



Chatbots in maritime education – the potential of chatbot technology in the maritime industry

Veneta Hristova¹, Bogusz Wiśnicki²✉, Piotr Wolejsza³

¹  <https://orcid.org/0000-0002-2511-2987>

²  <https://orcid.org/0000-0003-2932-8969>

³  <https://orcid.org/0000-0003-4284-5223>

¹ St. Cyril and St. Methodius University of Veliko Tarnovo, Bulgaria

^{2,3} Maritime University of Szczecin, Poland

e-mail: ¹vhristova@ts.uni-vt.bg, ²b.wisnicki@pm.szczecin.pl, ³piotr@pm.szczecin.pl

✉ corresponding author

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Abstract

The presented research shows the possibilities of using chatbot technology in the maritime industry. The authors pay special attention to maritime education, broken down into standard and complementary education. The research is based on the results of a survey, which addresses students of five European maritime universities and examines their opinions about chatbots. Additionally, analogies are applied to the case studies of the successful implementation of chatbots in non-maritime businesses. This research determines the current status and development opportunities of maritime chatbots.

Introduction

The rapid development of information and communications technology (ICT) in recent years has decisively redrawn business and educational horizons, and the COVID-19 pandemic has also redrawn our way of life. The technological solutions developed up to this point offer good options but can be considered more as alternatives to current models. After 2020, technologies entered all spheres of our economy and society with a definite sweep, proving that limitations are actually opportunities for effective change. One of these relatively new communication tools that is increasingly being used is the chatbot. Although the first such programs were created way back in 1966 (The Harvard Gazette, 09, 2012), today, increasingly more research proves the entry of artificial intelligence into all spheres

of human activity, and the chatbot (or simply bot) is perceived as an integral part of everyday life. A chatbot is a communication tool, a program that automatically responds to certain queries by creating the feeling of having a conversation with a person. This “virtual” interlocutor answers questions through answers in databases, reacts to certain commands, and can also deliver certain information. Currently, chatbots are primarily used to connect with customers and serve as a tool to increase sales, but their application goes far beyond that. One of the more underutilized areas of their application turns out to be education. The present development focuses on precisely this by seeking answers to two research questions:

1. How are chatbots used in education?
2. What is the role of chatbots in maritime education and business?

Literature review

The first appearance of a chatbot is usually associated with the development of ELIZA by Joseph Weizenbaum in the 1960s (Adamopoulou & Moussiades, 2020b). It is a relatively simple but effective natural language processing program for human-machine communication, simulating therapy sessions. From this first attempt to the present day, chatbots have been intensively researched both in the direction of theoretical studies and their practical application (Brown et al., 2020; Caldarini, Jaf & McGarry, 2022). The theoretical interest in them can be traced via the number of publications on this topic in primary and scientific databases (Figure 1), which shows that around, during, and after the pandemic, there is an almost two-fold increase in research connected with this focus. The same trend is observed in the number of publications, the subjects of which are chatbots and education (Figure 2).

A significant number of authors with key contributions can be found in the literature. At least the following studies should be mentioned: the article ‘Learning Phrase Representations using RNN Encoder-Decoder for Statistical Machine Translation’ (Cho et al., 2014), in which a novel neural network model called RNN Encoder-Decoder is proposed that consists of two recurrent neural networks; the new simple network architecture, called Transformer, that is crucial to the development

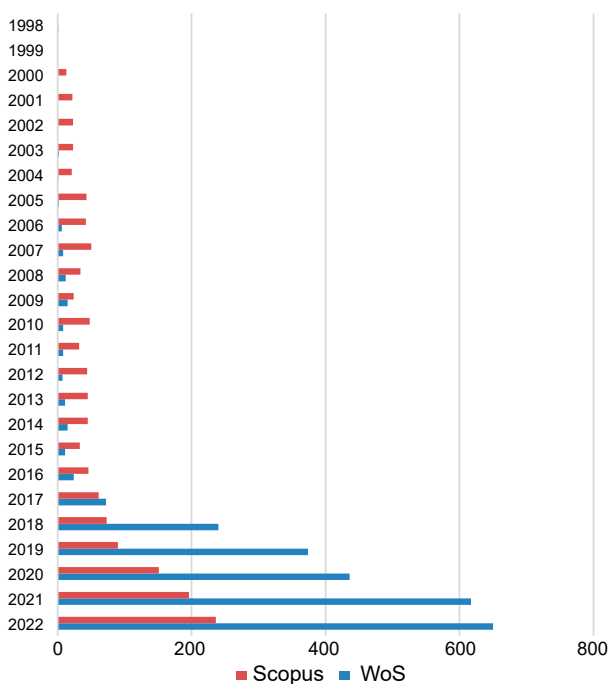


Figure 1. Publications with the topic of chatbot and connected terms in Scopus and WoS

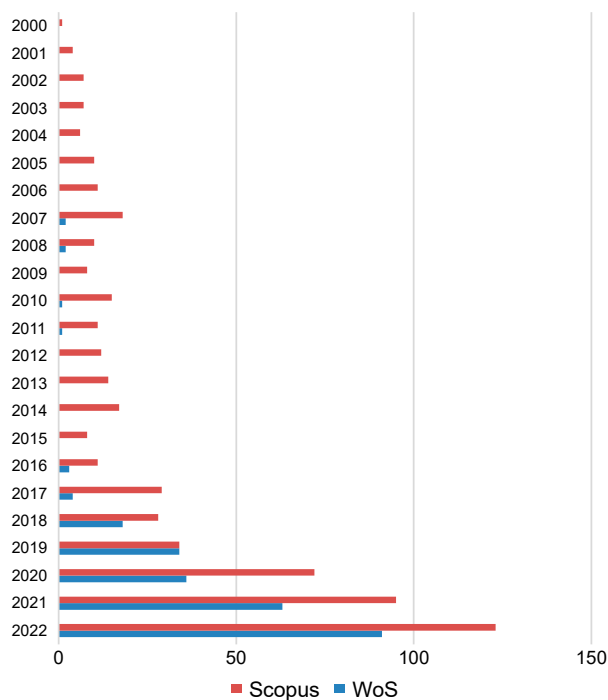


Figure 2. Publications with the topic of chatbot and education in Scopus and WoS

of powerful and efficient natural language processing models (Vaswani et al., 2017); the BERT model for pre-training transformers, which achieves impressive results in a wide range of NLP tasks (Delvin et al., 2019).

A significant leap in the development of chatbots is taking place with the wider adoption of artificial intelligence, and here we should note the development of OpenAI (2020), in which a complex model for natural language processing is presented, which demonstrates the possibility of repeated prediction and learning with little examples, called GPT-3.

Main areas of chatbot application

The use of chatbots is applied by companies mainly to serve their customers; it significantly helps to increase user experience. Chatbot programs serve as assistants that help with online shopping and tracking orders. In other words, they serve to simplify the purchase process, thus forming a positive shopping experience. At the same time, they can provide customized services as well as integrate various others for the specific user. Increasingly, the software of some of the chatbots incorporates artificial intelligence, which “remembers” the queries and answers of the user and, in subsequent communication with the user, upgrades the communication exchange. Not surprisingly, experts predict that 90% of customer interaction in banks will be automated

by 2022 (Jovic, 2023). What makes a chatbot such a recognizable tool by companies? The indisputable arguments in support of their implementation are in the following directions: undoubtedly, the 24-hour operation of the bot is one of its most serious advantages, this software solution is easy to use and works without interruption throughout the day and weekends, and it allows you to work with clients from all over the world, effectively eliminating the difficulties that come from their location. In addition, it can promote new products, collect valuable marketing information for each company, receive feedback from customers, collect data on their behavior, and more (Speedflow, 2017; AI Multiple, 2022). These benefits have spread the usage of chatbots not only among large companies but also among small- and medium-sized ones, and their application is not limited either in terms of their field of work or the specific way of use. The most common areas of chatbot use are in the areas of insurance, finance, hotel, real estate, restaurants, and therapeutic advisors (Phaneuf, 2020).

In the future, trends in the use of chatbots indicate their stable popularity. This is evident from the relentless interest in searching for information about them on the internet (Figure 3). According to Google Trends, users continue to be interested in this topic as during the “first wave” of the Covid-19

pandemic we can see the highest levels of interest to them.

The entry of chatbots should also be considered through the prism of their diversity. According to Nimavat and Champaneria (Nimavat & Champaneria, 2017), the classification of chatbots can be completed based on the knowledge they have access to, their level of interaction, and the method of generating the response. They suggest that the types of chatbots can be divided into four major groups as follows (Figure 4):

- Based on the knowledge to which they have access or the amount of data to which they are trained, chatbots can be distinguished by the following types: open domain (can talk on common topics and respond appropriately) and closed domain (focused on a specific area of knowledge but may not answer other questions).
- According to the type of service provided, bots are subdivided into interpersonal bots (they provide services such as restaurant reservations, air travel, bots with frequently asked questions, etc.; they are supposed to receive information and transmit it to the user, they can be friendly to consumers, and they are likely to “remember” information about them); intrapersonal bot (perform tasks that are in the user’s personal domain) and inter-agents (will be widespread in the dominant areas

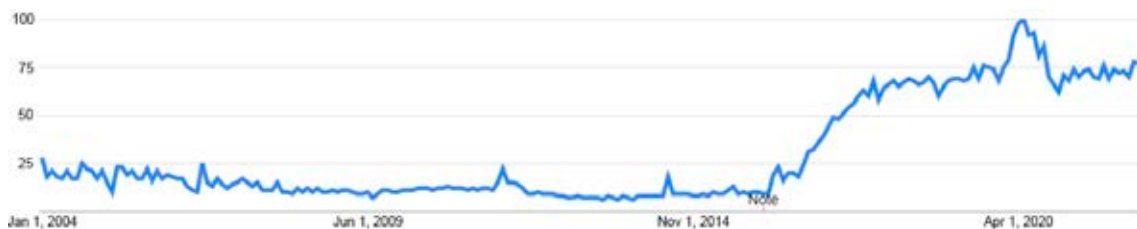


Figure 3. Global search trends for the word “chatbot” from Google Trends (01.2004 – 04.2022) (Google, 2022)

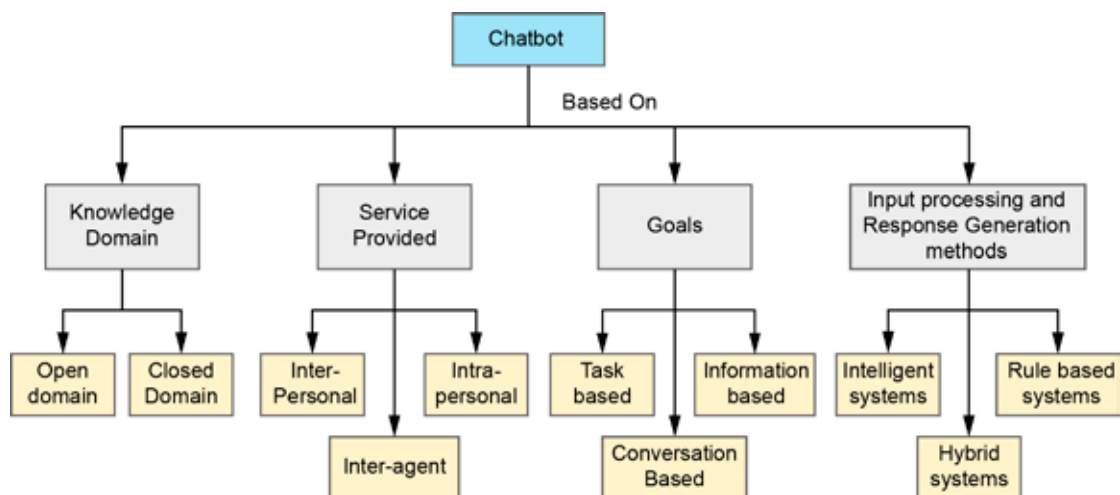


Figure 4. Classification of the chatbot according to Nimavat and Champaneria (Nimavat & Champaneria, 2017)

of the internet of things (IoT), these bots communicate with each other to perform a specific task).

- From the point of view of the goals that the chatbots fulfill, we find informational (designed to provide the user with information that is stored in advance or is accessible from a fixed source), chat-based / chatbots (they talk to the user like another human with the goal of responding correctly to the sentence given to them, e.g., Siri, Alexa), and task-based (perform a specific task, such as booking a flight or help when browsing, for example, at the store).
- According to the methods for processing input and response generation, chats are intelligent systems (they generate responses and use natural language comprehension to accept the request), which are rule-based systems that use image matching and can be employed when the number of possible outcomes is fixed and the scenarios are clearly outlined. The last species – the hybrid – is a combination of the previous two kinds.

Adamopoulou and Moussiades (Adamopoulou & Moussiades, 2020a) added another two classifications to those that are outlined by the authors given above: the amount of human-aid in their components

(human-aided chatbots utilize human computation in at least one element from the chatbot) and the build method (according to the permissions provided by their development platform – developed in open-source or closed platforms).

According to chatbot technology, two main types of chatbots can be outlined; lately, we can also speak of the hybrid model. The short characteristics of these types of chatbots are presented in Figure 5.

Chatbots have significantly evolved from their invention to the present day; today, we can talk about “understanding” bots, similar to the perceptions that people have. This evolution can be traced in Figure 6. What the future holds is yet to be seen, but surely, there will be a variety of chatbots that include education as one of the spheres preferred for their application.

Chatbots in education

Education is a rather fresh application that is still a developing area in which chatbots are used. Only 7% of respondents to the questionnaire (see iSOL-MET Survey) used a chatbot for educational purposes. Only 6% of Facebook Messenger chatbots

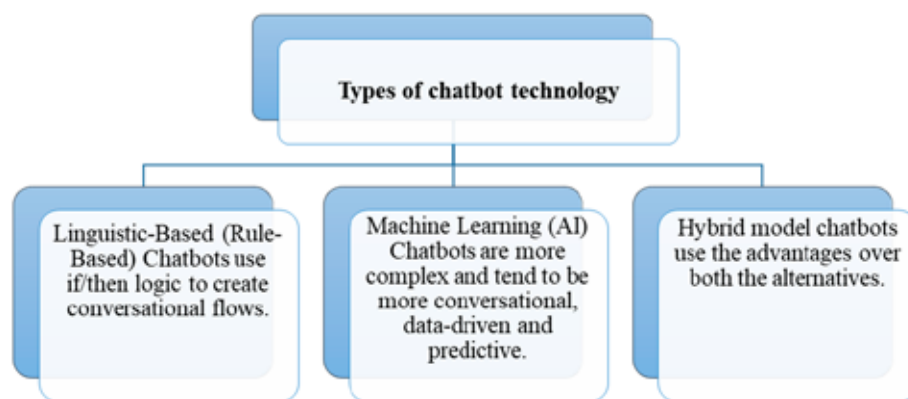


Figure 5. Chatbot based on types of technology (Artificial Solutions, 2020)

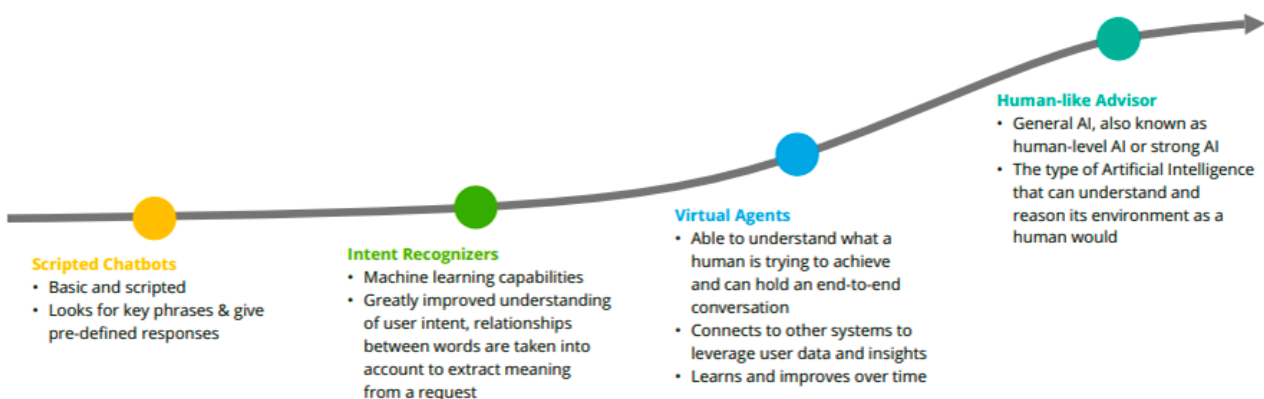


Figure 6. Evolution of conversational AI (Deloitte, 2018)

are employed in the education category (Smutny & Schreiberova, 2020). Distant learning, forced mainly by the COVID-19 pandemic, heavily influenced the approach to the education process. Many new tools have been developed or refreshed since the beginning of the pandemic. In the first phase, the focus was mainly on tools that ensure effective video communication, like Skype, Zoom, MS Teams, Google Meet, etc. Established in 2002, the Moodle platform became very popular again. After meeting the basic needs, i.e., communication, developers began to offer tools that not only enable but also improve the process of remote education. There is no doubt that chatbots are such tools. The important element of the mentioned process is also monitoring academic records at a higher education institution. Although the system is usually already available in the form of a website, it is still considered too complicated because it must involve a troublesome authentication process, especially for parents. Nowadays, chat applications are widely used by the community, both young people and even the elderly (Heryandi, 2020). This is just one example of applications; however, the mainstream of development is typical educational chatbots. Such a chatbot is planned to be delivered as the result of the international project BOT-Learning as a modern teaching method for GEN Z (Science4People, 2022). As an example, an entrepreneurship course will be created. However, the idea is to create a generic application that can serve other topics and courses. On the ERASMUS + Dissemination Platform, there are 13 projects that contain the word “chatbot” in the title or description (ERASMUS, 2021). Only three of them started before 2019, which shows the strong “chatbot trend” in education projects.

The pandemic and distance education are the only factors that accelerated the global trend. In recent years, the number of students per lecturer has constantly risen (Nicol & Macfarlane-Dick, 2006). At universities, there are many lectures with more than 100 students. Individualized support provided by lecturers is nearly impossible (Brinton et al., 2015). Lack of individualized support leads to weak learning outcomes, high dropout rates, and dissatisfaction. The best solution is to have one teacher per student. Due to financial and organizational restrictions, this is impossible (Oeste et al., 2015).

Chatbots have the potential to solve this problem using examples of other sectors. Chatbots have a growing presence in modern society, becoming integral parts of everything from personal assistants on mobile devices to technical support help over

telephone lines, and even being used for health interventions (Winkler & Söllner, 2018).

In 2015, the size of the chatbot market comprised 113 million US dollars and is projected to be 994.5 million US dollars in 2024 (Berg, Gilson & Phalin, 2016). The usage of messaging apps in the past years has also increased. In 2016, it was estimated that about 75% of all smartphone users used some sort of messaging app (Maruti Techlabs, 2022). Moreover, analysts predict that, by 2020, 30% of all web browsing sessions will be done without a screen, 50% of all searches will be by voice commands, and customers will manage 85% of their enterprise relationships without interacting with a human (Gartner, 2016).

Chatbots in maritime education and business (iSOL-MET Survey)

The goal of the survey, which was executed during the spring school of the project Innovative SOft Skills to Maritime Education and Training (iSOL-MET), funded by the Erasmus+ Programme of the European Union, was to determine the current status of maritime chatbot development. The anonymous questionnaire was addressed to students who were soon to launch their careers in maritime economy enterprises, i.e., as seafarers, sea transport operators, port terminal operators, forwarders, and customs agents. The 60 students participating in the survey, representing five major European maritime universities, were in the last two years of their study program in the fields of navigation, ship mechanics, and port and fleet exploitation. According to students' declarations, 62% of them represent technical study specializations (i.e., informatics, engineering, technology, military, etc.) and 38% non-technical ones (management, economics, law, etc.). Importantly, the student placement, which lasts several months, gives them an opportunity to make observations and draw conclusions concerning ship operations, crew management, ship-to-port operations, as well as cooperation with shippers and freight forwarders. Obviously, the students are not familiar with all the factors determining the maritime industry. Nonetheless, their impartial and long-term perspective and perception of the shipping and related markets are valuable. As representatives of the Z generation, they are technology savvy and have well-developed sustainability awareness, with many of them engaged in sustainability initiatives. Information about the study sample is provided in Table 1.

Table 1. Characteristics of respondents

University	Number of respondents	Technical specialization	Non-technical specialization
University of the Aegean, Greece	14	64.3%	35.7%
Nikola Yonkov Vaptsarov Naval Academy, Bulgaria	12	66.7%	33.3%
T. C. Piri Reis Universitesi, Turkey	15	60.0%	40.0%
Universitatea Maritima Din Constanta, Romania	9	66.7%	33.3%
Szczecin Maritime University, Poland	10	50.0%	50.0%
Total/Average	60	61.7%	38.3%

The survey questions prompted respondents to identify the current and future potential of chatbot technology in maritime education. The survey included the following questions:

- Q1 Have you ever interacted with a chatbot?
 Q1a If YES, what was the purpose? (please name the website/company/institution/brand). Did you like it?
 Q2 Have you ever used an educational chatbot?
 Q2a If YES, please share your experience. What content was provided by this chatbot? Was it helpful?
 Q3 How do you see the perspective of using chatbots in maritime education or maritime business?

The responses received were meaningful and inspiring. The structure of the answer to the first question is very important, i.e., it tells us that as many as 58% of students have not had any experience relating to chatbots (Figure 7). This confirms the initial phase of the market implementation process of the chatbot technology, also in the target group of young 20–30-year-old consumers. It is also information with a very high development potential, conditioned by appropriate marketing activities.

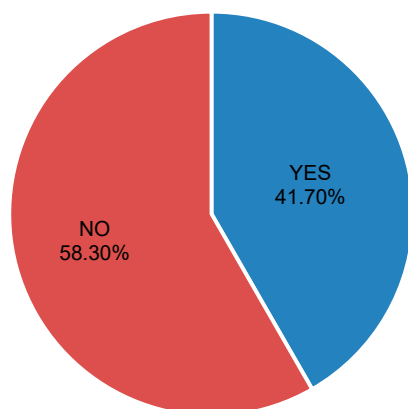


Figure 7. Answers to Q1: “Have you ever interacted with a chatbot?”

An additional question (Q1a) on where the student used the chatbot provided a variety of answers. In the vast majority of responses, chatbot functionality was associated with the tools obtained from selected social media, entertainment, instant messaging, and online stores. The indications that were repeated in the answers include *Telegram*, *Facebook*, *Netflix*, *Simsimi*, *Siri*, *Cleverbot*, and *Trendyol*. Other indications were quite precise: “... when I had a problem with my email”, “... for a gym registration”, “... It was about telephone and post company”, and “call centers”. All these chatbot applications combine the goal of automating and improving customer service.

Quite surprising is the marginal number of students, i.e., 4 out of 60, who interacted with an educational chatbot (Figure 8). Only one answer given to Q2a clearly indicated the chatbot’s educational functionality: “It provided information about movies”. The other three replies do not provide any conclusions.

Many valuable responses were attained from Question 3, which relates to the prospects of using chatbots in maritime education or maritime business. The collected 60 responses can be divided into

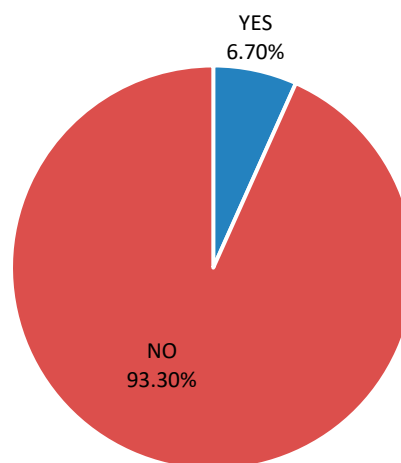


Figure 8. Answers for Q2: “Have you ever used an educational chatbot?”

positive, neutral, and negative. The vast majority, as many as 48 out of 60, were positive. Repeatedly entrusting answers included the following phrases: *useful, efficient, and very interesting*. It is worth highlighting a set of ten self-explanatory arguments given by different students:

- 1) *“I think it can be very useful. It would be a helpful tool to have, maybe ask about jobs, specific terminology and information.”*
- 2) *“A very good approach to digitalization.”*
- 3) *“That has a big potential to be used, but we need to remember that the human teachers are very important. I think the chatbots can be used as help for the teachers.”*
- 4) *“Much easier for students. It will facilitate the process.”*
- 5) *“It’s a really good perspective. We have other opportunities to learn.”*
- 6) *“Highly helpful as people with special needs can be recruited, too.”*
- 7) *“Like everything, if they ease the human job, why not?”*
- 8) *“It could also be a good opportunity to develop additional skills and knowledge.”*
- 9) *“... it can be used as a good practice tool, especially about topics such as giving and taking orders and performing tasks during the bridge or engine watches, I think they could bring simulations to a new level via proper use.”*
- 10) *“It can be a means of communication with the board or organizations for information purposes, or information similar to the changes made in the law can be accessed quickly by asking a question.”*

In the group of neutral responses, those related to the lack of knowledge of the respondents about chatbots prevailed, e.g., *“I don’t know”* or *“No idea. I never tried it before”*. However, one answer is particularly important because it gives a quality condition relating to the functionality of the chatbot. This answer is: *“I think it would be really helpful, but only if the chatbot is designed properly, being able to provide us with an immediate and correct resolution.”*

Four responses were in the negative group. Of these, three are backed up by significant argumentation:

- 1) *“Personally, I believe it’s not a good idea because we need critical thinking on both maritime education and business. We need an ‘out of the box’ way of process in order to make progress, not just some options we can choose from.”*
- 2) *“I think that nothing is better than ‘real’ education. People are programming robots to teach*

students by installing them some ‘ready’ sentences. What about questions from students if they do not understand something? The robot has the same ‘recipe’ for all.”

- 3) *“I think chatbots can take over the world. They must be destroyed!”*

Conclusions

Having in mind the successful implementation of chatbots in business “on land”, the authors assume that their adaptation to “sea conditions” will come soon. From the point of view of considerations about the future, it was important to focus the research on young people, the future managers in the maritime sector. The study group of 60 students who took part in the research process was not very large, but it was selected in such a way that it fully reflected the maritime education market in Europe, both in terms of geographical selection and teaching areas. General and specific research conclusions include:

1. Chatbot technology is developing rapidly and is effectively implemented in services. Education, including maritime education, is at the beginning of this process.
2. Existing e-learning solutions during the pandemic will be further developed, and there is a demand for new technologies.
3. European maritime school students have no experience with educational chatbots, but the vast majority are positive about the perspective of using chatbots in maritime education and maritime business.
4. Students at maritime universities point to the great importance of the chatbot quality and the possibility of using this technology in the following areas:
 - employing people with special needs in the shipping industry,
 - crewing and crew management processes,
 - remote complementary education of seafarers,
 - on-board procedures and ship-shipowner and ship-terminal communication.

We can tentatively claim that the application of chatbots in education is yet to expand, and in the near future, this will grow into solutions based on artificial intelligence. The use of different types of chatbots will expand as they become an integral part of modern learning. Their wide applicability in different fields of study will provide even more chances for maritime students to learn with the help of bots.

References

1. ADAMOPOULOU, E. & MOUSSIADES, L. (2020a) An Overview of Chatbot Technology. In: Maglogiannis, I., Iliadis, L., Pimenidis, E. (eds) *Artificial Intelligence Applications and Innovations. AIAI 2020. IFIP Advances in Information and Communication Technology* 584. Springer, Cham, doi: 10.1007/978-3-030-49186-4_31.
2. ADAMOPOULOU, E. & MOUSSIADES, L. (2020b) Chatbots: History, technology, and applications. *Machine Learning with Applications* 2, 100006, doi: 10.1016/j.mlwa.2020.100006.
3. AI Multiple (2022) *Top 15 Chatbot Benefits in 2022 For Companies & Customers*. [Online]. Available from: <https://research.aimultiple.com/chatbot-benefits> [Accessed: May 27, 2022].
4. Artificial Solutions (2020) *Chatbots: The Definitive Guide (2020)*. [Online]. Available from: www.artificial-solutions.com [Accessed: May 27, 2022].
5. BERG, J., GILSON, K. & PHALIN, G. (2016) *Winning the expectations game in customer care*. [Online] September 7. Available from: <https://www.mckinsey.com/business-functions/operations/our-insights/winning-the-expectations-game-in-customer-care> [Accessed: May 27, 2022].
6. BRINTON, C.G., RILL, R., HA, S., CHIANG, M., SMITH, R. & JU, W. (2015) Individualization for Education at Scale: MIIC Design and Preliminary Evaluation. *IEEE Transactions on Learning Technologies* 8 (1), pp. 136–148, doi: 10.1109/TLT.2014.2370635.
7. BROWN, T., MANN, B., RYDER, N., SUBBIAH, M. et al. (2020) Language Models are Few-Shot Learners. In *NIPS'20: Proceedings of the 34th International Conference on Neural Information Processing Systems*, Article No. 159, pp. 1877–1901, doi: 10.48550/arXiv.2005.14165.
8. CALDARINI, G., JAF, S. & MCGARRY, K. (2022) A Literature Survey of Recent Advances in Chatbots. *Information* 13 (1), 41, doi: 10.3390/info13010041.
9. CHO, K., VAN MERRIËNBOER, B., GULCEHRE, C., BAHDANAU, D., BOUGARES, F., SCHWENK, H. & BENGIO, Y. (2014) Learning Phrase Representations using RNN Encoder–Decoder for Statistical Machine Translation. In *Proceedings of the 2014 Conference on Empirical Methods in Natural Language Processing (EMNLP)*, pp. 1724–1734, Doha, Qatar, Association for Computational Linguistics, doi: 10.3115/v1/d14-1179.
10. Deloitte (2018) *Chatbots point of view*. [Online]. Available from: <https://www2.deloitte.com/content/dam/Deloitte/nl/Documents/deloitte-analytics/deloitte-nl-chatbots-moving-beyond-the-hype.pdf> [Accessed: May 27, 2022].
11. DEVLIN, J., CHANG, M.W., LEE, K. & TOUTANOVA, K. (2019) BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding. In *Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 1 (Long and Short Papers)*, pp. 4171–4186, Minneapolis, Minnesota. Association for Computational Linguistics, doi: 10.18653/v1/N19-1423.
12. ERASMUS (2021) *Projects connected with a bot*. [Online]. Available from: https://ec.europa.eu/programmes/erasmus-plus/projects_en#search/project/keyword=chatbot&matchAllCountries=false [Accessed: February 14, 2021].
13. Gartner (2016) Gartner Predicts a Virtual World of Exponential Change – Smarter With Gartner. [Online] October 18. Available from: <https://www.gartner.com/smarterwithgartner/gartner-predicts-a-virtual-world-of-exponential-change/> [Accessed: May 27, 2022].
14. Google (2022) *Chatbots 2004–2022*. [Online]. Available from: <https://trends.google.com/trends/explore?date=all&q=chatbot> [Accessed: May 27, 2022].
15. HERYANDI, A. (2020) Developing Chatbot For Academic Record Monitoring in Higher Education Institution. *IOP Conference Series: Materials Science and Engineering* 879 (1), 012049, doi:10.1088/1757-899X/879/1/012049.
16. JOVIC, D. (2023) *The Future is Now – 37 Fascinating Chatbot Statistics*. [Online] June 17. Available from: <https://www.smallbizgenius.net/by-the-numbers/chatbot-statistics/#gref> [Accessed: July 27, 2023].
17. Maruti Techlabs (2022) Why can chatbots replace Mobile Apps immediately? [Online]. Available from: <https://www.marutitech.com/why-can-chatbots-replace-mobile-apps-immediately/> [Accessed: May 27, 2022].
18. 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), pp. 199–218, doi: 10.1080/03075070600572090.
19. NIMAVAT, K. & CHAMPANERIA, T. (2017) Chatbots: An overview Types, Architecture, Tools and Future Possibilities. *IJ-SRD – International Journal for Scientific Research & Development* 5 (07), pp. 1019–1026.
20. OESTE, S., LEHMANN, K., JANSON, A., SOLLNER, M. & Leimeister, J.M. (2015) Redesigning University Large Scale Lectures: How To Activate The Learner. *Academy of Management Proceedings* 2015 (1), 14650, doi: 10.5465/AMBPP.2015.14650abstract.
21. PHANEUF, A. (2020) *7 real examples of brands and businesses using chatbots to gain an edge*. [Online] February 12. Available from: <https://www.businessinsider.com/examples-brands-companies-chatbots-business-2017-10> [Accessed: May 27, 2022].
22. Science4People (2022) BOT-Learning as a modern teaching method of GEN Z. Strategic Partnership for Higher Education, ERASMUS +, project number 2020-1-PL01-KA203-081777. [Online]. Available from: <https://bot.science4people.eu/> [Accessed: May 27, 2022].
23. SMUTNY, P. & SCHREIBEROVA, P. (2020) Chatbots for learning: A review of educational chatbots for the Facebook Messenger. *Computers & Education* 151 (5), 103862, doi: 10.1016/j.compedu.2020.103862.
24. Speeflow (2017) *What is Chatbot and how will it help your business?* [Online]. Available from: <https://speedflow.bg/blog/what-is-a-chatbot/> [Accessed: May 27, 2022].
25. VASWANI, A., SHAZEER, N., PARMAR, N., USZKOREIT, J., JONES, L., GOMEZ, A.N., KAISER, Ł. & POLOSUKHIN, I. (2017) Attention is all you need. In *NIPS'17: Proceedings of the 31st International Conference on Neural Information Processing Systems*, pp. 6000–6010, doi: 10.5555/3295222.3295349.
26. WINKLER, R. & SÖLLNER, M. (2018) Unleashing the Potential of Chatbots in Education: A State-Of-The-Art Analysis. *Academy of Management Proceedings* 2018 (1), 15903, doi: 10.5465/AMBPP.2018.15903abstract.

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