT framework proposed by Cai and Yang (2023) to design a pedagogical task assisted by Generative Artificial Intelligence (GAI) to teach negotiation skills to business undergraduate students.

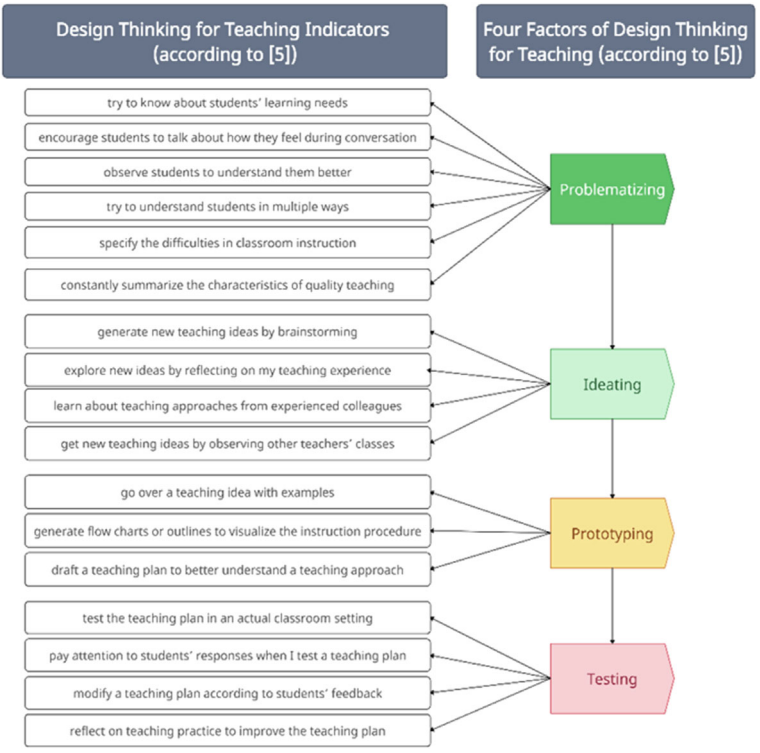

Fig. 2.1 Scale of design thinking for teaching, based on (Cai & Yang, 2023)

2.2.2 Teaching Negotiation Skills

Negotiation can be defined as a process in which two or more parties attempt to reach an agreement on what each will offer and receive from the other(s) (Aldhizer, 2013; Thompson, 1990). Negotiation is practiced not only in the workplace but also in individual daily life. For this reason, negotiation skills have been recognized as an essential competence for individual professional and personal development. It is not surprising that the World Economic Forum has placed negotiation in the top 15 skills that graduates need for their future careers in various industries or disciplines (World Economic Forum, 2020), and business schools around the globe have thus developed negotiation training courses to equip their students across study programs with negotiation principles, skills, and tactics. Tyler and Cukier (2005) provide some common objectives for negotiation training as follows:

- To impart some type of theoretical framework for understanding negotiation;
- To provide opportunities to practice negotiation;
- To reflect on students' experiences of negotiation;
- To encourage students to continue their learning process.

Teaching negotiation skills effectively remains a challenge for business educators as students need to not only acquire the theories but also be able to apply these theoretical underpinnings to their profession and personal lives (Oehlschläger & Merz, 2023). Accordingly, negotiation training often requires skill-based pedagogical techniques such as simulations or role-plays, which allow students to experiment and incorporate various strategies, concepts, principles, and tactics in a low-risk educational context (Butler, 2008; Oehlschläger & Merz, 2023; Rundle, 1986; Spencer & Hardy, 2008). The role-play should be concluded with a debriefing session to help students reflect and draw out meaningful learning for their future practice of negotiation (Butler, 2008). It should also be noted that role-play scenarios designed for negotiation training must be specific and contain sufficient details, or students will "waste valuable preparation and negotiation time asking questions about inane details, figures, and statistics" (Tyler & Cukier, 2005). Therefore, for role-plays to be effective, negotiation trainers need to ensure that they are "credible, relevant, and contextual" (Spencer & Hardy, 2008) and that they can lead students to embrace a rich reflection of their negotiation experience.

While negotiation training courses are often delivered face-to-face to assist in-person interaction and communication, studies show that information and communication technology (Oehlschläger & Merz, 2023) and virtual-human technology (i.e., explainable artificial intelligence) (Core et al., 2006) have already been used in teaching negotiation skills. Interestingly, the research by Core et al. (2006) has been among the few studies suggesting that explainable artificial intelligence can model human-like negotiation behavior to assist negotiation training. Nevertheless, Core et al. (2006) note that learners still need guidance from teachers or tutors to interact with virtual humans effectively and learn from the negotiation experience. In addition, the challenges in adopting these technological advances in negotiation training also lie in their inability to address negotiation problems that involve consideration of human emotions, attitudes, and desires.

The study conducted by Core et al. (2006) was published in 2006, and although it was funded by the United States Army Research, Development, and Engineering Command (RDECOM), the AI technology it offered at that time could not be compared to the AI technology that has been developed 15 years later. Indeed, the current AI technology, where ChatGPT is an example, offers numerous opportunities for business and management education (Tarabasz et al., 2018). Specifically, to use AI-based applications such as ChatGPT effectively in negotiation training, particularly in role-plays, there is a need to develop instructions and guidelines on using advanced technology such as AI to conduct skill-based training courses.

2.2.3 GAI-Assisted Pedagogy

Integrating AI into pedagogy is not new; however, it has been emphasized recently due to the great advances in machine learning, big data, and learning analytics. How AI can be embedded into management pedagogy, e.g., teaching negotiation

skills, has attracted researchers' attention. For this purpose, it is worth exploring the pedagogical requirements for teaching such skill sets and AI's abilities to support management pedagogy accordingly.

AI is a type of algorithm or computation method designed by inspiration to reflect models of human thinking, perceiving, and acting toward subject matters or solve problems (Winston, 1993). Among various methods, AI in recent years has been vastly applied to the generation of content and possible solutions to a particular problem. The significant number of such applications of AI coins the term Generative AI (GAI).

The ability of GAI to generate content complying with certain criteria and rules proposes a possibility to help students with learning new concepts, reinforcing the ability to recognize instances of concepts, distilling what is learned into knowledge, and applying it to pseudo-real-life situations. Specifically, GAI can perform the following tasks effectively and efficiently (Winston, 1993):

- Generate positive examples and negative ones to illustrate particular definitions and demonstrate what are examples for concept defined and what are not;
- Generate multiple activities that meet specific predefined criteria;
- Flexibly and promptly compose adaptive responses to learners' behaviors;
- Assess the quality of learners' behaviors;
- Suggest alternative behaviors for students' reference.

Indeed, there have been dozens of GAI systems that assist in teaching negotiation skills in various ways (Dinnar et al., 2021), such as:

- Generating human-like characters to role-play predefined-scenario negotiation with preset parameters, namely difficulty level and fixed points for agreement with learners, and providing learners with a range of predefined behaviors to choose from, in order to teach learners negotiation techniques or to help learners reinforce procedures;
- Analyzing learners' activities such as voice, text, posture, and facial expressions during several negotiation scenarios offered by the system, reporting learners' performance, and providing feedback to learners' negotiation behaviors;
- Generating responsive character to negotiate with learners on a given scenario without a clear point for agreement and replying adaptively to learners' responses.

Among these approaches, we propose that a GAI-assisted pedagogical system can support educators in composing role-play scenarios and adaptively delivering the role-plays with participants' responses and progress for effective negotiation training. Among the currently available GAI systems which can generate role-play scenarios for negotiation training, ChatGPT is the most capable (Haleem et al., 2022).

ChatGPT is a natural-language-processing AI product of the OpenAI organization (https://openai.com). Introduced for the first time in the form of a research project in 2020 and launched to the public in late 2022, ChatGPT has been growing significantly in the number of users and getting vastly popular. The -GPT stands for Generative

Pre-trained Transformer, a machine learning model capable of understanding ordinary (or natural) languages and composing as well as generating ordinary language-based responses. Therefore, ChatGPT can perform tasks related to languages, such as composing documents, answering questions, conversing, tutoring, translating, and role-playing (OpenAI: GPT Model., 2023). We can use ChatGPT by signing up an account with OpenAI at the link https://platform.openai.com/signup. ChatGPT can be used in the same way as online messages are sent and received.

ChatGPT is diverse in topics and human-like tones of communication. It can join conversations with a wide range of complexity levels, from everyday conversation to expertise-related matters. A case report (Haleem et al., 2022) studied the usage of ChatGPT and showed that it had been involved in various contexts, from business to academic works. It has done various tasks, from generating texts, examining documents, comparing essays, giving feedback, composing papers, and dialoguing in real time. Despite a few incorrect or out-of-context replies, ChatGPT provides logical responses when conversing in decently set contexts, such as assignments or negotiation role-play scenarios in university courses.

2.3 Research Methodology

Among the most commonly shared objectives of negotiation training courses (Tyler & Cukier 2005), this study attempts to design a teaching task that focuses on two areas: (1) to provide opportunities for practicing negotiation and (2) to help students reflect on their experience of negotiation. In our proposed pedagogical task for reaching these two goals, we use a role-play offered by Gomolka et al. (1993) as a scenario for students taking negotiation training courses. The role-play was selected because it meets the requirements for role-plays used in negotiation training courses, i.e., credible, relevant, and contextual (Butler, 2008; Oehlschläger & Merz 2023; Rundle, 1986; Spencer & Hardy, 2008; Tyler & Cukier 2005).

What makes our teaching task different from other negotiation training activities is that we incorporate ChatGPT in conducting the role-play activity for students while adopting the Design Thinking for Teaching (DTT) Framework (Cai & Yang, 2023) during the process of designing this task. As this compelling student-centered model underpins our pedagogical task design process, we can ensure that our intention to integrate GAI in teaching negotiation skills places learners at the heart of the teaching process (rather than how the advanced technology is used). We also employ the approach of "working with AI black boxes rather than trying to see inside the technology" (Bearman & Ajjawi, 2023) to promote learner interactions with AI. The following sections describe how we employ the DTT framework in designing a GAI-assisted pedagogical task to teach negotiation skills.