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DEVELOPING A TEACHING CHATBOT FOR LEARNING TOOLS AND EQUIPMENT IN TECHNOLOGY CLASSROOMS

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Abstract

This study aimed to develop a 'Living Technology LINE Bot' on the LINE app for teaching hand tools and equipment in secondary school technology classrooms in Taiwan. The bot covers 45 items, including measuring tools, hand tools, power tools, classroom basic equipment, and electrical equipment. Each item offers instructions, operating procedures, skills, troubleshooting, and maintenance tips. The user-friendly interface allows point-and-click navigation and keyword input for rapid information retrieval. Online trials and surveys collected 113 responses revealing positive feedback. Participants found the bot useful and easy to use, and intended to continue using it, thereby enhancing the technology classes for teachers and students.

Key Words: Technology education, Chatbot, Tools and equipment, Teaching aids.

Introduction

From industrial art education to literacy-oriented technology education, the use of tools and equipment for designing, making, and problem-solving has always been crucial in technology classrooms (International Technology and Engineering Educators Association [ITEEA], 2020). However, students must be aware of their proper use so as to avoid making mistakes and causing unsafe situations. Learning about tools and equipment involves understanding their usage, processes, troubleshooting, and practicing.

In Taiwan, secondary school technology includes Information Technology and Living Technology, both of which are compulsory in grades 7–12. However, each subject only has one weekly class hour assigned to it for grades seven to nine (Ministry of Education, 2018). Students have limited time to use tools, making it difficult for them to understand their usage and safety. Therefore, the provision of instant learning resources is vital.

Instant messaging software (e.g., LINE, FB Messenger, and WeChat) is widely used. Chatbots are convenient tools used in various fields and are able to offer instant responses. They are also increasingly used in education. Chatbots are digital programs that simulate human conversations and provide appropriate responses based on user input (Dahiya, 2017). They have effectively aided synchronous and asynchronous classroom learning.

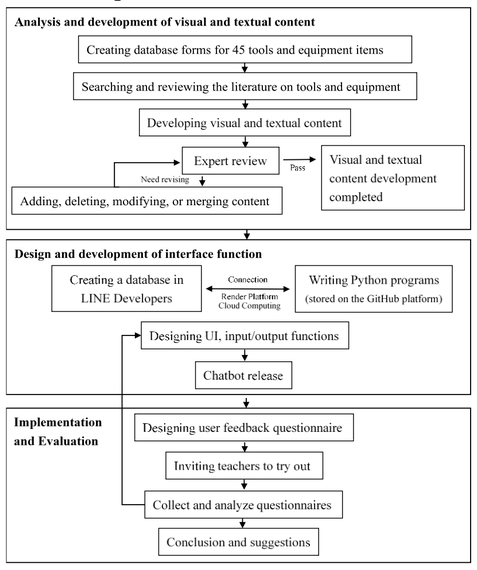
Purposes

This study focused on developing a “Living Technology LINE Bot” for the LINE app. Elementary and middle school teachers who teach technology courses were invited to participate in online trials to analyze users' experiences and gather feedback.

Research Process

This study adhered to the ADDIE model for chatbot design, which is a systematic instructional design framework that is extensively employed in the field of information education. This process comprises Analysis, Design, Development, Implementation, and Evaluation (Peterson, 2003). The research process is illustrated in Figure 1.

Fig. 1
Research processes



Research objects and instruments

After constructing the Living Technology LINE Bot, this study used convenience sampling via online communities to invite teachers of grades 1–12, and who teach living technology courses, to participate in the trials and to provide feedback.

The "Usage Feedback Questionnaire" was designed by adapting and revising the Technology Acceptance Model (TAM) (Davis et al., 1989), and which covers four dimensions: "Perceived Usefulness," "Perceived Ease of Use," "Behavioral Intention to Use," and "Attitude." This resulted in 16 questions rated on a scale of strongly disagree (1) to strongly agree (5). The questionnaire was administered using Google Forms. Additionally, teachers had the opportunity to offer qualitative feedback on potential improvements at the end of the questionnaire.

Data Analysis

This study gathered a total of 113 valid questionnaires. The data analysis includes descriptive statistics and qualitative feedback analysis.

Results

Analysis and development of visual and textual content

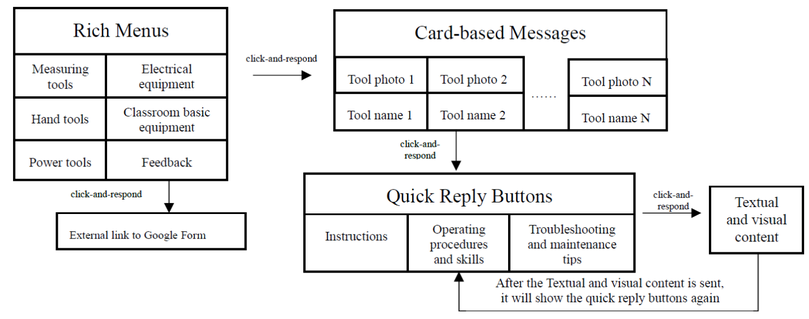
Aligned with the equipment benchmarks established by the Taiwan Ministry of Education (2019), 45 tools and equipment items were included, covering items from measuring tools, hand tools, power tools, classroom basic equipment, and electrical equipment. The instructional content was presented through text messages and images, comprising (1) instructions, (2) operating procedures and skills, and (3) troubleshooting and maintenance tips. A collection of 169 text message groups and 401 images were developed (an example is shown in Figure 1). Subsequently, three technology education experts with distinct expertise were engaged so as to review the textual and image contents. Adjustments were made based on the expert feedback in order to ensure content accuracy.

Design and development of the interface function

The appearance of the "Living Technology LINE Bot" is depicted in Figure 2. The UI design comprises rich menus, card-based messages, and quick reply buttons (depicted in Figure 3).

Fig. 2
The basic appearance

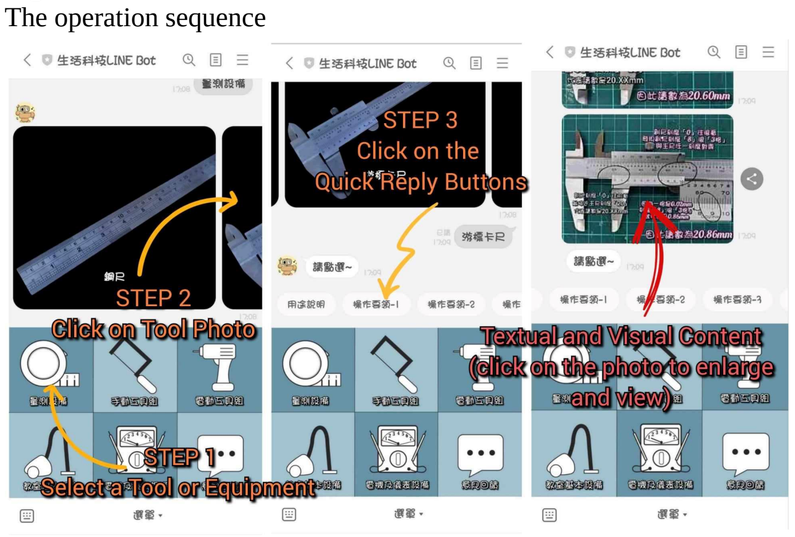
Fig. 3
The UI interface structure



Taking Figure 4 as an illustrative example, the operational sequence unfolds as follows:

1. **Select a Tool or Equipment:** Users initiate by choosing a tool or piece of equipment within the rich menus. For instance, clicking "Measuring tools" leads to the card-based messages which presents various measurement tools.
2. **Click on Tool Photo:** Upon clicking on the image of the desired tool in the card-based messages, three or more quick reply buttons emerge: "Instructions," "Operating Procedures and Skills," and "Troubleshooting and Maintenance.“
3. **Quick Reply Interaction:** Subsequently, by clicking on the relevant quick reply button — such as "Instructions" — users access textual and visual instructional content about the vernier caliper's fundamental usage.

Fig. 4
The operation sequence



Implementation, Evaluation and Conclusion

Descriptive statistics were obtained for the basic user information of the teachers who completed the survey (n = 113). The majority of participants were mainly middle school teachers (n = 88, 77.9%) and were qualified living technology teachers (n = 74, 65.5%); only a few were nonspecialized teachers.

From the feedback of the items across each of the four dimensions, the proportion of items marked as “Agree” or “Strongly Agree” is higher than 85%, indicating that most teachers hold a positive view of, and provide positive evaluations for, the bot. Regarding the qualitative feedback, many teachers offered suggestions for improving the bot, including integrating video content, refining the UI, and incorporating search functionality. These insights will be utilized to optimize the bot with the aim of enhancing its utilization.

After the trials, most teachers agreed that the bot was useful, easy to use, and intended to continue its use. However, while the Living Technology LINE Bot is intended for junior high school students, the current study only tested the bot with teachers and did not gather feedback from students. Hence, future teaching experiments are required to explore the influence of the Living Technology LINE Bot on classroom teaching and learning.

Reference

Dahiya, M. (2017). A tool of conversation: Chatbot. International *Journal of Computer Sciences and Engineering, 5*(5), 158-161.
Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of computer technology: A comparison of two theoretical models, *Management Science, 35*(8), 982-1003. https://doi.org/10.1287/mnsc.35.8.982
International Technology and Engineering Educators Association [ITEEA] (2020). *Standards for technological and engineering literacy.* https://assets-002.noviams.com/novi-file-uploads/iteea/standards/18193-00018_iteea_stel_2020_final_security.pdf
Ministry of Education (2018). *Curriculum guidelines of 12-year basic education for elementary school, junior high and general senior high schools: the domain of technology.* https://cirn.moe.edu.tw/Upload/file/38226/104343.pdf
Ministry of Education (2019, August 1). *Criteria Governing Facilities and Equipment in Elementary and Junior High Schools.* https://gazette.nat.gov.tw/egFront/detail.do?metaid=108797&log=detailLog
Peterson, C. (2003). Brining ADDIE to life: Instructional design at its best. *Educational Multimedia and Hypermedia, 12*(3), 227-241.