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Ni máquina, ni humano ni disponible: Do College Admissions Offices Use Chatbots and Can They Speak Spanish?

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Abstract

Colleges continue to use technology to connect students to information, but a research gap exists regarding how colleges use a ubiquitous technology in the business world: chatbots. Moreover, no work has addressed whether chatbots address Spanish-speaking students seeking higher education in the form of automated (AI) chatbot responses in Spanish or Spanish-programmed chatbots. This study randomly sampled 331 United States institutions of higher education to learn if these institutions embed chatbots on their undergraduate admissions websites and if these chatbots have been programmed to speak Spanish. Results suggest 21% of institutions (n=71) embed chatbots into their admissions websites and only 28% of those chatbots (n= 20) were programmed to provide Spanish-language admissions information. Implications for college access and equity for English learners and L1 Spanish speakers are addressed.

Keywords: admissions, college students, linguistics, Spanish, chatbots, Internet

Introduction

United States (U.S.) higher education has struggled with facilitating access to higher education for non-English speakers (Astin, 1982; Auerbach, 2004; Ceja, 2001; Collatos et al., 2004; Cook et al., 2012; Flores & Drake, 2014; Núñez & Oliva, 2009; Núñez et al., 2016), including those who are native, L1 speakers of Spanish (Collatos et al., 2004; Cook et al., 2012; Gonzalez et al., 2015; Martinez et al., 2013; Núñez & Oliva, 2009; Núñez et al., 2016). For decades, researchers have attempted to inform institutional leadership and other stakeholders as to how to increase access to higher education for Spanish speakers, including advocacy for K-12 school districts to facilitate better college counseling (Ceja, 2001; McClafferty-Jarsky et al., 2009; Núñez et al., 2016; Ryan & Ream, 2016), connecting institutional resources and cultural capital to Spanish-speaking communities (Ceja, 2001; Fann et al., 2009; Núñez et al., 2016; Ryan & Ream, 2016; Tierney, 2002; Torrez, 2004), and translating higher education access materials from English into Spanish (Astin, 1982; Núñez & Oliva, 2009; Núñez et al., 2016; Pérez & McDonough, 2008; Post, 1990; Taylor, 2018, 2019). However, as some access gaps have been closed (Núñez et al., 2016; Taylor, 2018), many invested stakeholders lament the fact that White, English-speaking students in the U.S. still access higher education at a greater rate than their Latinx, Spanish-speaking peers (Núñez et al., 2016; Taylor, 2018).

Alongside this decades-long line of research into L1 Spanish speaker access to higher education is another line of proximally related inquiry: advances in communication technology and how institutions of higher education engage with these technologies to increase access to higher education. Since the advent and teeming widespread use of the Internet in the early 1990s, institutions of higher education have adopted Internet technologies such as websites (Taylor, 2018, 2019; Venegas, 2007), social media (Peruta & Shields, 2017), video platforms (Burdett, 2013; Taylor, 2018; Jones, 2008), and now virtual reality experiences (De La Cruz, 2020) to share postsecondary information with both prospective and current students, as well as other stakeholders (De La Cruz, 2020; Jones, 2008; Peruta & Shields, 2017; Taylor, 2018; Venegas, 2007). However, even as Internet technologies have advanced and institutions have largely embraced these technologies (Venegas, 2006, 2007; Taylor, 2018), these technologies have seemingly not been used to increase access to higher education for L1 Spanish speakers. Recent research has found that less than 5% of institutional websites translate admissions or financial aid content from English to Spanish (Taylor, 2018). Moreover, there remains a dire need for institutions to translate higher education access content

(admissions instructions, institutional-level FAFSA instructions, degree exploration, etc.) from English to Spanish (Núñez & Oliva, 2009; Núñez et al., 2016; Pérez & McDonough, 2008; Taylor, 2018, 2019), even though researchers from decades ago made the same call to action (Astin, 1982; Post, 1990).

One popular Internet technology that has revolutionized how the business world conducts transactions and provides customer support is the chatbot (Oracle, 2021). Loosely defined, a chatbot is a "computer program that simulates and processes human conversation" (Oracle, 2021, para. 1). As the fields of computer science, computational linguistics, and business have coalesced, countless businesses were early adopters of chatbots in the mid-2000s (Io & Lee, 2018), and institutions of higher education have followed suit in an attempt to better convey information to Internet users without incurring the cost of human resources (Taylor & Hartman, 2019). Yet, as ubiquitous as chatbots are in the business world, very little empirical research has explored how chatbots are used by institutions of higher education (Santoso, 2020; Sjöström & Dahlin, 2020; Taylor & Hartman, 2019). Connecting technology to postsecondary access, no studies have addressed how institutions of higher education use chatbots to increase access for L1 Spanish speakers, including how chatbots are programmed in various languages, whether chatbots connect Internet users to real, Spanish-speaking human agents, and how L1 Spanish speaking students use chatbot technologies to gain institutional information and access U.S. higher education.

Given these gaps in knowledge, this study provides novel insight as to how U.S. institutions of higher education use (or do not use) chatbot technology to provide students with access to undergraduate admissions information and whether that chatbot information is provided in English, Spanish, a combination of both, or neither. This study randomly sampled 331 institutions of higher education websites in the United States to answer three critical research questions related to higher education communication technology and L1 Spanish speaker access to U.S. higher education:

R1: Do undergraduate admissions websites embed chatbots to facilitate prospective and current students' access to information?

R2: If so, are these chatbots assigned human agents or have they been built to provide artificial intelligence (AI)?

R3: Are chatbots (human agents or AI) programmed to speak Spanish?

Answering these questions will inform both researchers and practitioners as to whether U.S. institutions of higher education have embraced chatbot technologies, whether these chatbots are linguistically inclusive of L1 Spanish speakers, and how future research and policy advocacy can better inform how institutions of higher education can implement emerging technologies to facilitate access to higher education for marginalized populations.

Literature Review

Two separate strands of research guide this study: 1) research into L1 Spanish speaker access to higher education and 2) how institutions of higher education integrate AI and chatbot technology into their communications to increase student access to higher education.

L1 Spanish Speaker Access to U.S. Higher Education

The U.S. higher education access and equity gap is not due to dwindling enrollment of L2 students in U.S. public schools, as the number of L2 students in U.S. public schools has grown considerably over recent decades. In Fall 2018, 6 million or 10.2% of all K-12 public school students were L2 compared to 3.8 million or 8.1% in 2000 (National Center for Education Statistics, 2021). Despite this growing population, L2 student access to U.S. higher education has remained elusive, as only 2.4% of the student population at 625 nationally ranked colleges and universities per U*.S. News & World Report* participated in postsecondary ELL/ESL/L2 programming in 2016, even though L2 students comprised nearly 10% of the K-12 public school population (Friedman, 2017). Furthermore, on average, less than 2% of all L2 students in the U.S. have taken postsecondary entrance exams, such as the SAT or ACT, since 2000 (Sanchez, 2017), compared to over 60% U.S. high school graduates since 2000 (Adams, 2017).

In the largest study of L2 student access to and achievement in U.S. higher education at the time of this study, Kanno and Cromley (2013) used data from the National Education Longitudinal Study (NELS) of 1988 to articulate differences in access and achievement between L1 and L2 students. The authors explained about 20% of L2 students were high school dropouts, rendering it nearly impossible to pursue a postsecondary education, whereas only 6% of L1 students dropped out of high school. Ultimately, Kanno and Cromley (2013) found 12.5% of L2 students earned a bachelor's degree, compared to 33% of L1 students who earned a bachelor's degree from the same NELS 1988 cohort.

Researchers, policymakers, and practitioners have made various

attempts to assuage the persistent postsecondary access gap between L1 and L2 students in the U.S. These attempts have included educating high school counselors to the needs of L2 students pursuing higher education (Cook et al., 2012; McClafferty-Jarsky et al., 2009; Núñez & Oliva, 2009), modifying language policies to better serve L2 students (Kanno & Varghese, 2010), providing the parents of L2 students with postsecondary access materials and information (Astin, 1982; Auerbach, 2004; Taylor, 2018), and facilitating equitable access for L2 students to pursue advanced placement courses in high school to prepare these students for college entrance exams and rigorous postsecondary curricula (Kanno & Kangas, 2014). Despite these efforts, the U.S. higher education gap between L1 and L2 students has persisted (Kanno, 2018a, 2018b; National Center for Education Statistics, 2021).

Pertinent to language, researchers have examined the role of English fluency in L2 students' inequitable access to and achievement in U.S. higher education. Multiple longitudinal studies have found L2 students and their parents often do not have enough information or understanding about the postsecondary processes of applying for admission (Auerbach, 2004; Collatos et al., 2004; Tornatzky et al., 2002) and financial aid (Auerbach, 2004, Collatos et al., 2004), resulting in L2 students ultimately foregoing a postsecondary education. Even among gifted L2 students, Kanno's (2018a) case study of two high performing L2 students found these students cited a lack of specific postsecondary knowledge and confidence in their ability to speak English as reasons to avoid a four-year institution and instead enroll in community college.

Some researchers have pointed to the fact that, historically, research on English language learners (one type of L2 student) has "emerged primarily from the field of applied linguistics, rather than from the field of higher education itself," (Núñez et al., 2016, p. 44). Núñez et al. (2016) reasoned that research focused on English language learners' access to higher education has been limited because of the classification of English language learners at the K-12 level but not the higher education level. Moreover, federal and state policies have never specified that English language learners have a right to an education beyond K-12 education (Núñez et al., 2016). Relatedly, being an English language learner is a relatively fluid status and can change over time; thus, it can be difficult to identify a specific student population and their educational progress. English language learners can be associated with multiple terms, and data limitations have often made it cumbersome to conduct research on English language learners and their access to and success in higher education (Núñez

et al., 2016).

Institutional Use of AI and Chatbots to Facilitate Higher Education Access

Early chatbots in higher education emerged in 2018 in both U.S. and non-U.S. contexts. Santoso (2018) developed a chatbot for Universitas Dian Nuswantoro in Semarang, Indonesia to manage student candidates (known in U.S. enrollment management as 'prospective students' or 'leads') and their questions regarding the undergraduate admissions process. However, Santoso's (2018) chatbot was monolingual and used AI to manage all inquiries without elevating to human agents. Similarly, Lalwani et al. (2018) developed a chatbot to fetch information regarding admissions, course examinations, and student organization activities for the Shri Ramdeobaba College of Engineering in Maharashtra, India, but this chatbot was also monolingual. Researchers have also developed chatbots for university use in Finland (Banerjee, 2021), India (Neelkumar et al., 2019; Sharma, 2019), and Palestine (Salamin & Jboor, 2021), yet these chatbots also do not allow for polylingual communication.

Stateside, Georgia State University developed a chatbot to help admitted first-year students transition to college by using AI to nudge students to complete certain enrollment management tasks such as applying for financial aid or registering for classes on time (Taylor & Hartman, 2019). Similar efforts have been made at the University of Southern Mississippi to develop a financial aid-focused chatbot (Robinson, 2019) and at Arizona State University to develop a student affairs-focused chatbot (Grossnickle, 2019). However, none of these studies or processes of chatbot development addressed minoritized language populations or programming the chatbot to speak multiple languages, especially non-English languages.

To date, the only chatbot to be programmed as bilingual from its inception to launch is Jooka, a bilingual chatbot for university admissions at the German University in Cairo, Egypt. A research team led by Hefny et al. (2021) developed a university admissions chatbot in English and Arabic due to high concentration of bilingual parents and K-12 students speaking both English and Arabic. As a result, the German University felt it necessary to provide information in both languages to ensure that parents and students had adequate information to make their college decision, and ultimately, decide upon the German University for its linguistic inclusiveness. Hefny et al. (2021) demonstrated that the development of bilingual chatbots is possible but requires a wealth of collaboration between language populations. Hefny et al. (2021) insisted that despite the rigor of

collaboration to program a bilingual chatbot, the benefits far outweighed the costs, as both parents and prospective students raved about the chatbot for its ease of use and linguistic inclusivity.

Methods

This section outlines how the research team conceptualized this study's population and sample, gathered data, analyzed data, and addressed limitations. Future research will be addressed in the discussion section of this study. All datasets are available upon request from this study's first author and principal investigator.

Population and Sample

Per the Integrated Postsecondary Education Data System (IPEDS; National Center for Education Statistics, 2019), there were over 2,700 four-year, Title IV-participating institutions of higher education in the United States in 2020, including public, private for-profit, and private not-for-profit institutions. These 2,700 institutions represent the overall population of the study; however, analyzing both admissions and financial aid text information from over 2,700 institutions of higher education was simply unfeasible in terms of completing this study in a timely manner.

Given this study's overall population, the research team decided to perform a power analysis with a 95% confidence level and confidence interval of 10, a common confidence level and interval for identifying feasible, statistically strong sample sizes in educational research. This power analysis produced a sample size of 345 institutions of higher education. After exploring readability sample sizes in earlier studies (Taylor, 2018b, 2018d; Taylor & Bicak, 2019a), the research team learned it was necessary to over-gather data, as for-profit institutions close on an annual basis (Taylor, 2018b).

Moreover, public institutions, private institutions, or a combination of the two have merged in recent years: perhaps most notably, Purdue University's 2017 merger with the private, for-profit institution Kaplan University to create Purdue University-Global (Fain & Seltzer, 2017). To ensure that this study's sample size represented all types of four-year Title IV-participating institutions (public, private not-for-profit, and private for-profit), the research team identified a sample size of 331 institutions of higher education (114 public, 175 private non-profit, and 42 private for-profit). This sample appropriately represented the population of Title IV institutions in the U.S., as our sample included 34% public institutions (30% of all four-year Title IV institutions are public), 53% included private non-profit (58% of all four-year Title IV institutions are private non-profit), and 13%

included private for-profit (12% of all four-year Title IV institutions in the U.S. are private non-profit).

This sample size allowed this study to maintain its statistical rigor while also allowing us to build upon this dataset in the future to compile longitudinal datasets using the original sample of institutions.

Data Collection

To gather data for this study, the research team employed IPEDS to gather institutional URLs to each institution's website. We decided to engage with Internet resources for the purposes of this study, as educational research has suggested the Internet is the leading source of pre-enrollment material for prospective postsecondary students in the United States across multiple student demographics (Burdett, 2013; Daun-Barnett & Das, 2013; Jones, 2008; Venegas, 2006, 2007). For this reason, we analyzed institutional .edu websites for this study. Moreover, we decided to gather data during the college search and exploration process, typically occurring between August and November of each year, as undergraduate applications are most commonly due in December or January (Hossler & Gallagher, 1987). Understanding both student exploration and institutional information practices, we gathered all website data for this study in October 2020. We also only gathered information from institutional undergraduate admissions websites instead of program-specific webpages (e.g., institutional webpages for Spanish majors or Spanish-language programs), as prospective students cannot apply for admission through departmental webpages on U.S. institutional websites. For this reason, we gathered chatbot information from institutional undergraduate admissions websites and not separate departmental webpages.

Once we gathered URLs from IPEDS, we navigated to each institution's website and employed the search tool embedded into each institutional website to search for undergraduate admissions application instructions. We used the embedded search tool to eliminate researcher bias, as using a popular search engine such as Google would render search results influenced by one's own browsing history, cookies, and bookmarks. To locate undergraduate admission application instructions, we entered the search terms "apply for undergraduate admission" and "apply for admission." Using both search terms successfully located undergraduate admission application instructions for all 331 institutions in this study. As previously mentioned, students cannot apply to a U.S. institution

through a departmental webpage, and all 331 institutions in this study included their undergraduate admissions instructions on their main admissions website and not a separate departmental webpage.

Once we located each institution's undergraduate admission application instructions, we coded the page for the presence of a chatbot using a binary coding strategy (0=no, 1=yes), as well as search the undergraduate admission application instructions for any non-English languages, including links to other webpages and materials (e.g., PDF files) in non-English languages. These initial queries were made in Spanish, using the search tool embedded within the institutional website. However, after failing to find any Spanish language information to lead us to the undergraduate admissions instructions, we queried in English and located the correct websites. We also employed the same binary coding strategy to the presence of polylingual content on undergraduate admission application webpages (0=no, 1=yes), helping generate our descriptive statistics evidenced in Table 1 of this study. Finally, we interacted—in Spanish— with each chatbot during normal business hours at the institution (generally 8:00AM to 5:00PM local time) to explore whether these chatbots fell into a particular category of chatbot, explained in the following section.

Data Analysis

Each chatbot underwent three phases of examination and was coded for several variables. First, features were marked on a binary variable (0=no, 1=yes) to assess their functionality with browser extensions. Chatbots were then determined to be either AI-driven or connected to live representatives. In each of these categories, chatbots were coded on an additional binary variable, 'Spanish fluency.' The live representative category included a third 'non-responsive' option. Table 2 reports the results from the latter four of these variables.

First, chatbots were checked to determine whether they functioned in Internet browsers configured to block web page overlays; the research team used a Mozilla Firefox browser with extensions enabled to prevent pop-up windows and screen overlays for this purpose. If a chatbot was blocked by this browser, it was opened in Google Chrome, with no browser extensions, instead. Since extensions to block screen overlays and pop ups are commonly used to avoid advertisements and increase Internet security, many users may not specifically search for chatbots, so chatbots which did not appear in browsers with these privacy and security settings enabled were likely to be missed by users.

When querying the chatbot, all queries were made in Spanish. Once a chatbot was opened, we assessed whether it was operated by AI or whether it connected users to a live representative. Chatbots were coded as connecting to a real person ('Live Person Only') if the interface indicated that a live representative was being contacted; if a representative was introduced by name at the beginning of the chat; or if the researcher judged, based on the interaction, that the chatbot had connected them to a live representative. Interfaces which connected to live representatives usually required some type of identity verification (email, phone number, name, etc.) or involved a wait time while a representative was identified, making them easily identifiable. If the chatbot introduced itself with a name, that was not enough to establish the bot as being operated by a human. Instead, the chatbot needed to respond in accurate Spanish or respond in English and directly answer our question to be coded as having a live representative.

In some cases, chatbots that connected to live representatives were unavailable for assessment because the feature was unable to connect to a representative, no representatives responded to the initial query, or representatives were not online at the time that the research team attempted to contact them (during standard U.S. business hours). These non-responsive cases were coded as 'No response/representative unavailable.'

Once connected to a live representative, the research team asked, in Spanish, if they could speak in Spanish or if the agent could connect them to a Spanish speaker or Spanish resources. If the representative was unable to understand or respond in Spanish, the research team members explained the research project in English and asked again if Spanish language resources were available. Chat functions were marked as 'Live Person, Spanish Fluent' if they connected to a Spanish-fluent operator or if the operator could connect users to a representative who spoke Spanish. Again, all queries were made in Spanish.

If the chatbot did not connect the research team member to a live representative, it was coded as 'Bot Only', and team members tested to see if it could respond to a simple prompt in Spanish (usually ¿Se habla español? 'Do you speak Spanish?'). If the chatbot responded in Spanish, its Spanish competence was then qualitatively assessed through queries about how to apply, if application requires the Common App, when the deadline is, and other information relevant to college admissions. We followed links provided by the chatbot and noted if this additional information was provided in Spanish, if websites could be translated to Spanish, or if links provided novel

information in addition to what the chatbot or the main admissions page provided. We also noted the amount of information provided directly within the chatbot (versus information in external links) and the grammatical proficiency of the chatbot as determined by correct spelling, punctuation, and grammar in Spanish.

If the chatbot did not respond to the initial query in Spanish, we checked to see if the language could be manually changed to Spanish. If so, the research team repeated the above procedure to assess the AI's Spanish fluency and the availability of Spanish materials. Chatbots were coded as 'Bot Only, Spanish Fluency' if AI-run chatbots could speak any amount of Spanish and otherwise were marked as English only.

Limitations

The research team limited this study in several important ways, including this study's sample and population, the depth of data collection and analysis, and the type of information and websites that the research team analyzed.

First, there are thousands of institutions of higher education in the United States, and for the feasibility of data collection and analysis and the temporal nature of Internet information, the research team decided to gather a simple random sample of institutional website information for this study. As a result, the research team only extracted chatbot information from a random sample of institutions to conduct the study in a timely manner. Moreover, data analysis was a considerable strain on researcher capacity, as the research team needed to manually interact with each chatbot and then report and code interactions with the chatbot. As a result, this study may underreport on how pervasive chatbots are in higher education and whether there are statistically significant differences between institutional sectors regarding chatbot integration. From here, future research could expand upon this sample and analyze a larger number of institutional websites using computational linguistics methods or artificial intelligence methods of data mining from chatbots.

Second, as several research team members were fluent Spanish speakers, the depth of data collection and analysis varied from researcher to researcher. One member of the research team was born and raised in Mexico and is a fluent Spanish speaker of the Mexican dialect of Spanish, whereas other research team members were L2 Spanish-fluent speakers and native speakers of English. Although potentially a limitation of the study, the research team conceptualized this linguistic differentiation as a strength of the

study, as different research team members brought different levels of Spanish fluency and insight to the data, rendering deeper findings and provoking deeper levels of discussion. However, had the research team been strictly native Spanish speakers, this study would likely have yielded more nuanced and different results.

Finally, this study gathered information from admissions websites and did not investigate other forms of information from institutional websites, including access to materials related to financial aid, scholarships, housing, and other areas. From here, future researchers should expand the scope of this study and explore other forms of institutional information and the embedding of chatbots, including in other types of institutional websites on both desktop and mobile devices. Expanding this line of research, future work may be able to understand how institutions of higher education prioritize communication technologies and whether these technologies are built with equity in mind for minoritized communities. Ultimately, this study's data and research methodology is unique in higher education spaces and any limitations could be mitigated by the novelty of its data and the ingenuity of the methods to inspire future research and policy advocacy.

Results

Results of the content analysis of admissions websites embedding translated admissions content and/or chatbots into their communications structure can be found in Table 1.

Table 1

Results from content analysis of undergraduate admissions webpages (N=331)

Institution type	Provided Translated Admissions Content	Embedded Chatbot into Admissions Website
Public	9 of 114 (7.9%)	33 of 114 (2.9%)
Private non-profit	8 of 175 (4.6%)	29 of 175 (16.6%)
Private for-profit	0 of 42 (0%)	9 of 42 (21.4%)
Total	17 of 331 (5.1%)	71 of 331 (21.5%)

Data in Table 1 suggest few institutions of higher education either publish non-English language content on their undergraduate admissions webpage or embed chatbots on these webpages to

facilitate access to non-English admissions content for minoritized language populations seeking U.S. higher education. Although not a guiding hypothesis of the study, the research team was surprised to learn that the random sample of institutions provided so little non-English content and prioritized an artificial linguistic technology (chatbot, 21.5% of all institutional webpages) over translations of admissions content (5.1% of all institutional webpages). The research team will address this prioritization and its implications for equity in the discussion section of this study. Overall, only 5.1% of institutions provided non-English language content on their admissions webpages (several Spanish, few Simplified Chinese, few using Google Translate for hundreds of languages), while 21.5% of institutions embedded chatbots on their admissions webpages.

Table 2

Results from quantitative chatbot analysis (N=71)

	Chatbots		Live Chat		
Institution type	Bot-only	Spanish fluency	Live person only	Spanish fluency	No response or representative unavailable
Public (n=33)	17 (23.9%)	14 (19.7%)	11 (15.5%)	3 (4.2%)	5 (7.0%)
Private non-profit (n=29)	6 (8.5%)	5 (7.0%)	12 (12.9%)	1 (1.4%)	10 (14.1%)
Private for-profit (n=9)	1 (1.4%)	0 (0.0%)	6 (8.5%)	1 (1.4%)	2 (2.8%)
Total	24 (33.8%)	19 (26.8%)	29 (40.8%)	5 (7.0%)	18 (25.3%)

Extending the results and data in Table 1, data suggests chat applications embedded into admissions webpages fall into two categories: chatbots (33.8%) and live chat applications that connect users to real people (40.8%). The largest percentage of institutions embed live chat applications who connect to a real person (40.8%), but few of those people can communicate in Spanish (7.0%). Meanwhile, 33.8% of chatbots are fully AI and do not connect the user to a live person; even fewer of those chatbots have been programmed to converse in Spanish (26.8%). Perhaps most problematic, 25.3% of all chatbots were programmed with a live chat application meant to connect an Internet user to a live person, but the person was not responsive or available, bringing into question the usability and purpose of the live chat application. Moreover,

results suggest that institutions prioritize chatbots programmed to speak Spanish (26.8%) instead of recruiting and employing Spanish-fluent live chat agents (7.0%). Implications of these results will be addressed in the Discussion section of this study.

To provide a geographic understanding of where institutions use chatbots, we used the IPEDS database to gather lines of latitude and longitude from each institution to create a geospatial map. This map can be found in Figure 1. Although we had discussed the role that geography may play when institutions integrated chatbots on their websites (e.g., proximity to Mexico and many Spanish speakers), there did not seem to be a relationship between the potential geographic location of Spanish speakers and institutions publishing chatbots.

Figure 1. Geospatial map of institutions integrating chatbots into their undergraduate admissions websites (n=71)

U.S. institutions may be designated as Hispanic-Serving Institutions (HSIs) if they enroll 25% or more undergraduate Hispanic or Latinx full-time students (Taylor, 2018, 2019), but only six of the 71 institutions who integrated chatbots into their undergraduate admissions websites had HSI designations, and of those six institutions, only one institution integrated a bilingual chatbot (University of Texas at Rio Grande Valley). In this case, data from this study does not suggest that Spanish language chatbots are intentionally integrated by institutions who recruit or enroll large Spanish-speaking populations, nor is there a relationship between HSI designation and bilingual chatbot integration.

Major Themes from Chatbot and Live Chat Application Spanish Fluency Analysis

Chatbots Programmed in English Only (With Little/No Spanish Resources). A small number of the chatbots (n=5) never connect users to live people and had no functionality in Spanish. Often, these bots also included fixed programming that required users to select pre-set items from a menu to interact with the bot or did not provide responses, even in English, to the original query. For example, the chatbot provided by the University of Central Arkansas, when asked in English if it speaks Spanish, provided a set of links to the department of Language, Linguistics, Literatures, and Cultures and the Latin American and Latino Studies Minor. Foothill College used the same bot, which professed functionality in both Spanish and English. However, when asked if it speaks Spanish, it provided a pre-set dialogue option in Spanish which offered, but did not provide, links to relevant material. In general, AI-driven chatbots programmed only in English, or which profess Spanish fluency but do not deliver, were easily confused by unexpected input and relied heavily on redirecting users to websites, usually in English, rather than providing information directly in the chat window.

In addition to fully-AI chat features, most chat interfaces that connected users to live representatives included a pre-contact step requiring users to input some combination of their name, email address, or phone number before being connected. In five cases, the chat required users to connect to either a Facebook Messenger account, a Google account, or to use a two-step email verification process. Members of the research team often failed to navigate the processes that required dual authentication due to factors such as email delays, link timeouts, redundant redirects, etc. These identity verification processes presented several challenges, which exceptionally tax Spanish speakers. First, these initial chatbot interfaces were available exclusively in English, limiting access for monolingual Spanish users, even if the eventual live representatives did speak Spanish or could connect users to a Spanish speaker. In addition, since these chat interfaces require disclosure of personal information, they deter users who are hesitant to record this information online or with unknown parties. Finally, these identity verification procedures were often tedious, confusing, or impossible to navigate for the English-fluent members of the research team, suggesting that they may present an insurmountable barrier regardless of a user's language proficiency.

Chatbots Programmed in Spanish (With Varying Levels of Fluency). Chatbots that have some Spanish functionality (n=14) are more

mixed than those programmed exclusively in English. The most popular chatbot "skins" in this sample are used by five institutions each. Bridgewater State University and Broward College exemplify these two interfaces, both of which require users to (semi)manually change the chat language from English (the default) to Spanish. Once in Spanish, these bots provide grammatically correct responses in Spanish and provide users with links to web pages (usually in English) detailing the application process. Unlike the chatbots programmed exclusively in English, the ones with some multilingual functionalities tend to be more difficult to confuse; they generally do not require users to select their queries from a list of pre-set options, though they provide pre-set options as starting points, and they respond relatively well to input with minor grammatical or typographical errors. The Broward College model requires users to select their language manually from a drop-down list of options; the Bridgewater State interface allows users to either manually select their language or to work through a series of in-line prompts, available only in English, to set a preferred language.

Not all chatbots require a manual change of language, however. A very small number of chatbots automatically adjust when spoken to in Spanish. Florida State College at Jacksonville offers what might be considered the best-case scenario. This interface appears, on the surface, to be the same chat program as some which profess, but do not deliver, Spanish options. However, it opens with a bilingual statement that it can answer questions in both Spanish and English, and it automatically changes to Spanish responses when addressed in Spanish. Unlike other chatbots with similar front ends, this interface provides basic step-by-step instructions outlining the admissions process along with a link to the application portal when queried about the process.

Chatbot Connects to Live, English-Fluent Person (With Caveats). The majority of admissions website chat functions (n=47) connect users not to an AI, but rather to a live representative. In contrast to the chatbots, most of which had some level of Spanish capability, a slim majority of the live operators were unable to speak Spanish and did not have Spanish resources or operators. In several cases, operators stated that no resources were available in Spanish because all classes were offered in English. In one case (Alfred University) the operator did not speak Spanish, but instructed users to change the language of the website to Spanish; this outcome contrasted with most cases with AI chat interfaces which included some level of Spanish functionality inline but redirected users to web pages exclusively available in English. In some cases, monolingual representatives relied on automated translation software; in at least

one case (Strayer University-Alabama), the feature connected users to a monolingual English speaker who conducted a conversation using automated translation software (Google Translate). Another (Grace College and Theological Seminary) connected members of the research team to a live operator who stated that the chat system had the option to enable a Spanish language, but that the institution had not enabled it.

Like the English-only AI interfaces, chat functions that connected live people also exhibited noteworthy variation in their accessibility. Many interfaces which connected to live operators were only available during designated times or did not reply to incoming messages. Of these options, fourteen either provided no response within half an hour of the original message or did not have online operators when members of the research team tested the functions (during morning business hours in the U.S. Central Time Zone). Like the chat options that collect personal identifying information to connect users to a live counselor, the chat functions which fail to respond or respond only during designated times create barriers to access for applicants, particularly applicants in different time zones or those who are unavailable during normal business hours (e.g., students enrolled in school or potential applicants with jobs during normal business hours)

Chatbot Connects to Live, Spanish-Fluent Person. The remainder of the chat functions connected users to live operators who either spoke Spanish or directed users to specific staff members who did speak Spanish and could be contacted by email or phone. Of these, only a small number of operators (n=5) were Spanish fluent. The remainder of operators were English speakers who provided contact information for specific staff members in their admissions office who could provide information in Spanish.

An additional hitch of many widely used bot options is related to their integration to the rest of the web page. When accessed on a browser that blocks some screen overlays (e.g., with browser settings configured to block some advertisements and Javascript), many bots (n=18) do not appear, which means that these settings may be unavailable to applicants who have these settings enabled and are not specifically searching for chat options.

Discussion

Ultimately, data from this study successfully answers this study's research questions and implies much for professionals working in enrollment management, admissions, and financial aid in U.S. institutions of higher education, as well as L1 Spanish speaking

students and families pursuing U.S. higher education. Although Hefny et al.'s (2021) bilingual chatbot at the German University in Cairo, Egypt is a precursor to this research study, data suggests that very few U.S. institutions of higher education program have followed Hefny et al.'s (2021) lead. This finding is troubling, given decades of research suggesting that L1 Spanish speaking students and their families could greatly benefit from translated content to understand the complexities of college admissions and financial aid during their pursuit of U.S. higher education (Astin, 1982; Ceja, 2001; Kanno, 2018a; Núñez & Oliva, 2009; Post, 1990; Taylor, 2018; Torrez, 2004).

Data in this study also suggests that as technology has advanced and universities are embracing this technology in the form of chatbots. There has not been a similar embrace of minoritized language populations, especially Spanish speaking families and students pursuing higher education. For example, data from this study suggests only 71 out of 331 overall institutions use chatbot technologies on their undergraduate admissions website, even though this technology has been widely available for the past five to ten years and is nearly ubiquitous in the business world (Taylor & Hartman, 2019). Perhaps chatbot technology is too expensive for many institutions of higher education, but as technology advances, it often becomes cheaper and more efficient to operate, and thus, institutions of higher education should be able to embrace this technology to open the doors of information to prospective students and families in the future (Hefny et al., 2021). Currently, 21st century college students may expect institutions of higher education to be embracing advanced technologies such as chatbots or virtual college tours; however, these institutions may be lagging in the technological prowess and expectations of their prospective student base.

Additionally, data in this study evidences the continued minoritization of non-English language populations in United States higher education, as Hefny et al. (2021) demonstrated that bilingual chatbot programming is possible. Yet, very few U.S. institutions of higher education have programmed their chatbots to speak Spanish, nor have these institutions staffed Spanish speaking admissions professionals to provide Spanish language content if a chatbot is not functional in Spanish. In this regard, English-only chatbots facilitate even greater access to higher education for native English speakers and further minoritizes L1 Spanish speaking students and families, continuing a troubled cycle of a denial of access to higher education for the latter populations.

Additionally, the data in this study does not suggest a relationship

between geography or Hispanic-Serving Institution designation and chatbots, whether they be English-only or English-Spanish bilingual. For example, the states of California, Arizona, Texas, and Florida are home to institutions that enroll the greatest numbers of students identifying as Hispanic or Latinx, specifically the population that is most likely to be Spanish-speaking or have Spanish-speaking families and support networks (Fann et al., 2009; Martinez et al., 2013; Taylor, 2018). However, as Figure 1 displays and the data implies, geographic location of an institution or its potential to be Hispanic-Serving may not be associated with Spanish fluent chatbots and accessible information structures for prospective Spanish-speaking undergraduates pursuing higher education in the United States.

From here, professionals and researchers working in enrollment management, admissions, and financial aid ought to prioritize the bilingual or polylingual programming of advanced linguistic technologies such as chat bots to facilitate even greater access to postsecondary information for minoritized language populations. To achieve this goal, U.S. institutions of higher education should value the cultural capital and community cultural wealth (Yosso, 2005) that these populations possess and work with these communities and professionals to ensure that translated content and polylingual programming is native and as authentic as possible. A refusal to work alongside minoritized language populations effectively sends the message that U.S. institutions of higher education do not value diverse people and do not value their diverse languages.

However, several institutions in this study did provide a high quality bilingual chatbot or Spanish speaking professional that provided high quality information. For instance, Newberry College programmed their chatbot to automatically change to Spanish if a Spanish language inquiry was entered into the chatbot. Similarly, the University of Nebraska at Kearney provided a bilingual website, although their chatbot required a manual change to Spanish and did not have information in Spanish that could be provided without interacting with a human agent. Perhaps the two best chatbots discovered in this study belonged to Indiana University at Bloomington and Broward College, both of whose bots required a manual change to Spanish but then did provide high quality native translations of access information into Spanish without requiring elevation to a human agent. In these regards, several U.S. institutions of higher education are leveraging both information technologies and minoritized languages to open the doors of access to non-native English speakers.

Despite several instances of linguistic equity, data in this study overwhelmingly demonstrates that many U.S. institutions of higher education are both failing to leverage 21st century communication technologies and have not invested in minoritized language communities. This shortfall falls onto the shoulders of information technology professionals and leaders of enrollment management and admissions at U.S. institutions of higher education. If Hefny et al.'s (2021) study can serve as a springboard—along with positive outcomes from chatbot development at Georgia State University and Arizona State University, among others—U.S. higher education could become a much more linguistically inclusive space for minoritized language populations, especially L1 Spanish speakers. Until then, communication technology will continue to advance while minoritized language populations will continue to wonder when that technology will communicate with them.

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