Understanding College Student Perceptions of Artificial Intelligence

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ABSTRACT

Artificial intelligence (AI) is such a part our lives it seems to be changing us, or at least how we do life, without us being aware of its gradual omnipresence. Despite the push by business and government to develop AI, there is a concern about the real effects it is having on society. This study was designed to explore student perceptions of AI through quantitative statistical methods. The results of this study suggest that the general perception of AI is positive, but there exists some concern about the rapid development of AI and how it will affect humankind. In particular, being more informed about AI developments has a significant influence on both positive and negative perceptions of its impact on individuals and society. Furthermore, this paradox, along with the lack of understanding about AI, seems to add to a social tension arising from the inevitable advance of technology and the uncertainty of the effect of AI.

Keywords: Artificial Intelligence, Society, Perceptions, Potential Impact, College Students.

1. INTRODUCTION

The pervasiveness of AI has deep and far-reaching social effects for humanity [1]. We have become dependent upon AI to do everything from the mundane to the seemingly impossible, and on any given day a person will come into contact with AI in a variety of ways. What makes AI so valuable to individuals is the level of personalization it provides [2], [3]. The subtleties of how AI impacts our society can be seen in the plethora of machine agents and assistants that are imbedded in our daily tasks, from search engines, to shopping sites, to navigation systems.

As AI becomes more ubiquitous in our lives, it may be difficult to truly understand how it is affecting who we are and how we live. There is a tension between the idea that AI will do mundane tasks and give humans more time for creativity and enjoying life, versus the possibility that AI will take away jobs and create greater global socio-economic disparity. For older generations, the benefits of AI are most likely the former, especially as advances in AI will continue to revolutionize healthcare and the quality of life for seniors. For the rest of society, the question of AI should be of high importance because, if undiscussed and unattended, it may well lead us down a path of unalterable, unwanted change, as has been the case with consumerism's reliance on and the unalterable effects of plastics and fossil fuels. Markoff [4] warns that it is not the getting to superintelligence that matters, so much as how we get there. If history be the lesson, we are in a critical phase of natural and human stewardship when it comes to the economic and power basis of AI development..

2. REVIEW OF LITERATURE

There seems to be a general lack of awareness as to the extensiveness of AI in society. A distinct possibility is that AI is so prevalent that we do not recognize it for what it is even as we are using it. In a study by Pega [5], when participants were asked if they had ever interacted with AI, participants were split nearly evenly between those reporting yes (34%), no (34%) and not sure (32%). Furthermore, participants of the study were split over whether or not they are comfortable with businesses using AI to interact with them, with the largest percentage of respondents (37%) reporting not being sure. The study went on to report that almost three-fourths of participants (72%) understood what AI is, but half (50%) did not understand the basic concept of AI as a technology that utilizes deep learning and natural language processing for complex problem solving.

As a technological advancement, AI is having an unprecedented impact on society due to exponential growth in development and implementation that seeks to take advantage of its inherent efficiencies and innovative functionality [6]. While some may argue that AI development is not progressing as quickly as hyped, the reality is that great strides in AI development are being made and the current development is already into the phase of deep learning by machines [7]. Growth in AI development is fueled in large part, at least in the United States, by both corporate and military interests [4], [8]. The enthusiasm for research and development in the United States is not lost on other countries around the globe. According to the World Economic Forum, the real future for AI rests on China and the commitment by its government to be the world leader in AI by 2030 [9]. A report by PwC [3] predicts China boosting its GDP by 26% by 2030, and outpacing by nearly double the estimated 14.5% GDP growth in North America. Together, the two economies are expected to grow by $10.7 trillion, which will account for 70% of the world's economic impact. Thus, with the world's two largest economies committed to AI, the rest of the world will be compelled to follow.

The commercial use of AI will be a success factor for businesses of all sizes and varieties in the coming years. In a study of more than 3,000 Japanese firms, it was reported that AI was expected to have a favorable impact on their business and that this outlook was especially true for global economic activities [10]. Industry experts predict that AI is such a big factor in the future of business that those failing to jump on the bandwagon will be left behind [6].

Indeed, many sectors of society have the potential to benefit from AI developments. Gherhes and Obrad [1] suggest that AI can be a change agent for many global social and sustainability issues. Fast and Hovitz [11] make a similar argument in a meta-review of articles written about AI where they report that the potential of AI touches nearly every aspect of human life, such as, making work easier, new forms of transportation, enhancing the health and well-being of people, and helping to make better decisions. In many of the examples listed, AI could be described as working in conjunction with humans, and many believe this machine-human collaboration is the most likely outcome of AI development [7]. Others that are less confident postulate that AI might not have such an overall positive benefit to society.

We live and work among AI at an ever increasing rate, and thus, it should not be seen as something in the future that we do not yet have to deal with. What once seemed like an academic novelty has fast become a part of our daily lives in countless ways [4]. Most likely, the impact of AI on our lives is impossible to measure because of its prevalence in much of the developed world where our dependence on it has been gradual, but consuming. As Markoff [4, p. 23] explains, "Like the frog in a pot, we have been desensitized to the changes wrought by the rapid increase and proliferation of information technology.". AI influences so many facets of our lives it is likely that we seldom know when we are in contact with it as indicated in the Pega [5] study. It is in this lack of recognizing AI in action and its impact on our lives that there exists a societal conundrum.

A growing number of individuals are raising concerns about the potential negative impact of AI on society. In the summer of 2018 a study of technology leaders, developers, and activists found a high level of concern about the AI/human relationship in several key areas: (1) humans giving up or losing their ability to make decisions on their own, (2) data abuse for economic gain, (3) reduced human cognitive and social abilities, and (4) military or criminal uses that include autonomous weapons and weaponized information [12]. This list is telling in that it shows concern for not only the physical well-being of human-kind but also raises the awareness of the dangers of AI to the emotional and psychological well-being of individuals. Padios [13] speculates that even though AI began ostensibly as a scientific endeavor, its use to catalog, categorize, and analyze all facets of human existence solely for the purpose of commercial and political gain should be of real concern to society.

It may be argued that some of the apprehension about AI is the result of entertainment like the movies Terminator and The Matrix. Movies like these, where AI takes over and makes humans subservient to machines or even kills off the human race, may create a mistrust of AI by feeding audiences ideas about extreme negative possibilities. In their meta-review of articles, Fast and Horvitz [11] reported that the most common concerns about AI are: (1) the fear losing control over the machines and (2) the lack of ethics concerning AI development to the point that human life, and humanity altogether, would be threatened. Pega [5] also reflected this apprehension of AI: over 70% of participants had some level of fear regarding AI and 25% of those participants worried about machines overtaking humans. Similarly, in their study of student perspectives regarding AI, Gherhes and Obrad [1] found that 38.8% of participants believe the threat of AI destroying humanity to be high compared to 29.0% believing the threat to be low and another 32.3% being neutral or not answering the question.

What the public knows and believes about AI is as elusive and tumultuous as the rate and state of AI development. A review of articles covering AI topics over a 30-year span by Fast and Horvitz [11] finds that since 2009 there has been a very sharp increase in both positive and negative sentiment regarding AI, and that most articles had an optimistic viewpoint of the technology. Elsewhere, in a study of over 900 Romanian students, Gherhes and Obrad [1] found that the majority of participants (58.3%) believed that AI was a positive influence on society and just over half (52.7%) were not concerned with the rapid development of AI. Yet the same study reports that while the vast majority (84.6%) of participants claim to know what AI means, almost half (45%) of participants felt poorly or very poorly informed about AI. These findings are echoed in a global study on consumer perceptions of AI conducted by Pega [1] that found consumers were optimistic about the future of AI but unsure of exactly how it will be used in business. This result seems to point to confusion in the general public about what exactly AI is and what it does.

Within the available literature, there appears to be uncertainty about the future of AI and its impact on society. Once more, from the study conducted by Gherhes and Obrad [1], only 39.4% of participants were optimistic or enthusiastic about the future of AI. In comparison, 36.9% of study participants reported being indifferent or confused about the future of AI and 23.7% felt concerned. Indeed, society at large is still wrestling with the deluge of new AI developments and lack of awareness of how AI is making its way into our daily lives.

Purpose of the Study
Today's younger generations are entering adulthood in the beginning stages of the fourth industrial revolution and will be the most drastically affected by the positive and negative potentials of the burgeoning technology. The purpose of this study is to explore how college students perceive AI by asking questions about their level of (1) understanding and information about AI, (2) belief in the potential benefits of AI, and (3) concern about the future of AI development. The results of this study will add to the awareness of how AI is perceived by the public and inform policy makers seeking to raise questions regarding the need for discussions about AI development. The significance of this study is to add to the growing body of literature about AI and its social and psychological impact on society, and in particular, focusing on a generation that is the first to grow up with intelligent agents and automated intelligence all around them.

3. STUDY DESIGN

This is a non-experimental study with an emphasis on exploration of a phenomenon. This study utilizes both descriptive statistics to provide information about the participant's perception of AI and correlational statistics to aid in the identification of possible relationships among study variables that may merit further research [14]. This study utilizes a purposeful sampling design with selection based on the criteria that students be enrolled as undergraduates in a medium-sized, private, four-year liberal arts institution located in the midwestern United States.

The instrument used in this study is a combination of new items developed by the researcher and items modified from a study conducted by Gherhes and Obrad [1]. The survey was administered online during March of 2019 and consisted of four demographic questions, seven closed-ended questions regarding AI, and one open-ended general question on AI. Descriptive statistics were used to organize and summarize data about demographics and provide a starting place for exploring variable relationships by other statistical analysis methods [15]. Multiple regression is used to express the predictive relationship between variables and is suitable for non-experimental designs as it measures the direction and relative contribution of possible predictive relationships [15], [16]. To determine whether a significant difference exists between group means whenever a significant relationship is identified, an independent-sample t-test will be used for groups of two and a one-way analysis of variance (ANOVA) will be used for groups of three or more. When a significance is found in ANOVA comparisons, Tukey's HSD post hoc test will be used to determine the exact location of

significant difference(s). Statistical analysis of the survey data includes the use of the Pearson product moment correlation coefficient (Pearson's r) to determine if a relationship between two random variables exists and, if so, the strength and direction of the relationships [15], [14].

4. RESULTS

Of the 230 respondents that participated in the study and completed all questions, 61.7% (n=142) were female and 38.3% (n=88) were male. The mean score for age fell in the 21-year-old range (M=3.92, SD=1.77). For ethnicity, the largest percentage of participants (72.2%, n=166) reported to be White, followed by those reporting to be Asian (13.5%, n=31). When it comes to college rank, the largest number of participants (35.7%, n=82), but the mean score for college rank fell in the junior range (M=2.74, SD=1.16). The largest number of participants (23.9%, n=55) identified Business and Technology as his or her major, followed by the major of Nursing, Healthcare, and Social Work (20.9%, n= 48) and then Education (16.5%, n=38).

Participant Survey Results
When participants were asked about their level of understanding of what AI means, over half of the scores (55.2%, n=127) were in the moderately high to very high ranges with the mean falling in the moderately high range (M=4.51, SD=1.35). Figure 1 shows the results of participant responses to the question regarding participant's level of understand of what AI means. The multiple regression results between level of understanding of what AI means as the criterion variable and each of the demographic variables as predictors found a correlation of significance for gender, $F_{(5, 224)} = 2.556$, p<.05 with $R^2 = .054$ and adjusted $R^2 = .033$. An independent-sample t-test found that there was a significant difference in the mean score for male (M=4.80, SD=1.26) and female (M=4.33, SD=1.38) participants; t(229)=4.509, p<.001.
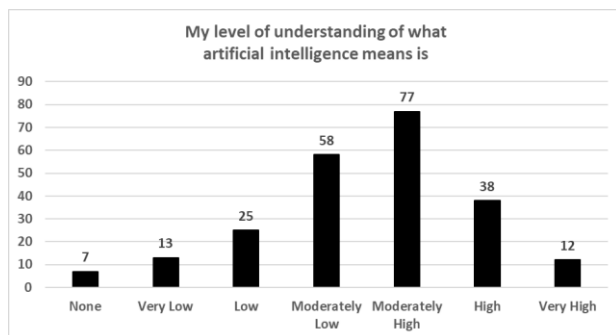

Figure 1.

Participants were asked to rate their level of information about current developments in AI and the highest number of scores fell in the moderately low range (34.3%, n=79), which was the also the mean score range (M=3.80, SD=1.36). Figure 2 shows the results for participant understanding of current AI developments. Two significant correlations were found using multiple regression to investigate possible associations between the level of information about current AI development as the criterion variable and each of the demographic variables as predictors, $F_{(5, 224)} = 6.208$, p<.001 with $R^2 = .122$ and adjusted $R^2 = .102$. The first significant difference in group scores concerned gender, with scores for males (M=4.23, SD=1.26) higher than females (M=3.53, SD=1.37); t(229)=3.796, p<.001. The second significant difference in scores is found between age groups.

ANOVA testing for between group differences found that significant differences existed between age groups of participants, $F_{(5, 224)} = 4.037$, p<.05 and Tukey's multiple comparison found a significant difference between the age groups of 23 or older (M=4.30) and 19 or younger (M=3.14).
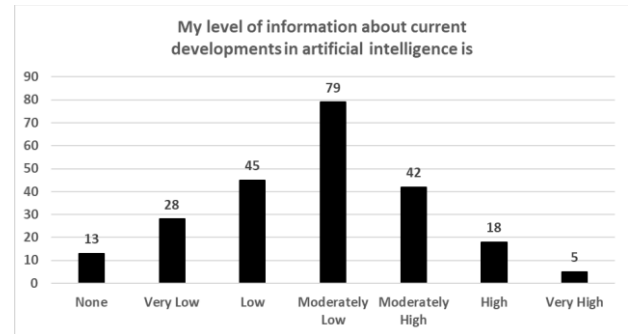

Figure 2.

When it comes to the level of belief the AI will have a positive influence on society, the mean score (M=4.29, SD=1.425) fell in the moderately low range. The scores for this question were closely split between those reporting AI's influence to be either moderately low (27.8%, n=64) or moderately high (26.5%, n=61). Figure 3 shows participant responses to the question of AI's positive influence on society. When multiple regression was conducted between the criterion variable of belief that AI will have a positive influence on society and each of the demographic variables as predictors a correlation of significance for gender was found, $F_{(5, 224)} = 6.147$, p<.001 with $R^2 = .121$ and adjusted $R^2 = .101$. There was a significant difference in the mean scores for male participants (M=4.76, SD=1.37) than for female participants (M=3.99, SD=1.39) participants; t(229)=4.287, p<.001.
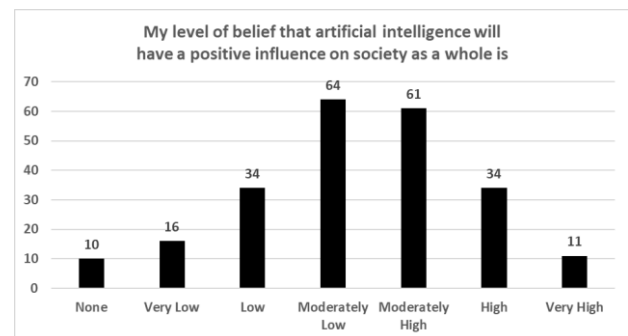

Figure 3.

The mean score for the question regarding the belief that AI will increase a person's well-being fell in the moderately low range (M=4.11, SD=1.485) with the largest number of scores nearly evenly split between the moderately low range (26.1%, n=60) and the moderately high range (26.5%, n=61). Figure 4 shows the results of the question on the belief that AI will increase a person's well-being. Multiple regression analysis using the belief that AI will increase the participant's well-being as criterion variable of and each of the demographic variables as predictors found a correlation of significance in two instances, $F_{(5, 224)} = 5.614$, p<.001 with $R^2 = .111$ and adjusted $R^2 = .092$. Gender was found to have group scores with a significant difference and the mean for males (M=4.56, SD=1.475) was higher than that for females (M=3.82, SD=1.417); t(229)=4.133, p<.001. Also, a significant difference in group scores was found for ethnicity and

Tukey's multiple comparison found a significant difference between the Asian group (M=4.71) and the Black or African American group (M=3.44, p<.05), as well as, the Asian group and the White group (M=3.68, p<.001).
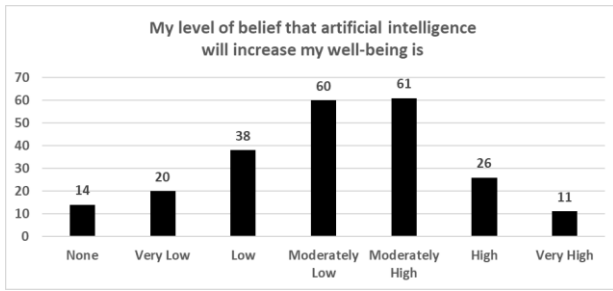

Figure 4.

When asked to rate their level of concern about the rapid development in AI, the largest number of scores were also evenly split between moderately low (26.1%, n=60) and moderately high (26.5%, n=61) ranges with the mean falling in the moderately low range (M=4.30, SD=1.533). Figure 5 shows participant's level of concern about the rapid development of AI. The results of multiple regression found no correlations of significance.
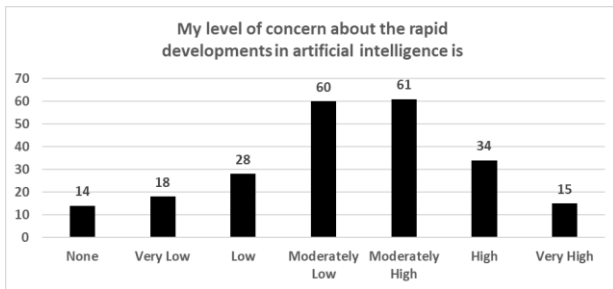

Figure 5.

For the question concerning participants level of concern that AI will replace human jobs, the highest percentage of participant (25.2%, n=58) scores were in the moderately high range, which was also the mean score range (M=4.65, SD=1.638). See Figure 6 for all responses. The results of multiple regression found no correlations of significance.
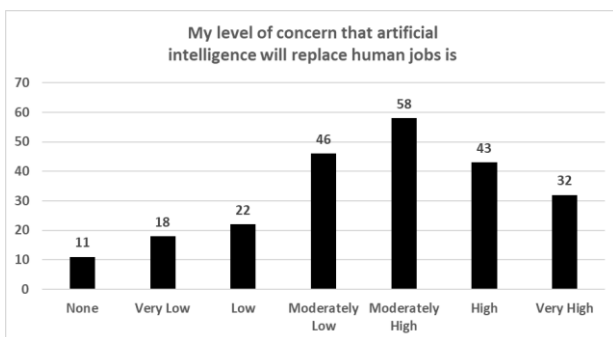

Figure 6.

For the question regarding participants' level of concern that artificial intelligence will surpass human intelligence, the mean score (M=4.40, SD=1.799) fell in the moderately low range which also garnered the largest percentage of scores (24.3%, n=56). The result of participant concerns regarding AI surpassing human intelligence are shown in figure 7. No correlations of significance were found.
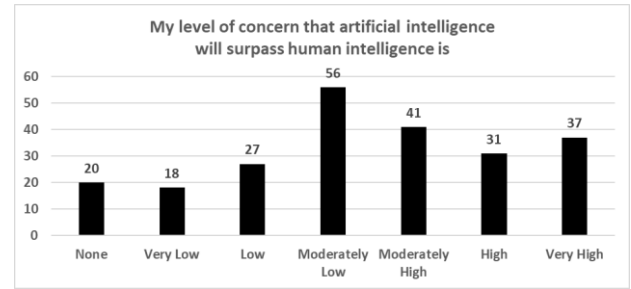

Figure 7.

Bivariate correlation was used to explore the relationship among the seven random AI variables and the results found that there were significant positive correlations for all but two variable interactions and that no significant negative correlations existed. The strongest of the significant positive correlations were found to exist between (a) level of understanding of what AI means and level of information about current developments in AI, $r(230) = .756$, p<.001, (b) level of belief that AI will have a positive influence on society as a whole and level of belief that AI will increase the participant's well-being, $r(230) = .711$, p<.001, (c) level of concern about the rapid developments in AI and level of concern that AI will replace human jobs, $r(230) = .591$, p<.001, and (d) level of concern about the rapid developments in AI and level of concern that AI will surpass human intelligence, $r(230) = .507$, p<.001. Overall, the variable for level of understanding of what artificial intelligence means was shown to have a significant positive correlation with all of the other random AI variables with a decreasing strength of the relationship found between it and the three levels of concern variables. This scenario of relationships was also true of the variable for level of information about current developments in AI and the other random AI variables.

Participant Comments
When asked to provide additional details about his or her perceptions of AI, 31 (13.5%) of the 230 survey participants opted to give responses. The indication from an analysis of comments is that AI is generally perceived as a positive technology advancement. Participant 84 comments:

> Artificial Intelligence itself [is] a great way to further advance the technology we use in today's times. The use of it can bring about new changes in development in the medical field as well as standard technology itself. I believe it will be ever changing thing as everything constantly evolves and improves over time. Artificial Intelligence will help us evolve as well into the next stage of research and discovery.

The above positive sentiment about the potential of AI was shared by several other participants, and others, like Participant 182, also suggested that the development of AI was inevitable and should be embraced.

Some participants perceive AI as having negative possibilities. Participant 154 suggests, "Human intervention within the realm of AI is a must because a computer cannot replicate human compassion and empathy." Participant 157 goes on to warn that

allowing machines to replace humans in the workforce will create even greater social disparity by creating "further division of economical classes between those who do the replacing and those who are replaced." This view of technological disruption is countered by Participant 84 who observes, "Like other forms of progress, AI will no more eliminate jobs than electricity did, or the industrial revolution - yes, some jobs will become obsolete, but many more will open up and new opportunities will outweigh old ones lost."

Caution is a theme expressed most commonly by participants. For instance, Participant 133 stated a belief that overall AI is a positive thing but goes on to warn, "I also believe, however, that in the wrong hands and without certain precautions the side effects may be unfortunate." This sentiment of cautiousness is echoed by several other participants, including Participant 6 that believes AI is still early in development and does not "warrant worry" at this point but still thinks AI development "needs an eye over it." Participant 54 sees AI as necessary, but "like anything in this world, it can and will be abused." More pragmatically, Participant 139 emphasizes that AI is neither good nor bad, but rather sees the problem arising with "those who develop them and with what intentions, not on AI itself."

Other participant comments indicate that a lack of understanding regarding AI is exacerbated with portrayals of AI in mass media and this may be the reason for some participants' cautious attitude. Participant 6 admits that while AI is interesting, there is skepticism because all they know about it comes from science fiction. Participant 18 expresses this sentiment more bluntly: "Movies make it look crazy." It may be this representation that leads Participant 120 to claim that people overreact to AI. In terms of fueling a lack of understanding about AI, Participant 52 chastises the researcher by suggesting that, "doing surveys asking random people about artificial intelligence only influences the problem even more" and Participant 14 recommends that people not in the field are not aware enough to form "proper" opinions and that the researcher is implored to, "Please ask the experts only. Please."

Within the spectrum of responses, there appears to be tension between the inevitable advance of technology and the call for caution and control. This tension might best be seen between the comments of Participant 83 that feels AI will run its course like all technological advances and that humans will always be in control because AI will only be as "smart as we decide to make them," in contrast to Participant 104 who posits, "Technology is taking over and we need to be careful. Just because we have the ideas and tools to do something, doesn't mean we should follow through with those plans… to me, artificial intelligence is playing God, and that's not right."

5. CONCLUSIONS

The purpose of this study is to explore how college students perceive AI as it pertains to her or his level of (1) understanding and information about AI, (2) belief in the potential benefits of AI, and (3) concern about the future of AI development. Most telling from the results of this study are the conflicting beliefs about the potential impact of AI. For instance, those participants believing that AI will benefit her or him personally are also concerned about the rapid development of AI and the impact it will have on human jobs. The more informed the participant is about AI developments, the more pronounced their uncertainty of these outcomes. The overall conclusion is that a participant's

level of information on AI has a significant impact on her or his perception of AI and that there exists a tension between what an individual believes about the benefits of AI and the concern that AI will negatively affect her or his life.

In particular, the results indicate that participants with higher ranges of understanding of what AI means and higher levels of information about current developments in AI are more likely to (a) have a higher level of belief that AI will have a positive impact on society and his or her own well-being, (b) have a higher level of concern about rapid AI developments and that AI will replace human jobs, and (c) have a higher level of concern that AI will surpass human intelligence. Furthermore, participant comments indicate that AI is generally perceived as a positive technological advancement, but there needs to be caution because there are possible negative outcomes. A lack of understanding of AI, along with mass media portrayals, may contribute to participants' cause for caution about AI developments. Some participants expressed a belief that AI was an inevitable technological advancement that would always be under human control. Other participants were more cynical in their viewpoints and warned that AI has the potential to "take over" or, at the very least, be used by other humans to create greater societal disparity. The results of this study align with the existing literature in which AI is seen as a development that has great potential for both positive and negative effects on humankind. The literature also suggests that developed countries are so heavily immersed in the use of AI that people may not even be aware of when they are engaging with it. This creates a tension between the inevitability of AI development versus its real impact on humanity. On one hand, this tension is welcome because it promises to make life easier while on the other hand, there is apprehension because of its far reaching individual and social implications. This tension will only escalate as AI development continues to gain speed fueled by businesses and governments trying to attain a competitive advantage.

The inevitable advance of technology has far reaching impacts on our lives. Future generations will be subject to the manner in which the great positive and negative potential of AI is handled by us. Awareness of AI is not the same as being informed about AI, and the latter seems to be the most significant in the call for caution. The results of this study should encourage further research into (a) the full impact of how AI is currently being used in business and industry, (b) perceptions of the potential benefits and detriments of AI to all facets of society, and (c) perceptions of ethical considerations of AI. In particular, such research should provide value as benchmarking the need for discussions regarding the questions about the "who, how, and why" will AI be used.

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