DEVELOPING A DIGITAL TOOL FOR RAISING AWARENESS OF MOBILE BULLYING

Portia Mathimbi [1,2]

[1]Department of Information Systems, University of Cape Town,
Cape Town, South Africa
[2]Department of Computer Science, University of South Africa,
Florida, South Africa

ABSTRACT

It is common for social scientists to consider building awareness interventions when faced with a social issue. The aim of which is to share knowledge about the issue at hand and inform society about the dangers, and possible responses. For example, raising awareness of healthy eating, including the benefits thereof and the dangers of lifestyle diseases. Or for raising awareness of information security, including the safe use of information technology resources about the dangers of technology abuse. One of the information security issues at hand is the bullying that takes place on mobile devices (mobile bullying), which has been increasing in recent years, especially among adolescents. The problem with mobile bullying is that it has severe consequences such as suicide and mental health difficulties. Despite current interventions, mobile bullying remains on the rise. The current study followed the design science research process to develop a digital artefact in the form of a chatbot to raise awareness of the mobile bullying social issue. The findings of this study reveal that information systems artefacts such as chatbots make awareness possible because they are easy to use, accessible to mobile device users, and allow for one-on-one confidential conversations with the users in the privacy of their mobile devices. The use of a chatbot is also scalable and makes it easy to reach a large audience through mass communication of awareness messages. The conversational element allows the users to direct the conversation, as opposed to it being push notifications.

KEYWORDS

Artefact development, awareness intervention, cyberbullying, technology abuse, design science.

1. INTRODUCTION

Awareness interventions may be proactive to prevent or reduce the likelihood of an undesired event, or reactive to respond to the occurrence of an undesired event. As the use of information technology expands to domestic purposes and mobile applications for convenience, education, and efficiency, so do digital harms such as bullying [1], [2]. With bullying now taking place online and, especially with the use of personal mobile phones; mobile bullying has become a growing social problem which requires the development of various interventions to raise awareness of this problem [3]. The term "mobile bullying" describes the practice of using mobile technology to bully others [4]. The phenomenon of mobile bullying has detrimental effects, particularly when it results in suicide or physically violent outbursts [5], [6]. Despite current interventions, the prevalence of mobile bullying is still rising [7]. Existing interventions are not enough to stop the increase in mobile bullying [8], [9]. According to several studies [10], [11], [12], the persistence of mobile bullying can be ascribed to both a lack of awareness and the inefficiency of current interventions. As such, it remains necessary to make efforts towards raising awareness of mobile bullying.

This study employed design science for the development of an information systems artefact whose function was to raise awareness of mobile bullying. The use of awareness interventions to inform society was seen on a global scale in recent years about the spread of the coronavirus outbreak. There are many awareness interventions implemented across industries and social contexts. The study poses the following question, "How can a digital tool be developed and used to raise awareness of mobile bullying"? Awareness has been defined as knowing what is going on in the surrounding environment. Awareness is to develop a mindful and acknowledging that an issue or topic exists [13]. Although most of the awareness literature merely refers to the term in passing without a definition, with the implicit assumption that the reader will use the dictionary definition [14], [15], [16]. The Cambridge Dictionary defines awareness as: "Knowledge that something exists or understanding of a situation or subject at present, based on information or experience". (Cambridge Dictionary).

The process of raising awareness is closely related to learning such that awareness requires learning [17]. Learning is the process of acquiring a skill as an outcome of the learning process. A person can only become aware of an issue, after having learnt about that issue. The learning process does not have to be formal, structured, or intentional, for someone to develop awareness. Furthermore, the term, "awareness" has been used extensively in literature to refer to an individual's consciousness and comprehension of what is going on around them, especially in the research area of cyber security awareness and health risk awareness [18], [19].

In addition, learning processes can help raise awareness, especially situational awareness. Situational awareness is the ability of an individual to observe, comprehend, learn from, and act on the elements of their environment or situations, to project possible future events in the same environment [20], [21], [22]. Therefore, an individual's failure to observe, comprehend, learn from and or act on the elements of the environment to project possible future events and plan future actions in their environment constitutes a lack of awareness.

This study aimed to raise awareness in the context of mobile bullying amongst adolescents. Similarly concerning mobile bullying, it could be said that an individual lacks awareness of mobile bullying when that individual has failed to observe mobile bullying in their environment, does not comprehend the implications that mobile bullying has on their daily activities or goals, and cannot project possible future occurrences of mobile bullying in their environment [23].

2. RELATED WORKS

Research on mobile bullying has focused on what tools to use in reducing mobile bullying as well as the factors that give rise to mobile bullying such as culture, the social environment and age [24], [25]. For those who reported on awareness, it was often an auxiliary concept contributing to the need for more resources on reducing mobile bullying [26]. On the other hand, the term awareness has been used to refer to the lack of teacher and parent knowledge on bullying activities among children and not to refer to awareness education [27], [28]. In addition, awareness is used to refer to the escalating occurrence of the phenomenon [26]. Awareness in this context includes knowledge of the phenomenon, its enablers as well as possible responses.

Awareness of mobile bullying as a topic has received little attention compared to other behavioural topics about mobile bullying [12]. There is therefore a lack of research focused on raising awareness of mobile bullying in the form of active awareness education and training similar to awareness education and training conducted for information security and privacy [29], [30]. This study adopted the definition and builds upon the work of [3], concerning the working definition of mobile bullying "awareness". The phrase, "Mobile bullying awareness" is henceforth used to refer to possessing knowledge about the kind of behaviour that is considered

mobile bullying behaviour; and also knowing about the enablers of this behaviour as well as responses and preventative measures. The aspect of mobile bullying awareness efforts that is concerned with the design of the intervention has received little attention as compared to the behavioural topics on mobile bullying awareness such as the socio-economic influencers of aggressive behaviour [3].

Meanwhile, mobile bullying continues to escalate due to a lack of awareness [9], [31]. Essentially, cyberbullying in general remains a rising social issue in many South African schools [32], [33]. While there have been interventions put in place to address it, this form of aggression continues to escalate among adolescents [34]. It is still not clear why this is the case; however, some studies have attributed this problem to the lack of effective awareness and the ineffectiveness of existing interventions to reduce mobile bullying [35]. Parents are often not aware when their child is being bullied, due to the reluctance of children to talk to their parents about bullying-related [36].

Even when parents become aware, they often do not know what to do to help their child in the bullying situation, which suggests that raising awareness should include the necessary coping mechanisms to deal with mobile bullying [37]. Researchers further encourage parents to respond by notifying the school and cooperating with the school as opposed to taking matters into their own hands and approaching the bully or the bully's parents [38], [39]. Many of the interventions currently used to raise cyberbullying awareness are contact sessions and paper-based programs which are not easily scalable; and have focused on the factors that give rise to mobile bullying such as culture, the social environment and age, and measuring the prevalence of the phenomenon, as opposed to raising awareness [8], [40]. The paper-based interventions do not communicate awareness vastly enough, their reach is limited by their physical distribution [8]. In addition, program-based interventions to address mobile bullying can be expensive and are dependent on the availability of participants whereas a mobile intervention can be made available to a wider audience as and when they choose to access them online [41]. Digital interventions are ubiquitous. Hence a digital intervention was developed in this study to raise awareness of mobile bullying.

3. METHODOLOGY

This study followed the [42] design science process as the research strategy as depicted in Figure 1. Design science research process steps were followed to pragmatically define, design, and develop an information systems artefact or awareness intervention in the form of a chatbot application.
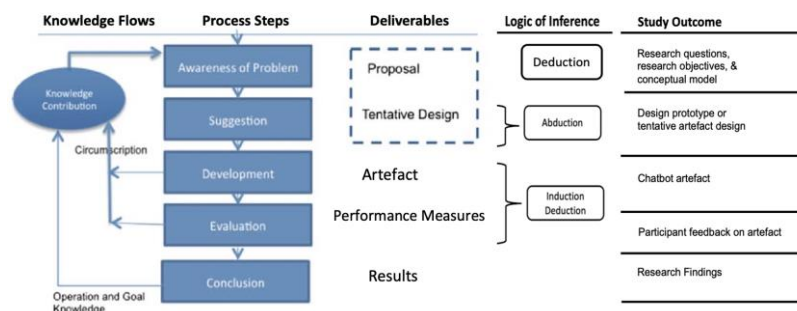

Figure 1. Design science general steps [42]

Information systems (IS) is a discipline which encompasses the technology, and processes, as well as the people and organisations that use the technology and processes for operations [43]. Additionally, An artefact in the information systems context, according to [44], is defined as, the socio-technical instantiation within a design science project.

The artefact could be in the form of a software mock-up, a prototype, or a visual illustration of a design such as a unified modelling language (UML) sequence or use-case diagrams [44]. The research question for the study can thus be contextualised and rephrased for the research context as follows:

"How can a digital tool be developed and used to raise awareness *of mobile bullying*?"

The design science research process steps were thus followed to answer the research question and develop the artefact.

3.1. Design Science Research

The first step in the design science process is the problem awareness phase. [45], suggests that the first step that the researcher should take in scientific inquiry is to assert that their research question is relevant and persisting in their respective field, and secondly to show a command of the literature in the said field of study. As such, the problem awareness for this study as the first step of the design science process, was achieved by way of conducting a literature review to establish that the research question is persisting and relevant, which guided the research problem, objectives, and the conceptual model. The second step of the design science process is the suggestion phase which produces a tentative design of the system. Therefore, in the second phase of the design science approach to research for this study, the design thinking methodology to artefact designs was applied to conceptualise a prototype design of the artefact.

Design thinking is a design methodology of prototyping which is grounded in design science to design artefacts [46], [47]. Whereas design science research also known as design theory is an overarching research approach to artefact development with a focus to develop, assess and theorise on the development of artefact to address practical problems [48]. However, it is worth noting that problem awareness in the design science process is consistent with the first step of the design thinking methodology, which is to empathize with the audience and understand the problem [47]. In the same way, the second step of the design thinking process is to produce a tentative system design or prototype, congruent with the design science process [49].

Hence it can be said that design thinking encapsulates the problem awareness and suggestion phases of the design science process to clarify the design problem and develop a system prototype [50], [51]. In a methodological study to demonstrate the use of design science, [44] provide guiding examples of how to operationalise the design science framework by providing the process and related outcomes in tabular form.

Similarly, Figure 1 reflects the design science process followed for the current study, and the study outcomes for each process step as guided by the work of [44]. The reasoning logic of inference used for each of the design science process phases in chronological order was: Deductive reasoning in the problem awareness phase through a literature review to develop research questions, objectives, and conceptual mode, see Figure 1 [52].

Design science problem awareness phase: The problem awareness is reflected in the first chapter of this study as well as the literature review and conceptual model chapters. This step is

referred to as the deductive initialisation of design science research projects, which should be motivated by gaps identified in existing literature to define the research problem [44].

Table 1 reflects the problem definition conducted for design science research in the current project. [44] provide an efficient way to tabulate an overview of the design decisions and logic of inference at the design science problem awareness, suggestion, and development phases. The table format was similarly used to present the overview in the first three phases of design science, see Tables 1, 2 and 3.

TABLE 1 Deductive Problem Awareness (Adapted From (Koppenhagen Et Al., 2012)

References	Deductive initialisation *(Problem awareness)*
(Koppenhagen et al., 2012)	The research idea was sparked by noticing that there were frequent occurrences of bullying and mobile bullying incidents in South Africa that involved adolescents. The research was driven by the need to proactively inform and help lower mobile bullying involvement by adolescents.
(Islam et al., 2020; Pearce et al., 2011; Yang et al., 2021) (Gaffney et al., 2019)	A literature review was conducted to establish the extent of the problem and whether the problem was researchable. It was noted in literature that the severity of the problem included suicide (cyberbullicide).
(Patchin & Hinduja, 2017; Uludasdemir & Kucuk, 2019) (Koppenhagen et al., 2012)	Literature called for more awareness interventions to proactively remedy the ongoing problem. The theoretical framework was guided by theories.

A literature review was also conducted in the suggestion phase to find existing guidelines or requirements for developing interventions as well as to determine the intervention characteristics necessary for raising awareness. Furthermore, in the suggestion phase, abductive logic was used to develop an inexpensive prototype of the anticipated artefact based on incomplete existing prior requirements or specifications from the literature review [42], [56].

The Artefact development phase followed deductive logic to test the research hypotheses [57]. Whereas the evaluation phase relied on both the deductive and inductive reasoning from the survey questionnaire and interview feedback respectively [42], [58].

The next section presents the suggestion phase of the design science process of the study, with a focus on the literature review discussion to identify the requirements and guidelines for an awareness intervention.

Design science suggestion phase: The suggestion phase requires the development of prototypes or some tangible system representations of the intended system. Thus, the initial image of the thought process for developing prototypes of the solution system is depicted in Figure 2 and Figure 3.
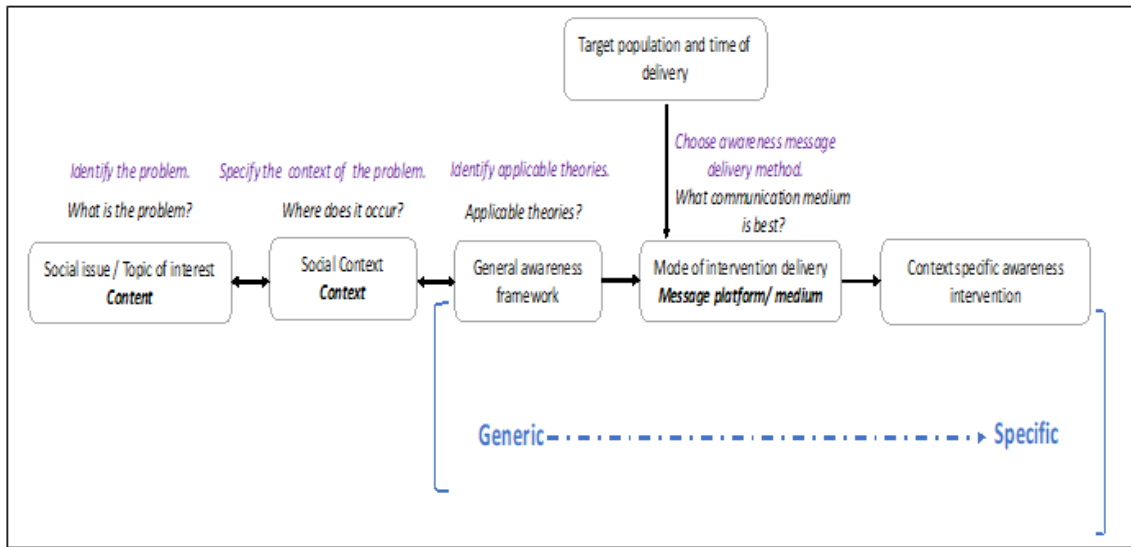
Figure 2. The ideation outcome of design thinking (Synthesised by the researchers, 2021)

The anticipated artefact is a chatbot which from Figure 3, should allow the user to log in to the platform. The user should be presented with a menu list of mobile bullying awareness topics when they start a chat, the menu limits the available text and images presented, related to the topic of mobile bullying awareness. The chatbot artefact should have human-aided responses that are rule-based for the adolescent user, and not autonomously generated by artificial intelligence. This aspect is to make sure that the content is age and topic-appropriate.

The chatbot user should be able to navigate between topics using the main menu and exit the chat when they are done.
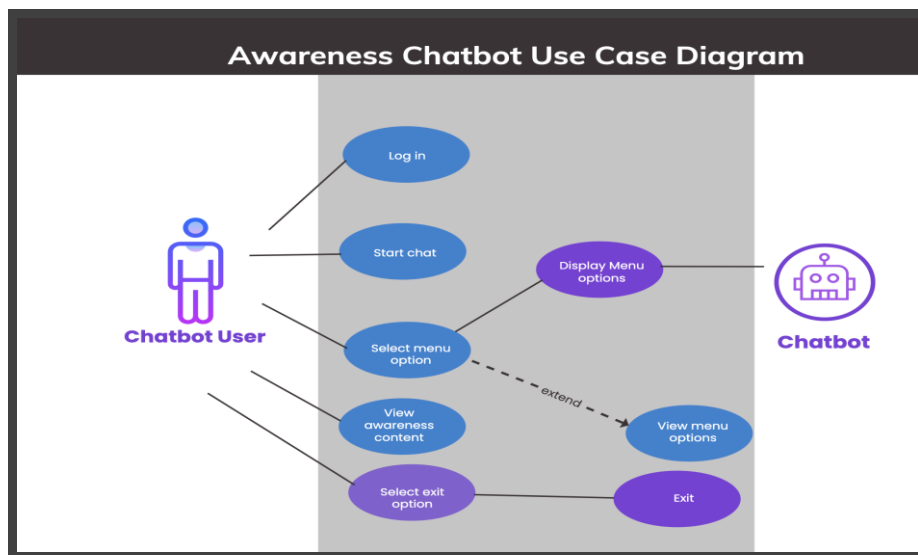

Figure 3. Initial Chatbot user interaction use-case diagram (synthesised by the researchers)

In search of the most relevant, appropriate, and useful requirements or guidelines for developing awareness interventions, the literature review was thus conducted across industries and in multiple disciplines, where interventions had been developed for raising awareness, including in

the health and wellness industry, linguistics, and the information security context. Some guidelines from the literature review were found to apply to the current study. The applicable guidelines were extracted from the occupational health and safety interventions guidelines by [59]. The inference logic for the ideation or suggestion phase is presented in Table 2

Table 2 Abductive suggestion using design principles, adapted from [44]

References	Design principle abductive *(suggestion)*
(Burstein et al., 2019)	The abductive literature review to determine useful features for an awareness intervention provided the design guidelines from the antibiotic awareness study by Bernaud, Manuti and Herrera-Sánchez, 2017.
(Bider et al., 2013)	The output guidelines were used to develop the basic requirements for awareness interventions. The basic requirements then informed the artefact prototype designs as well as the use case diagrams, and the sequence diagram.
(Wieringa, 2014; Wieringa & Morali, 2012)	Design principles guided the testing of the prototypes or the design validation per Wieringa (2014).

The next phase after the suggestion phase in the design science process is the development phase.

Design science development phase: Several chatbot development tools were available on the internet to provide software development environments. For example, the software development environment that was used for the first system prototype for the proposal, was app.botsociety.io, which had deactivated its development platform or shut down in 2022, after the COVID-19 pandemic when the second prototyping was needed. Therefore, a second platform was investigated for developing the chatbot.

The chatbot presented predefined text to the users and provided limited responses to block internet searches and the use of artificial intelligence capabilities as a safety filtering mechanism, to make the chatbot safe for use by children.

From the intervention development phase, Table 3 shows a summary of the design decisions as well as the mapping of the design principles to the design science artefact development process execution.

Table 3 Deductive intervention development (adapted from [44])

References	Deductive artefact (Development)
(Wieringa, 2014; Wieringa & Morali, 2012)	The design decisions for the project were instantiated using the unified modelling language, in the form of a use case diagram in Figure .3.The use case diagram was guided by the theoretical model for the study.
(Bronfenbrenner, 2004) (Bandura, 1989, 1991) (Bornstein, 2018) (Frenzel, 2017; Lengel, Robert, H. and Daft, Richard, 1988)	The chatbot intervention functionality was tailor-made for adolescent users in high school as informed by the socio-ecological model and the social cognitive theory for reducing cyberbullying behaviour and participation in their immediate environments. The user system roles were as informed by the role theory to give an understanding of the mobile bullying roles. The functionality was guided by the awareness intervention characteristics, the media richness theory, and the marketing mix.

Design science artefact evaluation phase: This phase is executed through the utilization of qualitative interviews and survey questionnaires. Artefact evaluation in design science involves a comprehensive examination and assessment of the developed artefacts within the context of the research project [58], [69]. The purpose of artefact evaluation is to gauge the designed solution in terms of its effectiveness, efficiency, and relevance in addressing the research problem [70].Artefact evaluation as the next step after artefact development, serves as a crucial component of the design science methodology, facilitating the creation of innovative and impactful solutions that address real-world problems, see Figure 1 for the evaluation in the process steps heading. Table 4 presents an overview of the evaluations conducted for the study.

Table 4 Overview of artefact evaluations (synthesised by the researchers)

Evaluation of Artefacts (Testing)			
Artefact	*draft prototype*: What the artefact could do.	*A use-case of artefact functionality:* How the artefact could function.	*A Screenshot of the actual artefact in operation*: How the artefact functions in context.
Evaluated by	Conference attendees, including information systems academics and postgraduate students.	Family and friends, specifically those that have adolescent children.	Study participants (high-school learners and teachers).
Evaluation process	The researcher presented the study at the NEMISA 2021 conference. Feedback comments on recommended improvements and changes to the prototype.	The first iteration of the implemented chatbot was made available to friends and family members to use and provide feedback comments on how they experienced the chatbot.	The learners were given the pre-intervention survey questions to get their views before interacting with the chatbot. Then they presented with the chatbot for interaction. Thereafter, followed by post intervention questions. A one-on-one interview was conducted with each teacher. The teacher was given a copy of the interview schedule with the open-ended questions.

The artefact evaluation process was instrumental in finding out the features that a mobile application should have to effectively raise awareness of mobile bullying. The study found that when developing an awareness intervention, the developers of such interventions should answer the following questions to determine the key characteristics of their intervention:

- Who is affected by the identified social problem or who are they trying to reach (target audience) ?
- And where can the audience be reached (awareness context)?
- How can they be reached (medium or communication tool)?
- When is the best time to reach them with the awareness message (schedule time)?
- What should be communicated to them for awareness purposes (content/ awareness message)?

The questions assisted in deciding the type of intervention for the phenomenon of interest, in the chosen research context. These questions inform a conceptual framework for developing an awareness intervention. These questions were collated from the prototype evaluations and were instrumental in deciding the awareness intervention for this study. It is recommended that these questions be taken into consideration as intervention requirements in the suggestion stage of the design science process. Even [60] found similar questions useful in their study. Similar questions were noted in the study about raising awareness of antibiotic resistance.

Amongst the artefact evaluation feedback suggestions, was to include a direct link to the child helpline for the adolescent users of the chatbot who seek urgent help to access professional help immediately. The Childline contact details were then included in the information presented in the chatbot messages after the evaluation. Another suggestion was made to include age-appropriate responses therefore a rule-based response mechanism was used. Some of the evaluation feedback was an appreciation for the privacy provided by the chatbot as an interface integrated into a WhatsApp platform, which was familiar to them. The familiarity of the platform provided a comfortable user experience. One of the key features recommended was to keep the type of media simple to cater for low data costs. Therefore, only text and images were presented, no videos. These are some of the recommendations that were taken into consideration in the development of the final version of the resulting mobile bullying awareness chatbot. The next section presents the results from the artefact development process.

The next section presents the results from the artefact development process.

4. RESULTS

For the current study, a chatbot application was built from the design science artefact development process. Design science was a guiding principle to pragmatically define, design and develop the awareness intervention in the form of a chatbot application. The resulting chatbot had the chatbot classification characteristics provided in Figure 4.

Figure 4. Chatbot characteristics (adapted from [71])

The type of chatbot was domain-specific to focus on sharing information related to mobile bullying preventative and protective measures. The service provided through the chatbot was interpersonal such that it provided a one-on-one interaction per user. The goal of the chatbot was to provide information, thus informative. The responses were human-mediated and rule-based as opposed to being autonomously from the chatbot. The chatbot still provides instant responses within the defined rules and scope of awareness conversation. See Figure 5.

The chatbot was developed on a commercial platform and catered for text and image media. Voice communication can be subject to misinterpretation based on the listener's accent and familiarity with the speaker's accent and dialect. Thus, text and images were used as they are easier to interpret and understand. The chatbot was well received as an improvement to paper-based interventions and push notifications such as short message services (SMS)es for awareness. The chatbot was easy to use and comfortable for the end users.

However, the chatbot intervention had some limitations, it provided content that was only limited to the scope of mobile bullying awareness.
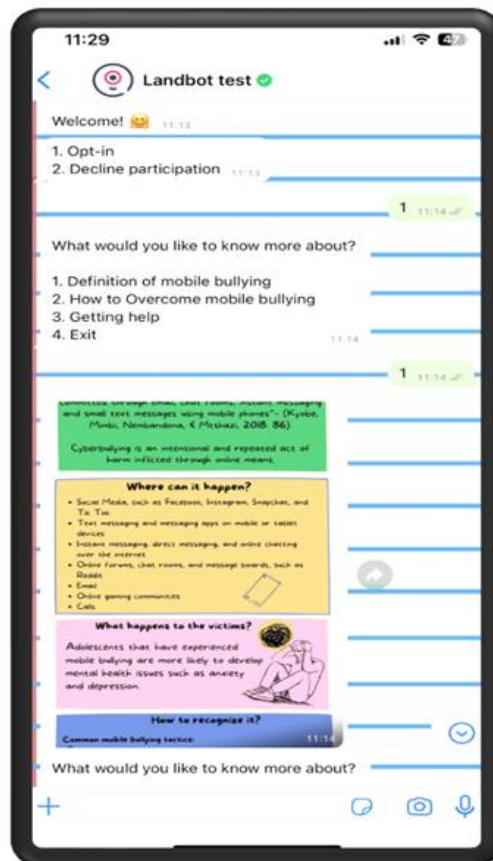
Figure 5. Chatbot message exchange (synthesised by the researchers)

The closed-domain nature of the chatbot and its rule-based responses narrowed down the type of answers returned to users by the chatbot, see Figure 5. The interaction was not seamless like that of an autonomous chatbot. The developed chatbot demonstrated the use of design science for artefact development. The study extended the design science process, by including research outcomes for each step of the design science process as noted in the last column in Figure 1.

The chatbot can be used to raise awareness of different topics, across contexts. There is potential for further research into the helpful usage of chatbots for societal benefits. Chatbots are a communication tool and provide a basis like that brought about by the introduction of letter writing, telegrams, telephones, and mobile technological devices. Also, the chatbot's ability to integrate into WhatsApp provides a seamless way to have conversational awareness campaigns. The chatbot developed in the current study had restrictions to protect the participants from exposure to inappropriate content, as it was rolled out to adolescent children, who are considered a vulnerable population. The implementation was for research purposes and the scope was limited. Some of the features that are available to businesses might have been unavailable to the research team.

5. CONCLUSION

For the current study, a chatbot application was built from the design science artefact development process. Design science was a guiding principle to pragmatically define, design and develop the awareness intervention in the form of a chatbot application. The resulting chatbot had the chatbot classification characteristics provided in the results section. This study presented the

design science process that was followed for artefact development, including the design thinking and software development methodologies. The study outcomes for each design science process step were presented as summarised in the methodology section. The design prototypes from the suggestion phase and the artefact representations from the development phase were presented. The design science process was useful to guide the development of the artefact. Although it does not include the selection of the type of artefact to be developed. This is a crucial step that would have been useful for the current study. A change management step should be added to the design science process. For example, the service provider of the platform on which the chatbot was being developed shut down the platform, just after the chatbot prototyping phase, before the development and evaluation processes of the study. An alternative had to be sought. Which led to multiple chatbot development environments, or platform service providers being used for prototyping and development.

Most chatbot development platforms are provided for chatbots that serve as commercial automated customer service and support agents. The chatbot development platforms were intended for use by corporate entities. As such, the platforms have requirements that are specific to this niche market. One such requirement is that it is mandatory to have a valid registered company whose details can be used for the chatbot integration into the WhatsApp messaging service (Facebook business). A registered business registration is required for this. Although WhatsApp is commonly used by adolescents, it is also popularly used by businesses to reach their clients directly using chatbots for customer service. Therefore, to have stability and continuity in the development process, it is recommended that the intervention developers spend sufficient time reviewing and testing out development platforms, before selecting at least two. One being their most preferred one and the second one being a contingency option.

REFERENCES

[1] H. Lim and H. Lee, 'Cyberbullying: Its Social and Psychological Harms Among Schoolers', vol. 4, no. 1, pp. 25–45, Apr. 2021, doi: 10.52306/04010321KNSZ7360.

[2] S. Cho and J. M. Lee, 'Explaining physical, verbal, and social bullying among bullies, victims of bullying, and bully-victims: Assessing the integrated approach between social control and lifestyles-routine activities theories', Child Youth Serv Rev, vol. 91, pp. 372–382, Aug. 2018, doi: 10.1016/J.CHILDYOUTH.2018.06.018.

[3] H. Gaffney, D. P. Farrington, and M. M. Ttofi, 'Examining the Effectiveness of School-Bullying Intervention Programs Globally: a Meta-analysis', International Journal of Bullying Prevention, vol. 1, no. 1, pp. 14–31, 2019, doi: 10.1007/s42380-019-0007-4.

[4] M. Buthelezi and M. Kyobe, 'Factors Affecting the lack of Awareness: Towards a Framework for Raising Mobile Bullying Awareness', International Conference on Electrical, Computer, and Energy Technologies, ICECET 2021, 2021, doi: 10.1109/ICECET52533.2021.9698790.

[5] M. I. Islam, R. Khanam, and E. Kabir, 'Bullying victimization, mental disorders, suicidality and self-harm among Australian high schoolchildren: Evidence from nationwide data', Psychiatry Res, vol. 292, Oct. 2020, doi: 10.1016/j.psychres.2020.113364.

[6] M. Camodeca and E. Nava, 'The Long-Term Effects of Bullying, Victimization, and Bystander Behavior on Emotion Regulation and Its Physiological Correlates', J Interpers Violence, vol. 37, no. 3–4, pp. NP2056–NP2075, Feb. 2022, doi: 10.1177/0886260520934438.

[7] S. Gabrielli, S. Rizzi, S. Carbone, and E. M. Piras, 'School interventions for bullying–cyberbullying prevention in adolescents: Insights from the upright and creep projects', Int J Environ Res Public Health, vol. 18, no. 21, Nov. 2021, doi: 10.3390/IJERPH182111697.

[8] A.-G. G. Chalamandaris and D. Piette, 'School-based anti-bullying interventions: Systematic review of the methodology to assess their effectiveness', Aggress Violent Behav, vol. 24, pp. 131–174, Sep. 2015, doi: 10.1016/j.avb.2015.04.004.

[9] V. H. Wright, J. J. Burnham, T. I. Christopher, and N. O. Heather, 'Cyberbullying: Using virtual scenarios to educate and raise awareness', Journal of Computing in Teacher Education, vol. 26, no. 1, pp. 35–42, 2009.

[10] C. E. Notar, S. Padgett, and J. Roden, 'Cyberbullying : Resources for Intervention and Prevention', Universal Journal of Educational Research, vol. 1, no. 3, pp. 133–145, 2013, doi: 10.13189/ujer.2013.010301.

[11] S. Hinduja and J. W. Patchin, 'Cultivating youth resilience to prevent bullying and cyberbullying victimization', Child Abuse Negl, vol. 73, pp. 51–62, Nov. 2017, doi: 10.1016/j.chiabu.2017.09.010.

[12] D. Uludasdemir and S. Kucuk, 'Cyber Bullying Experiences of Adolescents and Parental Awareness: Turkish Example', J Pediatr Nurs, vol. 44, pp. e84–e90, Jan. 2019, doi: 10.1016/J.PEDN.2018.11.006.

[13] W. W. Choong, A. H. Mohammed, and B. Alias, 'Energy Conservation: A Conceptual Framework of Energy Awareness Development Process', Malaysian Journal of Real Estate, vol. 1, no. 1, pp. 58–67, 2006.

[14] D. Ashenden, 'Information Security management: A human challenge?', Information Security Technical Report, vol. 13, no. 4, pp. 195–201, Nov. 2008, doi: 10.1016/j.istr.2008.10.006.

[15] M. H. Bornstein, The SAGE Encyclopedia of Lifespan Human Development. 2018. doi: 10.4135/9781506307633.

[16] A. Reichard, G. Quirchmayr, and C. C. Wills, 'Challenges in Implementing Information Security Policies.', HAISA, 2011, [Online]. Available: https://books.google.com/books?hl=en&lr=&id=3apGAwAAQBAJ&oi=fnd&pg=PA22&dq=%22inf ormation+security+user+awareness%22&ots=8-V_EvLlgz&sig=uI8L6SkM1fpiFwlvCwv99Ala9yo

[17] M. A. Raza et al., 'Situational awareness measurement in a simulation-based training framework for offshore well control operations', J Loss Prev Process Ind, vol. 62, p. 103921, Nov. 2019, doi: https://doi.org/10.1016/j.jlp.2019.103921.

[18] R. Kenny, B. Dooley, and A. Fitzgerald, 'Developing mental health mobile apps: Exploring adolescents' perspectives', Health Informatics J, vol. 22, no. 2, pp. 265–275, Jun. 2016, doi: 10.1177/1460458214555041.

[19] A. Yazdanmehr and J. Wang, 'Employees' information security policy compliance: A norm activation perspective', Decis Support Syst, vol. 92, pp. 36–46, 2016, doi: 10.1016/j.dss.2016.09.009.

[20] M. R. Endsley and C. A. Bolstad, 'Individual Differences in Pilot Situation Awareness', Int J Aviat Psychol, vol. 4, no. 3, pp. 241–264, Jul. 1994, doi: 10.1207/s15327108ijap0403_3.

[21] J. C. Lo, E. Sehic, K. A. Brookhuis, and S. A. Meijer, 'Explicit or implicit situation awareness? Measuring the situation awareness of train traffic controllers', Transp Res Part F Traffic Psychol Behav, vol. 43, pp. 325–338, Nov. 2016, doi: https://doi.org/10.1016/j.trf.2016.09.006.

[22] J. Webb, A. Ahmad, S. B. Maynard, and G. Shanks, 'A situation awareness model for information security risk management', Comput Secur, vol. 44, pp. 1–15, Jul. 2014, doi: 10.1016/j.cose.2014.04.005.

[23] P.-C. Lin et al., 'Relationships between Involvement in School Bullying and Quality of Life in Taiwanese Adolescents', Appl Res Qual Life, vol. 13, no. 3, pp. 545–559, Sep. 2018, doi: 10.1007/s11482-017-9544-5.

[24] E. Faccio, A. Iudici, N. Costa, and E. Belloni, 'Cyberbullying and Interventions Programs in School and Clinical Setting', Procedia Soc Behav Sci, vol. 122, pp. 500–505, Mar. 2014, doi: 10.1016/J.SBSPRO.2014.01.1382.

[25] R. Victor, M. Nickson, and S. Omeleze, 'A Mobile Forensic Readiness Model aimed at Minimizing Cyber Bullying', Int J Comput Appl, vol. 140, no. 1, pp. 28–33, 2016, doi: 10.5120/ijca2016909193.

[26] M. L. Teasley and L. Nevarez, 'Awareness, Prevention, and Intervention for Elementary School Bullying: The Need for Social Responsibility', Child Sch, vol. 38, no. 2, pp. 67–69, Apr. 2016, doi: 10.1093/cs/cdw011.

[27] B. Duy, 'TEACHERS'ATTITUDES TOWARD DIFFERENT TYPES OF BULLYING AND VICTIMIZATION IN TURKEY', Psychol Sch, vol. 50, no. 10, pp. 987–1002, 2013.

[28] S. P. Limber, D. Olweus, W. Wang, M. Masiello, and K. Breivik, 'Evaluation of the Olweus Bullying Prevention Program: A large scale study of U.S. students in grades 3-11', J Sch Psychol, vol. 69, pp. 56–72, 2018, doi: 10.1016/j.jsp.2018.04.004.

[29] E. Metalidou, C. Marinagi, P. Trivellas, N. Eberhagen, C. Skourlas, and G. Giannakopoulos, 'The Human Factor of Information Security: Unintentional Damage Perspective', Procedia Soc Behav Sci, vol. 147, pp. 424–428, Aug. 2014, doi: 10.1016/j.sbspro.2014.07.133.

[30] N. C. Rowe, S. L. Garfinkel, R. Beverly, and P. A. Yannakogeorgos, 'Challenges in monitoring cyberarms compliance', in Conflict and Cooperation in Cyberspace: The Challenge to National Security, 2016, pp. 81–99. doi: 10.4018/ijcwt.2011040104.

[31] M. Kyobe et al., 'The Nature of Mobile Bullying In the Western Cape High Schools of South Africa.', African Journal of, vol. 8, no. 2, pp. 4–5, 2016, Accessed: May 19, 2019. [Online]. Available: https://digitalcommons.kennesaw.edu/cgi/viewcontent.cgi?article=1344&context=ajis

[32] M. Kyobe, L. Mimbi, P. Nembandona, and S. Mtshazi, 'Mobile Bullying Among Rural South African Students: Examining the Applicability of Existing Theories', The African Journal of Information Systems, vol. 10, no. 2, p. 1, 2018, Accessed: Mar. 01, 2019. [Online]. Available: https://digitalcommons.kennesaw.edu/ajisAvailableat:https://digitalcommons.kennesaw.edu/ajis/vol1 0/iss2/1

[33] S. Lusinga and M. Kyobe, 'Testing a typology of mobile phone victimisation using cluster analysis', The Electronic Journal of Information Systems in Developing Countries, vol. 78, no. 1, pp. 1–36, 2017, doi: 10.1002/j.1681-4835.2017.tb00574.x.

[34] C. S. Bhat, M. A. Ragan, P. R. Selvaraj, and B. J. Shultz, 'Online Bullying among High-School Students in India', International Journal for the Advancement of Counselling, vol. 39, no. 2, pp. 112–124, Jun. 2017, doi: 10.1007/s10447-017-9286-y.

[35] L. M. Chen, 'School-based anti-bullying strategies in Taiwan and their effects', Studies in Educational Evaluation, vol. 59, 2018, doi: 10.1016/j.stueduc.2018.09.004.

[36] A. Nocentini, G. Fiorentini, L. Di Paola, and E. Menesini, 'Parents, family characteristics and bullying behavior: A systematic review', Aggress Violent Behav, vol. 45, pp. 41–50, Mar. 2019, Accessed: May 15, 2019. [Online]. Available: https://linkinghub.elsevier.com/retrieve/pii/S1359178918300375

[37] E. Larrañaga, S. Yubero, and R. Navarro, 'Parents' Responses to Coping with Bullying: Variations by Adolescents' Self-Reported Victimization and Parents' Awareness of Bullying Involvement', Soc Sci, vol. 7, no. 8, p. 121, Jul. 2018, doi: 10.3390/socsci7080121.

[38] S. Kuldas, A. Sargioti, E. Staksrud, D. Heaney, and J. O. Norman, 'Are Confident Parents Really Aware of Children's Online Risks? A Conceptual Model and Validation of Parental Self-Efficacy, Mediation, and Awareness Scales', International Journal of Bullying Prevention, 2023, doi: 10.1007/S42380-023-00157-X.

[39] N. Axford, D. P. Farrington, S. Clarkson, G. J. Bjornstad, Z. Wrigley, and J. Hutchings, 'Involving parents in school-based programmes to prevent and reduce bullying: What effect does it have?', J Child Serv, vol. 10, no. 3, pp. 242–251, Sep. 2015, doi: 10.1108/JCS-05-2015-0019.

[40] V. Stevens, I. De Bourdeaudhuij, and P. Van Oost, 'Anti-bullying interventions at school: aspects of programme adaptation and critical issues for further programme development', Health Promot Int, vol. 16, no. 2, pp. 155–167, 2001.

[41] G. Oosterwyk, M. Kyobe, C. Town, C. Town, and S. Africa, 'Mobile bullying in South Africa - Exploring its nature, influencing factors and implications', in European Conference on Information Warfare and Security, ECCWS, 2013, p. 2007. Accessed: Mar. 21, 2020. [Online]. Available: https://search.proquest.com/openview/ed2e0e29b98e3688f2f4fc21fd0a23bf/1?pq-origsite=gscholar&cbl=396497

[42] B. Kuechler and V. Vaishnavi, 'On theory development in design science research: anatomy of a research project', European Journal of Information Systems, vol. 17, no. 5, pp. 489–504, Oct. 2008, doi: 10.1057/ejis.2008.40.

[43] R. ; Baskerville et al., 'Design science research contributions Design Science Research Contributions: Finding a Balance between Artifact and Theory', J Assoc Inf Syst, vol. 19, no. 5, pp. 358–376, 2018, doi: 10.17705/1jais.00495.

[44] N. Koppenhagen, O. Gaß, and B. Müller, 'Design Science Research in Action – Anatomy of Success Critical Activities for', in ECIS 2012 Proceedings, 2012. Accessed: Dec. 22, 2023. [Online]. Available: https://madoc.bib.uni-mannheim.de/31687/1/ECIS-2012_Paper-Submission_DSR-in-Action.pdf

[45] O. Ngwenyama, 'The Ten Basic Claims of Information Systems Research: An Approach to Interrogating Validity Claims in Scientific Argumentation', SSRN Electronic Journal, pp. 1–40, Sep. 2019, doi: 10.2139/ssrn.3446798.

[46] J. Benson and S. Dresdow, 'Design for Thinking: Engagement in an Innovation Project', Decision Sciences Journal of Innovative Education, vol. 13, no. 3, pp. 377–410, Jul. 2015, doi: 10.1111/DSJI.12069.

[47] N. Kelly and J. S. Gero, 'Design thinking and computational thinking: a dual process model for addressing design problems', Design Science, vol. 7, p. e8, 2021, doi: 10.1017/DSJ.2021.7.

[48] E. Engström, M. A. Storey, P. Runeson, M. Höst, and M. T. Baldassarre, 'How software engineering research aligns with design science: a review', Empir Softw Eng, vol. 25, no. 4, 2020, doi: 10.1007/s10664-020-09818-7.

[49] J. Montero, 'Developing Empathy Through Design Thinking in Elementary Art Education', International Journal of Art and Design Education, vol. 42, no. 1, pp. 155–171, Feb. 2023, doi: 10.1111/JADE.12445.

[50] M. Apiola and E. Sutinen, 'Design science research for learning software engineering and computational thinking: Four cases', Computer Applications in Engineering Education, vol. 29, no. 1, pp. 83–101, Jan. 2021, doi: 10.1002/CAE.22291.

[51] N. Dreamson and P. H. H. Khine, 'Abductive Reasoning: A Design Thinking Experiment', International Journal of Art & Design Education, vol. 41, no. 3, pp. 403–413, Aug. 2022, doi: 10.1111/JADE.12424.

[52] N. Blaikie and J. Priest, Social research: Paradigms in action. John Wiley & Sons, 2017.

[53] N. Pearce, D. Cross, H. Monks, S. Waters, and S. Falconer, 'Current Evidence of Best Practice in Whole-School Bullying Intervention and Its Potential to Inform Cyberbullying Interventions', Australian Journal of Guidance and Counselling, vol. 21, no. June 2015, pp. 1–21, Jun. 2011, doi: 10.1375/ajgc.21.1.1.

[54] B. Yang et al., 'The consequences of cyberbullying and traditional bullying victimization among adolescents: Gender differences in psychological symptoms, self-harm and suicidality', Psychiatry Res, vol. 306, Dec. 2021, doi: 10.1016/j.psychres.2021.114219.

[55] J. W. Patchin and S. Hinduja, 'Digital self-harm among adolescents', Journal of Adolescent Health, vol. 61, no. 6, pp. 761–766, Dec. 2017, doi: 10.1016/J.JADOHEALTH.2017.06.012.

[56] A. Hevner, S. Chatterje, V. Vaishnavi, and B. Kuechler, 'Design Science Research in Information Systems Overview of Design Science Research', Ais, 2004.

[57] A. Karlsen, T. M. Hillestad, and E. Dysvik, 'Abductive reasoning in nursing: Challenges and possibilities', Nurs Inq, vol. 28, no. 1, Jan. 2021, doi: 10.1111/NIN.12374.

[58] V. Vaishnavi and W. Kuechler, Design science research methods and patterns: innovating information and communication technology. 2015. Accessed: Jan. 11, 2021. [Online]. Available: https://books.google.com/books?hl=en&lr=&id=OOE_CQAAQBAJ&oi=fnd&pg=PP1&dq=design+science+information+systems+artefacts&ots=ZHwgYtUbdz&sig=Zfrzq373244122tYHbsT6Ciu33s

[59] J.-L. Bernaud, A. Manuti, and I. M. Herrera-Sánchez, 'Steps to Ensure a Successful Implementation of Occupational Health and Safety Interventions at an Organizational Level', 2017, doi: 10.3389/fpsyg.2017.02135.

[60] V. R. Burstein, R. P. Trajano, R. L. Kravitz, R. A. Bell, D. Vora, and L. S. May, 'Communication interventions to promote the public's awareness of antibiotics: A systematic review', Jul. 08, 2019, BMC. doi: 10.1186/s12889-019-7258-3.

[61] Bider, P. Johannesson, and E. Perjons, 'Design science research as movement between individual and genericsituation-problem–solution spaces', in Lecture Notes in Information Systems and Organisation, vol. 1, Springer Heidelberg, 2013, pp. 35–61. doi: 10.1007/978-3-642-33371-2_3.

[62] R. Wieringa, Design science methodology for information systems and software engineering. 2014. Accessed: Jan. 11, 2021. [Online]. Available: https://books.google.com/books?hl=en&lr=&id=xLKLBQAAQBAJ&oi=fnd&pg=PR5&dq=design+science+information+systems&ots=bWCqbuSmJw&sig=2oIVo4-AOTllmtYXAAsobEVcX4o

[63] R. Wieringa and A. Morali, 'Technical action research as a validation method in information systems design science', in Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 2012, pp. 220–238. doi: 10.1007/978-3-642-29863-9_17.

[64] U. Bronfenbrenner, 'Environments in developmental perspective: Theoretical and operational models.', Measuring environment across the life span: Emerging methods and concepts., pp. 3–28, Oct. 2004, doi: 10.1037/10317-001.

[65] A. Bandura, 'Human agency in social cognitive theory.', American Psychologist, vol. 44, no. 9, pp. 1175–1184, 1989, doi: 10.1037/0003-066X.44.9.1175.

[66] Bandura, 'Social cognitive theory of self-regulation', Organ Behav Hum Decis Process, vol. 50, no. 2, pp. 248–287, Dec. 1991, doi: 10.1016/0749-5978(91)90022-L.

[67] L. V. Frenzel, 'Media Richness and Message Complexity as Influencers of Social Media Engagement', 2017.

[68] L. Lengel, Robert, H. and Daft, Richard, 'The Selection of Communication Media as an Executive Skill', Academy of Management Perspective, vol. 2, no. 3, pp. 225–232, 1988.

[69] Peffers, M. Rothenberger, T. Tuunanen, and R. Vaezi, 'Design science research evaluation', Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), vol. 7286 LNCS, pp. 398–410, 2012, doi: 10.1007/978-3-642-29863-9_29.

[70] Q. Deng and S. Ji, 'A Review of Design Science Research in Information Systems: Concept, Process, Outcome, and Evaluation', Pacific Asia Journal of the Association for Information Systems, vol. 10, no. 1, pp. 1–36, 2018, doi: 10.17705/1PAIS.10101.

[71] E. Adamopoulou and L. Moussiades, 'An Overview of Chatbot Technology BT - Artificial Intelligence Applications and Innovations', Artificial Intelligence Applications and Innovations, pp. 373–383, 2020, Accessed: Nov. 15, 2023. [Online]. Available: https://link.springer.com/chapter/10.1007/978-3-030-49186-4_31#citeas

AUTHOR

Portia Mathimbi is an academic currently pursuing an Information Systems doctoral degree. She explores the development of digital interventions for raising awareness of social issues, with a focus on mobile bullying.