

Receptivity of Mexicans to Humanoid Robots in the Workplace and in Private Relationships: An Empirical Study

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Abstract

This was a pioneering study in attempting to measure the cultural receptivity (i.e., potential acceptance in the workplace and in personal relationships) of Mexicans regarding Humanoid Robots (HRs). It is also a pioneering effort in assessing distinctions of such receptivity between students with business majors and those with majors in STEM. A robust quantitative study was conducted in a university in central Mexico where half the students majored in business and the other half in STEM. Four demographic independent variables (gender, year of study, academic major, and work experience) were tested along with twenty-five attitudinal questions. In addition, respondents were asked to rate the expected performance of HRs by occupation. The results indicated significant differences regarding the four demographic variables, the attitudinal questions, and occupational rating. Given the expected immense growth and impact of the HR industry in the next few decades, knowledge of the cultural receptivity to HRs in the workplace and households regarding perceptions, attitudes, preferences, and expectations provides utilitarian benefit for the coming challenges and opportunities of integrating HRs into human society

Key Terms: Artificial intelligence, Humanoid robots, Human-robot interaction, Job displacement, Cultural receptivity.

1. Introduction

The fusion of artificial intelligence and machine learning is allowing for significant technological development regarding the manufacturing of robots, in general, and humanoid robots (HRs) in particular. Increasing technological development alongside decreases in production costs guarantees the mass production of robots and their increasing adoption in the workplace and households (Goldman Sachs, 2024; International Federation of Robots, 2024; Markets and Markets, 2024). The International Federation of Robotics recently determined the number of industrial robots worldwide at about 3.9 million (International Federation of Robotics, 2024). Though the growth of the HR population is in its infancy, it is estimated to increase to at least fifty million by 2050, generating a potential annual revenue of up to \$1.5 trillion (USD) (Siepen et al., 2024). Elon Musk, whose Tesla Corporation created a prototype HR named Optimus with an estimated price tag of 20,000 USD per unit, provided a much more ambitious prediction of about one billion HRs in the 2040s (The Economic Times, 2024, January 22). Global X ETFs estimates a potential addressable market of \$4.85 trillion (USD) in 2035 with 1.74 trillion (USD) for industrial HRs and 3.10 trillion (USD) for the service industries but mainly for households where 15% of an estimated 1.5 billion global households could result in 225 million household HRs (Caspi, 2024). China is expected to surpass the global average, reaching about 2.16 billion yuan (approximately 300 million USD) in 2024 and reaching 38 billion yuan (approximately 5.2 billion USD – based on the current exchange rate) by 2030 (Global Times, 2024, April 20).

Despite the enormity of the future HR market and its potential impact on the workplace and personal interaction with humans, very few studies on their receptivity have been conducted. Most have focused on psychometric assessments relating to general anxiety and fear (Bartneck, et al., 2006; Kaplan, 2004; Krageloh, et al., 2019). In addition, most of these studies were conducted in Western Europe and the United States. Regarding Latin America, only one study has been conducted – in Argentina (Joosse et al., 2014).

This study is a pioneering effort that examined cultural receptivity (i.e., potential acceptance in the workplace and in personal relationships) to HRs in Mexico relating to the workplace and personal relationships. Few studies regarding robotics in Mexico have been conducted because, although its population is over 129 million (Worldometer, 2024), the country has lagged behind neighboring United States, Canada, and North American Free Trade Agreement (NAFTA) partners in the development of the robotics industry (Association for Advancing Automation, 2017). Partly because the Mexican government almost exclusively funds research in the physical sciences, existing literature from Mexico on HRs has primarily focused on mechanical aspects of assistive technologies (Caballero Morales, 2014, 2016, Caballero Morales et al., 2013; Lopez-Caudana; Nava-Lagunes, 2017; Nunez, et al., 2012; Ponce, et al., 2019). However, no business studies have been conducted in Mexico regarding cultural receptivity to HRs in the workplace or regarding personal relationships (i.e., friendship and intimacy). In addition, this is the first study ever to gauge receptivity to HRs based on the academic field of study (specifically, business majors v. STEM - Science, Technology, Engineering, and Math majors).

2. Research Objectives:

1. To determine if the degree of receptivity to HRs is affected by gender, level of education, field of study (Business majors v. STEM majors), and work experience.
2. To determine differentials regarding the ratings of how well HRs will perform in various occupations.
3. To determine perceptions of the potential impact of HRs in the workplace, including fear of job displacement.
4. To determine the degree of receptivity to friendship and intimacy with HRs.

3. Literature Review

Four demographic independent variables were used to examine receptivity: gender, level of education (specifically freshman – year 1 to senior – Year 4 in an undergraduate program), field of study (Business majors v. STEM majors), and work experience. Age was not used because the overwhelming number of respondents fell between 18 and 22 years of age. (See the demographic profiles of the general and inferential populations in the Research Design and Methodology section of this study.) In the limited body of literature on HRs, many studies did not utilize gender as an independent variable for consideration. Those that did use gender, found that male respondents reacted more positively to human-robot interaction (HRI) (Andtfolk et al., 2021; Nomura et al., 2015; Nomura & Takagi, 2011) while other studies indicated that female respondents expressed less negativity and stress regarding HRIs than males (Bartneck et al., 2006; Mavridis et al., 2012; Nomura et al., 2008). A few studies found that there were no significant differences regarding gender (Alemi et al., 2021; Kamide et al., 2012; Riek et al., 2010). Given the preponderance of the literature, this study presented the following hypothesis.

H1: There will be a statistically significant difference in ratings of the receptivity statements by gender.

No studies were found that gauged receptivity based on level of education. The general population of the educational institution under examination for this study was limited to undergraduates. However, unlike age, the independent variable of education attainment helps to determine if incremental knowledge on a burgeoning field of the scientific development of HRs affects receptivity.

H2: There will be a statistically significant difference in ratings of the receptivity statements by educational attainment, specifically year in college (Freshman, Sophomore, Junior, and Senior).

The undergraduate population of the educational institution examined for this study consisted of 51% of students with business majors and 49% with STEM majors. This offered the opportunity to assess whether a business orientation versus a scientific, non-business orientation affected receptivity towards HRs. Since no literature exists (Mexico and worldwide) regarding this academic orientation, this study is a pioneering effort that assumes such distinctions exist regarding receptivity.

H3: There will be a statistically significant difference in ratings of the receptivity statements by major field of study (Business vs. STEM)

There exists a fairly robust body of academic literature that presented negative perceptions of the potential impact of robots (including HRs) on labor markets in the future, including the threat of job displacement. (Carbonero et al., 2018; Ford, 2016, 2021; Liu, 2019; Morikawa, 2017;

Oxford Economics, 2019; Rodgers & Freeman, 2019; Thomas, 2021), while some studies have projected that the employment of humans will not be threatened and may actually increase. (Acemoglu & Restrepo, 2019; Autor & Salomons, 2017; Dahlin, 2019). This study examined the independent variable of work experience to gauge if exposure to the workplace would affect overall receptivity to HRs as co-workers in the business world.

H4: There will be a statistically significant difference in ratings of the receptivity statements by work experience (Greater than or equal to one year vs. less than one year)

This study determined to further explore receptivity by providing a series of occupations to assess the potential viability of employment by HRs. This listing is unique to this study.

H5: There will be statistically significant differences in the ratings of how well HRs will perform in various occupations

4. Research Design and Methodology

The undergraduate program of a university in central Mexico was examined for this study, using convenience sampling. A review of the undergraduate program found that 51% of its students had business majors and 40% had STEM majors. An inferential sample size of 276 was determined, using Krejcie and Morgan's (1970) table for such tabulations. However, the study's sample population was increased to 400 (41% of the total undergraduate population) and maintained its inferential integrity with 204 students with business majors (51%) and 196 students with STEM majors (49%). The exact gender breakdown of the undergraduate program was maintained within the same inferential sample: 57% male and 43% female. An exact breakdown, by percentage, of classification by year was obtained. (Note: The higher number of lower-classmates is because the university is fairly new.)

A self-administered paper questionnaire was administered to students in a classroom setting during a one-semester period. Students were informed beforehand that participation in the survey was voluntary and that refusing to participate would not affect their grades. They were also informed that the administration was anonymous with no name or student identification number. The research design in general, and the survey in particular, were approved by the university's research ethics committee. The research conducted adhered to the ethical principles developed in the Declaration of Helsinki regarding the testing of human subjects.

The research instrument was a survey that consisted of a 5-point Likert scale given to students in a classroom setting during a one-semester period. The 5-point Likert scale was structured from "Strongly Disagree" (weighted as 1) to "Strongly Agree" (weighted at 5) with "Not sure" as a middle value (weighted at 3). All scales had a Cronbach alpha internal reliability score of .80, thereby indicating consistency and high internal reliability (Hair et al., 2010; Sekaran, 2000). The questionnaire was in Spanish and was written and pre-tested by native speakers of Spanish. The

questionnaire consisted of four demographic variables: gender, year in college, academic major (business v. STEM), and work experience. Age was not operationalized as a demographic independent variable because the age range of the students (mostly 18 to 22) was too narrow. Other potential demographic variables such as ethnicity and religion were also not used due to very significant homogeneity of the population. In addition to the demographic variables used, there were twenty-five attitudinal questions (see listing in the Research Findings and Discussion section of this study) to explore dimensions of receptivity about different aspects of HRI.

5. Research Findings and Discussion

The receptivity variables were operationalized using a set of statements to which respondents reported their level of agreement. These statements are presented below. The order of the statements is the same as they were presented in the survey.

Receptivity Statements

<u>Dependent Variable</u>	<u>Corresponding Question in the Administered Survey</u>
Intro Good	The introduction of humanoid robots into society will be good for humans.
More Effective	Humanoid robots will perform work more effectively than humans.
More Cheaply	Humanoid robots will create products or services more cheaply than humans.
Enter Workforce	I believe that humanoid robots will enter the workforce in: One year (Likert value of 1) Five Years (value of 2) Ten Years (value of 3) Twenty Years (value of 4) More than Twenty Years (value of 5)
Take my Job	I believe that humanoid robots will take away my job in the future.
Better Soldiers	I believe that humanoid robots will be better soldiers than humans.
Lose Control	I believe that human beings may lose control of humanoid robots.
Right from Wrong	I believe humanoid robots can develop a conscience – i.e., know right from wrong – and will act on that conscious.
Fewer Babies	Humanoid robots may cause people to have fewer babies and the population may go down as a result.
Work with Well	I believe that I can work well with a co-worker who is a humanoid robot.
Cannot Angry	I like the idea that a humanoid robot cannot get angry at me or be abusive.
Accept Politician	I believe it is OK to have a humanoid robot as a politician making rules for us.
General of Army	I believe it is OK to have a humanoid robot as a General leading an army.
CEO of Company	I believe it is OK to have a humanoid robot as the Chief Executive Officer

Take over Control	I believe there is a chance that humanoid robots may try to take control over humans.
Harm Economy	I believe that bringing humanoid robots into the workforce will cause a lot of instability and harm the economy.
Good Friend	I believe that a humanoid robot can be as good a friend as a real human being.
Fall in Love	I believe it is possible to fall in love with a humanoid robot and have a relationship like a human.
Intent to Buy	When they become available, I would like to buy a humanoid robot to work in my home.
Lower Prices	I would choose to do business with a company that had humanoid robots that interacted with customers if it lowered the prices that the company charged.
Widely Accepted	I believe that humanoid robots will be quickly and widely accepted by the public, in general, around the world.
Replace Humans	I believe it is wrong for a company to replace humans with humanoid robots to lower the company's labor costs.
Plan Sex	When I have the opportunity, I plan to have sex with a humanoid robot.
Comfort	I would feel comfortable working with a humanoid robot.
Sick	People who have sex with humanoid robots are sick.

In addition to the HR receptivity statements a total of five demographic variables were self-reported in the survey including gender, class year in the university, their major area of study (business vs. STEM), and whether the respondent had worked in a job for at least a year. The statistics describing the sample are provided in Table 1.

Table 1: Sample Demographics

Gender		University Classification by Year of Study				University Majors		Worked at Least One Year	
Female	Male	Fr.	Soph.	Jr.	Sr.	Bus.	STEM	Yes	No
173	227	114	102	101	83	204	196	232	168

The first hypothesis, H1, suggested that significant differences in mean ratings to the receptivity statements would exist in the responses by gender. To test this hypothesis, a t-test was conducted on the data to identify any significant differences that might exist in responses to the receptivity statements. Since there was a lack of homogeneity of variance for the two groups for some of the statements, the SPSS t-test option for Equal Variances Not Assumed was used in examining the

results for differences when the Levene test indicated unequal variances across the two groups. The results of this hypothesis test are presented in Table 2.

Table 2: t-test Results of Mean Response Ratings for Humanoid Robots by Gender*

Receptivity Statement	Gender				Mean Differ	t	p
	Female (173)		Male (227)				
	M	SD	M	SD			
More Cheaply	3.94	.929	4.19	.937	-.249	-2.640	.009
Take My Job	3.34	1.020	2.67	1.244	.667	5.889	>.001
Better Soldiers	3.60	1.114	3.86	1.296	-.258	-2.136	.033
Lose Control	4.09	1.120	3.45	1.122	.633	5.596	>.001
Fewer Babies	3.19	1.222	2.93	1.077	.257	2.192	.029
Work Well With	3.30	.995	3.64	1.005	-.343	-3.393	.001
General of Army	1.89	1.070	2.19	1.161	-.299	-2.641	.009
Take Over Control	3.46	1.305	2.89	1.192	.577	4.546	>.001
Good Friend	1.94	1.290	1.57	.882	.368	3.223	.001
Fall in Love	4.29	1.006	3.97	1.136	.321	2.991	.003
Lower Prices	2.42	1.467	3.21	1.502	-.795	-5.300	>.001
Replace Humans	4.10	1.060	3.84	1.158	.261	2.318	.021
Plan Sex	1.44	.865	2.20	1.339	-.762	-6.809	>.001
Comfort	3.71	.883	3.93	.856	-.223	-2.558	.011
Sick	3.10	1.310	2.50	1.141	.606	5.416	>.001

* Where 1 = Strongly Disagree and 5 = Strongly Agree

The first hypothesis proposed that there would be significant mean differences in the acceptance responses between men and women. Table 2 indicates that differences were identified with over half, fifteen of the twenty-five receptivity statements: More Cheaply ($t = -2.640$, $df = 398$), Take my Job ($t = 5.889$, $df = 395.870$), Better Soldiers ($t = -2.136$, $df = 392.209$), Lose Control ($t = 5.596$, $df = 398$), Fewer Babies ($t = 2.192$, $df = 344.138$), Work Well With ($t = -3.393$, $df = 398$), General of Army ($t = -2.641$, $df = 398$), Take Over Control ($t = 4.546$, $df = 351.907$), Good Friend ($t = 3.223$, $df = 288.423$), Fall in Love ($t = 2.991$, $df = 389.157$) Lower Prices ($t = -5.300$, $df = 398$), Replace Humans ($t = 2.315$, $df = 398$), Plan Sex ($t = -6.809$, $df = 355.210$), Comfortable (working with) ($t = -2.555$, $df = 398$) and Sick ($t = 5.416$, $df = 398$).

The analysis indicated that there were significant mean differences in fifteen of the twenty-five receptivity statements by gender. Women had higher mean ratings for a total of eight statements: Take My Job, Lose Control, Fewer Babies, Take Over Control, Good Friend, Fall in Love, (wrong to) Replace Humans, and Sick. Taking this together these data would seem to indicate that women had a more negative view of accepting HRs except when it comes to having them as a friend. Men had higher mean acceptance ratings for seven statements: More Cheaply, Better Soldiers, Work Well With, General of Army, Lower Prices, Plan, and Comfort. Taken together, these ratings indicate a more positive acceptance view of HRs by men relative to women. Based on these findings, Hypothesis H1, that there would be differences in mean ratings of the acceptance statements by gender, received mixed support.

The next hypothesis, H2, suggests that mean ratings of the acceptance statements would differ significantly by year in college (i.e., freshman, sophomore, junior, and senior). To examine the data for differences in mean acceptance statement ratings by year in university, MANOVA was

selected as the appropriate statistical method to minimize any possible Type-1 error. Further, since the data failed to meet the requirements for homogeneity of variance and group size equality, a robust Welch test was used to examine the data for significant differences (Mendes & Akkartal, 2010). Table 3 provides the results of this test and shows the receptivity statements where at least two of the four university class groups exhibited significant statistical differences in ratings.

Table 3: Statistically Significant Differences in Receptivity Statement Means by University Class (Year of Study)

Receptivity Statement	Source	DF	SS	MS	F	Welch's F	p
More Cheaply	Between	3	12.697	4.232	4.931	4.884	.003
	Within	693	339.901	.858			
	Total	399	352.597				
Better Soldiers	Between	3	33.218	11.073	7.743	7.810	>.001
	Within	693	566.279	1.430			
	Total	399	599.498				
Harm Economy	Between	3	27.628	9.209	6.273	5.722	.001
	Within	693	581.349	1.468			
	Total	399	608.977				
Good Friend	Between	3	19.454	6.485	5.633	8.268	>.001
	Within	693	455.844	1.151			
	Total	399	475.298				
Fall in Love	Between	3	17.039	5.680	4.901	6.728	>.001
	Within	693	458.899	1.159			
	Total	399	475.937				
Widely Accepted	Between	3	10.402	3.467	3.196	3.216	.024
	Within	693	429.588	1.085			
	Total	399	439.990				
Replace Humans	Between	3	12.210	4.070	3.284	3.639	.014
	Within	693	490.790	1.239			
	Total	399	503.0004.				
Plan Sex	Between	3	15.093	5.031	3.837	4.226	.007
	Within	693	519.267	1.311			
	Total	399	534.360				

Therefore, differences were found to exist in mean receptivity statement ratings for eight variables: More Cheaply, Better Soldiers, Harm Economy, Good Friend, Fall in Love, Widely Accepted, Replace Humans, and Plan. To determine where those differences exist, a Games-Howell post hoc test was conducted which does not assume equality of variances. The results of this test are provided in Table 4.

Table 4: Statistically Significant Pairings of Receptivity Statements by University Class*

Receptivity Variables	Classifications	M	SD	p-value
More Cheaply	Fr. vs. Jr.	4.28 vs. 3.71	.883 vs. .966	.002
Better Soldiers	Fr. vs. Soph.	4.08 vs. 3.51	1.266 vs. 1.357	.004
	Fr. vs. Jr.	4.08 vs. 3.51	1.266 vs. 1.068	.001
	Soph. vs. Sr.	3.45 vs. 4.03	1.357 vs. 1.015	.011
	Jr. vs. Sr.	3.51 vs. 4.03	1.068 vs. 1.015	.007
	Soph. vs. Sr.	2.72 vs. 3.52	1.221 vs. 1.295	.001
Harm Economy	Soph. vs. Sr.	2.72 vs. 3.52	1.221 vs. 1.295	.001
Good Friend	Fr. vs. Sr.	1.65 vs. 1.34	.907 vs. .641	.045
	Soph. vs. Sr.	2.02 vs. 1.34	1.229 vs. .641	>.001
	Jr. vs. Sr.	1.78 vs. 1.34	1.262 vs. .641	.011
Fall in Love	Fr. vs. Sr.	4.08 vs. 4.51	1.181 vs. .786	.019
	Soph. vs. Sr.	3.86 vs. 4.51	1.161 vs. .786	>.001
	Jr. vs. Sr.	4.14 vs. 4.51	1.037 vs. .786	.033
Replace Humans	Soph. vs. Sr.	3.72 vs. 4.19	1.040 vs. 1.019	.020
Sick	Fr. vs. Jr.	2.45 vs. 2.99	1.040 vs. 1.158	.004

* Where 1 = Strongly Disagree and 5 = Strongly Agree

As indicated in Table 4, of the 150 pairings of the four classes over the twenty-five receptivity statements, a total of fourteen pairings (9.3%) were significantly different in their mean ratings by the various class groups. For the variable Widely Accepted, the post hoc test did not indicate significance for any of the pairings even though the Welch test did indicate that there were differences in one or more of the various pairings. Freshmen and juniors were close to being statistically significantly different at $p = .057$. As one might expect since there are few age or experience differences in what is usually comprised of a four-year period, not many differences were identified across class mean receptivity ratings. However, it does appear that students do become more divergent in their receptivity statement ratings as they advance in their class status. Freshmen, sophomores, and juniors were found to be significantly different from other classes six times respectively in the class pairings, while seniors were shown to be significantly different in their ratings a total of ten times, forty percent higher than the other classes examined. Hypothesis two receives partial support.

Hypothesis three, H3, suggested that there would be significant differences in ratings of the receptivity statements by the major fields of study of the respondents: Business vs. STEM. To test this hypothesis, a t-test was performed on the data. Again, since homogeneity of variance was, in many cases, not equivalent for the two groups, where appropriate, the SPSS t-test option for Equal Variances Not Assumed was used in exploring the results for differences. This was done when the Levene test indicated unequal variances across the two groups. Results of this test are presented in Table 5.

Table 5: t-test Results of Mean Response Ratings Receptivity Statements by Major Field Study1

Receptivity Statement	Major Field of Study				Mean Differ	t	p
	Business (204)		STEM (196)				
	M	SD	M	SD			
Introduction Good	3.41	.934	3.72	.931	-.318	-3.404	.001
Enter Workforce ²	2.94	.834	3.41	.964	-.467	-5.171	>.001
Lose Control	3.96	1.078	3.48	1.200	.476	4.169	>.001
Right from Wrong	2.36	1.177	2.63	1.244	-.265	-2.188	.029
Work Well With	3.36	1.034	3.64	.975	-.280	-2.784	.006
Cannot Angry	3.63	1.190	3.96	1.104	-.327	-2.845	.005
CEO of Company	1.71	1.037	2.41	1.260	-.702	-6.074	>.001
Take Over Control	3.39	1.229	2.87	1.269	.515	4.123	>.001
Harm Economy	2.68	1.183	3.35	1.199	-.666	-5.586	>.001
Widely Accepted	3.85	1.051	4.15	1.030	-.300	-2.882	.004
Plan Sex	1.65	1.057	2.19	1.364	-.540	-4.033	>.001
Comfort	3.77	.901	3.94	.814	-.176	-1.974	.049
Sick	2.96	1.136	2.46	1.128	.506	4.231	>.001

¹ Where 1 = Strongly Disagree and 5 = Strongly Agree

² Where 1 = One Year, 2 = Five Years, 3 = Ten Years, 4 = Twenty Years, and 5 = >Twenty Years

Hypothesis three suggested that there would be significantly different mean receptivity ratings based on the major field of study of the respondents. The results of the test of this hypothesis are presented in Table 5. This table indicates that fourteen of the twenty-five receptivity statements received significantly different mean receptivity ratings for the two groups. These statements included: Introduction Good ($t = -3.404$, $df = 398$), Enter Workforce ($t = -5.171$, $df = 385.028$), Lose Control ($t = 4.169$, $df = 389.538$), Right from Wrong ($t = -2.188$, $df = 398$), Work Well With ($t = -2.784$, $df = 398$), Cannot Angry ($t = -2.845$, $df = 398$), CEO of Company ($t = -6.074$, $df = 377.804$), Take Over Control ($t = 4.123$, $df = 398$), Harm Economy ($t = -5.586$, $df = 398$), Widely Accepted ($t = -2.882$, $df = 398$), Plan Sex ($t = -4.033$, $df = 220.683$) Comfort ($t = -1.974$, $df = 298.058$), and Sick ($t = 4.231$, $df = 398$).

The analysis indicated that business students rated only three of the significantly different receptivity statements higher than did the STEM students. These included Lose Control, Take Over Control, and Sick (to have sex with an HR). Business students were somewhat less receptive due to the possibility that control might be an issue between HRs and humans.

STEM students had significantly higher mean ratings for ten of the receptivity statements including: Introduction Good, Enter Workforce, Right from Wrong, Work Well With, Cannot Angry, CEO of Company, Harm Economy, Widely Accepted, Plan Sex and Comfort (to work with). Only one of these statements, Harm Economy, expresses a negative opinion of the introduction of HRs. The largest mean differences, those greater than .5 on the 5-point scale, were for the statements: CEO of Company, Take Over Control, Harm Economy, Plan Sex, and Sick. That STEM-rated HRs as being OK for CEO of a Company may be due to Business students possibly having a better understanding of what is required to function successfully as a CEO. Hypothesis three was partially supported.

Hypothesis four, H4, suggests that ratings of the receptivity statements will be significantly different for those who had a job for a year or more relative to those who had not. To test this hypothesis, a t-test was once again conducted on the data accounting for inequality of homogeneity of the distributions where indicated by the Levene test. The results of this test are provided in Table 6.

Table 6: t-test Results of Mean Response Ratings Receptivity Statements by Work Experience*

Receptivity Statement	Work Experience				Mean Differ	t	p
	≥ One Year (232)		< One Year (168)				
	M	SD	M	SD			
Fewer Babies	3.20	1.146	2.83	1.116	.375	3.267	.001
CEO of Company	1.93	1.169	2.22	1.230	-.294	-2.404	.017
Harm Economy	2.82	1.207	3.27	1.231	-.449	-3.641	>.001
Good Friend	1.83	1.125	1.58	1.029	.249	2.260	.024
Widely Accepted	3.89	1.037	4.14	1.055	-.245	-2.312	.021

*Where 1 = Strongly Disagree and 5 = Strongly Agree

The test of hypothesis four, that there would be significant differences in receptivity ratings between those that had at least one year of work experience as compared to those that did not result in five significant differences: Fewer Babies ($t = 3.267$, $df = 398$), CEO of Company ($t = -2.404$, $df = 348.918$), Harm Economy ($t = -3.641$, $df = 398$), Good Friend ($t = 2.260$, $df = 398$), and Widely Accepted ($t = -2.312$, $df = 398$).

Those who had worked at least a year had higher mean ratings for two statements: Fewer Babies and Good Friend. Those that reported not working for at least a year had three statements where their mean receptivity ratings were higher: CEO of Company, Harm Economy and Widely accepted. While no theme seemed to emerge from these differences, all differences were below .5 on the 5-point scale with which they were measured. Higher ratings that a HR would be OK as a CEO may be due to lack of experience in a working environment. Note that the group that had not worked had greater concerns that HRs might hurt the economy but also saw them as being widely accepted. While there were a few differences based on work experience, Hypothesis 4 received partial support.

The final hypothesis, H5, suggested that there will be significant differences in the ratings of selected occupations as to how well HRs would perform in those occupations. In order to test this, the mean across all occupations tested was determined to be 3.28 on a scale of one to five where one was "low probability" and five was "high probability" of performing well. A t-test was then conducted to see if the various occupations varied significantly from this mean rating. Results of this test are presented in Table 7.

Table 7: t-test of Differences in Mean Ratings for Expected Performance in Occupations Occupation

Occupation	Mean Expectation	SD	t	df	Mean Difference	p
Police/Firefighters	4.76	.624	47.155	399	1.472	>.001
Actors/Singers	3.94	1.085	12.018	399	.652	>.001
Childcare Providers	3.91	1.197	10.390	399	.622	>.001
Factory Workers	3.87	1.002	11.714	399	.587	>.001
Sex Workers	3.49	1.321	3.132	399	.207	.002
Airline Pilots	3.43	.971	3.024	399	.147	.003
Taxi Drivers	3.41	1.200	2.071	399	.124	.039
Housekeepers	3.40	1.238	1.806	399	.112	.072
Farmers	3.34	1.153	.986	399	.057	.325
Mean All Occupations	3.2857	.730				
Mechanics	2.96	1.525	-4.273	399	-.326	>.001
Construction Workers	2.52	1.187	-12.864	399	-.763	>.001
Teachers	2.48	1.152	-14.072	399	-.811	>.001
Retail Sales	2.28	1.277	-15.707	399	-1.003	>.001
Soldiers	2.21	1.169	-18.490	399	-1.081	>.001

Note: Where 1 = Very little chance of HRs replacing humans and 5 = Great chance of HRs replacing humans.

Source: Authors' calculations were derived from survey data

As indicated in the table, significant differences from the mean for all occupations were found for all individual occupations except two: housekeepers and farmers. This indicates that respondents viewed HRs as likely to perform well to widely varying degrees in the occupations with which they were presented to rate. Hypothesis five received partial support.

All hypotheses received partial support due to identified statistically significant differences found for some, but not all of the receptivity statements for each hypothesis tested. The specific results of the tests for differences across the various groups are summarized in Table 8.

Table 8: Hypotheses and Results Hypothesis

Hypothesis	Result
H1: There will be a statistically significant difference in ratings of the receptivity statements by gender	Partially Supported: 15 of 25 Statements
H2: There will be a statistically significant difference in ratings of the receptivity statements by educational attainment, specifically year in college (Freshman, Sophomore, Junior, and Senior)	Partially Supported: 7 of 25 Statements, 14 of 150 Pairings
H3: There will be a statistically significant difference in ratings of the receptivity statements by major field of study (Business vs. STEM)	Partially Supported: 14 of 25 Statements

H4: There will be a statistically significant difference in ratings of the receptivity statements by work experience (Greater than or equal to one year vs. less than one year)	Partially Supported: 5 of 25 Statements
H5: There will be statistically significant differences in the ratings of how well HRs will perform in various occupations	Partially Supported: 12 of 14 Occupations

6. Conclusion and Suggestions for Future Research

This study was a pioneering effort in attempting to gauge the attitudes, perceptions, and preferences within Mexico, a developing nation with a population of over 129 million (Worldometer, 2024) and the second-largest nation in NAFTA with over three times the population of Canada. The results indicated significant differences regarding the four demographic variables, the attitudinal questions, and occupational rating. The study was also a pioneering effort in that it is the first study in any country to gauge differentials between business majors and STEM majors regarding perceptions, attitudes, preferences, and expectations regarding HRs. This knowledge can be used to construct effective business strategies for the deployment of robots in the workplace and for creating training programs for humans that can prepare them for the challenges of opportunities of working with HRs.

The results of this study are limited by the fact that only one institution was studied in Mexico. In general, the respondents were primarily middle class whereas the middle class in that country is believed to be only from 28% to 45%, based on different measurements (Organisation for Economic Co-operation and Development, 2019; World Bank, 2021). By attending a university, the respondents were also better educated than the average citizen in that nation. Future studies in that country should be conducted to include representation from all socio-economic strata as well as all levels of educational attainment and should attempt to provide more validation regarding receptivity differentials between business and STEM students.

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