ARTIFICIAL INTELLIGENCE FOR USE IN INSTRUCTIONAL TECHNOLOGY IN AN EXTRA-TERRESTRIAL LEARNING ENVIRONMENT: A QUALITATIVE STUDY

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Abstract: The United States government as well as other countries are funding manned missions into the Earth's orbit and outer space and are researching ways to implement manned missions into deep space. For such manned missions to be successful, the crew's need to be able to have access to information would be paramount to the success of such a mission. The use of Artificial Intelligence (AI) technology, such as International Business Machines' (IBM) Watson technology could be crucial to the success of a manned crew to be as self-supportive as possible since such a crew will not be able interact with other human beings in the same way that they would in a terrestrial environment. This study focused on the human beings, technologies, and strategies used in contemporary distance-learning environments and how such technologies and strategies could be used as a basis for facilitating a learning environment for a manned mission to the planet Mars. This will be a qualitative, descriptive, phenomenological study. The results of the study are intended to help scientists and instructors implement technology to support instructional technology and communication in an extra-terrestrial environment. The theoretical framework chosen for this study is the Technology Acceptance Model (TAM).

***IndexTerms* - Component,formatting,style,styling,insert.**

I. INTRODUCTION

The use of an Artificial Intelligence (AI) technology such as IBM Watson in an extra-terrestrial learning environment could be fundamental to the success of a manned mission to Mars. The implementation of AI allows explorers aboard the manned mission to Mars to have access to vital information for research and real-time interaction with the AI. Since the explorers aboard the manned mission to Mars would have limited access to people on the Earth, their survival would depend on being able to operate in isolation from other human beings. Refinement and improvement of such technologies, particularly AI technology, can improve the chances of success of the extra-terrestrial explorers and by doing so make it easier for the explorers to research information that will be useful in helping mankind.

Extra-terrestrial explorers require an extremely high-level of self-sufficiency due to the confines of the extra-terrestrial environment. If a problem arises aboard the manned mission to Mars, explorers will not have access to much of the human support that they would have in a terrestrial environment (Harding, 2013). The ability to communicate with relevant support professionals on the Earth in time of crisis could be extremely helpful. However, even if an extra-terrestrial explorer is able to contact a human being on the Earth, this might not be enough to resolve the issue. Additionally, a situation could arise where there is not enough time to contact an Earthbound human. This is where a sophisticated AI technology could help.

If extra-terrestrial explorers are unable to reach live Earthbound humans in the event of an emergency, an AI technology equipped with proper support could save their lives. A user-friendly, robust, interactive database with information about how to deal with contingencies could very beneficial to the extra-terrestrial explorers. The use of AI computer technology which responds to voice operated commands would also be extremely helpful in such an environment. The technology for such an environment should be as intelligent and as easy to use as possible. The International Space Station (ISS) is a habitable artificial satellite that was put into orbit around the Earth in 1998. The ISS is, primarily, a research facility. The manned mission to Mars the result of a collaboration of a multi-national effort and it is also considered by scientist to have the most suitable testing environment for manned missions to the Earth's Moon and to Mars (World Spaceflight News, 2000). As such, the organizations on Earth who submit technology for the manned mission to Mars often do so with next-generation studies in mind. As there have been no manned missions beyond the Earth's Moon, this area of research fairly new.

Amateur Radio on the International Space Station (ARISS) has been allowing non-affiliated civilians to talk to researchers on the manned mission to Mars for several years (Howell, 2013). It has been in use since 1983, long before the manned mission to Mars was deployed. The ARISS is not a formal or mandated tool communication tool. It is a way for earthbound amateur radio enthusiasts or "hams" to interact with astronauts on the manned mission to Mars. A number of the astronauts communicate with earthbound humans as a form of entertainment. It's plausible that, perhaps, an explorer on the space station could use ARISS to contact the Earth in case of an emergency. However, reliance on such technology would not be very reliable on a mission to Mars due to latency of communication with current technology (Howell, 2013). Additionally, the same types of issues that could interfere with ARISS could also interrupt more formal communication channels.

In 2014, the High Definition Earth-Viewing System (HDEV) was launched by the National Aeronautics and Space Administration (NASA). Although the purpose of HDEV was to allow live streaming of the Earth by the manned mission to Mars, it does have some greater scientific and communications implementations (Moskvitch, 2002). HDEV allows for high

resolution, real-time streaming and the technology can also be used for instructional and recreational communication between manned mission to Mars and the Earth as well (Redd, 2014).

General Dynamics developed a software technology called Software Defined Radio (SDR) and tested it aboard the manned mission to Mars for one year starting in August of 2012. The goal of the testing was to see how reliable radio communication would be between the manned mission to Mars and the Earth in extreme temperatures. The research sought to measure attention based on extreme temperatures, how it affected communications technology, and how well it could automatically correct as much of the signal degradation as possible.

Communication between the humans on a manned mission to Mars would have some different challenges than those of the between the Earth and manned mission to Mars and the Moon. Beyond the planetary system of the Earth and the Moon, such as a manned trip to or on Mars, sending and receiving of information from Earth to Mars and vice versa would experience significant latency of about 13 minutes at a minimum (Gonzalez, 2013). As such, the Internet as we know it with our current technology and traditional communication might not be synchronous and therefore not a viable means of being able to communicate between humans who are on Earth and Mars, respectively. This is why the use of AI may need to be adapted to manned missions to deal with communication delays, blackouts, or complete failure of the interactive communication technology between the Earth and the manned mission. It is my hypothesis that instructors advising NASA would recommend some kind of balance between using AI and asynchronous communication based on current best technology practices in facilitation of an extra-terrestrial learning and communication environment.

II. Method

This study will be a qualitative, phenomenological study to evaluate the effectiveness of using AI for use in instructional technological and communication in an extra-terrestrial environment. The qualitative, phenomenological, design is most appropriate for this study because the data used in this research study will come from instructors who teach in a distance learning environment. The information compiled will be from the collective result of their experience, expertise, theories, and opinions of instructors who have taught in a distance-learning environment.

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III. Participants

The participants in this study will be comprised of 15 individuals who have experience teaching in a distance learning environment. The age range of the participants varies from 33 years of age to 57 years of age. There are 8 female participants and 7 male participants in the study. They are all instructors from a technical college that I have asked to participate in the study. They all live in the south central United States.

IV. Materials

In this study, participants were given a survey instrument which asked their opinions on the use of Artificial Intelligence in the learning environment. There were no other additional instruments used in the study. The survey instrument is simple document intended for ease of participant understanding of exactly what the study is about.

V. Procedure

The participants were given the survey instrument to answer the survey questions individually in a room that was separated from the public. The participants filled out the survey instrument and returned it to me, the researcher. Participants were coded in alphabetical lettering from Participant A to Participant. Participants were given a time of 12:00 pm to 1:00 pm to take the study on a pre-disclosed date in a pre-disclosed room.

Step 1: Give the student survey instrument with a pre-assigned code name (Participant A, Participant B, etc.).
Step 2: Assign the student a place to sit in the room.
Step 3: Collect the survey instrument from the participant.
Step 4: Tabulate the results of the data.

VI. Results

The results of the study showed that 12 of the 15 participants in the study, 80%, recommended that an Artificial Intelligence be used to help facilitate an extra-terrestrial learning environment. The study also revealed that 9 of the 15 participants in the study, 60%, recommended that a hybrid combination of Artificial Intelligence and standard technology be used to facilitate the extra-terrestrial learning environment. Thus, my hypothesis was proven correct. A majority of the participants in the study preferred the use of a hybrid solution as opposed to just using Artificial Intelligence over standard technology. The results of the study show that hybrid technology approach would be the most viable option. There were 60% of the participants who recommended a hybrid technology solution and, thus that is the recommendation that I would go with because the 80% who recommended using the AI solution is not practically more significant than the 60% who recommended the hybrid technology solution. I would recommend using a hybrid technology approach.

Similar to the relationship between humans on the Earth and those in an extra-terrestrial environment, communication is not likely to always be synchronous (Allain, 2013). Extra-terrestrial explorers need to be able to access as much pertinent information as they can at any time. This study was be based on the recommendations of those who teach or have taught in a distance-learning environment to weigh their views of what are the most effective of forms of asynchronous communication

technology to supplement synchronous communication technology. The Technology Assistance Model is most appropriate because it is designed to evaluate the usefulness of technology as it relates to human decision-making.

Due to the paucity of humans that have had the opportunity to explore an extra-terrestrial environment, it was not be feasible use study participants with actual experience in an extra-terrestrial environment. As such, study participants were comprised from educators with experience in communicating in a distance-learning environment or communication specialists responsible for helping to facilitate the distance learning environment. Since distance learning can actually include traditional United States mailing parameters, this study will only cover the technological forms of distance learning.

The educators and communication specialists chosen for the study gave their recommendations of the best ways to implement an extra-terrestrial learning environment based on their myriad of experiences in distance-learning education. The basis of these recommendations will serve as the foundation of the study and will represent the study's overall recommendations to the scientific community regarding the viability of the implementation of artificial intelligence in an extra-terrestrial environment.

The theories of what technologies to implement for communication in an extra-terrestrial learning environment will help the scientific community prepare for more advanced extra-terrestrial exploration. Just as with the early studies on life in an extra-terrestrial environment, much of this study will come from estimations based on approximated simulations from comparative situations with known technologies. The qualitative method is most suitable for this study in evaluating the relevant technologies for an extra-terrestrial learning environment as the information for this study is compiled on the opinions of experts in the field of distance learning technology.

VII. Discussion

It was my hypothesis that instructors might prefer some kind of balance between using AI and asynchronous communication in facilitation an extra-terrestrial learning environment. The data collected in the research showed my hypothesis to be correct. There were 60% of the participants who recommended a hybrid technology solution and, thus that is the recommendation that I would go with because the 80% who recommended using the AI solution is not practically more significant than the 60% who recommended the hybrid technology solution. I would recommend using a hybrid technology approach. Current research in the field shows that the Internet can be an effective tool for use even in the extra-terrestrial environment of the Earth's planetary system of the Earth, the Moon, and its various artificial satellites (Mann, 2013). However, the need for an AI such as an interactive database like, IBM Watson might prove useful to extra-terrestrial explorers. Communications technology inside of the Earth's planetary system can be interrupted by solar interference. On the Earth, there are far more alternatives to the communication challenges caused by solar interference than there would be on an extra-terrestrial environment like a manned mission to Mars. Since it takes about 13 minutes at minimum for communication signals to travel back and forth from the Earth to Mars, some kind of workaround technology that can minimize the latency would have to be implemented as a replacement.

One of the limitations on this study is that we have never actually had a manned mission beyond the Earth's planetary system of the Earth, Moon, and various artificial satellites. Because of that fact, much of the information regarding this study was based on scientific data already collected or instructors with experience and expertise in distance-learning environments. This study should provide scientists and other researchers with information they can use in considering how to communicate and support learning and communication in an extra-terrestrial environment.

There are times in research studies where there isn't an abundance of previously established peer-evaluated literature pertaining to a specific study and this study fits that criteria. The recommendations of the participants in the study are validated due to the participants being the most qualified persons to make recommendations on which technology strategies would be best suited for an extra-terrestrial learning environment. If NASA or a civilian organization wanted to develop technology to support an extra-terrestrial learning environment, they would likely solicit information from experts in the related fields such as education and information technology. This study will help give such organizations expert information to help them develop such technologies.

The technologies being evaluated for this study will be those technologies that have been more thoroughly evaluated in a human to human context either in a terrestrial environment or in an extra-terrestrial environment within our planetary system. We will have no way of knowing whether or not these terrestrial technologies will be completely adaptable to an extra-terrestrial environment until they are put to a live test. Since that may not be for many years to come, this study will try to hypothesize the best practical application of our current technology to implement for an extra-terrestrial environment.

This study goes to the heart of the very essence of human learning. It underscores our curiosity with the universe around us. Human beings have always been exploring. We have always continued to develop technology while constantly re-establishing new limits for what we previously thought were well-established technological boundaries. In the past, we have developed technologies to travel on land, in water, in the air, into our orbit, and to our Moon. With history as a guide, our next logical step in this path is traveling beyond our planetary system. The United States government and the international community are already in discussion and developing technologies for manned missions beyond our planetary system. This study can help with that process.

A robust interactive database should accompany manned expeditions in extra-terrestrial environments. Even on the Earth we can have breakdowns in communication for a myriad of reasons. These technology issues that can cause lapses in bi-directional communication with the Earth and an extra-terrestrial communication point begin to increase the further the distance is that the extra-terrestrial receiver is from the Earth. A manned extra-terrestrial mission would need to have access to comprehensive information in the event that synchronous communication with the Earth is not possible for some reason.

No matter how much preparation that is done aboard the manned mission to Mars in preparation for the journey, there will likely still be challenges that only the manned crew living on or in orbit around Mars would be able to experience firsthand. These issues could be biological as well as technological. While we do have data on weather patterns in Earth's planetary system and on Mars, it may still take a manned mission to Mars for a human being to understand how those patterns actually influence the challenges of communication technology in the Martian planetary system (Clark, 2015).

This study is necessary because human beings living in an extra-terrestrial learning environment will need to have robust technologies available to them in order to survive. Even if it is revealed that artificial intelligence is not a viable technological solution to help facilitate an extra-terrestrial learning environment, this study will help with the cause of developing the appropriate technologies by eliminating the less viable technologies. Either way, this study can be used to help to expand the research on extra-terrestrial communication technology. While the expectation is that human beings will continue to try to advance technology so that they can improve their long-range space exploration capabilities, this study can help to improve the current extra-terrestrial planetary communication technology.

Future implications of this study area would lend itself to deep space exploration for manned and unmanned missions. Eventually, we could have manned missions outside of our solar system. Being able to test interplanetary communications could be a step towards developing communications technology that could be used sufficiently within our solar system and beyond. The idea would be, ultimately, to develop effective synchronous communication from as far from Earth as human technology can travel. While this is not likely under currently known technology, it is possible that other scientific research could lead to improvements in technology that could help to facilitate those goals.

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Table 1
List of Participants and their tabulated results

Participant Name	Artificial Intelligence	Standard Technology	Hybrid if Applicable
Participant A	YES	NO	NO
Participant B	YES	NO	NO
Participant C	NO	YES	YES
Participant D	NO	YES	YES
Participant E	YES	NO	YES
Participant F	YES	NO	YES
Participant G	YES	NO	NO
Participant H	YES	NO	YES
Participant I	YES	NO	NO
Participant J	YES	NO	YES
Participant K	YES	NO	NO
Participant L	NO	YES	YES
Participant M	YES	NO	NO
Participant N	YES	NO	YES
Participant O	YES	NO	YES
Results of the Study:	80% of participants recommended that AI be used. 60% of participants recommended that a hybrid approach be used. 20% of participants recommended that standard technology be used.		

The percentage of the participants of the study recommending that an AI be used is, 80%, is significantly higher than the percentage of participants in the study recommending that standard technology be used at 20%. The percentage of participants recommending that an AI be used, 80%, is not as significant as the percentage of participants recommending that a hybrid approach be used, at 60%. Thus, I would recommend using a hybrid technology approach.

Table 2
Frequency table listing statistical analysis of Participant's preference for Artificial Intelligence, Standard Technology, or a Hybrid technology solution

AI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	12	80.0	80.0	80.0
	2	3	20.0	20.0	100.0
	Total	15	100.0	100.0	

Standard

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	20.0	20.0	20.0
	2	12	80.0	80.0	100.0
	Total	15	100.0	100.0	

Hybrid

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	9	60.0	60.0	60.0
	2	6	40.0	40.0	100.0
	Total	15	100.0	100.0	

There were 60% of the participants who recommended a hybrid technology solution and this is the recommendation that I would go with because the 80% who recommended using the AI solution is not practically more significant than the 60% who recommended the hybrid technology solution.