

Amazon Alexa Skills as a Novel Modality for In-service Professional Micro-Development (WiP)

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ABSTRACT

Intelligent digital assistants, such as products like Amazon's Alexa, are becoming more prolific and available as time progresses. This work reports on the process of developing applications, referred to by Alexa as 'skills,' to support in-service professional development for teachers. The precedent of allowing Alexa to be utilized within the classroom, but not necessarily for teachers' skill development, is explored to contextualize the application of the technology as a professional development modality. Across the entire content development spectrum – spanning script writing to deployment and release – lessons are presented from experience to assist future teams embarking on the process in the hopes they are able to avoid repeating the problems encountered by this research team. Finally, a general discussion relating to the future of intelligent digital assistants and their applications to professional development is presented with the intent of provoking discussion and setting the stage for more rigorous investigations into the usability, efficacy, and results of this technology.

CCS CONCEPTS

• **Human-centered computing** → **Natural language interfaces**; **Participatory design**; • **Software and its engineering** → *Software design techniques*; • **Computing methodologies** → Artificial intelligence.

KEYWORDS

professional development, education, amazon alexa, interdisciplinary engineering

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1 INTRODUCTION

As educational opportunities and teaching continues to advance in the online setting, pushed largely by the proliferation of technology within the classroom and further necessitated by the COVID-19 pandemic, the need to harness new technology becomes ever more apparent for in-service teacher professional development (PD). The role that PD plays in exposing teachers to new technology and bolstering their understanding of traditional pedagogy cannot be overstated.

Accompanying the shift in distribution of content into the digital form, the ability to hyper-focus on specific topics and content has emerged. What may previously have been a topic lacking enough local interest to be sufficiently explored, may instead be distributed online, at scale, in a way that targets the specialized demographic of interested parties. When applied to PD in the field of education, this concept may be referred to as professional micro-development. Specialized topics, such as the awareness of the underlying factors associated with dyslexia, may be pursued through digital means without the risk of not finding a large enough local audience to justify the content's creation. Additionally, this platform allows educational professionals to personalize their learning, choosing to engage in targeted content that meets their unique development needs. By relying on the global scale and reach of digital assistant marketplaces, these hyper-specific topics may effectively find their select audience.

To facilitate the adoption of modern technological innovations within the classroom, teachers must build a comfort and understanding of the technology. When PD makes use of the technology educators are asked to utilize within their classrooms, it has been argued that the desire and ability to implement meaningful lessons with said technology increases [1]. Furthermore, educators' personal interest with and motivation to use technology is an additional predictor of the success of integrating technology into the classroom [3]. Digital assistants, such as Amazon's Alexa or Apple's Siri, represent an intriguing crossroads between modern artificial intelligence topics and every-day integration of technology. The discovery of applications for these digital assistants is still in its infancy; however, exploration into how these applications could be integrated into the classroom and instructors' professional lives is starting to take shape [14].

This work presents a case study of the process undertaken by the research team to conceptualize, develop, and release an Alexa skill for professional micro-development. Our team currently plans to perform more rigorous study of the usability and efficacy of skills as a platform for engaging in PD. they present their experiences with

insights into the development of these applications here to enable others to avoid pitfalls encountered by this team. The team's desire is that this work will encourage and empower other researchers to explore digital assistants as tools for the delivery of PD – and more specifically focused micro-developments.

2 RELATED WORKS

This emerging approach to generating PD skills that target specialized audiences sits at the nexus of several points of research. The scope and content style of information presented in these skills aligns with the scope and presentation of micro-credentials, enabling the leveraging of micro-credential related research to assist in skill development. The technology makes use of cutting edge artificial intelligence techniques that are applied in the classroom in various manners. Digital assistant enabled learning, perhaps the most integral part of this entire process, examines directly how digital assistants are used to construct knowledge and understanding within a specific domain.

While generalized PD that targets broad skills for a wide group of educators will always have their place, the need for specialized knowledge leads to many educators requiring more personalized or individual development specifically tailored to their roles within the educational system. One such approach to providing the required level of knowledge is micro-credentials and other, similarly focused forms of certification [7]. However, the static nature of online delivery of micro-credential courses has been critiqued for the disconnected experiences of those who participate in the course [5]. Rather than socially engaging with fellow educators and PD instructors, as would be the case in traditional PD, online micro-credentials may see participants disconnected from any socialized form of learning. Digital assistants may present a way to engage the social aspect of learners by tasking them with holding a conversation while still maintaining the availability and accessibility of online, asynchronous, micro-credential PD.

Transitioning into the classroom, it is clear that technology and artificial intelligence has the potential to deeply impact the educational process. A survey of artificial intelligence applications within the sphere of education identifies three paradigms– AI-directed, AI-supported, and AI-empowered– for interfacing with artificial intelligence [11]. These identified paradigms represent a notable blending of the technological advancements of computer science within the traditional educational sphere despite the disconnect often present between these groups in the past. This lack of connection is best conceptualized by evaluating the manner in which algorithmic content presentation, such as content presented by a digital tutor, is accepted by educators. When given the choice between interacting with an algorithmic system and interacting with a person, teachers, both in-service and pre-service, are described as algorithm averse [9]. This aversion to algorithmic teaching is a qualified one, as it assumes that there exists a choice between algorithmic and interpersonal content presentation; however, in the absence of interpersonal presentation, educators may more willingly accept algorithmic content. More technical explorations into the underlying algorithms used to drive AI tutors has also been presented with beneficial outcomes [10]. The adaptability and learning

capabilities of modern AI systems may therefore be leveraged to support education and professional development.

The role of Alexa as a digital assistant has also been explicitly examined as it relates to the process of learning. Results indicate more positive degrees of acceptance for digital assistants than for generalized algorithmic instruction. Reportedly, learners enjoyed and found interacting with digital learning assistants helpful [6]. Additionally, the effectiveness and accessibility of the technology was noted as beneficial by users [2].

While applications of digital assistants within the classroom are still emerging, early explorations urge continued research and examination of the technology as an augment to traditional learning modalities. Within the collegiate realm, Alexa has been utilized to assist students with content comprehension, exam preparation, and digital assistant administered assessments [13]. The vocal nature of interacting with these digital assistants makes them an obvious candidate for reading, speaking, and various fluency related learning tasks. Alexa as a reading partner, has demonstrated (within a limited scope) to be a boon despite the current limitations of the technology [4]. Overall, the opportunities that Alexa and other digital assistants present in educational spaces is in its infancy; however, initial research suggests notable potential across disciplines, age levels, and backgrounds.

3 DEVELOPMENT METHODS

The primary contribution of this work is found in the following description of the process utilized to ensure quality development of an interactive micro-development skill. Specifically, the methodology and justification of the development process is presented. Following, our multi-phased procedures is reviewed and examined to demonstrate the efficacy of the modality design process implemented to develop and publish the micro-development skill.

3.1 Iterative Design Philosophy

The guiding question behind this project and the associated research – "What does development of a digital assistant application for professional development look like?" – led the research team to adopt an iterative, partwise approach to developing the application. The decision to use Amazon Alexa was motivated by the breadth of developer resources available for the Alexa platform specifically. Throughout the process, instead of directly polishing one section of the skill to production level quality (i.e. a vertical slice approach), the team made use of an agile development methodology akin to famous agile processes such as SCRUM or Kanban [8, 12].

After each phase of development, the research team engaged with and tested the skill. This testing not only assessed the skills technical aspects, but it also assessed the efficacy of the skill as a mode of information presentation. After reflection and deliberation specific to presentation efficacy, a number of observations directly led to modifications and refactoring of the skill. One example of a modification in response to the perceptions of the research team was to migrate from Alexa voiced text (i.e. using the digitized voice) towards voice recordings made by the team. This had the effect of making information more accessible and easier to digest since it took the form of human articulation and cadence rather than that of computer generated speech. While this iterative approach is

recognized as a significant benefit to the development and structure of micro-development skills, a primary goal of this work moving forward is to investigate the perceptions of users to determine the effectiveness of human speech over computerized dialogue.

3.2 Content Development

The initial skill developed by the team is the Amazon Alexa *Dyslexia Awareness Skill*. This skill was developed across two distinct phases beginning with the writing of a research based and vetted script (Phase 1) to the development of the actual Alexa skill (Phase 2). Within Phase 1, professionals from the field of education were called upon to offer their expertise on the fundamentals of dyslexia. The original script was generated by a school psychologist with professional development expertise and direct experience and knowledge of Dyslexia. Our team then performed major revisions to assure content was presented in a form applicable to the skill's development. Subsequently, the script was forwarded to nationally recognized literacy faculty, who reviewed the material and offered recommendations for clarification and improvement. Once all feedback was collected and reviewed, the script was updated and readied for AI production.

3.3 Skill Development

The development of the Alexa skill made use of an online, no-code interface to develop the logic of the system. Instead of directly programming and linking together intents through code, a drag-and-drop visual programming interface allowed for developing the flow of the skill in a manner similar to drawing a flow chart. The project began solely staffed by researchers from the Department of Education with little to no computer science experience before expanding by adding researchers with a background in software engineering in Phase 2. As a result, despite the short time period over which development took place, a number of design and refactoring patterns were developed to extend the skill and the ability to re-use aspects of the code in future skills. This approach to encapsulation further influenced the development team, resulting in a much "smoother" design in subsequent skill development. To aid other research teams in development, allowing them to bypass some of the struggles experienced by this team, specific guidelines and software engineering principles that can be adapted to new skill development are presented.

The primary engineering concept adapted from the software engineering field for the Alexa skill was that of encapsulation. The higher order structure of the first skill developed by the team made use of a construct known as a "flow," which allowed for shared behavior to be grouped into a single "block" for programming; these flows were used to place all actions for "section one" into a single logical group and all actions for "section two" into a disjoint logical group. The communication between these groups was then facilitated through a "main" flow. While initially this was a beneficial organization, placing all the administrative logic, on-boarding code, and certification code into a single flow meant that the maintainability and cyclomatic complexity of the flow grew far more than expected.

The solution explored by the development team in subsequent skill development was to take the encapsulation and continue it

to its logical end. Each of these logical groups, namely authentication, first-time actions, and certification, was migrated into a flow focused solely on said action. This also enabled more frequent code re-use, allowing for additional flexibility in designing pathways through the skill. A simple objective measure of the simplicity of the main flow is a count of logical code blocks. The development team focuses now on including zero logical blocks in the main flow and instead used the main flow as a de facto "router" which is solely responsible for moving between flows.

3.4 Deployment and Release

A discussion of the deployment and release life-cycle necessitates exploration of both the process of interacting with the Amazon Alexa skill review team and other external dependencies that facilitates the extended functionality of the application. Specifically, the team will share a narrow description of their interactions with the Amazon Alexa skill review team and the required skill review process prior to skill publication. Suggestions for others attempting to recreate the process detailed in this work will be presented. Additionally, the experience of integrating external technologies will touch on general best practices discovered by the team for others to consider as they conduct similar processes.

The Amazon Alexa skill review team places an explicit focus on the functionality and accuracy of a skill released to the Alexa marketplace. As a result, the submission process for the *Dyslexia Awareness Skill* took the research team three iterations from the initial submission before the skill was approved and released for public installation. After each submission, the Amazon Alexa skill review team provided an itemized list of problems identified within the skill. It appears that the review team uses an automated approach to test all paths through the submitted skill. Any error identified is prefaced by a list of intents that are used to reach the point of interest within the running skill. As a result, exact pain points are identified in an explicit and beneficial manner, making them simple to fix for the development team.

A number of pain points were identified by the research team that are worth discussion to prepare others more adequately to submit skills of their own. The primary challenge the team experienced in revising and resubmitting the skill centered around the institutional branding associated with it. As the skill was represented by the College of Education (CoE) of the University of Wyoming (UW) and contained branding and language identifying it as such, the submission was denied due to a lack of supporting institutional documentation permitting the use of the CoE UW logo and identifying language. The Amazon Alexa skill review team requested documentation from the institution stating that UW branding could be utilized in this manner. However, this instruction provided little indication as to what form that documentation should take. In the case of the *Dyslexia Awareness Skill*, the researchers ultimately obtained an official letter from the Administrative Director of Trademark and Licensing at UW affirming the approved usage of associated branding within the skill. This letter was submitted to the Amazon Alexa skill review team, who subsequently approved the use of the university branding.

The other type of difficulty encountered by the development team was associated with integration of external technologies. One

key behavior of the *Dyslexia Awareness Skill* is emailing a completion certificate to participants upon successfully finishing the skill and accurately answering assessment questions. This behavior was initially not enabled during the quality assurance skill review process, leading the review team to deny publication of the skill due to the skill's unsuccessful utilization of the user data that was requested (i.e. failure to email certificate after user's permission and request to receive the email). Additionally, the skill made use of a Google Sheets document, and the associated API, for data collection. While the platform used for development had built in integration with the Google Sheets API, the no-code environment meant that the development team was restricted to the functionality provided by the platform. This did not result in a loss of functionality, but it did necessitate an extended development period to perform the level of integration required for the project.

4 DISCUSSION

A primary challenge for researchers seeking to present information on the global scale is the technical requirements of distributing educational content. Furthermore, as the specialized nature of information continues to expand, the engineering requirements of a detailed AI professional development system expand in a manner that may be foreign to non-technical, education researchers. Leveraging existing technology frameworks to make learning accessible on a global scale allows for specialized and targeted PD to be delivered internationally to educators even with moderately low levels of access to devices. The recommendations presented within this work seeks to bridge the gap between the skill set and expertise required to develop strong PD and the technical requirements of delivering this PD at scale.

The acceptance and adoption of this technology is still open for debate. Time will be the arbiter of in-service teachers' acceptance of AI driven PD. However, the Professional Teaching Standards Board of the state of Wyoming has committed to collaborating with the development team to validate their skills for required continued education credits. The style of the skill, being a professional micro-development, lends itself well to providing a menu of content options to personalize and target continued teacher education. Rather than requiring educators attend traditional broad strokes PD on topics that may or may not be relevant to their practice, educators may select a series of professional micro-developments that are hyper-focused on a topic of interest and individual need.

The technology of digital assistants, and more specifically the Amazon Alexa marketplace, is positioned to attend to the need for specialized development, provided teachers accept and utilize the technology as an augmentation to traditional PD. With both institutional and research-level support to encourage participation with skills as a viable PD modality, the research team anticipates that more widespread adoption of the skill will follow for those educators willing to accept digital assistant-based micro-developments. However, the usability and desire for such methods of instruction, along with the efficacy and sustained understanding of content resulting from AI driven PD, must continue to be explored and evaluated before any conclusive assessments of the role such programs will play in the future of PD may be asserted. The research team hopes this work prompts others to consider digital assistant-based

modalities for their own presentation of material and that this increased number of providers will assist in the evaluation of the efficacy of AI driven PD.

5 CONCLUSION

The role of digital assistants, such as Amazon Alexa, has the potential to advance within the classroom and within the educational space as a whole in the coming years. The contribution of this work, presenting lessons learned from micro-development creation and publication, attempts to make the skill development process more approachable and accessible to others interested in creating similar PD opportunities. In this vein, the primary threat to the results of this work is the potential that the team's experiences will not generalize to that of others. To address this challenge, the research team presents both the explicit actions taken by the team as well as the inferences and impressions made throughout the process to allow others to develop their own solutions to similar challenges if the suggested responses are untenable given unique circumstances. Future work will examine the ways in which educators interact with digital assistants for PD, the usability of this technology, and the outcomes generated by AI driven PD opportunities.

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