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Discovering prompt engineering: A qualitative study of nonexpert teachers' interactions with ChatGPT

Katherine Carl, *Governors State University, kcarl@govst.edu*
Christopher Dignam, *Governors State University, cdignam@govst.edu*
Mucahit Kochan, *Governors State University, mkochan2@govst.edu*
Chevonne Alston, *Governors State University, calston@govst.edu*
David Green, *North Central College, dtgreen@noctrl.edu*

Abstract

Discussions of the use of artificial intelligence (AI) have become ubiquitous in research, industry, and education. Prompt engineering has emerged as a valuable skill desired by employers, and students have begun to express interest in learning effective ways of interacting with Generative AI. While much research has been done to formalize and optimize the process of prompt engineering, few studies have investigated the use of AI by nonexperts, including nonexpert teachers. In this study, we use qualitative analysis to characterize the process by which nonexpert teachers engage with and learn from ChatGPT as they engage with it as co-creators to develop an educational game designed to teach concepts of financial literacy. We address implications for nonexpert teachers' use of Generative AI, including suggested methods for the use of ChatGPT to develop educational games and for tacitly learning prompt engineering by using the tool.

Keywords: artificial intelligence, prompt engineering, information systems, financial literacy, qualitative research, thematic analysis, education, gamification

Introduction

Generative Artificial Intelligence (AI) has become increasingly important in higher education. Educators are grappling with the implications of AI as a tool for teaching and learning in addition to creating and enforcing acceptable use guidelines for learners. Some of the AI benefits specific to teaching and learning include personalized tutoring, automated essay grading, language translation, interactive learning, and adaptive learning (Baidoo-Anu and Ansah, 2023). Many teachers envision a future where AI may expand pedagogical innovation (Goudey, 2024). Although there are also adverse effects of Generative AI tools that may need to be mitigated, Husain (2024) suggests that positive innovations in teaching and learning may come from the development of new teaching strategies, curriculum designs, in-class activities, and course outlines.

Examples of innovation with Generative AI include a proposed use of Generative AI as the basis for an adaptive intelligent tutoring system to assist students with their computer programming education (Kwak, Jenkins, and Kim, 2023). While this example is impressive, it may not be an accessible option for most teachers who may not have the skills to build their own adaptive tutoring system with a Generative AI engine. Educators with novice level experience developing systems, assignments, simulations, or games may consider innovative approaches that use the Generative AI tool itself to create the product (i.e., educational artifact that may be used in the classroom for learning). As nonexperts use Generative AI

without formal training in prompt engineering, they will form opinions about the technology and develop unique methods of engaging with it to achieve their goals. When using Generative AI to develop a learning activity, nonexperts may tacitly learn prompt engineering methods and may also learn aspects of designing an educational artifact, whether a simulation, assignment, or an educational game. We use qualitative methods to analyze nonexpert teachers' interactions with the Generative AI chatbot, ChatGPT, to explore the following general research question: How can we characterize the relationship between nonexpert teachers and ChatGPT?

Literature Review

Generative AI continues to be a transformative influence in education as technology advances with appealing opportunities to enhance "teaching, learning, and educational processes" (Bahroun et al., 2023). While it has experienced exponential growth in recent years with developments of deep learning with generative models, AI dates back to the 1950s with generated sequential data and time series (Cao et al., 2018). Large language models (LLMs) have advanced prompt engineering methods as AI responses improve with user questions, and fluency improves over time with different prompts and learning (Cao et al., 2018, Bahroun et al., 2023; Olasik, 2023; Stojanov, A., 2023). Meta-analysis conducted in 2023 reviewed the use of Generative AI in educational settings from 2018 to 2023 in 217 articles using the PRISMA framework with content analysis in fields including computer science, engineering education, higher education, medical education, nursing education, communication, academia and general education (Bahroun et al., 2023).

Qualitative Research and Generative AI

Qualitative approaches, including ethnography and autoethnography, have been employed to examine interactions with Generative AI. Stojanov (2023) conducted an autoethnographic study to explore the use of ChatGPT as a more knowledgeable other (MKO) in higher education. Michel-Villarreal et al. (2023) employed ethnographic methodology alongside Generative AI to delve qualitatively into Generative AI responses, employing a thematic analysis approach for data interpretation. The use of ethnographic methodology facilitated the identification of potential challenges surrounding ChatGPT's impact on academic integrity and the need for ongoing evaluation of AI tools in educational settings. In another study,

Lo (2024) provided an autoethnographic reflection on creating a custom GPT based on oneself, exploring the implications for personal introspection and technology democratization. Additionally, Gupta, et al. (2024) discussed the role of metaphors in understanding AI, using autoethnography to reflect on their personal experiences and pedagogical approaches. Parra and Chatterjee (2024) explored the evolving roles of social media and Generative AI tools such as ChatGPT in online education, highlighting the shift from tool-centric to student-centered approaches. They emphasized fostering critical AI literacies to navigate the ethical and practical implications of AI tools in educational settings. Building on the theme of making AI more accessible and relatable, Desai and Twidale (2023) used playful metaphors to conceptualize practical uses of ChatGPT. Metaphors like "sounding board," "unreliable narrator," and "court jester" enhance the accessibility and comprehensibility of AI for nonexperts.

Generative AI as Co-Creator

The integration of AI into creative work has enabled new opportunities for collaboration between humans and computers. Previous literature explores the various aspects of co-creation with AI, focusing on capabilities and challenges. Recent studies by GEYER et al. (2021), Cress and Kimmerle (2023), Meron and Tekmen Araci (2023), Verheijden and Funk (2023), Turchi et al. (2023), and Subramonyam et al.

(2021), provide insights into the capabilities and challenges of AI as a co-creator. These studies highlight the transformative potential of AI when used as a partner in creative and educational settings, emphasizing the importance of effective human-AI collaboration. Geyer et al. (2021) report the technical advancements and potential applications of Generative AI. They show how new tools such as Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs) have significantly improved the quality of AI-generated content. They call for interdisciplinary research to create systems where AI enhances human creativity, exploring new AI-augmented user experiences, business applications, and methods to evaluate the success of these collaborations. Cress and Kimmerle (2023) explore the use of Generative AI tools like ChatGPT in knowledge construction. They argue that these tools can move beyond simply repeating known information to transforming it into complex ideas through structured dialogues.

This transformation process requires prompts that stimulate both the content and rhetorical aspects of knowledge, fostering a more interactive and profound learning experience. Meron and Tekmen Araci (2023) document the use of such applications in education. They evaluate the use of ChatGPT as a virtual assistant for creating course materials in higher education design programs. Their study finds that ChatGPT is effective in organizing content and brainstorming, helping educators save time and structure their course materials. However, they also highlight the need for significant human intervention to refine the AI's output, which often starts as generic content.

Theoretical Approach

A Cybernetic-Artificial Intelligence Lens

We approach our understanding of nonexpert teachers' interactions with ChatGPT through the theoretical frameworks of cybernetics and Activity Theory. Cybernetics is a field of systems theory that examines control and communications between living and nonliving entities and is relevant for understanding feedback systems between people, technology, and individuals and technology (Dignam, 2024; Tilak, 2023). Cybernetics is relevant to education as it emphasizes the significance of communications and comprehending the learning environment and the role of educators in shaping the learning environment for facilitating change (Murray, 2006). In addition, cybernetics is relevant for educator agency as it offers insights into the role of the participant observer in effecting systemic change and knowledge production, highlighting intersections between the observer and the system, and the significance of observation in comprehending and altering the system (Lee, 2021).

Cybernetics contributes to the evaluation of AI pedagogical processes, especially in terms of digital educational learning technologies and environments (Gushchin and Divakova, 2015). Understanding cybernetics affords a framework for comprehending how individuals within educational settings engage with and navigate complex learning environments, such as AI, thereby influencing the development of effective teaching and learning systems (Tilak and Glassman, 2022).

Artificial Intelligence, as a technological tool in education, significantly benefits from the principles of cybernetics by providing a framework for understanding self-regulation, feedback loops, and the dynamic interaction between individuals and their environment (Tilak, 2023). Cybernetics is an asset for learning within AI digital environments and emphasizes the importance of feedback loops for understanding learning and adaptation.

Feedback loops are central to self-regulation and control in various systems, including people and artificial systems. As a result of leveraging these principles, a cybernetic AI lens enhances learning experiences, optimizes administrative processes, and facilitates personalized education, ultimately contributing to the

development and establishment of a Community of Practice (CoP) (Dignam, 2024; Murray, 2006; Tilak, 2023).

Activity Theory and Human-Computer Interaction

Constructivist philosophy and cybernetics are closely related, as they both examine the active role of individuals in learning and adapting through their interactions with their environment as continuous processes in building knowledge from experiences (Tilak, 2023). Vygotsky's (1978) Theory of Cognitive Development asserts learner cognition first occurs as a result of social interactions and experiences and is followed by individual-level conceptualization in which students construct knowledge. Constructivism is also experiential and reflective and serves as a platform for building social capital. When constructivism is employed in AI settings, it forges social skills and cooperative learning opportunities for developing conceptual understanding (Dewey, 1933; Piaget, 1972; Kolb, 1984; Vygotsky, 1978). Vygotsky's constructivism aligns with cybernetics' focus on human cognition and behavior and emphasizes learning, adaptation, and the dynamic relationships between individuals and their environment (Tilak, 2023; Tilak and Glassman, 2022).

Human-Computer Interaction (HCI) is an interdisciplinary field focused on increasing understanding regarding the interaction and engagement of humans with technologies, systems, information, and work environments (Adam et al., 2021). Within the field of HCI, there is an exploration of how humans think, feel, and behave when interacting with technology. Descriptive HCI knowledge helps researchers and practitioners understand the various aspects of human experiences in relation to utilizing technology, which in turn, informs the design and development of more user-friendly and effective technologies. The study of HCI also provides descriptive knowledge that explains human cognition, affect, and the construction of knowledge (Adam et al., 2021).

Activity Theory focuses on understanding how individuals engage with technological tools and artifacts while involved with various tasks, such as learning and communications, and the influences of technology on human behavior (Karanasios et al., 2021). While cybernetics emphasizes feedback loops and control mechanisms, Activity Theory focuses on the mediating role of tools in human activities, with each complementing each other in studying complex systems and human-machine interactions. Both Activity Theory and cybernetics center on comprehending systems and interactions and how individuals engage with tools and technology to accomplish objectives. Activity Theory and cybernetics integrate constructivist principles by recognizing individuals' active role in constructing knowledge and meaning through interactions with tools, technology, and systems (Karanasios et al., 2021; Vygotsky, 1978). We use the theoretical lenses of cybernetics and Activity Theory to characterize the interactions between nonexpert teachers and ChatGPT.

Method and Results

Nonexpert teachers interested in teaching financial literacy concepts with an educational game used ChatGPT 3.5 to create a game and recorded their use of and interactions with the tool. Qualitative data was collected from recordings of participant interactions and thematic analysis was used to analyze and interpret the data. Purposive sampling was used to identify participants that are nonexpert business teachers interested in developing a game to teach financial literacy (Patton, 1990). Participants included one finance and one information systems faculty member at a regional university selected for their teaching effectiveness and interest in creating an educational game. Both participants had used ChatGPT previously,

but neither had used the tool to create learning activities for their courses, nor had they formally studied prompt engineering processes.

The participants were given written instructions to use ChatGPT to create an educational game that teaches undergraduate college students concepts of financial literacy while playing. No specific learning objectives or game requirements were provided, including modality. Participants were instructed to conclude their interactions with ChatGPT after they were satisfied with the game created by their use of the tool. Additionally, participants were provided with a tutorial of the screen recording software and a brief demonstration of the procedure.

Materials used by participants included Loom software, ChatGPT, and USB microphones. Participants were instructed to verbalize their thoughts related to their interactions with the tool, including thoughts about prompts they wrote, text generated by ChatGPT, and their progress towards the goal of creating a game while using the tool. They used the software tool Loom to record their screen and speech. After recording their interactions with ChatGPT, participants answered three interview questions related to their experience.

Stage 1: Data Preparation and Structural Coding

Preparation of user data—the identification, labeling, and aggregation of each component into meaningful collections of text—marked the inception of our structural coding process, as the data was first categorized by its origin and type without consideration of any textual meaning. Two sets of unstructured data were collected from each participant, including a link to the ChatGPT interaction and a video recording of the screen and speech of each participant while using the tool. Each of the ChatGPT interactions was transcribed into a text document, where labels of "Prompt" or "Response" were applied to each block of text to classify the transcribed text as either a prompt from the participant or a response from ChatGPT.

Teacher 1 wrote 22 total prompts and received 22 total responses during their interaction with ChatGPT and Teacher 2 wrote 18 total prompts and received 18 total responses during their interaction. Transcripts of the participants' recorded speech were automatically generated by Loom and verified and corrected manually by Author 1. Text of each vocalization was then added to the transcripts of prompts and responses in chronological order by occurrence and labeled as "Speech". Finally, a written summary of mouse actions and scrolling of each participant was produced by watching the screen recordings.

These summaries were then added to the transcripts of speech, prompts, and responses in chronological order by occurrence and labeled as "Action". This process resulted in a final interaction transcript (FIT) for each participant that included four components: 1) Speech, 2) Prompts, 3) Responses, and 4) Actions. We denote a collection of a single progression of related Speech, Prompt, Response, and Action as a SPAR. A sample SPAR from Teacher 1's FIT is provided below.

"SPEECH: Okay, let's create a fun and engaging financial literacy game using ChatGPT. I'm just gonna say that I want to create a financial literacy game for college students. Let's see what it says. Literacy game. For college students. Okay, the learning objective will be Understand budgeting, debt management and and investing.

PROMPT: I want to create a fun and educational financial literacy game for college students

RESPONSE: Creating a financial literacy game for college students sounds like a fantastic idea! Here are some steps and ideas to consider when developing such a game:

1. *Identify Learning Objectives: Determine what financial topics you want to cover in the game. This could include budgeting, saving, investing, managing debt, understanding credit scores, etc.*
2. *Game Format: Decide on the format of the game. It could be a board game, card game, online simulation, or even a mobile app. The format will depend on your target audience and resources.…*

ACTION: Scrolls down to view the entire response and then hovers over the response, highlights '7. Feedback and Learning' then hovers mouse over '1. Identify Learning Objectives'".

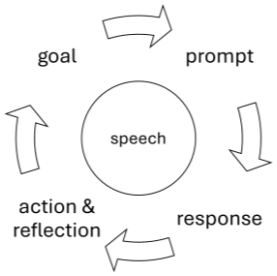

Figure 1: Process Diagram of Transcript Components

Transcription of the data and structural coding produced the process pattern shown in Figure 1, where users set a goal, write a prompt, ChatGPT generates a response, users reflect on the response and take action, and the process repeats while they produce related speech. Activity Theory guided interpretation of users' prompt writing, while cybernetics provided context for the process as a system of feedback between user and tool. Subsequent coding of the transcripts was an emergent process influenced by these theoretical lenses.

Stage 2: Initial Coding of FITs and Prompts

FIT1 and FIT2 were first approached as holistic texts that characterize the relationship between user and ChatGPT. Open coding was performed on each FIT while considering 1) how users worked with ChatGPT to achieve their goals, 2) how users perceived themselves as actors in relation to ChatGPT, and 3) how users perceived ChatGPT as a tool and as an entity in general with relation to not only their goal, but their personal system of beliefs and biases. These considerations emerged from our theoretical framework.

We then performed descriptive coding on users' collections of prompts in isolation from the other parts of the transcripts. In isolation, the prompts are the purest representation of user engagement with the tool as defined by Activity Theory. Process coding of the prompts was employed in conjunction with open and descriptive coding to characterize actions taken by the users to use ChatGPT to achieve their goal of producing a financial literacy game with their specifications. Thematic analysis was performed on the results of this coding process to uncover the main themes of each collection of prompts.

Stage 3: Application of Existing Frameworks

Recommendations for effective prompt engineering exist in both technical and non-technical areas of research, including LLM and education (Cao et al., 2018). To better understand how nonexpert teachers with no prior training approached prompt engineering, we first attempted to code user prompts using technical labels, including "zero-shot", "few-shot", and "chain-of-thought" prompting. However, many of the prompts written by the nonexperts did not fit well into any of these categories, as they were not familiar with prompt engineering terms or best practices. Having exhausted technical labels, we then searched for an existing prompt engineering framework from education and discovered Eager and Brunton's framework developed for educators creating educational activities using Generative AI outlined in Table 1 (2023).

Table 1: Eager and Brunton's Prompt-Writing Steps for Educators

Step	Action
1. Define Goal	Identify the specific outcomes you want the AI to achieve.
2. Determine Content Type and Format	Decide on the type of content and the format that best fits your objectives and context.
3. Craft Initial Prompt	Create a clear, concise prompt that effectively communicates the desired content and format to the AI model. Make sure to include necessary context, instructions, and parameters to guide the AI model towards the desired output.
4. Initial Testing/Prototyping	Input the prompt into the AI model to generate an initial output.
5. Reflect on the Output	Evaluate the AI-generated content to see if it aligns with your intended goal.
6. Iterate	Refine the prompt by adjusting the context, instruction, or constraints. Repeat the process until you achieve the desired output.

To explore how nonexpert users approached both prompt writing and the development of educational activities using Generative AI, we considered the steps outlined in Table 1. Each FIT was coded using the steps listed in this framework to measure users' adherence to a formal and prescriptive prompt writing process designed for educators. Initial coding of our users' prompts demonstrated a lack of adherence to the details of this framework consistent with their classification as nonexperts. The teachers engaged in each step listed in the formal prompt writing process outlined by Eager and Brunton, but with several notable adjustments that shifted the role of ChatGPT from tool to *co-creator*, the classification of which emerged as a pervasive theme in our data. Both teachers engaged in Steps 1 and 2, as they each stated their goal of using ChatGPT to create a financial literacy game with some information about content type and format:

"Okay, let's create a fun and engaging financial literacy game using ChatGPT. I'm just gonna say that I want to create a financial literacy game for college students. Let's see what it says. Financial literacy game. For college students." (FIT1, SPEECH1)

"My goal is to use Loom to record my session with ChatGPT as I'm developing a financial literacy game for a classroom and this will be at the college level. … So I'm going to ask ChatGPT to help me develop a financial literacy game that can be used in a college classroom." (FIT2, SPEECH2)

We also considered the key components of an initial prompt outlined by Eager and Brunton (2023). These are shown in Table 2.

Table 2: Recommended Initial Prompt Components

Component	Purpose
Verb	Indicates a specific action to be performed
Focus	Provides the process, product, or outcome of the action to be performed
Context	Explains the scope or parameters of the task
Focus and condition	Provides the focus and condition for the generated output, defining the subject matter and primary goal; narrows the scope of the task and clarifies what the content should include
Alignment	Instructs the AI model to align content with your desired goal
Constraints	Note any constraints or limitations that the AI should adhere to

We coded teachers' prompts with reference to these recommended initial prompt components and discovered that the recommended components of the initial prompt—constraints and limitations, in

particular—are scattered throughout each teacher's prompts and referenced in speech. The emergence of constraints and limitations throughout the prompts and the teachers' related speech and actions are consistent with both the iterative process described in Step 6 of Eager and Brunton's prompt writing process and the idea that the teachers learned aspects of it from engaging with ChatGPT. Step 3 in the framework is that of crafting the initial prompt.

While both teachers created an initial prompt, neither engaged in the process of "crafting" this prompt as outlined by Eager and Brunton. Rather, they created a short initial prompt, tested it (Step 4), and relied on Step 6 in the process, iteration, to move closer to their end goal. The initial prompts of both teachers are shown below. The first is a declarative statement about what the teacher wishes to do and the second is an imperative statement asking ChatGPT to help with the creation of the learning activity.

"I want to create a fun and educational financial literacy game for college students" (FIT1, PROMPT1)

"help me develop a financial game that can be used in a college classroom" (FIT2, PROMPT2)

While the prompts are both concise and the second is clear, neither "effectively communicates the desired content and format to the AI model" (2023). Examining the next SPARs is necessary to understand the shift of the role of ChatGPT and the adjustments made to the formal prompt writing steps outlined by Eager and Brunton.

Learning Prompt Writing with ChatGPT

Identifying recommended initial prompt components scattered throughout the teachers' prompts enabled us to construct their "ideal" initial prompts. The sequence of the first teacher's prompts are shown in Table 3 and led to the assembly of the following "ideal" initial prompt:

> *Create a game for 18-year-old college students learning concepts of financial literacy, including budgeting, debt management, and investing.*
>
> *The game should be a web-based game that includes three modules (one for each financial literacy concept) and should take approximately three hours to play. The game should offer three levels of difficulty for players, including beginner, intermediate, and advanced. The debt management module should include basic concepts of time value of money, compounding, and interest rates.*
>
> *Players should earn badges by completing modules and module components that are locked before previous components are successfully completed. Players should be able to flexibly choose their income expenses and other starting attributes. The game should have a storyline that includes the player and the GSU mascot of the Jaguar as a pet that grows and is equipped with new skills as the player progresses in the game.*
>
> *The story should include battles, like the Jaguar fighting a debt dragon.*

Comparing the reconstructed "ideal" initial prompt and the progression of prompts in Table 3, we find that the first teacher developed constraints and limitations by engaging with ChatGPT.

Table 3: Sample Teacher 1 Prompts

#	Text
1	I want to create a fun and educational financial literacy game for college students
2	Learning objective: Understand budgeting, debt managment, and investing
4	Could you give a possible gameplay for budgeting section
8	It may be very challenging to to create this game since it has many different type of elements. Make it more simple to create
9	How long do you think it would take to finish the whole game
11	Could you include all the learning objectives in this gameplay outline with all the levels (beginner, intermediate, and advanced)
13	web based game. Use the information given in previous prompts.
14	Using the information provided above, could you show me possible gameplay for budgeting, investing and debt managment.
15	assume I am the player

Stage 4: Selective Coding of Prompts

After coding the teachers' prompts using the formal prompt writing framework components outlined by Eager and Brunton, selective coding based on sentence type and meaning was used to explore how each user approached prompt engineering and tacitly learned about the process. The first teacher's prompts were categorized into the first five general categories shown in Table 4. The second teacher's prompts were categorized into all six general categories, including the category of prompts that provide feedback to ChatGPT about inconsistency in its responses. These final prompt categories led to refined research questions and additional thematic analysis informed by the theoretical lenses of cybernetics and Activity Theory.

Analysis revealed that the teachers in our study act as co-creators of a learning activity with ChatGPT, rather than users tasking Generative AI with the generation of a learning activity. This distinction and contextualization of ChatGPT and our teachers as co-creators, rather than "users and tool" is important, as recommendations exist for optimal prompt writing that do not consider users as such and thus, do not seek to understand the results of the co-creator interaction. *Informed by our analysis*, we refined our initial research question further into the following more specific questions to explore additional characteristics of the relationship between nonexpert teachers and Generative AI:

1) How do nonexpert teachers write prompts to co-create learning activities with ChatGPT?

2) What do nonexpert teachers tacitly learn about the prompt writing process by writing prompts to co-create a learning activity with ChatGPT?

Table 4: Prompt Categories

Description	Example
Declarative "I want" statements	*I want to have three levels for budgeting investing and debt managment: beginner intermediate and advanced (FIT1)*
Polite imperative "Could you…?" statements	*could you give me a sample gameplay for the investment section (FIT1)*
Incomplete sentences that require ChatGPT to refer to previous statements for context	*Learning objective: Understand budgeting, debt managment, and investing (FIT1)*

Description	Example
Interrogative statements that request information	*if I use paper money for the game, how much money should create for the gameplay by denomination? (FIT2)*
Declarative critique statements designed to refine responses	*let's change the game's goal to $100,000 instead $1,000,000 (FIT2)*
Declarative statements related to inconsistency in responses	*in the list above there appears to be only 10 spaces for the early-career stage and the mid-career stage although the number of spaces is listed as 15 for both (FIT2)*

Thematic Analysis of SPARs: ChatGPT as Co-Creator

To answer our first research question and further explore how nonexpert teachers write prompts, we examine how SPARs progress throughout teachers' engagement with ChatGPT. The first teacher scrolls to view the initial response from ChatGPT and then highlights "1. Identify Learning Objectives," engaging in Step 5 of the formal process (FIT1, ACTION1, RESPONSE1). They then issue the second prompt: *"Learning objectives: Understand budgeting, debt managment, and investing"* (FIT1, PROMPT2).

In an adjustment to the formal prompt writing process, ChatGPT has *joined* the teachers in their completion of Step 2 and assisted with decisions related to content and format. The second teacher also receives a response from ChatGPT that calls for defining learning objectives and verbalizes this in their speech.

Rather than prompting ChatGPT with learning objectives, however, they verbalize that ChatGPT is giving them instructions for game creation rather than creating a game. They thus issue their second prompt, *"create a game for me"*, after which they receive a detailed response from ChatGPT with instructions for a general financial literacy board game called "Financial Odyssey: Journey to Financial Freedom" (FIT2, RESPONSE1, PROMPT2, REPONSE2). T

he first teacher has begun addressing ChatGPT's understanding of the components needed to develop the learning activity and is now engaged with it as a co-creator. With their third prompt, the second teacher does the same, as they prompt *"what are some examples of the player token characters?"* (FIT2, PROMPT 3). The first teacher exhibits a pattern of using prompts to tell ChatGPT what they want and then follows up by asking ChatGPT to produce what they are describing. For example, "*I want the total play time to be 3-hours*" followed by "*Could you include all the learning objectives in this gameplay outline…*". The second teacher, in contrast, uses several prompts to elicit detailed information from ChatGPT about specific parts of the game suggested. For example, "*if I use paper money for the game, how much money should create for the gameplay by denomination?*" Each teacher's pattern of selective codes based on sentence type suggests a unique relationship between the teacher and ChatGPT that can be further explored.

Stories of Learning Activity Development

To answer our second research question and explore what nonexpert teachers learn about prompt writing by engaging with ChatGPT, we look at how their prompts evolved in concert with reflections verbalized in their speech. Teacher 1 dives into prompt writing without much reflection or planning and spends the longest period of reflection with nonverbal action after the first prompt returns as they process how ChatGPT might respond to further prompting and how they can use that information to more effectively reach their goal using the tool. Their speech pattern demonstrates trust in ChatGPT as a collaborator, as they use polite language and sentence structure, including modal verbs, to address ChatGPT and achieve their goal. For example, they reflect *"Could you include all the learning objectives in this detailed game gameplay outline will all levels? Beginner, intermediate, advanced."* (FIT1, SPEECH11). This teacher

vacillates between "I want" and "Could you…?" statements, working together with the tool with the goal of ChatGPT creating the game. The emergence of this pattern illustrates how they learned to interact with the tool, as they began with a general goal statement and progressed to a refinement process. The speech *"…When players are introduced to the story, they are also learning the concepts on budgeting, investment, investments, and debt management…So I want to communicate this to ChatGPT"* that occurred early in the process showed their understanding that they needed to learn how to effectively communicate their wants to the tool (FIT1, SPEECH3).

Teacher 2 was more goal-oriented in their interactions with ChatGPT, using more concise and declarative prompts, including a prompt that identified a discrepancy in responses from the tool. Interestingly, however, while their prompts were less conversational and more directive, their speech was extensive and rich. This teacher went so far as to personify ChatGPT and reflect on their personification, "*So now he's going going back. I called ChatGPT a 'he'"* (FIT2, SPEECH3).

They did not use playful language in their prompting, or seem to realize, however, that they were not communicating positive feedback or creative thoughts about ChatGPT's responses to the tool itself. For example, they verbalized *"Oh okay, this is interesting. So it's actually, bringing in a command screen to try to do an actual layout for segmenting the game board. So this would be what it looks like. It's also changed the name. Heh. Financial Odyssey: Journey to $100,000. Okay, I like that."* (FIT2, SPEECH16).

This speech is punctuated with a prompt that begins *"restate how the game board be designed?"* (FIT2, PROMPT16), with no reference to their satisfaction with the previous result. Their verbalizations identified cases where they learned to be more direct in their prompting with ChatGPT and led to a pattern of questioning ChatGPT for details about gameplay and short directive prompts used to revise the emerging game design.

Interview Results

Each teacher was asked questions related to their experience after engaging with ChatGPT to create an educational game. The first teacher explained that they learned that the structure and content of the initial prompt is very important and that it is "important to have a clear objective of what you want it to do for you." They also reflected that word choice is important, like "create" versus "design" and felt like they were talking to an expert when interacting with ChatGPT, which enabled them to eventually be more creative with their requests.

When asked to compare the use of ChatGPT with internet search to design an educational game, they reported that search is limited to what they put in the search bar and that ChatGPT can also teach them "how to ask and learn." The second teacher reported that they were not sure how many iterations they would go through to get to a practical game. This teacher was more goal-oriented than the first and expressed concern about the operationalization of the game, as they were not an expert in game design.

They also reported that in a short amount of time interacting with the tool made them "think of a lot of aspects of developing a game [they] hadn't considered" and that the results were not what they imagined they would be, but that they remained open to ChatGPT's suggestions. The teachers' responses to the interview questions related to their experience revealed that they had learned how to interact with ChatGPT from their use of the tool and, additionally, that more qualitative research is needed to understand what can be learned and how it can be learned from interacting with Generative AI—both about prompt engineering and about educational game design, which is a complex process.

Discussion

Through qualitative analysis, including the application of existing prompt writing frameworks designed for educators and the development of our own prompt categories through coding, we explored the relationship between nonexpert teachers and ChatGPT as it is used to co-create learning activities. The application of existing frameworks led to the emergence of ChatGPT as a co-creator that not only responded to teacher prompts, but also contributed to teachers' tacit acquisition of prompt writing skills related to the development of learning activities.

The teachers' reflection process was tacit and led to the evolution of goals, content type, and prompt crafting as part of the iteration process. We also observed additional communication with ChatGPT designed to elicit advice and "opinions" from the AI about game design components and the feasibility of its current end product. Additionally, both teachers observed in their speech when they liked ChatGPT's results, but only occasionally confirmed that they liked its results in their prompts. Their interactions with the tool evolved as they learned to more clearly state what they wanted the tool to do and pushed its boundaries. In particular, the first teacher remained fairly creatively conservative until they 1) confirmed that ChatGPT could help them achieve their goal and 2) confirmed that they were capable of using ChatGPT effectively enough to achieve that goal.

Once both of these confirmations were made, the first teacher not only expressed to ChatGPT that they liked the current state of the goal, but also added the concepts of dragon battles and mascot pets to their game design in their last and longest prompt. These observations lead to additional research questions about the relationship between teachers and Generative AI, including the process by which they explore the boundaries of the tool and their own capabilities as an instructional designer.

Implications and Applications for Education and Instructional Design

ChatGPT integration in educational environments creates new horizons and possibilities for curriculum enhancement, student engagement, and innovative teaching. Generative AI empowers educators to create dynamic learning experiences through collaborative content creation, from quizzes to educational games. The iterative nature of generative AI ensures continuous evolution of learning materials to meet specific goals. Students benefit from ChatGPT's support in project-based learning, developing essential skills and fostering peer collaboration. Real-time AI assistance in classrooms enhances lesson delivery and enables personalized learning for diverse student needs.

The study's approach to developing a financial literacy game serves as a blueprint for creating engaging, subject-specific educational games across disciplines. Findings offer a transformative approach to instructional design, emphasizing AI-assisted content creation. Implementing prompt writing frameworks enables more effective use of ChatGPT, resulting in higher-quality educational materials. Generative AI's ability to co-create interactive learning resources reduces designers' workload and introduces variety and engagement. Continuous refinement through iterative prompt writing ensures alignment with learning objectives and facilitates real-time lesson adaptation.

The study provides insights for Information Systems educators on innovative professional growth, course design, and Scholarship for Teaching and Learning (SoTL). In addition, educators are afforded opportunities to leverage AI effectively in teaching practices, enhancing content creation and delivery. ChatGPT's collaborative potential in developing course materials offers an efficient tool for creating comprehensive, engaging content. Designing prompts that elicit student preferences and performance data enables the creation of personalized learning pathways for addressing individual student needs more

effectively. In collaborative projects, ChatGPT serves as a virtual assistant, facilitating ideation, content development, and refinement processes for enriching the collaborative learning experience.

In addition, the utilization of Generative AI facilitates the creation of a systemic SoTL for supporting academic research, question formulation, and data analysis for enhancing curricula and student learning. Teacher agency is a principal catalyst in the development and sustenance of a supportive learning community among students and the tools teachers and students utilize for learning. Employing AI in educational settings also provides opportunities for teachers to apply a cybernetic lens for adaptive and personalized learning, predictive analytics, communications, reflective decision-making, and establishing a digital Community of Practice (dCoP) (Dignam, 2024). The utilization of dCoPs offers numerous advantages for integrating AI into classroom settings, including collaboration and enhanced communications.

Limitations and Future Research

Exploratory research related to Generative AI, including our study, is not without limitations. Generative AI tools, including the free version of ChatGPT 3.5 used in this study, continue to evolve as their developers adapt them to emerging user needs and available data, connectivity, and algorithms. The tool we chose did not have access to current web data, which likely affected user interactions with the tool and their perceptions of it. Additionally, two teachers were selected for this study whose background and experiences are unique. However, in the context of an exploratory qualitative study, there are still insights to be gained from analyzing individual interactions with an artifact. While this study explored nonexpert teacher interactions with a limited tool, it contributes to the ongoing and evolving discourse related to Generative AI tools and their use. Additional thematic analysis of the data, including values coding of speech and axial coding of all FIT codes would also provide further insight into nonexpert teachers' use of ChatGPT.

Conclusion

This study explored the interactions between nonexpert teachers and ChatGPT in the context of co-creating an educational game for teaching financial literacy. Thematic analysis revealed key insights into the dynamics of prompt engineering and the evolving role of Generative AI as a co-creator rather than a passive tool. The study found that nonexpert teachers who engaged with ChatGPT as co-creators employed a digital relationship-rich, iterative process. Teachers provided prompts and received feedback, which they used to refine their prompts and improve the educational game for a digitally based, supportive environment. The digital co-creation and relationship-rich iterative process emphasized the potential of ChatGPT to support teachers in instructional design, even without formal training in AI or prompt engineering. Through their interactions with ChatGPT, teachers tacitly learned the principles of prompt engineering. The study identified that teachers iteratively developed constraints, limitations, and refined their goals through the feedback loops provided by ChatGPT.

The iterative process identified aligns with the theoretical frameworks of cybernetics and Activity Theory, where continuous feedback and tool mediation play critical roles in learning and adaptation. During the study, teachers' interactions evolved as they gained confidence in both ChatGPT's capabilities and their own ability to utilize the tool more effectively. Data also indicated that while teachers were initially cautious, the study's teachers gradually expanded their creative input and incorporated novel elements into the game design. The process of building user confidence and competence in AI-assisted instructional design is an important element of prompt engineering and the authentic utilization of cybernetics and Activity Theory feedback loops for supporting a dCoP. This study contributed to the understanding of how nonexpert teachers interact with Generative AI and provides a foundation for further exploration of AI's role in educational innovation and instructional design.

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