1. Proposal Abstract:

The primary goals of this research is to explore code literacy divide among college students and study its impact on their social media consumption patterns, their projected career paths, and how they react to the power of control behind algorithms. Code literacy, or algorithm literacy, measures participants' understanding of the way computer programs select and process information, recommend social connections, and construct social realities for them.

To achieve the research goals, this research will first compare social media consumption patterns between students at different levels of code literacy and examine how the difference leads to bifurcated perspectives on information technology. This research also hopes to find out if code literacy has positive influence on students when they embark on digital journeys and prepare for their future careers. More importantly, it will examine how code literacy help them to imagine, understand, cope with, or even resist algorithms, depending on their understanding of the control of flow embedded in them.

The research background is the intensified call for code literacy during the past decades (Bucher, 2018). In 2016, the Pew Research Center lists seven themes of the Algorithm era after concluding the seventh Future of the Internet study. The last of the seven themes recognizes the growing need for algorithmic literacy, transparency and oversight (Raine & Anderson, 2017). It is argued that "public education should instill literacy about how algorithms function in the general public," and "those who create and evolve algorithms should be held accountable to society" (Raine & Anderson, p. 15).

According to Castells (2009), there are two ways power is exercised in the informational society: programming and switching. Programming orchestrates the network in terms of the goals assigned to it, and switchers are those in charge of connecting points between various strategic networks. Castells takes the programming capacity of the network goals as decisive because "once programmed, the network will perform efficiently, and reconfigure itself in terms of structure and nodes to achieve its goals" (p. 45-46). Therefore, it's necessary to study code literacy as a key predictor to the power-making process in the informational society.

The research method will include 1) a comprehensive review of literature on the topics of network society, informationalism, inevitability and concerns of algorithms, and how algorithms orchestrate social and political activities in forms such as "algocratic governance"(Raine &Anderson, p. 4), 2) a secondary data analysis of datasets provided by Pew Research Center in 2016 and 2018 that include responses on the subject of algorithm literacy and social media experiences, 3) a focus group study in Terre Haute on a convenience volunteer sample of college students to collect in-depth qualitative data on participants' code literacy, their patterns of using learning and social networks, and their assumptions, imaginations, acceptance, or resistance to algorithms.

The findings of this research will provide empirical evidence on how code literacy (or algorithm literacy) is having impact on young people's perceptions and uses of social and learning platforms. Unlike survey, focus group discussions generate data that are more spontaneous in nature and capture much more of the complexity of human minds. The findings will explain how code literacy can help individuals to perform their citizen duties with better understanding on how power is exercised in the digital society. The research will also give insights on their life and career choices on the condition of the inevitability of algorithms.

2. List other departments or agencies you have submitted a request to for this work:

As of October 1, 2019, this proposal has been submitted for competition in the "Advancing the Discipline Grants" sponsored by the National Communication Association (NCA) in the US. NCA is uniquely positioned to support work that is focused on the discipline itself. This is a highly competitive extramural grant with a maximum award of $5000.

3. Describe the significance of the project:

The significance of the research lies in the importance to explain the power-making process through the assumption, acceptance, and sometimes resistance of algorithms across social networks. Castells (2009) believes that the process of communication in society is the key field for programming projects, because "control of, or influence on, the networks of communication and persuasion along the lines that favor the projects of the would-be programmers, are the key assets in the ability to program each network....They are the fields of power in the network society" (p. 46). However, students studying communication often lack code literacy to understand how the control or influence take effect. Coding literacy has become the basic training for individuals to make informed decisions, especially when individuals' exposure to information is often the result of calculation based on previous inquiries. The research is explorative in nature, and will serve as a wakeup call for institutions to reconsider the role of code literacy in curriculums.

4. Describe the anticipated final products of the research (journal articles, presentations, research paper, etc.).

The final product of this research will take two forms. One will be a more extensive grant proposal to compete in the annual grant of the Waterhouse Family Institute for the Study of Communication and Society (WFI) at Villanova University. The deadline for submitting the grant proposal is in May 2020. The other will be a journal article to be submitted to *Computers in Human Behavior,* a peer reviewed academic journal published by Elsevier.

5. Identify the proposed external funding opportunities to which this project will contribute.

By May 2020, a fully developed grant project proposal on this subject will be submitted for consideration by the annual grant of the Waterhouse Family Institute for the Study of Communication and Society (WFI) at Villanova University. According to their mission

statement, "The WFI—endowed by Mr. Lawrence Waterhouse, Jr., and housed within Villanova University's Department of Communication—was founded on the principle that scholars, activists, and practitioners of communication have an important role to play in the creation of a socially just world. One of the ways that we enact this mission is through the annual funding of research grants. These grants support the work of Communication scholars across the world, work examining communication, its impact on the world around us, and its ability to create social change and social justice." The deadline for submitting the grant is in May 2020.

6. Describe how URC funding will contribute to the success of this research.

The goals of this research align with the goals of the URC in that it seeks external funding opportunity by conducting this research on code literacy. The URC funding will help the PI to launch the research by providing needed resources, including access to technical resources and study the trend of AI careers by using Lynda.com, research supplies, trip to top tier academic conference, and conducting focus group study. Without the support of the URC, the research will not have any support from within the university, and could miss the opportunity to compete for external grants.

7. Describe the qualifications, which enable you to do this research.

I am a tenured associate professor in the department of communication at Indiana State University. Throughout my academic career at ISU, I have used focus group discussion as a major research method to collect data. My most recent publication is on the topic of international students and their cultural adaptation in the US through using social media. Focus group discussion is used in the research to collect data from international students for textual analysis. In addition to analyzing my own data with NVivo, I plan to further analyze the secondary data collected by Pew Research on algorithm.

Moreover, I have basic knowledge in using html, CSS, Python, and JavaScript for interactive web development. I have experienced many ways the social reality is now shaped and transformed through algorithm-based communication. I have great interest to observe how information technology is creating the new order of our society, and explore the process of exercising power through algorithm. I believe the research on code literacy is necessary and meaningful for scholars studying how social cultural factors and technologies shape each other.

8. Proposal Narrative.

Introduction:

According to Castell (2009), there are two ways power is exercised in the informational society, "**switching and programming** the global networks" (p. 52). Compared to switching, which is about controlling the connecting points between networks, programming is more decisive in achieving network goals. As is explained by Castells, "once programmed, the network will perform efficiently, and reconfigure itself in terms of structure and nodes to achieve its goals" (p. 45-46).

Programming is done in the form of algorithms and data structure. According to Severance (2019), algorithms are a set of rules or steps used to solve a problem, like GPS routing for code. Algorithms are the most efficient in globalizing transactions, orchestrating flows of work, and presenting ideas. In this research, **code literacy** is the concept that indicates the understanding of algorithms through programming and coding.

"Life is not merely infused with media but increasingly takes place in and through an algorithmic media landscape" (Bucher, p. 1). One goal of this research is to study the role of code literacy among college students when they engage in activities on social platforms. By conducting research, the PI hopes to find out if code literacy has positive influence on students when they embark on digital journeys and prepare for their future careers. More importantly, it will examine how code literacy help them to imagine, understand, cope with, or even resist algorithms, depending on their perception of the control of flow embedded in them.

Research Background:

There has been an intensified call for **code literacy** during the past decades (Bucher, 2018). In 2016, the Pew Research Center lists seven themes of the Algorithm era after concluding the seventh Future of the Internet study. The last of the seven themes recognizes the growing need for algorithmic literacy, transparency and oversight (Raine & Anderson, 2017). It's argued that "public education should instill literacy about how algorithms function in the general public," and "those who create and evolve algorithms should be held accountable to society" (Raine & Anderson, p. 15).

The reason behind calling for code literacy is twofold. On the one hand, we rely on programming to accomplish economic, cultural, and political goals every day. A proper understanding of programming is necessary for making educated decisions on social matters. On the other hand, the divide in code literacy is still wide open, and it has become a barrier to participating in social development as the public are passively given all the convenience brought by information technology.

Pew Research Center released *The American Trends Panel Wave 35*, a 2018 survey on computer algorithms and social media, in which code literacy is measured. For example, the survey asks "[h]ow much, if at all, do you feel you understand why certain posts are included in your Facebook News Feed and others are not?" The answer to this question is also bifurcated in that 46% answers are "somewhat well" or "very well," and 53% are "not very well" and "not well at all."

Another question in the survey asks "How much control do you think users have over the content that appears in their Facebook News Feed?" The answers are "a lot" (14%) "a little" (57%) and "none" (28%). In the following question, participants are asked what actions they have taken to try and influence what shows up in their Facebook News Feed, and the result shows a majority of the responses tries various actions to do this.

In addition to code/algorithm literacy, this survey finds that Americans are frequently skeptical of algorithmic decision-making and artificial intelligence (AI) in daily life, including during job interviews, criminal risk assessment, and more (Smith, 2018). The general attitude toward computer programs is bifurcated in that 40% think they can be bias-free, while 58% believe they always reflect human bias. The survey included questions on algorithm literacy.

Code Literacy in the Informational Society:

According to Castells (2000), in contrary to the industrial economy that is based on manufacturing, the informational economy is not driven by productivity, but is motivated by profitability and competitiveness, which are the "actual determinants of technological innovation and productivity growth" (p. 94). Castells believes that informational society is a new social structure that emerged in the second half of the 20th century based on information technology, in which knowledge-based productivity is maximized (p. 219-220). The increasing polarization of the informational society is seen between the information-rich occupations and low-skilled jobs expand on each end of the society.

Like information literacy, which is the understanding of the production, value, and use of information, code literacy is about the understanding of how algorithms function through coding and programming. Code literacy has generated information-rich occupations in big technology companies centering around programming, web development, data surveillance, etc. For ordinary people, code literacy is helpful when making use of the convenience brought to us by information technology. More importantly, code literacy gives individuals the means to see behind the automated filtering process in algorithms and remain independent thinking. As programming becomes fundamentally involved in the operation, function, and maintenance of the society, code literacy is the key for the public to become informed consumers and citizens in the society.

Programming can be used to enact communication in our society. According to Castell (2009), "control of, or influence on, the networks of communication and persuasion along the lines that favor the projects of the would-be programmers, are the key assets in the ability to program each network. In other words, the process of communication in society, and the organizations and networks that enact this process of communication, are the key fields where programming projects are formed, and where constituencies are built for these projects. They are in the fields of power in the network society"(p. 46).

Apparently, the key assets of programming lie in the field of communication, where power making process takes place through functions of filtering, categorizing, ranking, and listing, etc. Without code literacy, individuals will be blinded from the functions used in the algorithm to navigate and filter information. Computer algorithms and Artificial Intelligence have made most humans inferior in processing information. Lacking transparency in algorithms

leaves the public in a weak position of uncertainty with little control over what information to receive and how their information is to be used.

Power in Programmed Sociality:

With information technology, programming, web development, database, network security, and AI, human beings have accomplished much freedom and mobility than any time before in history. In the digital age, code literacy benefit people when performing tasks such as interacting with data, creating graphics, conducting survey and research, managing online transactions, and using cloud services, ect.

Despite all the convenience brought by computer programming, users often question the power of algorithms on social media platforms when recommending what we should see and who we should be friend with. The moment of questioning is when humans challenge the flow of control embedded in algorithms. According to Bucher's "programmed sociality," Facebook site is an assemblage of users (human) and algorithms (nonhuman) mutually conditioning each other (2018).

For example, the fear for AI is one of the popular topics that reveals how code literacy affect individual's perception of information technology. "How could artificial intelligence harm us?" is a question posted on a StackExchange website that quickly became top voted after being viewed more than 9000 times in three days in September 2019, whereas most other AI related questions on the website receive only under 100 views each. Users discussed the problem from philosophical, social, cultural, economic, and political aspects. StackExchange users are developers and programmers working in IT. Popping up in the conversation are fears that jobs being replaced by AI, using AI with malicious intent, lack of transparency, political manipulation, human's blind trust in AI, etc. These concerns align with the themes brought up in the

According to Castells (2009), as power is exercised through algorithm, so will counterpower. But the forms of taking power are different, in that "the networks of power are usually global, while the resistance of counterpower is usually local" (p. 52). Therefore, when bias exists in a network that include only variables of interest, it's hard for counterpower to raise the concern and ask for reprogramming. As explained by Castells, exclusion from the network is a "fundamental" form of exercising power (p. 50).

In sum, Code literacy is critical for individuals to participate in this power exercising process. With code literacy we will be able to identify marginalization, confront bias, protect personal identify and privacy, and defend independent thinking skills. However, as much as the informational society has evolved into the new era, code literacy has not necessarily expanded to a wider scope as it should. As much as technology has brought convenience to human being in many unprecedented ways, it has built barriers for ordinary people to participate in the forming and reforming of technology. The light speed advance of technology has left many people behind, even those with proper traditional education. It's necessary to examine the divide in code literacy and find out its impact on the younger generation.

Research Goals:

Based on the frequent encounter with programming in everyday life and ongoing divide on code literacy, the primary goals of this research is to explore code literacy divide among college students and study its impact on their social media consumption patterns, their projected career paths, and how they react to the power of control behind algorithms. The research hopes to find out if code literacy has positive influence on students when they embark on digital journeys and prepare for their future careers. More importantly, it will examine how code literacy help them to imagine, understand, cope with, or even resist algorithms, depending on their perception of the control of flow embedded in them.

Research Methods and Expected Findings:

The research method will include 1) a comprehensive review of literature on the topics of network society, informationalism, inevitability and concerns of algorithms, and programmed socialities, 2) a secondary data analysis of datasets provided by Pew Research Center in 2016 and 2018 that include responses on the subject of algorithm literacy and social media experiences, 3) a focus group study in Terre Haute on a convenience volunteer sample of college students to discuss participants' levels of code literacy, their patterns of using learning and social networks, and their vision of future career as affected by algorithms.

This research will compare patterns of using learning and social networks between students with different levels of code literacy and examine how the difference leads to bifurcated perspectives on information technology. The findings of this research will provide empirical evidence on how code literacy (or algorithm literacy) is having impact on young people's perceptions and uses of social and learning platforms. The findings will also explain how code literacy can help individuals to perform their citizen duties with better understanding on how power is exercised in the digital society. The research will also give insights on the life and career choices made by college students when encountering the inevitability of algorithms.

References:

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9. Resume for the PI and each co-PIs. (See next page)

10. URC Budget Form (see next page)

11. Budget Narrative limited to 2 pages

Below is a rationale for the requested budget listed in my budget form:

1. Two years' subscription to Lynda.com. ($239.88 per year, in total 479.76)

Lynda.com provides a great resource for code literacy by providing multiple learning paths that leads to becoming programming or data experts. The resources feed this research with the most recent development in code literacy. All the tutorials are categorized under different learning paths that lead to careers such as Python developer, cloud developer, custom App developer, database developer, Azure developer, etc. Having access to these learning paths keep the researcher informed of the current code literacy. Some of the chapters will be used in the focus group discussion to test students' coding literacy.

2. A computer. ($2000)

This research will need a new mac computer to facilitate research.

3. Travel to ICA in Gold Coast, Australia from May 21-25, 2020. (total $2855)

The annual convention of the international communication association is the top conference in the discipline of communication. The 70th annual conference will be held in Gold Coast, Australia, from May 21-25, 2020. The conference will be a gathering of top researchers on a broad range of interdisciplinary topics including information technology and communication. The Information Systems Division focuses on original scientific research regarding how information is generated, processed, and distributed, and how individuals and society are affected by information in various contexts (e.g., health, politics, technologies, education, business, advertising, culture, journalism).

In addition to learning from the topnotch experts in the field, attending this academic conference will allow the researcher to invite feedback to the scope and angle of this research from established experts at the international level. Because the PI's department will not be able to support this trip, the University Research Grant, if awarded, will be the sole source of support to this trip. The expenditures is listed below:

- The mileage will be driving to and back from the Chicago O'Hare International Airport. ($200)
- Lodging includes five days stay in Gold Coast. ($700)
- Per diem is calculated using the standard of the closest city Brisbane. ($455)
- Other includes round trip flight tickets from Chicago to Brisbane and parking fees in Chicago. ($1500)

4. Faculty summer stipend ($3,000)

The researcher hopes to spend summer in 2020 to conduct qualitative data analysis and write the first draft of the article based on the research conducted in spring 2020. For the past six years, the researcher did not have regular summer teaching assignment, and there is no summer teaching expected for the researcher in 2020. In order to support summer research activities such as data analysis and writing, a stipend of 3000 is requested.

5. Lunch for focus group participants ($200)

In the past, the researcher provided lunch for participants of the focus group. Depending on the number of people sign up for this focus group research, $200 are requested for lunch.