January 2021

Reviewing the Interdisciplinarity of Professors at Colleges and Universities Globally Through a Meta-Analysis of Current Literature

Carson Babich
babichc@uwindsor.ca

Reviewing the Interdisciplinarity of Professors at Colleges and Universities Globally Through a Meta-Analysis of Current Literature

By

Carson Babich

A Major Research Paper
Submitted to the Faculty of Graduate Studies
through the Faculty of Education
in Partial Fulfillment of the Requirements for
the Degree of Master of Education
at the University of Windsor

Windsor, Ontario, Canada

2020

Reviewing the Interdisciplinarity of Professors at Colleges and Universities Globally Through a Meta-Analysis of Current Literature

by

Carson Babich

APPROVED BY:

_____

C. Cobb
Faculty of Education

_____

C. Smith, Advisor
Faculty of Education

December 21, 2020

DECLARATION OF ORIGINALITY

I hereby certify that I am the sole author of this thesis and that no part of this thesis has been published or submitted for publication.

I certify that, to the best of my knowledge, my thesis does not infringe upon anyone's copyright nor violate any proprietary rights and that any ideas, techniques, quotations, or any other material from the work of other people included in my thesis, published or otherwise, are fully acknowledged in accordance with the standard referencing practices. Furthermore, to the extent that I have included copyrighted material that surpasses the bounds of fair dealing within the meaning of the Canada Copyright Act, I certify that I have obtained a written permission from the copyright owner(s) to include such material(s) in my thesis and have included copies of such copyright clearances to my appendix.

I declare that this is a true copy of my thesis, including any final revisions, as approved by my thesis committee and the Graduate Studies office, and that this thesis has not been submitted for a higher degree to any other University or Institution.

ABSTRACT

The lineage of interdisciplinarity throughout history pushes us towards understanding the need for interdisciplinarity more than ever in a modern climate. Through a meta-analysis of current literature, topics and themes will be discussed to find answers on how interdisciplinarity of professors are present within institutes of higher learning on a global scale; in addition, the implications that can be drawn from interdisciplinarity of higher education professors. This global outlook of research will focus on a continental approach to observing the divergent forms of interdisciplinarity in North America, South America, Europe, Africa, Asia, and Oceania with nineteen different articles across nineteen different nations across the globe. Themes discussed in the literature relate to creating a free and autonomous interdisciplinarity in higher education, the need for sustainable education, new and integrative ways of learning, university frameworks for administration and professional development, and a global interdisciplinarity framework to consolidate the many socio-geographic forms of interdisciplinarity. Implications arose with the need to address the impact of inherent and biological interdisciplinarity, and the potential limitations of interdisciplinarity when used as a policy lever inside institutions. Ultimately, the need for interdisciplinarity relating to our innate convictions of making knowledgeable connections is not a new idea, rather a reinvigoration of primal concepts relating to knowledge attainment.

DEDICATION

I dedicate this work to my immediate family, my father Frank, my mother Brenda, and my sister Stephanie for being supportive during my scholastic endeavours.

I also dedicate this work to my grandparents who are no longer with us, Mary and William, who boarded a boat on the River Mersey in Liverpool, and Frank and Josephine who defected from communist Yugoslavia, both to start a new and better life in Canada.

ACKNOWLEDGEMENTS

I acknowledge the attention, support, and guidance from my Masters' supervisor Dr. Clayton Smith and my secondary reader Dr. Cam Cobb for their guidance and insight during this whole process. I would also like to thank my peers within the Master of Education program for being excellent teammates in my academic endeavours.

"The mystery of human existence lies not in just staying alive, but in finding something to live for."

- *Fydor Dostoyevsky, The Brothers Karamozov*

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS/SYMBOLS

GETs – Goal Engagement Treatments

GIdF – Global Interdisciplinarity Framework

IISP – Interdisciplinarity Index Standardized Percentage

MOOC – Massive Open Online Courses

SLR – Systematic Literature Review

UNESCO – United Nations Educational, Scientific and Cultural Organization

NOMENCLATURE

Andragogy: Methodology of teaching adult learners.

Anthropedagogical: The method of relating teaching to human development.

Anthropogeographical: A branch of anthropology relating to the geographical distribution of humans.

Coding: A research process of identifying and analyzing text to find scholarly connection.

Interdisciplinarity: The method of observing or creating two or more branches of knowledge.

CHAPTER 1: INTRODUCTION

"*Plurimi pertransibunt, et multiplex erit scientia"* (Bacon, 1863/1605, p. 78) are the words translating to "Very many shall pass through, and knowledge shall be multiplied" (Lerner, 2011, p. 7) citing the Book of Daniel. What Francis Bacon – the infamous enlightenment scholar – suggests is appreciation towards the attainment of knowledge through abundant and multiple domains. In addition, it serves as a reminder to the lengths one will go to achieve this knowledge. Interdisciplinarity has arguably been a line of succession throughout the tree of learning – dating back to pre-history when humans made knowledgeable connections growing into the massive civilizations of modern times. Today, the concept of interdisciplinarity has re-emerged in the form of educational policy, practice, and curriculum development. Recently, *The Guardian* discussed the role of interdisciplinarity and its role in a modern educational framework:

> "The higher education sector needs to find new structures that demonstrate we're set up in the most effective ways to wrestle with real problems. While cross-disciplinary and interdisciplinary research centres are common, they tend to be offshoots of departments (Irani, 2018, January 24, para. 7).

Although a classical concept, its revival is a relevant topic in the world of higher education research.

Background and Context

The history of interdisciplinarity has a long tradition. Gunn (1992) dates the tradition of interdisciplinarity all the way back to the Ancient Greeks where philosophers would balance and bridge their knowledge between philosophy and medicine. Enlightenment thinkers such as Descartes, Bacon, and Locke reflected interdisciplinarity

in their theories on experimental science across different areas and changes in conception to scientific knowledge (Osler, 1970). In modern years, interdisciplinarity became an important phrase within the academy relating to the research procedure. Kockelmans (1979) was first to outline the theoretical and practical assumptions of interdisciplinarity within a higher education system. From there, Klein (1990) and Lattuca (2001) were able to conceptualize it further to develop working definitions and application in educational systems.

Following this tradition, it is necessary to provide a working definition of interdisciplinarity to be used across this study. Using the definitions from Klein (1990) and Lattuca (2001), the working definition of *interdisciplinarity* is the internal and natural ability to make epistemological connections with augmentation to open a new inquiry towards a framework of learning. This definition will be the catalyst to understanding the aims of the research and the overarching view towards interdisciplinarity in a global context.

Purpose

The purpose of this meta-analysis is to review the literature on the concept of interdisciplinarity amongst college and university professors from different countries. This meta-analysis is a guide towards a global understanding on how interdisciplinarity can be effective for pedagogical practices and learning theory inside of an institute of higher education. What this study attempts to do is bring a new and fresh perspective on interdisciplinarity by expanding its global reach of interdisciplinary scholarship. This scholarship is defined by Lattuca (2001) as "[expanding] an individual's intellectual repertoire or disciplinary framework when theories, methods, analogies, and concepts are

borrowed from other disciplines" (p. 53). The investment of interdisciplinarity could be beneficial as a framework for students to learn, and for professors and administrators to lead and manage higher education institutions.

Significance

This study is important for individuals who work within higher education in either universities, colleges, trade and professional schools. The need for interdisciplinarity inside institutes of higher learning will be significant for the direction in a modern, globalized, and technologically advanced society. The economic aspect is important considering enrolment in higher education institutions have steadily increased, close to forty percent between the years of 2006 and 2016 and continue to rise (Weingarten, Kaufman, Jonker & Hicks, 2017). As we move steadfast into the twenty-first century, the institutional responsibility to prepare students for a contrasting workforce is needed more than ever given the complexity with technological innovation and social change.

In searching for past systematic literature reviews on this topic, one relevant article was found on the teaching and learning for an interdisciplinary higher education institution (Spelt et al., 2009). Looking at this study, critically assessing the need for a new review comes in two parts. First, the following literature review was completed in 2009, eleven years have passed, and newer research and understandings on interdisciplinarity have become relevant for the higher education institution. Second, the last review used literature that focuses closely on Western geographical perspectives. This review will look at literature on a global scale with the goal of obtaining data from six continents across the globe (North America, South America, Europe, Africa, Asia, and Oceania).

Research Questions

Research questions provide the guidance for a systematic literature review. Creswell and Creswell (2018) cite that within a qualitative study, research questions follow a specific formula of a main or central query followed by accompanying examinations. These questions follow a systematic inquiry relevant for a meta-analysis of reviewing research. The research questions are as follows: What does current research tell us about the interdisciplinarity of professors within their pedagogical practices in institutes of higher learning on a global level? What implications can be drawn for the use of interdisciplinarity in professor pedagogy in institutes of higher learning on a global level?

Limitations and Delimitations

Limitations and delimitation are a part of any research study and this study is no different. Some limitations to this study are that a global framework to interdisciplinarity can be different in its objective, and there could be hundreds, perhaps thousands of different articles relating to interdisciplinarity and education in *x* or *y* country. However, confidence in the exercise of article selection has provided a clear and fair outline for research used in the meta-analysis and follows fair collection guidelines that are effective for the process. Delimitations include the selection of the articles to ensure precise and consistent analysis relating to the topic of interdisciplinarity in a global framework. Research from – or relating to all six continents are in this study and the choice to include more compared to another – follows a guide based on informational availability. Chapter two will outline the process for the systematic literature review, implications of the methodology, and a rationale for the selection criteria and data analysis.

CHAPTER 2: REVIEW FRAMEWORK

This study is a systematic literature review (SLR) using relevant and recent articles connected to interdisciplinarity in higher education institutions from across the globe. Furthermore, augers in to understanding the interdisciplinarity of professors, instructors, administrators, and students inside higher education institutions. The following chapter will focus on the methodology including an explanation of the SLR process, the research design, how the articles were selected, criteria for the articles, data analysis, and a theoretical framework for conceptualizing the results. Furthermore, the attempt to highlight the tertiary components to developing an SLR attempts to lead to an interdisciplinarity framework to be used by educators and administrators.

Methodology

Using the five-step method from Briner and Denyer (2012), this SLR follows a concise method of planning, locating, appraising, analyzing, and reporting. Through this operation, the goal of the SLR is to find substantive information in the articles that guide towards a framework for interdisciplinarity. The understanding is to place pre-conceived notions of interdisciplinarity aside and look directly at the research to develop an effective framework. The researcher – in this instance – is at the subjugation of the literature to avoid as much bias as possible. In addition, the concept of *coding* will be used in this paper following the method from Owen (2014) who suggests when looking at educational policy – to decipher and analyze the information that is presented in the content presents a clearer image on what the policy is saying. The same applies for research. The goal is to code the research and develop a framework for interdisciplinarity through an expansive global outreach of research and design.

Research Design

The design of this paper will be qualitative in nature. This includes a phenomenological component which Creswell and Creswell (2018) describe as philosophical understanding of the lived exposure of individuals relating to a phenomenon they experienced. In this case, the research articles play the role of the participants and the content are the phenomenological experiences to codify and analyze developing frameworks through interrelation, and a new conceptualization of the phenomenon. In addition, this study will also use concepts of grounded theory to which Strauss and Corbin (1994) state as "a general methodology for developing theory that is grounded in data systematically gathered and analyzed" (p. 273) for a sensible assessment of literature towards connecting real-world implications that interdisciplinarity in education can have on colleges and universities globally.

The phenomenon is the interdisciplinary nature or interdisciplinarity found inside institutes of higher learning. For educators within post-secondary institutions, interdisciplinarity is the ability to use connected forms of knowledge and expand it beyond the borders of a specialized topic leading to new knowledgeable connections. Whereas students use interdisciplinarity to make knowledgeable connections from the specialized topic to augment a broad based approach to learning – insofar that both educators and students use interdisciplinarity in their continued endeavours in areas such as the profession, society, economics, and politics.

Selection Criteria

In order to procure a global selection of studies, research needed to be obtained from as many diverse areas as possible. The first step in the selection criteria was to use

Boolean Search Parameters to find articles relating to interdisciplinarity and six different continents across the globe. The Boolean Search Parameter used the phrase 'interdisciplinarity AND pedagogy AND *x* continent'. Active filters included a time range for new and relevant results from 2015-2020, peer-reviewed journals, articles, and keywords including: education, pedagogy, higher education, and instructional design. The active filters help deduce the articles to find a complete list of relevant literature pertaining to the review topic.

Article Selection

Through this process, 19 articles from all six continents and 19 different countries. These countries are either where the author or institution is located, plus the geographical location of the study. This is important for the selection as it uses a wide range of data. The initial database findings for 'interdisciplinarity AND pedagogy' rendered a result of close to 6000 articles, books, and reviews which needed to be reduced towards a more comprehensive list. After adding in the continent with the active filters, a clearer picture emerged with article selection from each continent. Duplicates showed up in some searches given the connection of nations and continents relating to author, institution, and location of research and this was considered. Meeting the criteria of the active searches, the 19 articles emerged that balances the impact of interdisciplinarity of pedagogy of higher education instructors on a global level were selected. Below, (Table 1) list the 19 articles selected based on author, year, author nation, institution nation, and research location to provide a geographical understanding for global interdisciplinarity.

Table 1

Selection of Articles for Systematic Literature Review

Author	*Year*	*Author Nations*	*Institution Nations*	*Research Location*
Altomonte et al.	2016	United Kingdom	United Kingdom	United Kingdom
Banda	2018	Zimbabwe	United States	United States and Zimbabwe
Beaule & Quintana	2017	United States	United States	United States
Biasutti et al.	2018	Italy and Greece	Italy and Greece	Jordan
Casinader & Kidman	2018	Australia	Australia	Australia
Code	2017	United Kingdom	United Kingdom	Norway and United States
Cohen-Miller et al.	2017	Kazakhstan	Kazakhstan and United Kingdom	Kazakhstan
Czernowitz et al.	2017	South Africa	South Africa	South Africa
Harkey et al.	2016	Colombia	Colombia and United States	Colombia
Jia et al.	2019	China	China	China
Karppinen et al.	2019	Finland	Finland	Finland
Kim & Song	2018	United States and Canada	United States and Canada	United States
Kishita et al.	2018	Japan	Japan	Japan
McDonald et al.	2018	United States	United States	United States
Restrepo et al.	2016	Colombia	Colombia	Colombia
Self & Baek	2017	South Korea	South Korea	South Korea
Servant-Miklos & Spliid	2017	Netherlands and Denmark	Netherlands and Denmark	Denmark
Webber & Miller	2016	Canada	Canada	Canada and United States
Wu & Shen	2015	Taiwan	Taiwan	N/A

The diverse selection of nations will present a view of interdisciplinarity in the context of that nation's educational history, philosophy, and perceived outcomes toward knowledge and learning. Most of the nations come from Asia, Europe, and North America: 15 of the 19 articles come from these three continents which is 79%. This relates to the global population, as these three continents make up roughly 77% of the world's people, therefore, the sample of articles are representative of global population. Below, (Table 2) is a breakdown of the countries based on the authors, institution, and research topic with (Figure 1) providing a visual representation on a global map.

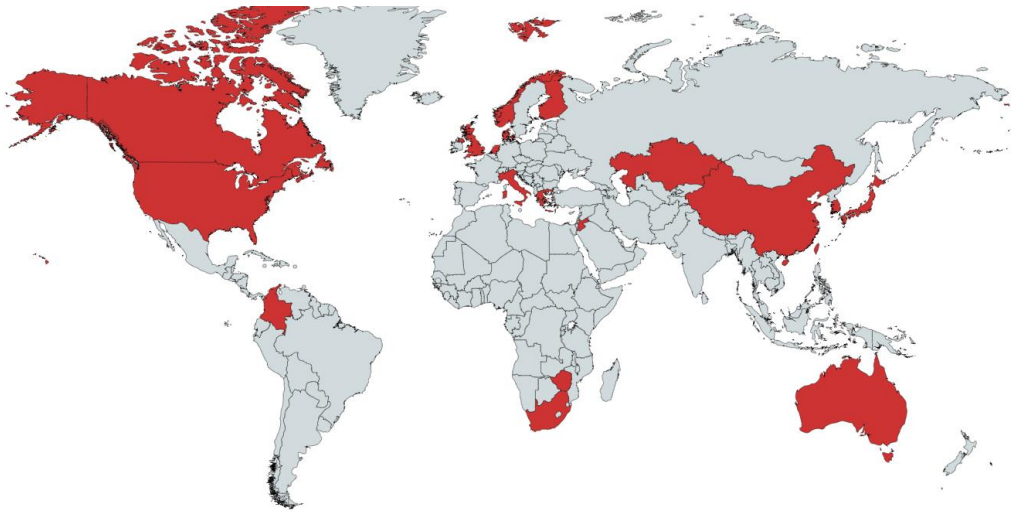
Table 2

Breakdown of Countries Based on Authors, Institutions, and Research Topic

Country	*Amount*
United States	4
United Kingdom	3
Canada	2
Colombia	2
Australia	1
China	1
Denmark	1
Finland	1
Greece	1
Italy	1
Japan	1
Jordan	1
Kazakhstan	1
Netherlands	1
Norway	1
South Africa	1
South Korea	1
Taiwan	1
Zimbabwe	1

Figure 1

Map of Countries, with Highlighted Countries Featured in the Research



Data Analysis

After selection of the articles, the action of codifying attempts to look for themes present within the research. Five distinct themes emerged including: creating interdisciplinarity for liberal and sustainable education; the role of sustainable education within the realm of epistemology; new, open, and integrative ways of learning; university frameworks and professional development; and a global framework for interdisciplinarity. What these themes outline is a scaffolding towards an understanding of the global framework of teaching and pedagogical practices by professors at institutions around the world and the implicative factors that come with an interdisciplinarity framework for teaching in the university of the future. This introduces implications for stakeholders like administrators, students, and members of the public as future direction of interdisciplinarity can impact how we learn and how we see learning from a new and sustainable perspective. In addition, we can use the global interdisciplinarity framework towards developing a standard on how to use interdisciplinarity as educators in post-secondary institutions.

Lattuca (2001) suggests the epistemological and societal need for interdisciplinarity in research and teaching, and for institutions and administrations to acknowledge interdisciplinarity on a greater level. What the research suggests is that interdisciplinarity attempts to address all these goals, notably Jim Wu and Shen (2015) who cite the United Nations goal for education through sustainable development enhancing liberal education, interdisciplinarity, cosmopolitanism and civics. Furthermore, a drive towards a global model for sustainable education through

interdisciplinary and transdisciplinary research presents initiatives to connect knowledge integration based in pragmatic, liberal, and real-world situations (Kishita et al., 2018).

The change in the mindset of interdisciplinarity comes from the research focusing on expanding ideals within a capacity towards growing models in all forms of knowledge integration including research – but in addition instructional design, pedagogy, andragogy, educational administration and understanding through global policy initiatives for education and the public. Interdisciplinarity may provide – in a modern global context – a new conception of freedom and autonomy for individuals involved in the education sector. In addition, allow itself to a broad, open, and nuanced look at how individuals teach outside the institutional silos we create, especially within higher education. Supplementary ideas on interdisciplinarity present a theoretical understanding toward its process as it relates to the interdisciplinary factors that influence our lives such as work, relationships, family, and society.

Theoretical Framework

The theoretical lens using the concepts of openness, natural sustainability, rational epistemology, and enhanced ways of learning follow a liberal concept of knowledge acquisition. The term liberal is used not in the modern sense of denoting a political lean discarding traditionalist values, rather in the classical ideal of the phrase which denotes a sense of freedom and autonomy for the individual with natural and inalienable rights relating to ones liberal values. The lineage in terms of learning can trace back to René Descartes (1850/1637) where he provides his most famous assertion on the foundational principles of humans “I think, hence I am” (p. 75) and his assignation about learning he received and the lack of expansive knowledge and foundational principles were

unfounded leaving him with glaring contradictions, searching for more. What Descartes provides is that knowledge ultimately is found within the human outside of some divine deity. This relates to the concept of interdisciplinarity as a way for the individual through liberal concepts to search beyond the disciplinary boundaries to find answers to relatively complex questions. Furthermore, to be free and explore the many different domains of knowledge that are available.

Descartes provides the base for this epistemological liberalism, but it is in the pages of *The Two Treatise of Government* where John Locke (1884/1681) outlines the origins of classical liberalism, commonly referred to as *Lockean Liberalism* – wherein suggests that humans and their natural inalienable rights should not be infringed by any sort of unnatural tyranny:

> "To understand political power aright, and derive it from its original, we must consider what estate all men are naturally in, and that is, a state of perfect freedom to order their actions, and dispose of their possessions and persons as they think fit, within the bounds of the law of Nature, without asking leave or depending upon the will of any other man" (p. 192).

In his later work: *Some Thoughts Concerning Education*, Locke (1898/1690) advocates the authentic nature of learning in developing knowledge from many different experiences as a child and from the child, creating a well-formed rational adult. The interdisciplinarity of Locke is reflected in his liberal notions of freedom and the ability to pursue many types of knowledge realms with the express consent of the individual free from outside tyranny.

What this theoretical framework outlines are the ability for students and professors to actively participate in their pedagogical and epistemological freedom of choice for the best method to guide their teaching and learning. Additional concepts come from expanding the knowledge scope outside of the disciplinary sphere to accommodate and connect the varied understandings of the world, especially in a complex modern landscape. Some additional questions of observation will be pursued in the meta-analysis results. First, how will interdisciplinarity provide a liberalized framework for education? Also, how will liberal free choice be a catalyst to understanding a global framework of interdisciplinarity?

CHAPTER 3: RESULTS

The future of education is an important topic of discussion. With interdisciplinarity, the future of education is paramount to develop an understanding on the direction we are moving towards – regarding epistemology in the modern world – connected and encompassing. With this, creating interdisciplinarity for liberal and sustainable education, the role of sustainable education, integrative ways of learning, and new frameworks of interdisciplinarity are needed to understand and take on the challenges that we face with an ever-changing world. Furthermore, we need to take a globalized look on how to understand interdisciplinarity and its place in the future of higher education for the purpose of an effective framework for interconnected learning on a large scale.

Creating Interdisciplinarity for Liberal and Sustainable Education

Liberal and sustainable education starts with how teaching and learning inside of an institution provides freedom towards the student and professors – and maintains a threshold of learning for more students to obtain knowledge. Providing classical-liberal ideals of freedom and autonomy, with modern concepts of sustainability, help to maintain growth objectives which are imperative to understanding the role of interdisciplinarity inside institutions. The first comes from methods used inside institutions from its leaders – as the literature suggests that interdisciplinarity within education can provide answers to a complex nature of questions through methods such as systems thinking, freedom to collaborate, and enhancing interpersonal skills through sustainable initiatives (Beaule & Quintana 2017; Code, 2017; Kishita et al., 2018). Furthermore, interdisciplinarity also provides a pathway to liberalized learning through open conversations and differentiated

methods for learning. This is displayed with using Massive Open Online Courses (MOOC) within African higher education and through the pedagogical work of Nancy Abelman in South Korea (Czerniewicz et al., 2017; Kim & Song, 2018). What we can draw from the different global examples is that there is a push towards sustainable education and enhancing freedom inside the learning sector. Africa – for example – has seen a change in their education system and could be a factor for its current sociological and economic growth in recent years, especially in the countries of Nigeria and Sudan; also, Cameroon, Zimbabwe, and Ghana (Babatunde, 2018; Elfaki et al., 2018).

What this shows is the influential connection between interdisciplinarity in learning and the causal effects on social and economic systems. Staying within Africa, the Brookings Institute (2020, January 8) already is suggesting the beneficial future of Africa through new trade agreements and the advancement of transformational technology for industry. Theoretically, one might make a connection between the epistemology ethos of a community connecting to the socio-economic successes or failures of a nation or nations in an interdisciplinary way.

Interdisciplinary objectives from teachers also provide students to be individuals through an experiential framework. Through a personal experience within the real-world educational affairs, students can draw connections from different knowledge streams done through interdisciplinary teaching. The connection to real-world comes from providing students the freedom to augment their experiences in the classroom, and encompassing an interdisciplinary framework is fundamental to the nature of learning (Banda, 2018; Casinader & Kidman, 2018). Geographical implications from students who experience interdisciplinarity can come from a shared vision of learning from

different geographical areas. It is in Banda's (2018) work where the geographical implications on multiple topics of learning reflect the divergence of education in the United States to the education in Zimbabwe through a personal account. Furthermore, Casinader and Kidman (2018) echo the sentiments of incorporating interdisciplinary objectives with a shared vision for goals in educational sustainability in Australia.

Liberal and sustainable objectives regarding education relate to the teaching and the free transmission of knowledge through learning on a large scale. What this reflects is that creating interdisciplinarity and building a foundational policy can work towards achieving interdisciplinary goals in education. According to the studies, creating interdisciplinarity can provide liberal and sustainable education to a wide variety of stakeholders especially students through consistent and pragmatic engagement from professors (Code, 2017; Jim Wu & Shen, 2015). The focus from an epistemological and administrative framework is to provide engagement with interdisciplinary practices; as it is Hamm, Chipperfield, Parker, and Heckhausen (2019) who conclude that motivation towards specific *Goal Engagement Treatments* (GETs) placed in classrooms reflect improved academic performance and academic persistence even with previous risk factors for motivation. The GETs framework is especially salient when discussing online learning and merging interdisciplinarity with technology.

Freedom and liberty are important topics within the research especially relating to pedagogical and epistemological freedom. The literature reflects the concept of freedom through open paradigms of technical, pedagogical, financial liberty, and integrative freedom of teaching styles and choice of learning for students (Beaule & Quintana, 2016; Czerniewicz et al., 2017; Kishita et al., 2018). Interdisciplinarity allows for this liberty to

be expanded through pedagogical practice opening a gateway to learners for their enhanced liberty in learning through epistemological connections.

Understanding the liberalized factors in relation to interdisciplinary education comes with understanding the relational factors between teaching and learning, notably the relationships between motivation, engagement, experience, and a pathway towards freedom in learning. Interdisciplinarity provides a liberalized framework through its ability to motivate and engage in different topics related to the student's and teacher's competencies with learning. Furthermore, classical-liberal learning ideologies can provide a westernized ethos to learning that produces benefits to other divergent learning styles through collaboration, systems-thinking, and sustainable frameworks. Classical liberalism presents the higher education institution as a bastion of freedom to be founded and to be expressed further. Free and autonomous concepts may provide a blueprint to how professors use their interdisciplinarity within pedagogical practices and a role for the use of interdisciplinarity on a global level.

The Role of Sustainable Education within the Realm of Epistemology

According to Leef (2015, April 15), sustainable education is a common buzzword within the education sector, given the recent growth of sustainable initiatives outside of the field in areas such as science, government, and sociology in the vein of Marxist principles of anti-capitalism and left-wing activism. In an attempt to reverse engineer sustainability, neoliberal concepts attempt to deregulate bureaucracy of sustainable education in order to maximize epistemological freedom for the benefit of individuals. The origins of sustainable development are not new, as almost fifty years ago, the United Nations hosted a conference in Stockholm, Sweden discussing international issues and

impacts involving the environment (United Nations, 1972). This spurred the concept of sustainable education through sustainable development in all facets culminating from The Brundtland Commission in the 1980's (Sustainable Development, 2015) to the Agenda 21 at the United Nations Rio Summit in 1992 that first outlines the objective of sustainable education to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (Leicht et al., 2018, p. 25). In relation to epistemology and knowledge, this global outlook introduces many concepts to the way teaching and learning is handled throughout different areas of the world. What this presents is a collaborative or cohesive framework to ensure sustainable education in higher education institutes – this is done through recognition, outreach and collaboration, and administrative initiatives.

Recognition continues to happen through the United Nations and their commitment to sustainable education. UNESCO's goal for Sustainable education attempts global recognition through integration of sustainable measures and an approach to curriculum policy. Furthermore, the focus on stand-alone courses, such as geography in the Australian curriculum (Casinader & Kidman, 2018), create a fundamental interdisciplinary concept through differentiated sustainable measures (Jim Wu & Shen, 2015). The connection of sustainable concepts with learning presents a multi-disciplinary approach with a classical understanding of sustainable pedagogy – following the concept of interdisciplinarity and the integration of different forms of knowledge. Although Casinader and Kidman (2018) outline a potential lack of priority standards for interdisciplinary work, fostering learning outcomes with cross-curricular design can expand the knowledge of learners.

The impact of sustainable education has to do with its impact with global outreach and collaboration. Online learning is an example that provides a viable method to collaborative sustainable education such as development of an online portal in the United Kingdom (Altomonte et al., 2016), where Code (2017) suggests a hybrid model in Norway and the United States saw the best for interdisciplinary and sustainable goals. In addition, collaborative and cooperative learning create a sustainable paradigm through project-based learning and a student-centered approach with Jordanian professors (Biasutti et al., 2018). The impact of online learning on global outreach and collaboration introduces a streamlined and effective transmission of pedagogical and epistemological methods through many access points towards open education. This relates to the initiative from the World Health Organization (2020) and the Global Health Workforce Alliance which focuses on building knowledge capacity through distinct methods – such as e-learning – to keep education competency high with economically sustainable outcomes at little to no cost to help individuals in low income countries. Interdisciplinarity with sustainable education will be an important discussion towards this goal of economic sustainability in the future.

Another area of sustainable development involves administrative initiatives for higher education. The involvement of sustainable and interdisciplinary programs can be used as minors or degree programs to be influential for a student's study path through higher education (Jia et al., 2019). Furthermore, this provides an autonomous measure for educators to enhance sustainable development through self-analysis and a production of knowledge (Callejas-Restrepo et al., 2016). This is reflected from Germany's initiative for sustainable development being used at Tongji University in China (Jia et al., 2019),

and the introduction of a sustainable emphasis in Colombian higher education institutions (Callejas-Restrepo et al., 2016). In Japan, sustainable education is divided into two domains: specialist and generalist-oriented programs. Specialist Oriented Programs (SOP) are inductive bottom up approaches to understanding sustainability in different disciplines, where Generalist Oriented Programs (GOP) are top-down deductive methods through systems thinking. Both provide a framework for initiatives to enhance knowledge and epistemology through sustainable development (Kishita et al., 2018).

Sustainable education attempts to provide more freedom to access education across many different geographical locations. With the continual growth of the internet, new knowledge will be readily accessed to more people in the world than ever before. Interdisciplinarity along with sustainable education will be the catalyst and the bridge that crosses the knowledge gap that has hurt many nations before. One example of that bridge deals with the nation of Estonia, who were under Soviet rule during most of the twentieth century. Estonia saw hardships under communist rule such as the expropriation of farmlands and the systematic murder of kulak farmers who opposed the collectivization attempts from communists and socialists (Frucht, 2005). Now after the Iron Curtain has lifted, Estonia enjoys a democratized and liberalized education system as it currently ranks third in the world through PISA ranks behind Singapore and Japan with high performances in science and value ownership in education (Organisation for Economic Co-operation and Development, 2015). In a modern world, with the embrace of sustainable and interdisciplinary practices in education, liberalization can be attained through a global acceptance of freedom within educational systems at the personal and governmental level.

New, Open, and Integrative Ways of Learning

Knowles (1980) describes the growth of adult education in schools coming out of World War I, reflecting older members of society wanting to engage in learning. Thus, the term *andragogy* was born using Deweyan pragmatism and experiential learning to teach adults through real-world practice. Andragogy is an example of new, open and integrative ways of learning, through the creation of new teaching, openness to more individuals, and integration considering this created the basis for modern day higher education. Today, newer ways of learning – such as e-learning and experiential education – are discussed to meet the needs and challenges of a modern-day student body and educator. In order to meet these challenges, one must branch outside of the disciplinary paradigm and find interdisciplinary concepts related to new ways of learning. Interdisciplinary concepts can be found through collaborative integration between students and educators, embrace of open technology in higher education classrooms, and redesigned methods bridging the gap between learning competency and culture.

Collaboration and integration relate to learning through teamwork and achieving goals through a shared academic purpose. Integration within learning reflects student-student collaboration or student-teacher collaboration. Methods of integrative teaching have reflected positive learning outcomes through metrics at a rate of 90% (Karppinen et al., 2019), and self-sufficient learning, embracing a level of real-world experience (McDonald et al., 2018). The concept of connected education was also relevant in the literature, place-based education along with transdisciplinary factors provided clear outlines for students to answer challenging epistemological questions (Jia et al., 2019; McDonald et al., 2018; Webber & Miller, 2016). Positivity metrics in self-sufficient

learning, embracing real-world experience, and the ability to answer challenging questions are all important traits of a college or university graduate. Relation to positivity metrics can be embraced through critical thinking in a modern age as Bøyum (2005) suggests that critical thinking in theory can relate to logical, autonomous, and skeptical thinking, potentially as objectives in liberalized education. Logic and autonomy in critical thinking is vital as we move forward into an ever-expanding connected economy and society. Self-sufficiency and expanding beyond academics into the work force is an interdisciplinary measure to prepare students for their futures in the economy and society.

With this focus on a connected economy and society, we can look at the impact technology has towards an interdisciplinary future. When discussing technology, we focus on open learning access to educators and students to be used widely in pedagogical practices. Open learning is shown to enhance transformative learning practices with evidence reflecting Information and Communication Technology (ICT) enhancing pedagogical outcomes, pace of learning, and interdisciplinary knowledge through online portals (Altomonte et al., 2016; Czerniewicz et al., 2017). Code (2017) also suggests that the use of blended learning, as in a mix of online and in-person, meets interdisciplinary and student needs through effective engagement in knowledge acquisition. Open learning provides a new way of knowing outside of the original paradigms of the higher education institution. Freedom through pace of learning, along with a blended mix of classical and contemporary concepts provide a beneficial outcome towards achieving learning objectives. Blended learning presents the pursuit of practical innovations of open education with higher education learning, such as online open education resources, and MOOC's being used more widespread in colleges and universities.

One of the themes with new and open ways of learning is the emerging concepts in academics such as the interdisciplinary field of medical humanities (Czerniewicz et al., 2017), the use of location-based apps for case study research (Altomonte et al., 2016), and the use of knowledge-based tools to open new ways of problem solving and decision making (Webber & Miller, 2016). Knowledge-based tools show that interdisciplinarity is being used not only at a theoretical-epistemological level, but at a practical-pedagogical level to find new ways of learning through creating new disciplines, research methodology, and mechanisms for problem solving in a real-world context.

Divergent methods of teaching can relate to pedagogy expanding beyond disciplinary boundaries. One of the more disparate methods is holistic teaching which embraces a natural epistemological connection to the whole of learning through many facets of life. Research of multi-disciplined learning suggests that holistic learning is founded both in educators and students through cross-disciplined classrooms, team-based learning, and cultural connectedness being a factor for enhancement (Karppinen et al., 2019; Self & Baek, 2017; Webber & Miller, 2016). Furthermore, students and educators were able to develop new learning through interdisciplinary cross-fertilization and meta-cognition related to goal-oriented strategies (Biasutti et al., 2018; Servant-Miklos & Spliid, 2017), with an embrace of cultural awareness (Cohen-Miller et al., 2017; Self & Baek, 2017). Holistic learning can be a catalyst towards bridging the gap between pedagogical competency and cultural connectedness to create a wide range of effective interdisciplinarity tools to use for teaching and learning. Holistic learning can liberate students and educators through embracing divergent methods towards interdisciplinary goals and achieving learning objectives.

New and independent methods will help shape the course for interdisciplinary learning in the future, not only through epistemology, but through liberalized concepts of education. Student and educator freedom on the basis of enhanced knowledge will be a continuing theme moving forward, given the availability of integrative teaching, online learning tools, and an embrace of divergent methods to bridge the knowledge divide between students obtaining education and access to educational resources.

University Frameworks and Professional Development

The role of higher education policy and administration will be important to enhance interdisciplinary initiatives on campuses. Interdisciplinarity is an important discussion for how university frameworks engage including research, hiring, recruitment, and job placement for students. Sa (2008) outlines that universities need to establish broad campus policy that direct these factors towards interdisciplinarity. Furthermore, outlining the need for universities to accommodate "multiple and competing demands for knowledge production through increasingly complex, layered, and intersecting organizational arrangements over several generations is a central feature" (p. 550). The complex and layered arrangements in the university model can open up further analysis when discussing interdisciplinarity. This may introduce a new framework for liberalized concepts for college and university policy.

Higher education frameworks relate to the mechanisms of the university, college, or professional school. It could be from a policy view, or a pedagogical view to understand how an institution manages their students, educators, and administration. Institutions that embrace interdisciplinarity for professors tend to embrace innovative practices, constructivism, and teacher autonomy in order to enhance learning objectives

which are largely embraced by the administration (Callejas-Restrepo et al., 2016; Karppinen et al., 2019; Servant-Miklos & Spliid, 2017; Sharkey et al., 2016). Focusing on administration, according to the research, Denmark and Australia seem to be closely aligned with administrative acceptance of interdisciplinarity through institution policy and curriculum policy (Casinader & Kidman, 2018; Servant-Miklos & Spliid, 2017). Certain geographical locations can reflect more interdisciplinary practices especially Europe and South America which embrace pedagogical concepts around a traditional or indigenous methodology to learning, teaching, and higher education administration. Traditional concepts provide a sense of autonomy towards individuals through the embrace of innovative practices in teaching such as contrasted methods of experiential learning and blended classroom models.

Professional development initiatives look outward from teaching towards administrative – and to an extent governmental controls towards embracing interdisciplinarity inside higher education institutions. In Colombia, professional development initiatives reflect policies with a professional development strategy through an autonomy, relationship, creation, and obligation model (ARCO) and a community-based pedagogy model (CBP) to allow multiple points of entry for learning (Callejas-Restrepo et al., 2016; Sharkey et al., 2016). Commonwealth nations such as the United Kingdom, Australia, and Canada also provide a sustainable framework towards professional development through consolidated knowledge, interdisciplinary innovation in problem-solving, and achieving key learning outcomes through cross-curricular design (Altomonte et al., 2016; Casinader & Kidman, 2018; Webber & Miller, 2016). Professional development initiatives create the interdisciplinary concept of education and

learning that proliferates through society in the area of economics, politics, and culture through the contrasting of business policy, government policy, and societal norms.

Although policies can be rigid in their bureaucratic and legalistic approach, the policies seem to accept and enhance educators to be free and pursue a pedagogical design with ongoing innovation as educators see fit, so long as the pedagogical design achieves desired learning outcomes. Liberalized concepts within innovation and autonomy provide a sense of freedoms for educators to expand on their philosophies of teaching to provide exciting and reforming methods to their students. The impact on a global scale can provide a greater expanse for learning, and critical understanding of new concepts through a modern interdisciplinary framework within higher education.

A Global Framework for Interdisciplinarity

To look at interdisciplinarity in a global framework, it must be understood through a concept of human geography, or an anthropogeographical analysis. Human geography or anthropogeography is the way that places and environments interact and are impactful based on human activities such as the economy, politics, and society (Human Geography, 2009; University of Heidelberg, 2020). Through a review of literature that spanned six continents and nineteen different countries, characterizations formed based on interdisciplinarity of professors and the geographical locations of the studies, the institutions, or the individual researchers that took part. The analysis narrowed down characteristics to the six different continents based on the studies culminating to create a Global Interdisciplinarity Framework (*GIdF*).

In the Americas, the characteristics of interdisciplinarity are based on a self-sustaining and self-sufficient model. Within North America, educators and learners embrace a dynamic valuation of interdisciplinarity through free and autonomous concepts in problem-solving and pedagogy, in addition, strive for effective outcomes through innovation (McDonald et al., 2018; Webber & Miller, 2016). Following this independent concept, personal development is an important characteristic as it has been shown as an impactful measure for professors in the classroom (Banda, 2018; Kim & Song, 2018). South America approaches interdisciplinarity through an elder approach to learning through indigeneity as educators develop a critical understanding through indigenous history, all while applying experiential strategies and familial involvement in relation to autonomous teaching and achieving interdisciplinary objectives (Beaule & Quintana 2017; Callejas-Restrepo et al., 2016; Sharkey et al., 2016).

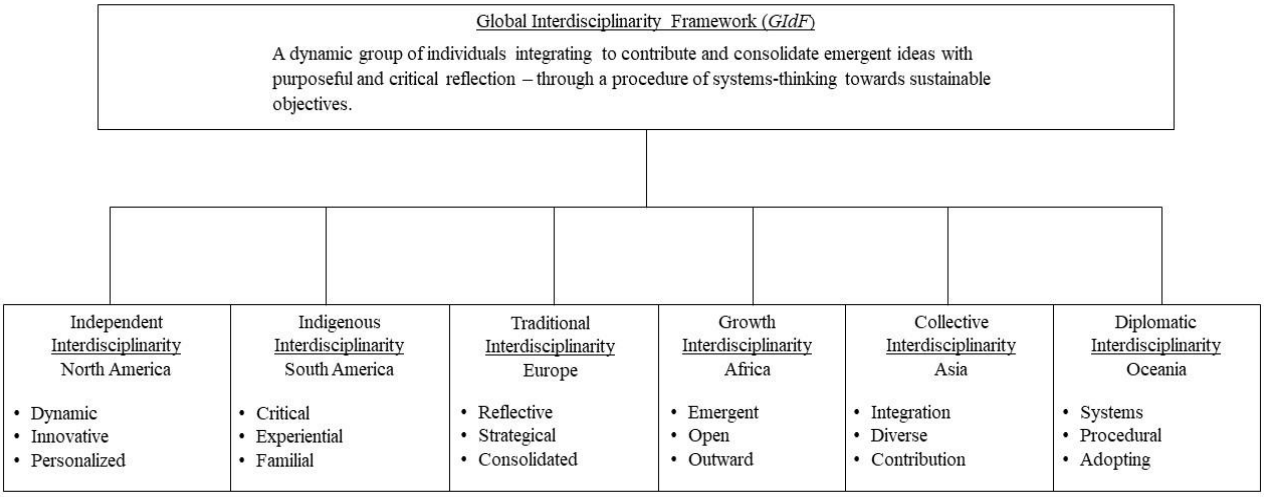
Europe follows a traditional framework of interdisciplinarity, perhaps this is attributed to its rich and plentiful history of academia. In the same concept of classical theorists such as Locke for freedom and Descartes for understanding, Europe employs a reflective and strategical methodology for their interdisciplinarity through experiential design and goal-orientation through meta-cognition (Karppinen et al., 2019; Servant-Miklos & Spliid, 2017; Biasutti et al., 2018). Furthermore, they attempt to consolidate classical and contemporary models of learning through the blending of traditional concepts in a modern framework (Altomonte et al., 2016; Code, 2017). Moving south, we see a more enhanced form of interdisciplinarity in Africa. Growth characteristics are shown through an emergent need of new technology, and open pathways to enhance interdisciplinary learning (Czerniewicz et al., 2017). There is also an outward connection

to real-world experience, especially when coming from an African nation to a Western nation (Banda, 2018).

Eastward in Asia, collective characteristics for teaching and learning are integrative with team teaching in countries such as Kazakhstan, Taiwan, and South Korea for better interdisciplinary design (Cohen-Miller et al., 2017; Jim Wu & Shen, 2015; Self & Baek, 2017). Asia also allows diverse paths towards interdisciplinary learning, and an acceptance of sustainable education in teaching as a collective (Jia et al., 2019; Kim & Song, 2018; Kishita et al., 2018). Lastly, Oceania with its prime representative of Australia, follows a diplomatic form of interdisciplinarity. Systems are developed for interdisciplinary models relating to procedures and adoptions from national and multi-national policies relating to education (Casinader & Kidman, 2018). Below, (Figure 2) outlines the *Global Interdisciplinarity Framework (GIdF)*.

Figure 2

Global Interdisciplinarity Framework (GIdF)



Given the characteristics of each continent and how they produce interdisciplinarity is quite striking based on the contrasting philosophies. We see the geographical implications of independence and indigeneity in the new world reflecting the past of nations such as Canada, United States, and Colombia with the attempt to build a bridge between modern independent and past indigenous concepts. For example, learning in Canada through indigeneity is produced through the Ontario Government policy initiative with the *First Nations, Metis and Inuit Education Policy Framework* (Ontario Ministry of Education, 2007). Since most of the traditions of learning happened in Europe (i.e. Greek Antiquity; Roman Empire; English, French, and German Enlightenment etc.), traditional aspects of interdisciplinarity based of reflective and strategical knowledge follow a tradition as old as the continent itself. Western interdisciplinarity of course is contrasted with the growth of the African nations in relation to their economy boom in the most recent years, it would seem the political changes and self-sustaining growth in the economy have proliferated into their teaching and learning. Asian interdisciplinarity follows a collective framework and it is reflected in their interdisciplinarity through education and learning. In addition, along with Oceania their objectives to create and enhance sustainable education goals.

These global concepts of interdisciplinarity culminate with the *GIdF* outlining a dynamic group of individuals integrating to contribute and consolidate emergent ideas with purposeful and critical reflection – through a procedure of systems-thinking towards sustainable objectives. The aim for this framework is to consolidate interdisciplinarity from many different nations and continents for a clear and concise understanding of how interdisciplinarity is displayed by professors of higher education on a global scale.

Furthermore, be implicative towards further understanding on the interdisciplinarity of national and multi-national conceptualizations of education policy.

CHAPTER 4: IMPLICATIONS

Common themes in the results reflect a liberal and sustainable notion towards the epistemology of interdisciplinarity, along with providing new and open ways of learning for college and university professors and that interdisciplinarity can be extrapolated towards a global framework. Through a global framework, interdisciplinarity provides a liberal foundation for professors to choose their philosophy on education, all while professors can embrace an autonomous action inside their classroom to drive effective and efficient learning for students. Discussing the implications of interdisciplinarity on professors inside higher education across the globe, we can reflect on the impact that interdisciplinarity will have on education and society. Furthermore, discussing the criticisms around interdisciplinarity and implications for future research is important to effectively critique interdisciplinarity as it provides a robust understanding and is an effective way to develop a broad analysis for future research on the topic.

Implications for Education and Society

Some implications on education and society reflect a sense of freedom and autonomy for educators that can proliferate outside of the institution. Callejas-Restrepo et al., (2016) and Servant-Miklos and Spliid (2017) reflect that faculty members have had the autonomy to build and teach their pedagogical framework that benefits student learning outcomes and prepares students for a global environment. In addition, interdisciplinarity in education and learning diversifies teaching outside of the classroom (Code, 2017), engage with learners (Kishita et al., 2018), and value sustainable initiatives towards enhancing interpersonal skills for educators towards knowledge attainment for complex problems (Cohen-Miller et al., 2017; Kim & Song, 2018). Sustainable initiatives

and enhancing interpersonal skills set a precedent that interdisciplinarity inside education and society for professors around the world enhance autonomy, engagement, and gaining knowledge toward problem solving.

Key questions are based on the grounds for inherent interdisciplinarity amongst humans – as in – are certain people educators because they are interdisciplinary? Or does interdisciplinarity become a common trait towards educators in the field? A question that is provided: Do educators become interdisciplinary or are they inherently interdisciplinary? Repko (2007) would suggest that a theoretical phenomenon of cognitive interdisciplinarity is present in humans, also establishing interdisciplinary commonalities in areas such as academic research are relatable to integrative work being done by undergraduates in the academy. Carruthers (2002) suggests a form of activity and sharing cognitive bias towards problem solving and creative thinking is inherent in humans. He suggests that this notion dates back almost forty-thousand years ago and one might conclude from this inherent interdisciplinarity of humans as an *anthropedagogical* precedent.

It could be that interdisciplinarity is inherent in humans and perhaps more inherent with individuals who want to take on careers in education, especially higher education. Could one conclude that all human beings throughout history garner some sort of interdisciplinary competence solely out of biological lineage? Sutton (2010) suggests through the extended mind hypothesis; our brains make extended cognitive constructs of social and technological systems to make knowledgeable connections. Therefore, it can be said that interdisciplinarity may have some inherent and biological traits; however, it is one's ability to expand their interdisciplinary competence towards education that is a

catalyst for teaching, learning, and society. Educators may be born with inherent interdisciplinarity, insofar, that educators are born with a beating heart, however, it takes their ability to expand their interdisciplinarity throughout their teaching and pedagogy towards making a deep impact on education and society.

Interdisciplinarity Criticism

Inside the literature, criticisms are found with the methodology of interdisciplinarity, especially when relating to learning objectives, teaching ability, and administrative levers of maintaining standards. Within learning objectives, Biasutti et al., (2018) found that students were resistant to interdisciplinary change through a pedagogical framework of sustainable development towards learning objectives. Furthermore, challenges are reflected in Altomonte et al. (2016) who found that interdisciplinary technology through the use of student portals were too complex with students typically reverting back to old means of learning. Certain issues relating to embrace of new epistemology and complexity may be issues moving forward with a global interdisciplinarity framework. Through observing work of philosophical text, McLevey et al. (2018) suggests that philosophical researchers tend to stay close to information that relates to their topic rather than clustering or diverging to avoid complexity. Issues relating to complexity need to be addressed in future research relating to interdisciplinarity and frameworks of learning.

What can be said about a reversion away from interdisciplinary education hindering the objectives of the student if the teaching is too convoluted or impenetrable for learning to take place? Even if the interdisciplinary design is good regarding the educator, Self and Baek (2017) conclude that it may not produce holistic learning

objectives for the student. What this shows is that although interdisciplinarity is an impactful method towards education and learning; issues do arise regarding what is best for the learner, presenting a self-reflection on the educator to take into account the needs of the student to achieve learning objectives.

Since interdisciplinarity encompasses many aspects of the educational field, it is no surprise criticisms from learning proliferate to criticisms of teaching ability and administrative levers of maintaining standards inside the institution. Teaching issues arose regarding equality for teaching resources, furthermore, introducing challenges on what field actually 'owns' the content, and a lack of priority for the original field, leading to a lack of priority with interdisciplinary standards (Casinader & Kidman, 2018; McDonald et al., 2018). Teaching ability can also be hindered through challenges with time-management and loss of teaching partners (Webber & Miller, 2016), reflecting negative outcomes and a decline of administrative and organizational models of traditional universities (Jia et al., 2019). In all levels of education, interdisciplinarity can present challenges on general teaching and administration, especially if it is not implemented properly. Administrative strife can cause a fractionation between educators in certain faculties, or even between faculty and administration if organizational objectives towards an institutions vision and mission is being disrupted.

It is in the Humian philosophy to understand the different tastes regarding knowledge and empiricism. Much like the story of the two individuals who share a bottle of wine, one observes a taste of metal, the other a taste of leather, only to find at the bottom of the bottle that there is a metal key with a leather tie attached to it (Hume, 2001/1757). What this reflects, although both men were drinking the same bottle of wine,

different tastes emerge when observing taste on a deeper level. Much like interdisciplinarity, the benefits may generate similar outcomes, but criticisms refer to taste and experience with the interdisciplinarity inside of higher education institutions. Epistemological preference presents a challenge to bridge the divide of understanding between students, educators, and administrators to enhance their interdisciplinarity, even if it means limiting dense theoretical concepts related to interdisciplinarity to ensure proper learning, effective management, and organizational levers are being maintained for the good of the whole institution.

Implications for Future Research

What are the future implications for additional research on the topic of global interdisciplinarity? Regarding implications on education and society, further research needs to be done in relation to educators and their connection to inherent interdisciplinarity. Academics can implement interdisciplinary research relating to education, psychology, biology, and anthropology developing further questions to the complexities of inherent interdisciplinarity to answer questions about this topic. Regarding implications on interdisciplinarity criticism, further research can observe the impact of interdisciplinarity on college and university educators and administrators reflecting on interdisciplinary goals. Furthermore, on how they plan to achieve those goals at their institution through a pedagogical and organizational levels.

Further research may be needed in the areas of teaching practice and administration policy to better understand interdisciplinarity, as its concepts can present the ideas in a sort of shroud theory that misses its tangibility. Future research can look

towards scaffolded or quantitative measures to better understand interdisciplinarity-in-practice.

One of the most salient implications to be reviewed in further research is studying the competency of educators inside higher education institutions to ensure these results and implications are being measured for sufficient data. It is Self and Baek (2017) who theorize towards educators being disciplined within the classroom so that their students can achieve deep learning. Altomonte et al. (2016) also suggest through blended-learning models of online and in-person pedagogy avoids complexities with teaching to ensure students achieve learning objectives. Moving forward, a suggestion on how interdisciplinarity through teaching leads towards enhancing learning objectives for students from many different research modes will be significant to understanding interdisciplinarity in the future. Furthermore, provide additional research needed to advance the future of education in colleges and universities.

Rosenblatt (1977) discusses writings through a retrospective and prospective framework for literature on pieces of work long after they have been written. She recognizes that literature can change as the future progresses, and critical concepts about work produces new ideas. Change and progression are important for the implicative nature of research and future research on the topic of interdisciplinarity of professors inside higher education institutions. Since the globe has changed so much in its long history, so too will the ideas of learning, epistemology, and society. Therefore, we must reflect and return to initial findings to relate to the current trends within society; from there, we can critically assess through reflection to continue theories or make new admissions for the betterment of research. New theories will develop over time on the

role of interdisciplinarity with professors in higher education and this work will hope to add to the current research being a critical reflection for future studies.

CHAPTER 5: CONCLUSION

In this meta-analysis, the questions pursued were: What does current research tell us about the interdisciplinarity of professors within their pedagogical practices in institutes of higher learning on a global level? Also, what implications can be drawn for the use of interdisciplinarity in professor pedagogy in institutes of higher learning on a global level? Through a systematic review of global research articles, themes emerged that suggests interdisciplinarity of professors is found by creating a liberal and sustainable education philosophy. Furthermore, sustainable epistemology is present through enhancing freedom and autonomy for educators, creating new ways of learning for educators and students, a connection to administration and policy, and the movement towards the *Global Interdisciplinarity Framework (GIdF)*, a multi-national concept for interdisciplinarity. Implications that can be drawn for the use of interdisciplinarity in professor pedagogy are reflecting the socio-educational implications on students and effectively addressing the criticisms of interdisciplinarity. Additional work can be done through further understanding of inherent interdisciplinarity, achieving student outcomes, and further research to bridge the divide through consistent reflection of study on interdisciplinarity and continue the conversation on how to enhance interdisciplinarity in the future.

The impact of interdisciplinarity is present in its inherent nature to make knowledgeable connections. As previously iterated, this is not a new phenomenon, rather a continual lineage through the proceedings of biological and sociological growth through human history. This pattern of interdisciplinarity sets the precedent of interdisciplinarity being a commonality and a humanistic trait towards life, especially

learning. Throughout the meta-analysis, the importance of using countries from around the globe reflect the idea that this is not an isolated condition in a specific socio-economic system, rather a universal understanding on how to form teaching and learning for higher education in every corner of the globe. These tenets of interdisciplinarity are not educational fads, or just methods to implement; rather, they are inherent and foundational towards the proliferation of learning throughout our history and will continue in the future.

Limitations of the study relate to the potential of differing research articles available in different countries that are written in the native language. All articles that were selected were from international journals in the English language. Perhaps, further inquiry into more localized articles may be beneficial to understanding each country's interdisciplinarity. One example could be to assess the interdisciplinarity through some form of ethnographic study in specific countries or analyze national, provincial and local mandates through policy analysis to better recognize the impact of interdisciplinarity on nations in connection with their socio-economic traits. Moving forward, ethnographic and policy analysis research can be connected through an anthropogeographical analysis to develop and obtain more information of teaching and learning through individualized nations.

Some limitations to the research focus on the practical aspects of interdisciplinarity and its utility especially through an administrative framework. The challenge with interdisciplinarity in a professional field such as education is its tangibility. The theoretical components for discussion on epistemology and the nature of teaching are robust with interdisciplinarity; however, the practicality of interdisciplinarity

relating to policy levers for higher education administration or praxis within the classroom remains vague. Future undertaking of research may use processes such as implementing the Educational/Innovation System from Klein (1990), perhaps using the Interdisciplinarity Index Standardized Percentage (IISP) from Babich (2020) in an attempt to clarify interdisciplinarity in a practical way and how it can be tangible inside classrooms and in administrative policy.

Interdisciplinarity or interdisciplinary learning has been a common buzzword throughout the halls of academia recently, in the sense of fostering a new way of learning. However, interdisciplinarity is not new given the creation of knowledgeable connections are a natural sense (see Carruthers, 2002) much like touch, taste, and smell. The walls of academia would like interdisciplinarity to be the catalyst of change by using interdisciplinarity, however, it may be a return to what the university was – and should have been all along. It was the Roman philosopher Boethius (2001/522) who made connection between humans and different forms of knowledge leading to the seven roads of liberal arts in the *trivium*: grammar, logic, and rhetoric; and *quadrivium*: music, arithmetic, geometry, and astronomy. It is in this quote where he lays out the constitutions of learning and their connection to the human:

> "The answer is that the species are very closely bound in with one another. There are indeed many *constitutiones* in a case; but they are no more parts of cases than *status* is part of the species" (p. 490).

Boethius himself follows this creed of learning connection and the ability to learn in many different forms. So too, us as humans have the capacity to be interdisciplinary and expand our own personal interdisciplinarity in our learning. Much like professors across the globe, the use of interdisciplinarity and the multiplication of knowledge are beneficial – moving from the past, present, and into the future.

REFERENCES

Altomonte, S., Logan, B., Feisst, M., Rutherford, P., & Wilson, R. (2016). Interactive and situated learning in education for sustainability. *International Journal of Sustainability in Higher Education, 17*(3), 417-443. http://dx.doi.org/10.1108/IJSHE-01-2015-0003

Babatunde, S. A. (2018). Government spending on infrastructure and economic growth in Nigeria. *Economic Research, 31*(1), 997-1014. https://doi.org/10.1080/1331677X.2018.1436453

Babich, C. (2020). *The interdisciplinarity reformation: A reflection of learning, life, and society*. eCampus Ontario. https://ecampusontario.pressbooks.pub/interdisciplinarityreformation/

Bacon, F. (1863). *The advancement of learning* (T. Markby, Trans.). Parker, Son, and Bourn. (Original work published 1605).

Banda, R. (2018). Changing the things I cannot accept: My African experience of a U.S. classroom. *Journal of International Students, 8*(1), 488-495. https://www.ojed.org/index.php/jis/article/view/176/133

Beaule, C. D., & Quintana, B. (2017). Llama herders and urban elites: Interdisciplinary readings of early colonial narratives in the Americas. *Arts & Humanities in Higher Education, 16*(1), 97-112. https://journals.sagepub.com/doi/pdf/10.1177/1474022216635824

Biasutti, M., Makrakis, V., Concina, E., & Frate, S. (2018). Educating academic staff to reorient curricula in ESD. *International Journal of Sustainability in Higher Education, 19*(1), 179-196. http://dx.doi.org/10.1108/IJSHE-11-2016-0214

Boethius. (2001). *An overview of the structure of rhetoric: Topica Boetii* (P. Bizzell, & B. Herzberg, Trans.). Bedford/St. Martins Press. (Original work published 522).

Bøyum, S. (2005). The legitimacy of critical thinking: Political liberalism and compulsory education. *Thinking: The Journal of Philosophy for Children, 18*(1), 31-46. https://folk.uib.no/hfisb/resources/PDF-Preprints/2005-leg-critical-think-pre.pdf

Briner, R. B., & Denyer, D. (2012). Systematic review and evidence synthesis as a practice and scholarship tool. In M. D. Rousseau (Ed.), *The Oxford handbook of evidence-based management* (pp. 112-129). Oxford University Press. https://www.researchgate.net/profile/Rob_Briner/publication/283725915_Systematic_Review_and_Evidence_Synthesis_as_a_Practice_and_Scholarship_Tool/links/5645ab2908ae54697fb91f46.pdf

Brookings Institute. (2020, January 8). Foresight Africa: Top priorities for the continent 2020-2030. https://www.brookings.edu/multi-chapter-report/foresight-africa-top-priorities-for-the-continent-in-2020/

Callejas-Restrepo, M. M., Blanco-Portella, N., Ladino-Ospina, Y., Tuay-Sigua, R. N., & Ochoa-Vargas, K. (2016). Professional development of university educators in ESD: a study from pedagogical styles. *International Journal of Sustainability in Higher Education, 18*(5), 648-665. http://dx.doi.org/10.1108/IJSHE-02-2016-0031

Carruthers, P. (2002). Human creativity: Its cognitive bias, its evolution, and its connection with childhood pretence. *The British Journal for the Philosophy of Science, 53*(2), 225-249. http://faculty.philosophy.umd.edu/pcarruthers/Human%20creativity.pdf

Casinader, N., & Kidman, G. (2018). Fieldwork, sustainability, and environmental education: The centrality of geographic inquiry. *Australian Journal of Environmental Education, 34*(1), 1-17. https://doi.org/10.1017/aee.2018.12

Code, J. M. (2017). Innovations in agroecology education: From bicycles to blended learning. *Journal of Education, 197*(3), 34-45. https://doi.org/10.1177/0022057418782353

Cohen-Miller, A. S., Faucher, C., Hernandez-Torrano, D., & Hajdukova, E. B. (2017). Practical steps for using interdisciplinary educational research to enhance cultural awareness. *International Journal of Research and Method in Education, 40*(3), 288-298. https://doi.org/10.1080/1743727X.2017.1310834

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

Czerniewicz, L., Deacon, A., Glover, M., & Walji, S. (2017). MOOC – making and open educational practices. *Journal of Computers in Higher Education, 29,* 81-97. https://link.springer.com/content/pdf/10.1007/s12528-016-9128-7.pdf

Descartes, R. (1850). *Discourse on the method* (Dinburgh, Sutherland, & Knox, Trans.). Simpkin Marshall and Co. (Original work published 1637).

Elfaki, K. E., Poernomo, A., Anwar, N., & Ahmad, A. A. (2018). Energy consumption and economic growth: Empirical evidence from Sudan. *International Journal of Economics and Policy*, *8*(5), 35-41. https://search.proquest.com/docview/2116337660?accountid=14789

Frucht, R. (2005). *Eastern Europe: An introduction to the people, land, and culture*. ABC-Clio.

Gunn, G. (1992). Interdisciplinary studies. In J. Gibaldi (Ed.) *Introduction to scholarship and modern languages and literatures,* (2nd ed.), (pp. 239-261). Modern Languages Association of America. https://pages.mtu.edu/~rlstrick/rsvtxt/gunn.pdf

Hamm, J. M., Perry, R. P., Chipperfield, J. G., Parker, P. C., & Heckhausen, J. (2019). A motivation treatment to enhance goal engagement in online learning environments: Assisting failure-prone college students with low optimism. *Motivation Science, 5*(2), 116-134. https://www.researchgate.net/deref/http%3A%2F%2Fdx.doi.org%2F10.1037%2Fmot0000107

Human Geography. (2009). In *the dictionary of human geography* (5th Ed.). Wiley-Blackwell.

Hume, D. (2001). *Of the standard of taste* (P. Bizzell, & B. Herzberg, Trans.). Bedford/St. Martins Press. (Original work published 1757).

Irani, Z. (2018, January 24). The university of the future will be interdisciplinary. *The Guardian: News and Media Ltd*. https://www.theguardian.com/higher-education-network/2018/jan/24/the-university-of-the-future-will-be-interdisciplinary

Jia, Q., Wang, Y., & Fengting, L. (2019). Establishing transdisciplinary minor programme as a way to embed sustainable development into higher education system. *International Journal of Sustainability in Higher Education, 20*(1), 157-169. http://dx.doi.org/10.1108/IJSHE-05-2018-0095

Jim Wu, Y. C., & Shen, J. P. (2015). Higher education for sustainable development: a systematic review. *International Journal of Sustainability in Higher Education, 17*(5), 633-651. http://dx.doi.org/10.1108/IJSHE-01-2015-0004

Karppinen, S., Kalluniki, V., & Komulainen, K. (2019). Interdisciplinary craft designing and invention pedagogy in teacher education: Student teachers creating smart textiles. *International Journal of Technological Design Education, 29*, 57-74. https://doi.org/10.1007/s10798-017-9436-x

Kim, E., & Song, J. (2018). Introduction: Reflections on Nancy Abelmann's legacy. *The Journal of Asian Studies, 77*(4), 945-952. https://www.cambridge.org/core/services/aop-cambridge-core/content/view/F13A235F97557B5602DFC80E8DD3909C/S0021911818000967a.pdf/introduction_reflections_on_nancy_abelmanns_legacy.pdf

Kishita, Y., Uwasu, M., Hara, K., Kuroda, M., Takeda, H., Umeda, Y., & Shimoda, Y. (2018). Toward designing sustainability education programs: a survey of master's programs through semi-structured interviews. *Sustainability Science, 13*, 953-972. https://doi.org/10.1007/s11625-018-0546-5

Klein, J. T. (1990). *Interdisciplinarity: History, theory, and practice*. Wayne State University Press.

Knowles, M. (1980). *The modern practice of adult education: From pedagogy to andragogy*. Prentice Hall.

Kockelmans, J. J. (1979). *Interdisciplinarity and higher education*. Penn State University Press.

Lattuca, L. R. (2001). *Creating interdisciplinarity*: *Interdisciplinary research and teaching among college and university faculty*. Vanderbilt University Press.

Leef, G. (2015, April 15). Sustainability: A new college fad with fangs. *The James G. Martin Center for Academic Renewal*. https://www.jamesgmartin.center/2015/04/sustainability-a-new-college-fad-with-fangs/

Leicht, A. Combes, B., Won Jung, B., & Agbedahin, A. V. (2018). From Agenda 21 to Target 4.7: The development of education for sustainable development. In Leicht, A., Heiss, J., & Won Jung, B. (Eds.), *Issues and trends in education for sustainable development*., (pp. 25-38). United Nations Educational, Scientific, and Cultural Organization [UNESCO]. https://unesdoc.unesco.org/ark:/48223/pf0000261801

Lerner, R. E. (2011). Pertransibunt plurimi: Reading Daniel to transgress authority. In Canning, J., King, E., & Staub, M. (Eds.) *Knowledge, discipline, and power in the middle ages*., (pp. 7-28). Brill Publishing.

Locke, J. (1884). *Two treatise of government* (H. Morley, Trans.). Routledge and Sons. (Original work published 1681).

Locke, J. (1898). *Some thoughts concerning education* (R. H. Quick, Trans.). Cambridge University Press. (Original work published 1690).

McDonald, J. K., West, R. E., Rich, P. J., & Pfleger, I. (2018). "Its so wonderful having different majors work together": The development of an interdisciplinary design thinking minor. *TechTrends, 63,* 440-450. https://doi.org/10.1007/s11528-018-0325-2

McLevey, J., Graham, A. V., McIlroy-Young, R., Browne, P., & Plaisance, K. S. (2018). Interdisciplinarity and insularity in the diffusion of knowledge: An analysis of disciplinary boundaries between philosophy of science and the sciences. *Scientometrics, 117,* 331-349. https://doi.org/10.1007/s11192-018-2866-8

Ontario Ministry of Education. (2007). Ontario First Nation, Métis, and Inuit education policy framework. *Queens Printer of Ontario*. http://www.edu.gov.on.ca/eng/aboriginal/fnmiframework.pdf

Organisation for Economic Co-operation and Development. (2015). *The programme for international student assessment (PISA) 2015 report*. https://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf

Osler, M. J. (1970). John Locke and the changing ideal of scientific knowledge. *Journal of the History of Ideas, 31*(1), 3-16. http://www.jstor.com/stable/2708366

Owen, G. T. (2014). Qualitative methods in higher education policy analysis: Using interviews and document analysis. *The Qualitative Report, 19*(52), 1-19. http://www.nova.edu/ssss/QR/QR19/owen52.pdf

Repko, A. F. (2007). Integrating interdisciplinarity: How the theories of common ground and cognitive interdisciplinarity are informing the debate on interdisciplinary integration. *Issues in Integrative Studies, 25*, 1-31. https://interdisciplinarystudies.org/docs/Vol25_2007/03_Vol_25_pp_1_31.pdf

Rosenblatt, L. M. (1977). *The transactional theory of literary work: Implications for research*. Modern Language Association of America.

Sa, C. M. (2008). 'Interdisciplinary strategies' in U.S. research universities. *Higher Education, 55*, 537-552. https://www.csun.edu/sites/default/files/Creso%20M.%20Sa%20%CC%81%20-%20Interdisciplinary%20Strategies.pdf

Self, J. A., & Baek, J. S. (2017). Interdisciplinarity in design education: understanding the undergraduate student experience. *International Journal of Technological Design Education, 27,* 459-480. https://doi.org/10.1007/s10798-016-9355-2

Servant-Miklos, V. F. C., & Spliid, C. M. (2017). The construction of teaching roles at Aalborg university center, 1970-1980. *History of Education, 46*(6), 788-809. https://www.tandfonline.com/action/showCitFormats?doi=10.1080/0046760X.2017.1360402

Sharkey, J., Olarte, A. C., & Ramirez, L. M. (2016). Developing a deeper understanding of community-based pedagogies with teachers: Learning with and from teachers in Colombia. *Journal of Teacher Education, 67*(4), 306-319. https://journals.sagepub.com/doi/pdf/10.1177/0022487116654005?casa_token=x6wuxM2Twj8AAAAA:VbvXrD5GukIo_2KaFTYX61v5V90YK7ChHNHjguu2nMO6yIzyswyL9lJ5h069o7-REGZjwSgpOlSp

Sutton, J. (2010). Exograms and interdisciplinarity: History, the extended mind, and the civilizing process. In R. Menary (Ed.), *The extended mind* (pp. 189-225). MIT Press. https://philpapers.org/archive/SUTEIA.pdf

Spelt, E. J. H., Biemans, H. J. A., Tobi, H., Luning, P. A., & Mulder, M. (2009). Teaching and learning in interdisciplinary higher education: A systematic review. *Educational Psychology Review 21,* 365-378. https://link.springer.com/article/10.1007/s10648-009-9113-z

Strauss, A., & Corbin, J. (1994). *Grounded theory methodology: An overview.* In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 273–285). Sage Publications.

Sustainable Development. (2015). *The Brundtland Commission*. https://www.sustainabledevelopment2015.org/AdvocacyToolkit/index.php/earth-summit-history/past-earth-summits/58-the-brundtland-commission

University of Heidelberg. (2020). *Human geography*. https://www.geog.uni-heidelberg.de/human/index_en.html

United Nations. (1972). *Report of the United Nations conference on the human environment.* Stockholm, Sweden: June 5-16. https://www.un.org/ga/search/view_doc.asp?symbol=A/CONF.48/14/REV.1

Webber, G., & Miller, D. (2016). Progressive pedagogies and teacher education: A review of the literature. *McGill Journal of Education*, *51*(3), 1061-1079. https://doi.org/10.7202/1039628ar

Weingarten, H. P., Kaufman, A., Jonker, L., & Hicks, M. (2017). *College sustainability: Signal data*. Higher Education Quality Council of Ontario. http://www.heqco.ca/SiteCollectionDocuments/Formatted%20College%20SustainabilityNEW%282%29.pdf

World Health Organization. (2020). People's open access education initiative. *Global Health Workforce Alliance*. https://www.who.int/workforcealliance/members_partners/member_list/peoplesunai/en/

VITA AUCTORIS

NAME:	Carson Babich
PLACE OF BIRTH:	Windsor, ON
YEAR OF BIRTH:	1989
EDUCATION:	Essex District High School, Essex, ON, 2007
	St. Clair College, OCAD, Windsor, ON, 2010
	University of Windsor, B. A., Windsor, ON, 2019
	University of Windsor, M.Ed., Windsor, ON, 2021