Geographic Information Systems and Marketing:
A Transdisciplinary Approach to Curriculum Development

by

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A Thesis Presented to the
FACULTY OF THE USC DORNSIFE COLLEGE OF LETTERS, ARTS AND SCIENCES
University of Southern California
In Partial Fulfillment of the
Requirements for the Degree
MASTER OF SCIENCE
(GEOGRAPHIC INFORMATION SCIENCE AND TECHNOLOGY)

December 2022

Dedication

To Bob, Avril, Mark and Sam

You are always with me

Acknowledgements

I am grateful to my mentor, Dr. Jennifer Bernstein, for the direction I needed and for her patience as we worked together. I am also grateful to Drs. Vos and Wilson who gave me assistance when I needed it. I would like to thank my employer, USC, who allowed me to complete this work. I am deeply grateful to Professor Miriam Burgos who made the creation and the development of this course a reality in the Marketing Department in the Marshall School of Business.

Table of Contents

Dedication ii

Acknowledgements iii

List of Tables vii

List of Figures viii

Abbreviations ix

Abstract xi

Chapter 1 Introduction 1

1.1 Overview 2

1.1.1. Motivation: The Problem 3

1.2. Curricular and Pedagogic/Andragogical Considerations 4

1.2.1. Pedagogy and Andragogy 5

1.2.2. Spatial Thinking 5

1.3. Project Description 6

1.3.1. Study Focus 6

1.3.2. User Audience 7

1.3.3. GIS in Marketing 8

1.3.4. Methods 8

1.3.5. Thesis Organization 9

Chapter 2 Related Works 10

2.1. Disciplinary Thinking 10

2.1.2. Hard/Soft, Pure/Applied Sciences 12

2.1.3. Disciplinary Thinking in Spatial Sciences 15

2.1.4. Disciplinary Thinking in Marketing 18

2.1.5. Multidisciplinary Thinking in Marketing 20

2.2. Scholarly Interactions Between Disciplines in Higher Education 23
2.2.1. SSI and GIS in Higher Education 24
2.2.2. GIS in Marketing 25
2.2.3. GIS Expertise 27
2.2.4. Critical Thinking and Critical Literacies 32
2.3. Implementing New Technologies in the Higher Education Space 33
2.3.1. Universal Design for Learning and Backwards Design 34
2.3.2. Learning Characteristics of the Students 35
2.3.3. Online Education in Business: Instructor and Social Presence 36
2.3.4. Technology Pedagogy Content Knowledge (TPACK) 38
2.3.5. Transdisciplinary Andragogy 41
2.4. Research Method Thematic Ethnographic Approach 42
Chapter 3 Methodology 43
3.1. Establishing the Criteria for Disciplinary Thinking 43
3.1.1. Institutional Review Board (IRB) 44
3.2. Thematic Ethnographic Approach 44
3.2.1. Establishing the Criteria for Disciplinary Thinking in Spatial Science and in Marketing 45
3.2.2. Comparing SSI and Marketing Interviews. 47
3.3. Establishing The Research Method For The Interviews 47
3.3.1. Analysis of Interviews 47
Chapter 4 Results 52
4.1. Results of the Literature Review – a Framework 53
4.2. Results From the Disciplinary Thinking Questions 54
4.3. Results from the Qualitative and Quantitative Question 57
4.4. Results from the Linear and Non-linear Question 59

4.5. Results From the Multi-, Inter- and Trans-Disciplinary Questions 62
4.6. Applying the Results to Curriculum Design 64
4.6.1. The Course 64
4.6.2. An Example of Applying the Research to the Course Outcomes 65
4.6.3. An Example of Applying the Research Results to an Assignment 66
Chapter 5 Discussion and Conclusions 76
5.1. Findings 76
5.2. Conclusions 77
5.3 Limitations 80
5.4. Recommendations 81
References 83
Appendices 88
Appendix A: Interview Questions 88
Appendix B: Original Syllabus 599 GIS and Decision Making in Marketing 90

List of Tables

Table 1: Characteristics of a Discipline as Applied to Spatial Sciences and Marketing 13

Table 2: 22-concept framework for disciplinary thinking in spatial sciences and marketing 53

Table 3: Disciplinary Thinking in Marketing and Spatial Sciences 68

Table 4: Disciplinary Thinking Constructs Applied to an Assignment 71

Table 5: Applying Qualitative, Quantitative, Linear and Non-linear Constructs to an Assignment 73

List of Figures

Figure 1. Visualization of Emergent Transdisciplinary Space 11

Figure 2. Disciplinary Categories 14

Figure 3. The Cynefin four-quadrant model of knowledge development 22

Figure 4. Covid-19 cases from Feb. 3 – Mar. 2, 2022 30

Figure 5. A screenshot of a dynamic map..... 31

Figure 6. TPACK framework. 40

Figure 7. Process for investigating disciplinary thinking 46

Figure 8. Multiple step analysis of interview and analysis process..... 48

Figure 9. Coding of interview data: Annotating interview transcript..... 49

Figure 10. Movement of annotations to jamboard..... 50

Figure 11. Reorganization of jamboard seeking patterns and relationships 51

Figure 12. Relationship between disciplinary thinking and transdisciplinary thinking..... 79

Abbreviations

4 P's	Place, Price, Product, Promotion
ARCH	Architecture
B2B	Business-to-Business
BCA	Business and Cinema Arts
CK	Content Knowledge
CLV	Customer Lifetime Value
ECON	Economics
EMBA	Executive Master of Business
GIS	Geographic Information System
GIST	Geographic Information Systems and Technology
IBEAR	International Business Education And Research
IRB	Internal Review Board
ITP	International Technology Program
LO	Learning Outcome
MAUP	Modifiable Areal Unit Problem
MBA	Master of Business
MBV	Master of Business for Veterans
MKT	Marketing
MMS	Master of Management Science
MSBA	Master of Science in Business Analytics
MSEI	Master of Science in Entrepreneurship and Innovation
MSFIL	Master of Science in Food Industry Leadership

MSGSC	Master of Science in Global Supply Chain
MSM	Master of Science in Management
NAP	National Academy Press
ACS	American Community Survey
OMBA	Online Master of Business Administration
PCK	Pedagogical Content Knowledge
PK	Pedagogical Knowledge
SS	Spatial Sciences
SSI	Spatial Sciences Institute
START	**S**tate the concept, theory, and/or formula, **T**ake it apart, **A**nalyze assumptions, **R**elate to other phenomenon, **T**ranslate to the real world
STEM	Science, Technology, Engineering and Mathematics
STP	Segmentation, Targeting and Positioning
TCK	Technological Content Knowledge
TPK	Technological Pedagogical Knowledge
TK	Technological Knowledge
TPACK	Technological Pedagogical And Content Knowledge
UDL	Universal Design for Learning
USC	University of Southern California

Abstract

Researchers in the field of Spatial Sciences often use Geographic Information Systems (GIS). Marketing, a sub-field of business, has increasingly used GIS to address and solve marketing problems. The Marshall School of Business at the University of Southern California (USC) has only recently recognized the importance of teaching GIS to better prepare their students for the workforce. The school sought to rectify the situation through a marketing course focused on the analysis, interpretation, and application of spatial data. However, when a transdisciplinary course is created, the disciplinary constructs must be informed by disciplinary experts and the design grounded in educational research. This thesis examined disciplinary thinking in Spatial Sciences and Marketing to inform the development of a graduate elective course "GIS and Decision Making in Marketing." Interviews were conducted with USC professors in both fields on the nature of disciplinary thinking, approaches to research and analysis, and commonalities between fields. These interviews were analyzed using content analysis. In general, marketing is an evolving discipline that currently defines disciplinary thinking as gathering and analyzing data, applying frameworks, evaluating constraints and assumptions, and drawing actionable conclusions. Spatial sciences sees disciplinary thinking as knowing theories, using improved computational tools, and engaging in spatial thinking, reasoning, and communicating. These findings were incorporated into the development of a transdisciplinary curriculum for the elective, which fostered students creating knowledge. While it is too early for formal assessment, informal assessment of the unit suggests that it improved students' ability to reason spatially within the marketing context. This project can inform other business schools seeking to integrate GIS into their curriculum, or other fields seeking to engage in transdisciplinary approaches to education.

Chapter 1 Introduction

Traditionally, the view of departments in Higher Education is to foster disciplinary specialization with their students. This was viewed as sufficient for students to graduate and become employed. However, many departments are reexamining this view, concluding their students need more than disciplinary specialization (McGregor 2017, 5). No longer can one be a student in higher education and study within a single department, then graduate as an expert in the field. To better prepare students for the workplace, an emerging approach is to support students' development of transdisciplinary capabilities (McGregor 2017, 6). The many interdepartmental collaborations on courses and programs that exist at USC tout the importance of this approach. For instance, in the Marshall School of Business alone there are collaborations with Engineering, Economics, Public Policy, Communications and Cinema Arts. This provides the basis for using USC, and Marshall specifically, as a case study for the larger phenomenon of departments collaborating and creating courses and programs that are focused on students developing expertise in multiple disciplines. Curriculum and pedagogical practices have shifted as course development wisdom is increasingly shared between departments (McGregor 2017, 7).

This project conducted interviews with experts in different disciplines to shape the instructional design of a course in GIS and marketing that was offered at USC in the Spring of 2022. The particular focus of the interviews was to better understand the relationship between the spatial sciences and graduate-level marketing curricula. There were several instructional design goals for this course before the interviews were conducted. The responses to these question items, once analyzed, informed, and shifted the development of the course.

1.1 Overview

Traditional disciplines in higher education are actively reexamining their offerings, increasingly establishing relationships between one other and sharing their approaches to instruction (Welch-Devine et al. 2018, 54). These networks are the basis for a significant subset of learning that is taking place within academia. In some cases it is a course that is cross listed. For instance ECON 351 which is a course in both the Economics department in the USC Dornsife College of Letters, Arts and Sciences, and the Finance and Business Economics department in the USC Marshall School of Business. In other cases it is a full degree granting program such as Business Cinematic Arts (BCA) which graduates students prepared to enter both business and cinema professions (USC Marshall 2022).

These academic networks create an environment that is ripe for a transdiscipline approach to these courses and programs. Transdisciplinarity in curriculum is a characteristic of learning that is necessary for addressing complex global problems. Howard Rheingold, an author well known in education studies, stated that: “transdisciplinarity goes beyond bringing together researchers from different disciplines to work in multidisciplinary teams. It means educating researchers who can speak languages of multiple disciplines” (Institute for the Future 2006, 31).

Transdisciplinarity is one of the “Ten Skills for the Future Workforce” identified by the Institute for the Future (2011, 11). They see the ability of our society to solve the problems of our time, such as climate change and poverty, as requiring transdisciplinary thinking.

Designing curriculum from a transdisciplinary approach enables students to become literate in multiple disciplines and use this literacy in real world applications (McGregor 2017, 6). In transdisciplinary learning, students tackle real-world problems with a broader base of abilities derived from their learning experiences with different disciplines. In these learning

experiences, students engage in multiple disciplines to create and apply new knowledge in ways that would not be possible through the perspective of a single discipline. Creating these learning experiences requires expertise in the disciplines represented (Welch-Devine et al. 2018, 54) as well as expertise in instructional design (Levinson 2016).

The potential compatibility for transdisciplinary learning between the disciplines of spatial sciences and marketing was the foundation of this research, and subsequently, the approach to the course developed based on this research. There is a need to clarify the distinction between the terms spatial sciences and GIS. GIS is a software being used, while spatial sciences is the broader academic discipline. Being able to utilize GIS software is one of several foundational approaches and technology platforms used in the spatial sciences. The approach to this research project is that GIS software supports the trandisciplinary nature of learning in a spatially enabled marketing course. This grounds the course being developed in the theory and methods of both spatial sciences and marketing. The intention is for students to become literate in the spatial sciences and marketing, and to be able to apply these literacies to marketing challenges using GIS technology in a thoughtful and informed manner. An additional intention is for students to be metacognitive about their thinking, and approach marketing problems and decisions using transdisciplinary perspectives. The research conducted for this project was intended to help achieve these goals.

1.1.1. Motivation: The Problem

At the core, the motivation for this project was the need to examine the spatial sciences and marketing to identify points of integration. Marketing is an applied discipline and must address the "profound complexity" of our world (McGregor 2017, 3). Complexity implies approaching problems from an emergent thinking perspective, namely gathering experts from many

disciplines to create a solution where no clear path existed before (Snowden 2017). Transdisciplinarity provides students with a number of approaches to thinking, based in multiple academic disciplines, that they can bring to the table.

Although this thesis focused on spatial sciences, marketing, and GIS, this approach is scalable to the broader academic community. There are many opportunities at USC and beyond to create a transdisciplinary curriculum with Spatial Sciences, with the appeal of GIS tools being used to advance and further learning outcomes. Recommendations will be made as to how to support those possibilities in the final chapter.

1.2. Curricular and Pedagogic/Andragogical Considerations

Marketing and spatial sciences are inherently connected, which should make their integration a priority for educators and instructional designers. The USC Dornsife Spatial Science Institute (SSI) has discussed the uses of GIS technologies to fill the needs of marketing professionals for location data, spatial analysis and the creation of predictive models with location data (USC Dornsife Spatial Science Institute 2021b). Esri, distributor of the industry standard ArcGIS software suite, attests that such software can serve marketing purposes by visualizing the location of customers, profiles and segmenting, and locating and targeting the customer segments (Esri 2010). However documentation is scant as to the value of spatial sciences within marketing beyond the use of the software. This provides an opportunity to deepen the relationship between the spatial sciences - not just GIS technologies - and marketing. The intention with this project was to gather qualitative data in the form of interviews to go beyond the idea that marketing students should simply learn new software, but rather understand the broader importance of spatial thinking. The idea that GIS software should not just be a ‘plug and play’ into a marketing course drove the content development of this project.

1.2.1. Pedagogy and Andragogy

To create courses that achieve their learning objectives, there must be the understanding and application of pedagogical principles. To apply pedagogical principles appropriately, we need to understand how students learn. This requires making sense of the different needs of learners at different stages of their lives. Within educational theory, these different approaches are referred to as pedagogy and andragogy. The difference between the two is that andragogy focuses on adult learning needs, and pedagogy refers to how children learn. However, pedagogy is frequently used as the generic term to refer to the principles for designing instruction based on how students learn. In this project the two terms will be used interchangeably with the understanding that the 34 students enrolled in the USC Marketing course are 28-35 year old adults enrolled in a residential or online MBA program in the Marshall School of Business.

Blended pedagogy is used to design instruction in both face-to-face and online learning modalities. The focus is on active learning and self-directed learners utilizing relevent, authentic classroom experiences (Bowling and Henschje 2020). As this is an online course, this is the approach taken in the development of the curriculum.

1.2.2. Spatial Thinking

Spatial thinking is fundamental in geography (Bednarz and Bednarz 2008, 316), as well as other disciplines such as business, marketing, public policy, and health. It involves a high level of cognition, with a focus on reasoning, communication, creative representation, and the adoption of concepts of space and time to solve problems (Montello and Raubel 2013, 251; Bednarz and Bednarz 2008, 317). Most disciplines have some element of spatial thinking. Academic programs at USC that which offer spatial content include Policy, Planning and Development (PPD 427, PPD 631, PPD 631), Landscape Architecture (ARCH 439), the Information

Technology Program (ITP 322), and the new course this project is developing, GIS and Marketing (MKT 599). This is an indication that in higher education, there is an increasing interest in spatial thinking across the university. This project interviewed subject matter experts in the spatial sciences and marketing about their perceptions of spatial thinking and its relevance in the respective disciplines. The results and conclusions, based on the outcome of these interviews, discuss how to design, develop, implement, and evaluate this new course with spatial thinking as a core consideration. Initial course modules are provided and discussed.

1.3. Project Description

This project was used to inform the development of the curriculum for a USC Marketing (MKT) 599 course called "Geographic Information Systems (GIS) Applications in Marketing Strategy". The course is part of the graduate curriculum of the Marshall School of Business (hereafter "Marshall") at the University of Southern California (USC) and is a graduate elective in the Marketing department. The objectives of the course are to address marketing challenges by leveraging geolocated data and GIS. This includes how GIS supports the marketing frameworks of the 4 P's (price, promotion, product, place), STP (segmentation, targeting and positioning), and CLV (customer lifetime value).

1.3.1. Study Focus

The study focus for this project is MKT 599, a current course in Marshall, and an online elective for the master's degrees, primarily for MBA students. There are 54 student slots for this class, of which 34 were filled for the Spring of 2022. It is scheduled to run again in the Fall of 2022. The course is co-taught by Professor Miriam Burgos, MBA, a marketing professor in Marshall and Beth Wellman, Ed.D. (the author of this study). The students are drafted from the following groups of programs.

1. From online or blended programs: the Online Master of Business Administration (OMBA), Master of Science in Food Industry Leadership (MSFIL), Master of Science in Global Supply Chain Management (MSGSC), and the part-time Master of Business Administration for Professionals & Managers (MBA-PM).
2. From other MBA programs: International Business Education And Research MBA (IBEAR) and its associated STEM track International Management Science, Full-time MBA, Master of Business for Veterans (MBV), and the Executive MBA (EMBA).
3. From Specialized Master's programs: Master of Science in Business Analytics (MSBA); Master of Science in Entrepreneurship and Innovation (MSEI); Master of Science in Finance (MSF); Master of Science in Marketing (MSM); Master of Science in Social Entrepreneurship (MSSE), and the Master of Management Studies (MMS).
4. From certificate programs: Graduate Certificates in Business Analytics, Marketing, Sustainability and Business, Optimization and Supply Chain Management, Management Studies, Strategy and Management Consulting, and Food Industry Management.

The broad range of graduate programs which this course drew on is both a pedagogical challenge and an advantage, as the course has the potential to have a wide-ranging impact across business disciplines.

1.3.2. User Audience

The audience for this study is higher education faculty and instructional designers who are interested in creating a transdisciplinary course focusing on the integration of disciplinary thinking between their discipline and spatial sciences, including GIS software solutions as part of the curriculum. The course created based on this research is intended to be a prototype for other courses with similar learning objectives. This could better enable administrators and

professors in applying transdisciplinary approaches, spatial thinking, and GIS software in conjunction with their courses, preparing students for future employment opportunities (Bednarz and Bednarz 2008).

1.3.3. GIS in Marketing

The application of geographic information technologies in Marketing and Business is asking the marketer to engage in analyses of spatial data. These analyses assist the marketing professional by providing methods to spatially segment customers for the purpose of making advertising and social media decisions, among other applications. According to Esri (2013), the 4 keys are the geographic aspects of assets, infrastructure, transportation, and the environment. Leveraging spatial data analyses facilitates how an organizations' operations use this spatial information to create a marketing strategy. One goal of the proposed course is for students to emerge from the course with the ability to understand how geospatial data supports decision making, knowledge production, tackling problem solving with real life problems, marketing decision making, and conduct a business analysis using GIS software and spatial data.

1.3.4. Methods

The methods in this study consisted of two parts. Part 1 was investigating what disciplinary thinking meant in SS and marketing. This was achieved through a thematic ethnographic approach conducting in-depth interviews with a subset of experts in the two fields, after which the text of the interviews was analyzed. In part 2, these results were used to inform the curriculum for the aforementioned GIS and Marketing course. This includes a description of instructional artifacts, including pre-work, in-class activities, out-of-class activities, group activities, and assessments.

1.3.5. Thesis Organization

Chapter 2 provides a discussion of related works. It includes examining the nature of a discipline, disciplinary thinking, and scholarly interactions between disciplines as these relate to spatial sciences and marketing. In addition, it considers the factors important to implementing new technologies in Higher Education. Chapter 3 describes the thematic ethnographic approach used in the research project. This includes the process of conducting and analyzing interviews. Chapter 4 discusses the results of the research, the implications for course design, the development of course materials, and a description of the effectiveness of the course innovations. Chapter 5 offers a summary, some conclusions, and ideas for future work.

Chapter 2 Related Works

The related works described in this chapter are framed within disciplinary thinking in marketing and spatial sciences. This discussion is extended to the concept of expertise and the benefits of having both spatial sciences and marketing expertise to solve problems and make decisions as a marketer. It is this premise that underlies the curriculum development that has occurred and the future development of the curriculum of a graduate level elective course in marketing on decision-making with GIS. To better understand the connections and the differences between these disciplines, we need to explore more deeply what disciplinary thinking is in each discipline and what the interactions are between the disciplines. This analysis requires looking at the work that has been done in these areas in the service of establishing what a collaboration between these disciplines might look like to support curriculum development. The goal is to provide students a learning experience that improves their ability to think in a transdisciplinary way about using GIS to make marketing decisions.

This course is an online course in the graduate school at USC Marshall. The students are adults who are currently or who intend to work in the field of marketing. The related work section on how the curriculum will be developed and delivered includes standard pedagogical approaches such as Universal Design for Learning (UDL) and Backwards Design. It also includes approaches that are most appropriate for the online learning environment. Finally, the andragogical considerations of how students learn when applying a new technology (GIS) to content knowledge will be discussed.

2.1. Disciplinary Thinking

The space for synergy between two disciplines can be understood as the overlap in their disciplinary thinking. This is where both are integrated, and it is the space from where

transdisciplinary thinking emerges (see Figure 1). To arrive at this emergent space, delineation of what comprises a discipline and thinking in a discipline is needed. Applying this delineation to our analysis provides a greater understanding of both disciplines and the unique characteristics of the synergy that result from their integration. This section examines what a discipline is in academia by considering the research of spatial sciences academics and professionals, as well as marketing academics and professionals.

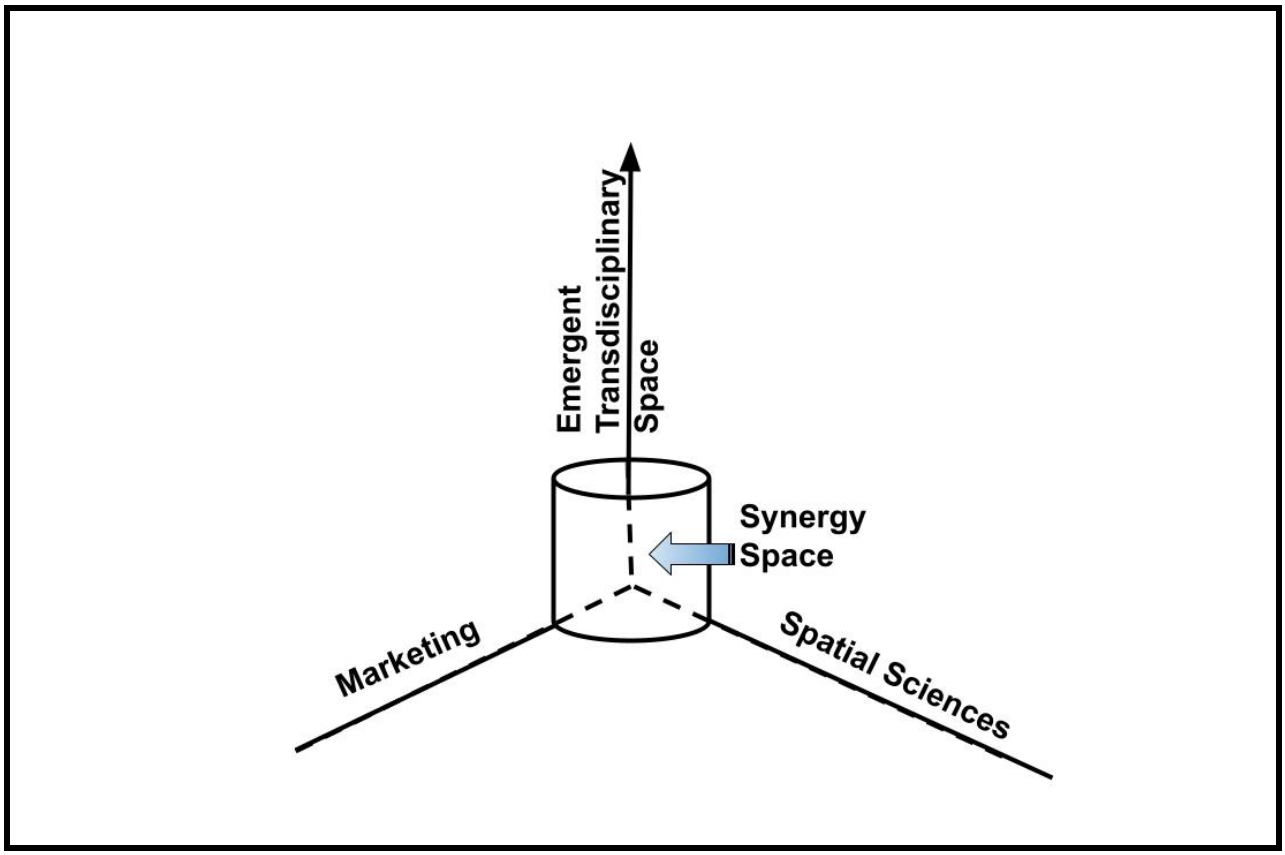

Figure 1. Visualization of Emergent Transdisciplinary Space

2.1.1. Characteristics of a Discipline

Scientific disciplines, such as spatial sciences, exist to fulfill two primary goals – to develop theoretical knowledge and document it (usually as peer reviewed articles), and to translate theory into action (Prinsloo 2018, 148). Serenko and Bontis (2013, 480), in the context of establishing

Intellectual Capital as a scientific discipline, lay out the process of going from scientific theory to action and scientific practice. When a discipline contributes to the academy by developing both theoretical and methodological foundations, it is referred to as a reference discipline (Serenko and Bontis 2013, 481). A discipline that draws on those contributions is referred to as the receiving discipline. Within the context of this work, spatial sciences is the reference discipline and marketing is the receiving discipline. Translating the theory of spatial sciences into action within marketing is the synergy space between the two disciplines.

Disciplines have a set of common characteristics. Once the characteristics are identified, it is the responsibility of the experts to fully practice that discipline. In Table 1 the characteristics of disciplines according to Prinsloo (2018, 149) are delineated. How each of these characteristics *could be* reflected in spatial sciences and marketing is also delineated, as this was done subjectively by the primary researcher. It is important to understand that these specific delineations are neither unique nor comprehensive. What is important is that each of the discipline characteristics are manifested in both spatial sciences and marketing. According to Prinsloo (2018) this makes these fields disciplines. It is left to the individual disciplines to debate exactly what the optimal specific delineations are for their discipline.

2.1.2. Hard/Soft, Pure/Applied Sciences

Disciplines can be specified as either hard pure, soft pure, hard applied, or soft applied disciplines. Prinsloo (2018) conducted a study using this framework to compare the epistemology, the nature of the teaching, the purpose of the learning, and the teaching methods of different disciplines (see Figure 2). Hard, pure sciences are exemplified by disciplines such as physics or chemistry. Knowledge is cumulative and quantitative, students retain facts and become informed in mass lectures and problem-based seminars (Prinsloo 2018, 149). At the

other end of the framework, soft, applied sciences include the discipline of education where knowledge is gained and reiterated, students improve their practice through protocols and procedures, and are motivated by personal growth. They learn through active learning strategies such as discussions and tutorials (Prinsloo 2018, 149).

Table 1: Characteristics of a Discipline as Applied to Spatial Sciences and Marketing

Discipline Characteristic	Spatial Sciences	Marketing
Professional Publications and Conferences	Annals of American Geographers American Association of Geographers annual conference	Journal of Consumer Research Marketing Profs B2B Forum
Distinctive subject content	Spatial Sciences examines the world through a spatial lens of thinking and analysis. (USC Dornsife 2021)	Marketing examines consumer behavior, digital advertising, and new product development (USC Marshall 2021)
Leading Intellectuals	Michael Goodchild Karen Kemp	Malcolm Gladwell Michael Porter
Mounting Corpus of Knowledge	Existing graduate programs include Master's and Doctoral programs. The students' products contribute to the knowledge production and creation in the field.	Existing graduate programs include Master's and Doctoral programs. The students' products contribute to the knowledge production and creation in the field.
Acknowledged scholarly societies	American Association of Geographers	American Marketing Association
Established networking outlets	Esri Esri Users Conference	eGase Group's Los Angeles Marketing Analytics
Appointment within academic curricula	A critical number of professors engaged in both theory and practice within the department	A critical number of professors engaged in both theory and practice within the department
Intellectual output	For example: "Using Deep Learning Models for Image Recognition"	For example: "Leapfrogging, Cannibalization and Survival during Disruptive Technology"
Influences other disciplines	Reference Discipline	Receiver Discipline

Sources: Data adapted from Prinsloo 2018, 149; Serenko and Bontis 2013, 479

	Hard	Soft
Pure	Hard Pure	Soft Pure
Applied	Hard Applied	Soft Applied

Epistemology	Knowledge is based on facts
Nature of Learning	To master the physical environment through products and practices
Purpose of Learning	Acquire practical compentencies. Theory to practice
Teaching methods	Simulations and Case Studies
Register	Disciplinary Language Codified, explicit, technical

Figure 2. Disciplinary Categories (Prinsloo 2018, 149).

In between these two are the hard, applied sciences. Prinsloo (2018) sees these as knowledge based on facts; teaching to develop products and procedures; students learning practical competencies and applying theory to practice; and case studies are commonly used as teaching methods.

In spatial sciences, knowledge is based on facts (geolocated data for instance); teaching is developing products and procedures (maps as a product, procedures as accepted ways of approaching data analysis); students develop practical competencies (fluidity with applying GIS or remote sensing approaches); and use case studies. The language of spatial sciences is data based and technical. As a whole, these characteristics establish it as a hard, applied science.

Characterizing marketing as a hard, applied science is a result of examining the changes in marketing as a discipline in the last 10-20 years. Historically, marketing has involved much more qualitative approaches and is viewed as more creative – characteristics of soft, pure sciences. For the purposes of this project, the heavy use of geolocated quantitative data, the application of frameworks to practical situations, and the common use of case studies as a method of learning lead to the conclusion that in this course, it is a hard, applied science.

2.1.3. Disciplinary Thinking in Spatial Sciences

The spatial sciences include spatial thinking (Bednarz and Bednarz 2008), geography (Perkins 2015; Rivera and Groleau 2021), scientific thinking (Shook et al. 2019), and big data (Romeo 2005). Spatial thinking in and of itself plays such a major role that it is considered in a separate section below. However, an additional consideration of this project was finding other disciplinary thinking modalities used in the spatial sciences. Spatial sciences is quantitative and engages in extensive empirical research (Johnston 2001). It seeks out empirical regularities to identify features and trends in spatial data. This research approach is particularly relevant within the era of big data.

It was once assumed that the statistical approaches used by other disciplines would apply easily to spatial analyses of point, line, flow, and area patterns (Haining 1990). Haining argued against a separatist approach to thinking about spatial data analysis. However, two problems arose which are now understood as concerns to always consider as part of a spatial approach to data analysis. The first is spatial autocorrelation, or the tendency of areas that are close to together to be similar. The second is the modifiable aerial unit problem (MAUP) or the difficulty in aggregating data in a reproducible way. The advent of the use of technologies such as geographic information systems (GIS) allowed spatial scientists to apply their skills to these

problems. Both of these issues exist in the marketing field, although they are not framed with the same language. Johnston (2001) discusses the use of spatial sciences to tackle spatially targeted niche marketing strategies. Recognizing the way in which spatial sciences requires its own set of statistical approaches is critical as the field is better integrated with marketing curricula, the developers of whom may not be aware of the unique challenges. Thus, this formed a core component of the questions asked during the interviews and influenced the development of course materials.

2.1.3.1. Spatial Thinking

Key to the spatial sciences as a discipline is applying critical spatial thinking abilities to spatial problems, often using geographic information systems (GIS) and related technology platforms. Spatial thinking has been recognized for decades as a form of cognition different from other forms of generalizable thinking such as linear thinking or textual thinking (Bednarz and Bednarz 2008). It specifically focuses on non-textual representations of knowledge. Learning spatial thinking is a critical developmental process and there is considerable debate over its' relative 'innateness'. There are four theories related to the development of spatial thinking: nativist (people are born with the ability); Piagetian (people develop it incrementally); Vygotskyan (people develop it in relationship to cultural and social influences); and integrative (a combination of all three) (Montello and Raubel 2013). Spatial literacy, an outcome of spatial thinking, involves developing habits of mind to problem solve and make decisions while working with spatial data. The bottom line is that spatial thinking and spatial literacy can be learned.

The application of spatial thinking to Science, Technology, Engineering and Mathematics (STEM) fields is well accepted. However, this implementation of spatial thinking in STEM is

domain knowledge specific and highly contextual (Atit, Uttal and Stieff 2020). Atit, Uttal and Stieff (2020) characterize the acquisition of spatial thinking skills as having three elements. The first element is the generalizable concepts of spatial thinking which apply to all STEM disciplines. The second element is the tools of representation which are discipline specific. The third element is the reasoning processes which draw on generalizable spatial concepts and are applied to the disciplinary context. Learning spatial thinking is possible, however, it works best when it takes place in disciplinary contexts (National Research Council 2006). It can be transferred from one discipline to another, such as from spatial sciences to marketing, however it should be explicitly developed in a structured curriculum with metacognitive elements (National Research Council 2006). By integrating spatial thinking across the curriculum and by providing motivating and contextually appropriate interactions such as real-world examples, the development of spatial thinking can lead to a lifelong ability to utilize and apply it within a discipline.

Spatial cognition is used in problem solving across disciplines through cognitive tasks that involve spatial reasoning, communication, symbolic representation, and concepts of space and place. The development of spatial thinking is critical to support our students developing the skills they need to tackle real-world problems using geospatial technologies. Bednarz and Bednarz (2008) believe it is a form of cognition both fundamental and critical in spatial sciences. Montello and Raubel (2013) go further by linking the development of generalizable spatial skills to working with a GIS. It includes having literacy with graphs, diagrams, flow charts, and maps. Utilizing spatial cognition when designing in a GIS can lead to improving the effectiveness, the efficiency, and the usability of the GIS, as well as further developing literacy in spatial cognition. Within spatial sciences, spatial thinking is both a way of working with geographic information

systems and related approaches and technologies (the tools) as well as an outcome of working with geographic information (the reasoning processes).

In addition to the importance of spatial thinking within spatial sciences, it is important to create critical spatial thinkers outside of the field. Even those who don't specialize in the field should have literacy with spatial thinking. Kim and Bednarz (2013) specifically relate this type of thinking as an important skill in the increasing complexities brought by the digital age. Spatial thinking will be a cognitive domain that will be increasingly adopted across many disciplines, including business.

2.1.4. Disciplinary Thinking in Marketing

Marketing as a discipline has evolved since it was first recognized in 1936, with the most profound changes emerging since 1996 when the internet and social media became increasingly important. Kumar (2015) breaks down this history into 9 decades of evolving and differentiating themes. They are:

1. 1936-1945 Marketing as applied economics
2. 1946-1955 Marketing as managerial
3. 1956-1965 Marketing introduces quantitative data
4. 1966-1975 Marketing introduces behavioral science (buyer processes)
5. 1976-1985 Marketing introduces strategy and decision science (marketing practices)
6. 1986-1995 Marketing develops empirical techniques, frameworks, and interdisciplinary applications
7. 1996-2004 Marketing focuses on customer profitability and resource allocation.
8. 2005-2012 Marketing focuses on investment from the corporation

9. 2013-present Marketing focuses on efficiency, effectiveness, integrating marketing into the corporation

In 1996, the field of marketing started viewing itself as part of the corporate world (Kumar 2015). Increasingly, those within the marketing field utilized their research to identify customer value potential, maximize the value of each customer, utilize consumer segmentation, and assess customer profitability. This is known as the "resource conscious" approach to marketing, and it evolved because of rapid changes in technology during the mid-to-late 1900s and the early 2000s (Kumar 2015).

Corporations, seeing the value of these data, increasingly began investing in marketing, contributing to its evolution as a discipline (Kumar 2015). By the 2010's, marketing made a major paradigm shift from marketing as selling products to marketing as an investment in developing and nurturing the needs of their customers. This occurred in tandem with marketers exploiting the cultural phenomenon of constant media use.

Marketing today takes an integrative science approach with conceptual, empirical, and interdisciplinary aspects to decision making. Empirically, the seismic shifts in media use leave corporations with voluminous amounts of quantitative data that need to be analyzed. Interdisciplinary quantitative tools, such as GIS software, allows them to optimize efficiency and effectiveness in developing and implementing a marketing plan. This broader context is the environment for which the curriculum developed for this project was built. Given the increasing importance of technology within the field, specifically location data, spatial thinking and analysis will become increasingly important in developing effective marketers. This focus on empirical data analysis and interdisciplinary tools further supports the view that marketing has increasingly

become a hard, applied science (Prinsloo 2018). This creates the necessity of an integrative approach for disciplinary thinking in the graduate marketing classroom.

2.1.5. Multidisciplinary Thinking in Marketing

Marketing is complex. As discussed in the previous section, it has evolved significantly over the last 85 years, broadening to include not just business-related thinking but rather an integrative multidisciplinary approach that better prepares its students for the reality of a complex corporate world (Walker et al. 1998) A graduate education in marketing should include knowledge about core theories and practical principles in addition to cross-functional disciplinary knowledge, analytical skills, and complex problem solving (Walker et al. 1998). Walker et al. (1998) made an early case for a multidisciplinary approach in balancing theory and practice in marketing curricula. Students in marketing, to develop expertise and to be able to apply that expertise in the workplace, should be given explicit opportunities to incorporate thinking from other disciplines and apply that to their problem solving and decision making (Walker et al. 1998). These authors recommend that more generalizable multidisciplinary skills such as agile and flexible thinking, and communication skills be fostered in this learning environment.

A multidisciplinary approach asks a student to balance thinking skills from the very quantitative, in the form of statistical thinking, to the very qualitative, in the form of creative thinking, in the development of marketing plans. Providing students with a curriculum of this breadth poses a challenge for marketing departments in higher education business schools. This project attempted to provide learning opportunities for the integration of a spectrum of disciplinary thinking such as analytical and complex problem-solving skills in the service of decision making. The integration of both spatial sciences thinking and the GIS technology into a marketing course provides opportunities for students to engage with marketing thinking and

spatial sciences thinking as integrative and multidisciplinary. The specific approach that we took was transdisciplinary.

2.1.5.1. Cynefin

Disciplinary thinking in spatial sciences and marketing was the focus of the development and implementation of the initial offering of this course. However, a general framework is useful to help situate the various types of disciplinary thinking, thus informing the curriculum developed during this project. A framework from business management for knowledge making is particularly appropriate as it comes from the business discipline and explicitly addresses complex problem solving. The Cynefin framework (Snowden 2011) focuses on the progression of practices associated with knowledge making, a goal of this course. Cynefin is non-hierarchical and collaborative. Since its introduction, it has been used in many fields, including education (Wellman and Snow 2007). Snowden proposes methods to introduce variety into organizational thinking and avoiding a single model of practice and strategy. The framework envisions knowledge making in four quadrants – simple, complicated, complex, and chaotic (Figure 3). Best practices, complicated practices, complex practices, and novel practices are the levels of practice Snowden sees as corresponding to his four-quadrant model. It is important to note that the most straightforward approach is called best practices (Desha, Caldera and Hutchinson 2019). Snowden asserts that best practices be reserved for situations where there is one starting point and ending point and there is a 'best' or 'optimal' route between them. The fact that the phrase 'best practices' is only used for simple problems that have one path to a single answer is significant. This is not the common use of the phrase best practices. In business, 'best practices' is commonly used to indicate the "guidelines, ethics or ideas that represent the most efficient or prudent course of action" (TH@T! Company 2017). Yet, Snowden's characterization is more representative of the approach to curriculum development in this course.

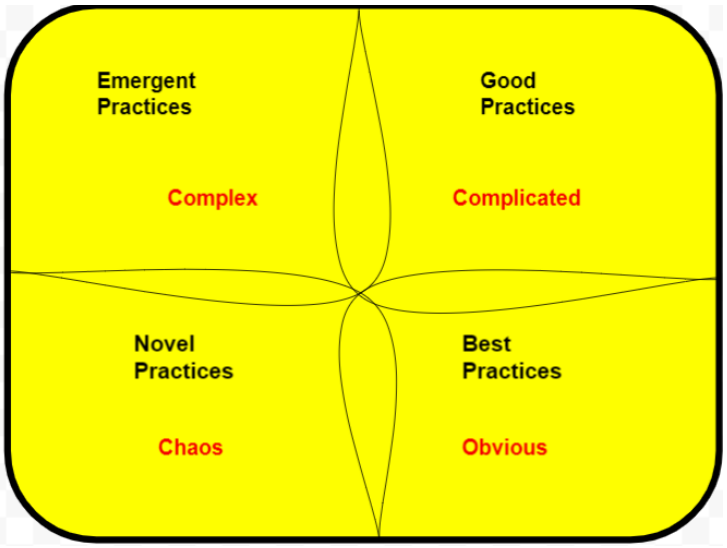

Figure 3. The Cynefin four-quadrant model of knowledge development (Snowdon 2011).

When applied to marketing, the Cynefin framework considers marketing and its disciplinary thinking as a range of different approaches that can be applied to decision making, knowledge production, and problem-solving. This is particularly crucial when using software that allows us to work with messy problems and develop more complex approaches. Specifically, use of GIS software creates a space for rethinking established ways of thinking in marketing.

The discipline of marketing matches three functional quadrants of the Cynefin framework – obvious, complicated, and complex. For instance, an obvious solution to providing potential customers information about your product is a mass marketing campaign where information is sent out to thousands with the hope that some small percentage of the customers will respond. This is a best practice. A good practice would be to engage in the framework of segmentation, targeting and positioning. Different information will be sent to different customers (targeting) based on identified characteristics of customer segments. Complex problems need to be met with emergent practices (Snowden 2011). For instance, solutions to the fluidity of the customer experience need to include complex, just-in-time solutions. These solutions involve the combined expertise of marketers, statisticians, c-suite executives, financial experts and

researchers who use focus groups, surveys and other forms of qualitative and quantitative data. All of these people come together to 'brainstorm' or use other processes for emergent decision-making. Using the Cynefin framework for categorizing and analyzing solutions to cases in marketing was one of the core organizing features of the content for this course.

2.2. Scholarly Interactions Between Disciplines in Higher Education

Multidisciplinary, interdisciplinary, and transdisciplinary are the usual ways scholarly interactions between disciplines are described in the literature. This section will compare the definitions of these terms and propose how this project fits into these perspectives. Importantly, these distinctions affected the andragogical approach to developing the curriculum as the andragogy for transdisciplinary is different than for multi- or inter-disciplinary studies. As the goal of this project is to develop curriculum with a transdisciplinary approach and for an adult audience, it is important to distinguish multi-, inter- and trans-disciplinarity to avoid the pedagogical pratfall of designing only for multi- or inter-disciplinarity.

Students in higher education are immersed in disciplinary learning beginning at the undergraduate and continuing to the graduate level. For them to master a discipline, they need to engage in two levels of knowledge: complex concepts (essential to the discipline) and secondary concepts that help us make sense of the discipline (McGregor 2017). However, limiting marketing students to one field of disciplinary thinking may be doing them a disservice. Marketing jobs today require broader thinking, especially for innovation (Tellis, n.d.). To explore alternatives to singular disciplinary thinking, multidisciplinary thinking and learning offers a first step forward. Multidisciplinary learning is learning more than one discipline with no integration between disciplines (McGregor 2017). Applied to this course, this means the students' experience with the GIS technology would be without the context of disciplinary

thinking from marketing, which based on the professional context of contemporary marketing, is not an optimal solution.

The important distinction between multi- and inter-disciplinary is that in interdisciplinarity students consider both disciplines and the interaction between them in an integrated way (McGregor 2017). This speaks to higher education's goal of disciplinary mastery but leaves out a critical element – the world outside of the university.

Finally, there is transdisciplinary. Transdisciplinary thinking incorporates both of the disciplines that are being considered for the curriculum as well as the context for learning in both more broadly (McGregor 2017). These thinking skills provide students with a more comprehensive view of the content. Students become active producers and creators of knowledge in the transdisciplinary environment (Nicholescu 2014). It is in these elements of transdisciplinarity – active producers and creators of knowledge-that the complex quadrant of Cynefin is evoked. Both disciplines, within the context of real, complex problem analysis and solving, are needed for emergent thinking. This is a transdisciplinary approach. This course was a spatial sciences and marketing endeavor, not a GIS and marketing endeavor. The distinction comes in the curricular emphasis – students are learning spatial sciences and marketing thinking and applying them to solving marketing challenges using GIS technology in a thoughtful and informed way. The intention is for students to be metacognitive in their thinking, learning both theory and practice, and discussing their approach to marketing problems from both spatial sciences and marketing perspectives.

2.2.1. SSI and GIS in Higher Education

Spatial sciences thinking and GIS technology in higher education falls into two categories – teaching *about* spatial sciences thinking and GIS and teaching *with* spatial sciences thinking and

GIS (Perkins 2015). The course developed based on the interviews conducted during this project proposes to do both, and thus looks at the literature that addresses both 'about' and 'with' in spatial sciences and GIS. According to Perkins (2015), the ubiquity of spatial literacy and critical thinking across the curriculum provide the basis for considering GIS as an important element in a multitude of disciplines. This is a consideration of teaching *about* spatial sciences.

Teaching *with* spatial sciences and GIS in higher education reflects our current information and communication-based society. A number of applications of GIS in STEM studies reference spatially developed databases, GIS software, and analytic tools as examples of teaching with spatial sciences and GIS (Perez-delHoyo, et al. 2020). In the use of a GIS for learning, Perez-delHoyo et al. (2020) go further to assert that teaching with the spatial sciences and GIS can result in the acquisition of knowledge; development of critical thinking, spatial reasoning and problem solving; engaging students; collaborative work; and active learning strategies. All of these learning strategies were considered in the development of the curriculum based on the interviews. In the following section spatial sciences and GIS in marketing is considered.

2.2.2. GIS in Marketing

The idea of using GIS for marketing and business applications dates back to the 1990s. How it should be used has evolved since that time. More specifically, it has evolved in conjunction with the evolution of GIS technology. In the late 1990s large companies such as Proctor and Gamble had in-house GIS teams (Miriam Burgos, pers. comm., Jan 8, 2022). However, business school curriculum lagged in meeting the needs of the private sector. For instance, Miller, Holmes and Mangold (2007) found that GIS was not well integrated into the marketing curriculum because of financial, training, faculty, technical and resource difficulties. However, they posited that GIS

applications within the business field could (and should) include demographic mapping, socio-economic mapping, market area analysis, site selection, territorial analysis, customer profiling, routing and logistics planning. They proposed a process for the development of learning modules, including GIS and its capabilities, to integrate it through the curriculum instead of treating it as a discrete topic. This project is taking the same approach of integrating GIS into the curricula. This article supports this project, insofar as it advocates for a curricular approach to integrating *spatial thinking* and GIS into the marketing curriculum throughout the semester. However, Miller, Holmes, and Mangold (2007) did not take the next step of examining *disciplinary thinking* and the deeper integration of spatial sciences thinking in the business world.

Teaching spatial sciences in a transdisciplinary way is not common in the literature as a whole, including the literature on marketing and business curricula. This project sought to address this gap. The approach that this thesis took is akin to the approach where geography and business programs combine existing modules to create a hybrid GIS/business course (Shephard, 2009). Important differences exist between the curriculum being developed here and Shephard's perspective. One core difference is that rather than the collaboration coming from a geography department, it will be coming from a spatial sciences department (technically "institute"). Another core difference is that rather than a hybrid model, the transdisciplinary model will be used.

The posing of messy and unstructured problems is critical to the integrative development of students in business, marketing, and spatial sciences (Ambrose et al. 2010.) The existence of 'wicked' problems in geography and in business – problems with no clear solutions and involving complexity in thinking – provides opportunities to blend spatial sciences and

business. It is through cognitive involvement in these messy problems, that provide these students with research experiences that are embedded in the course, an active learning andragogical approach. The deep involvement in these problems also requires the development of spatial thinking.

2.2.3. GIS Expertise

The goal of this project was to better understand the relationship between GIS and marketing, to better integrate GIS into the business curriculum at USC within the context of a single course. Understanding of the elements of GIS expertise is essential for the "aim of aiding interdisciplinary collaboration" (Duckham 2015, 515). Duckham posited five categories as the minimal core of GIS expertise: structure, uncertainty, dynamism, language and cognition, and design. Each of these categories is explained in more detail in the subsections below.

2.2.3.1. Structure in GIS expertise

The concept of structure in GIS expertise refers to the knowledgeable application of the inherent structure of geographic information. This construct consists of sub-concepts including the interrelated concepts of spatial autocorrelation (Tobler's First Law of Geography), spatial and temporal heterogeneity, the MAUP, and scale and scale dependence.

Tobler's First Law of Geography manifests itself in geographic information as spatial autocorrelation. Tobler's First Law, (Bolstad 2016, 534) states "everything in the universe is related to everything else, but closer things are more related." Statistically a positive spatial autocorrelation means that high values of an attribute are close to high values and low values are close to low values (Bolstad 2016, 536). A negative spatial autocorrelation means that high values are close to low values.

Related to spatial autocorrelation are the concepts of spatial and temporal heterogeneity. Spatial hetereogeneity is the "tendency for properties to vary from one area to another" (Goodchild 2008, 603). When looking at a property across a geographic area, spatial heterogeneity manifests itself as 'clumping' in space (Duckham 2015). When making decisions utilizing spatial heterogeneity, the concept of scale dependence is key. The larger the scale, the more precise the location of the values of the attribute and the more apparent are meaningful clumps or clusters. This scale of analysis (size effect) is further implicated, along with shape (zoning effect), in the MAUP (Bolstad 2016, 392). As the name states, it is a problem insofar as size and zoning effects of data aggregation can distort the perception of the data, calling any conclusions into question. Taken together, all of these sub-concepts that address the structure of geographic information are critical to GIS expertise (Duckham 2015). They should be considered in any discussion of the discipline and in any curriculum development incorporating GIS expertise.

2.2.3.2. Uncertainty and Dynamism in GIS Expertise

The inherent uncertainty in geospatial information means that this characteristic must be grappled with as part of GIS expertise (Duckham 2015). Uncertainty exists because of innate imperfections within spatial information and data. Causes of uncertainty include imprecision and inaccuracy or a lack of detail (Duckham 2015). This can refer to the data itself as data collection has inherent sources of error, or it can refer to the imprecision of the language used to discuss the data. For example, the phrase 'above' could mean 'to the north of' or it could be 'at a higher elevation'. As with the concept of structure, inherent uncertainty should be considered in any curriculum development that involves the spatial sciences.

The dynamic nature of geospatial information means that it is inherently changing over time. This links dynamism to the sub-concept of temporal heterogeneity – the tendency of data at one point to vary over time. According to Duckham (2015, 503), investigating temporal change is one of the challenges facing spatial scientists and has been researched actively. This dynamism, like uncertainty, needs to be considered in any analyses or curriculum development (Duckham 2015).

2.2.3.3. Design in GIS Expertise

Designing geographic and/or cartographic visualizations is core to the communication of geographic information (Duckham, 2015). Mapped-based visualizations can serve many purposes. First, they communicate information for a particular audience. Identifying the communication strategy to best connect with a particular audience is an important consideration for marketing professionals and others.

Geovisualization can take many forms. Traditionally, visualizations have been static. Static visualizations show the subject at a particular time, which can be useful for presenting baseline information. The Covid-19 map reproduced in Figure 4 is an example of a static map depicting the number of cases in the last 28 days at the time this map was accessed. Marketing professionals can use static maps to depict of any number of pertinent attributes – wealth, buying preferences, or traffic patterns, for example.

Dynamic, interactive, and exploratory visualization interfaces have become increasingly prevalent. For example, the Johns Hopkins map (Figure 4) has a list of attributes that a user can explore. These include total cases, incident rate per capita, case-fatality ratio, global vaccinations, and US vaccinations. They can also depict change over time, as is the case with the animated map “Where COVID-19 cases are increasing?” (Figure 5). Clicking PLAY starts the

map ‘running’ at 1/20/2020 and continues to the present day. Dynamic maps can be a compelling experience for their audience. Marketing professionals can use dynamic maps to reinforce their talking points or to draw the attention of their audience or to provide a persuasive visualization to convince their audience of a particular perspective.

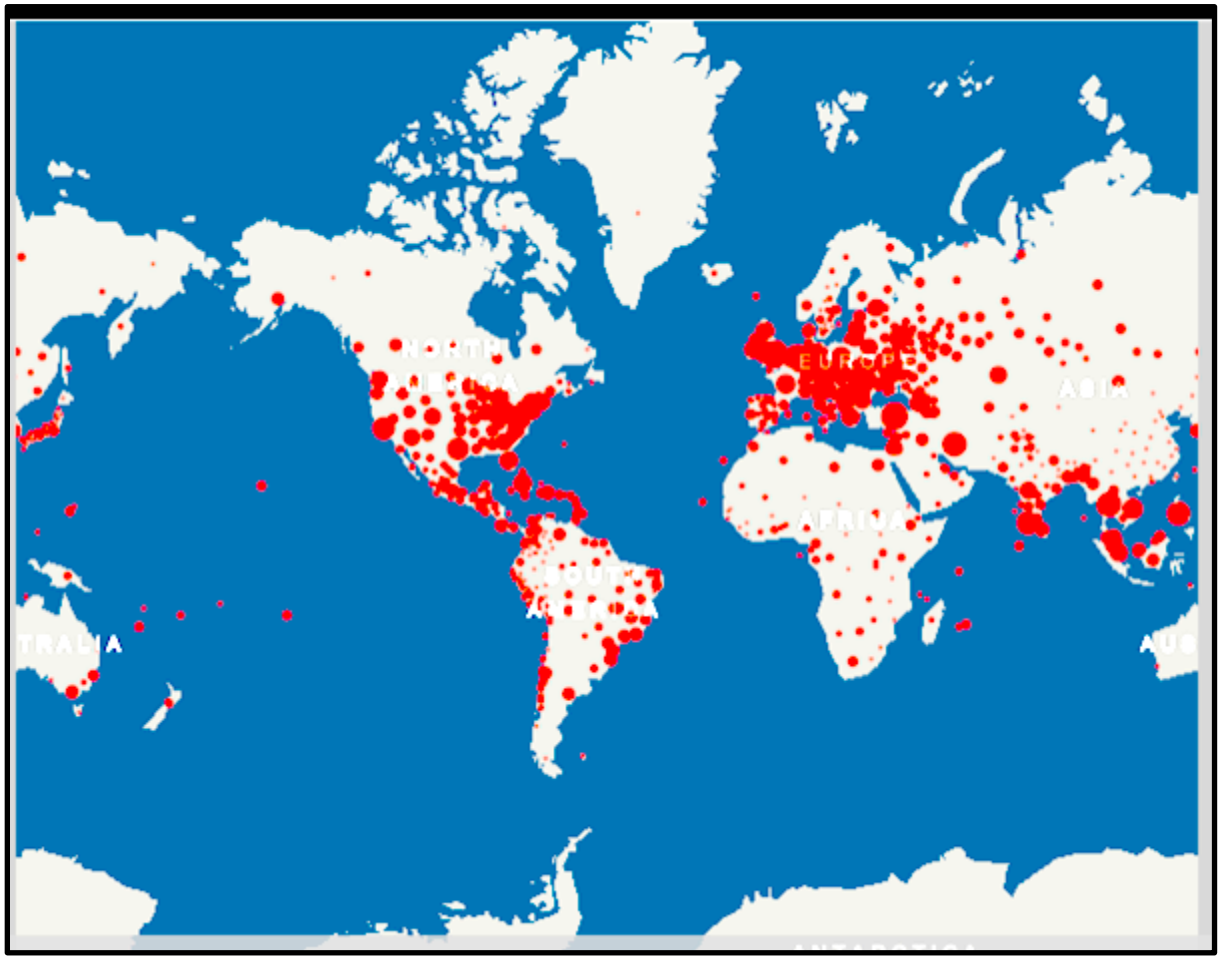

Figure 4. Covid-19 cases from Feb. 3 – Mar. 2, 2022 (Johns Hopkins University, School of Medicine 2022).

2.2.3.4. On expertise

The discussion in this section has assumed the role expertise in GIS plays is central to supporting the functions of a marketing professional. This is a two-part consideration. First is that expertise is necessary and second is that GIS is needed to support the work of a marketing professional. Considering expertise first, the question is why is expertise so important, so central, to our

discussion? Duckham (2015) writes: “Experts in solved problems are typically in low demand.” Rephrased, this infers experts in unsolved problems are typically in high demand. Identifying what that expert brings to unsolved problems that a non-expert could not is discussed next.

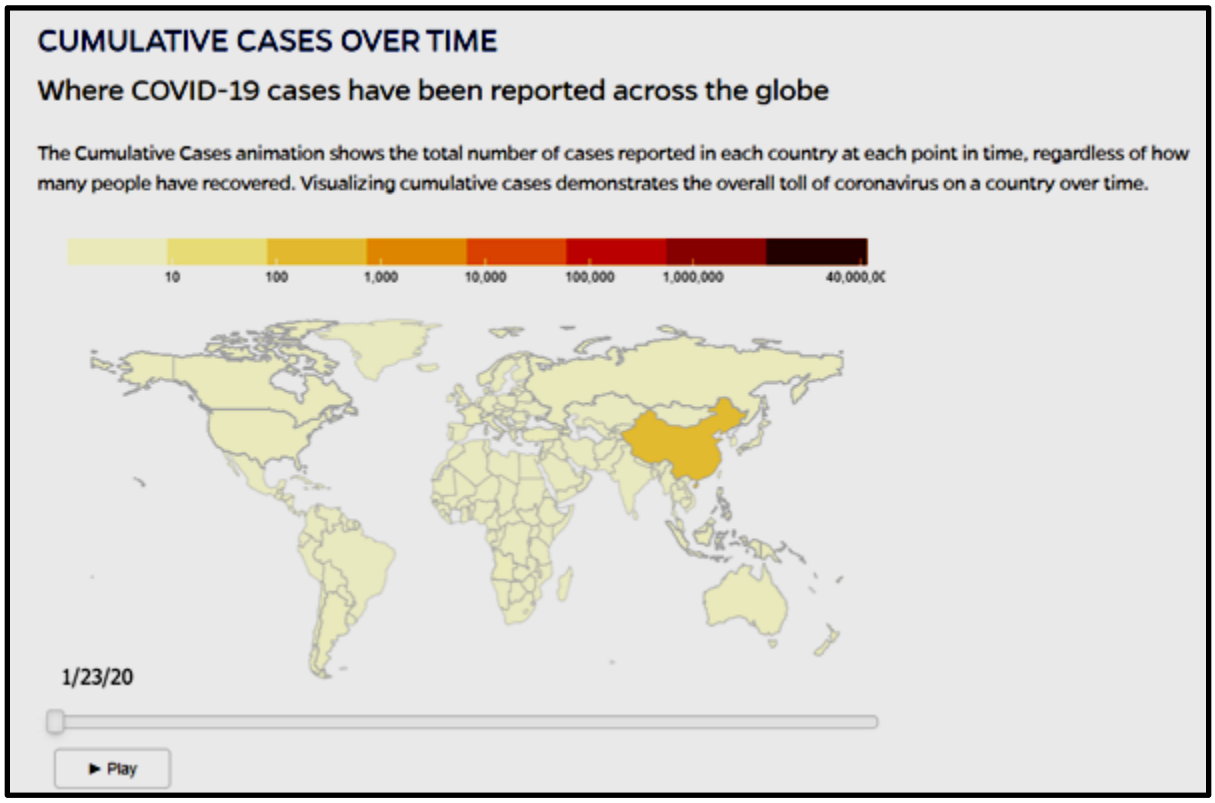

Figure 5. A screenshot of a dynamic map. Johns Hopkins University, School of Medicine 2022

An unsolved problem is a moment for new understandings. We can reason that many of the unsolved problems are ‘messy’ or ‘wicked’ problems. Expertise allows the practitioner to integrate the known situations and the unknown situations (Duckham 2015). Experts assemble information and data, both qualitative and quantitative, in new and innovative ways. The expert sees unsolved, messy problems as an opportunity to develop and apply their expertise. They transfer their expertise with solved problems and with messy problems to the new situation. The result can be the development of a novel approach to the marketing challenge, but one that is grounded in expertise.

Considering the second part of this, expertise in GIS is part of what can be thought of as the marketing professional's toolbox. This can be the development of spatial models in marketing (Bradlow et al. 2005), the use of location data to personalize customer experiences (USC Dornsife Spatial Sciences Institute. 2021), or the use of GIS for target marketing and customer segmentation (Esri 2010), among other applications. Expertise in GIS and in marketing provides an environment where unsolved spatial problems in marketing can be explored, using qualitative and quantitative methods. As a result, novel approaches can be developed, furthering the field of marketing.

2.2.4. Critical Thinking and Critical Literacies

Teaching critical spatial skills in higher education is an important element of spatial sciences. A great deal of education using GIS focuses on the technical and not the thinking and literacy skills. This is concerning. The author's personal experience with students, regardless of academic level, is that the disciplinary content comes first. Once the content and the outcomes are identified, then an analysis of the optimal andragogical approaches for student learning needs to be completed. These considerations then drive the application, and learning, of the technology. Bearman et al. (2016) believe that the technical side of GIS can be used to teach these skills. Spatial cognition and literacy are critical to Geographic Information Science and Technology (GIST), which was emphasized in the development of this course. Bearman et al. (2016) also would like to see future research addressing the concept of a spatial citizen – a secondary outcome of this course.

2.2.4.1. USC Marshall's critical thinking initiative

USC Marshall has instituted a Critical Thinking Initiative providing us with guidance on the nature of critical thinking in a business school and how it may work with spatial sciences in a

transdisciplinary manner. It includes a 5-step problem solving process that can be applied to messy and ambiguous problems called START. START stands for:

State the concept, theory, and/or formula

Take it apart

Analyze assumptions

Relate to other phenomenon

Translate to the real world.

This is a broad framework that can be applied in most hard, applied sciences and will be applied within this curriculum.

The critical thinking initiative supports business professors in helping their students build creative thinking, eliminate bias, and evaluate claims and evidence (USC Marshall, 2021). Critical thinking will be addressed as part of the literature on transdisciplinarity to provide a well-rounded view on disciplinary thinking in business.

2.3. Implementing New Technologies in the Higher Education Space

The use of statistical software packages for disciplinary learning in higher education is common. In the Marshall School of Business, statistical and programming packages such as Excel, SAS, JMP, R, Python and Orange are used regularly in courses in most departments, including marketing. The Technology, Pedagogy, And Content Knowledge (TPACK) framework (Koehler, 2012) for backwards design specifically acknowledges that integrating technology into a curriculum requires an expert understanding of the dynamic relationships between technology integration and andragogy as they are situated within the context of the discipline.

The instructional design approach to utilizing the TPACK framework is informed by two key principles: UDL and Backwards Design. In turn, both are based on the characteristics of the learner, the modality of delivery and the relative importance of instructor and social presence in the classroom.

Utilizing GIS technology in a discipline outside of spatial sciences or geography requires a heightened level of thoughtfulness. The choice in this project is to pursue a transdisciplinary andragogy as particularly appropriate for the integration of geospatial software into marketing curriculum. The roles of TPACK, UDL, Backwards Design, the characteristics of the learner and the specific considerations of an online course, are discussed in the subsections that follow.

2.3.1. Universal Design for Learning and Backwards Design

UDL is a well-known approach for designing the learning experience of students. According to CAST, the UDL Guidelines (2022) consists of three core principles. First, to provide multiple means of engagement for the students. Second, to provide multiple means of representation of content and third, to provide multiple means of student expression. Notice that at no point in these three principles does it mention 'teaching'. To the contrary, these are all student-centered principles. Learning, not teaching, is the operative word. Although the words teaching and instruction will be used in this discussion, they are always used in the service of student-centered learning.

The other design principle used for the course is Backwards Design. This approach considers the outcomes that we want for the students first and then designs the curriculum backwards from those outcomes (Wiggins & McTighe, 2005). This is a three-step process. First, we identify the desired student results. This is expressed in the learning outcomes. As a side note, the phrases learning objectives and learning outcomes are frequently used interchangeably.

Using the word outcome is preferable because it is a concrete expression of what the students should have achieved at the end of the course. Learning outcomes are definitive. The phrase 'learning objective' is more aspirational.

The second step in backwards design is deciding how the learning outcomes will be measured (Wiggins and McTighe, 2005). Learning outcomes must be measurable, otherwise there is no mechanism for the instructor to know if the students have mastered the content and achieved those outcomes. Measuring outcomes usually involves designing assessments that will determined what students have learned. Assessments can be formative or summative. Formative assessments are assessments that are given while students are in the process of a learning path. They serve the purpose of informing both the professor and the student about the students' progress towards meeting the learning outcome(s). Summative assessments are assessments that are given at the end of the learning path and provide both the professor and the student with information on whether the student has met course learning outcomes.

The third step in backwards design is planning the learning experiences and instruction that, when the student engages with them, will result in the student meeting the learning outcomes (Wiggins and McTighe, 2005). When utilizing both UDL and backwards design, the UDL principles are considered during the third stage of backwards design. In Chapter 3 a deeper discussion and examples of UDL and backwards design are provided.

2.3.2. Learning Characteristics of the Students

The target audience for the GIS Applications in Marketing course were and will continue to be students in one of several MBA programs, specialized masters' programs, and certificate programs in the Marshall School of Business. These programs require students to take electives. The GIS Applications in Marketing course is an elective which is available to the students

enrolled in these programs. These programs serve 28 to 36 year olds. Many of the courses are online or held in the evenings and weekends. This course was held in the evening, in a 3-hour synchronous online class.

Learners in this age range are adult learners who have experience outside of academia that can be brought to the learning environment. They tend to be more self-directed, self-motivated and proactive. They have varied backgrounds, from a content perspective and from an experience perspective (Arghode, Breiger and McLean 2017). In adult learning, the expertise in the classroom is interpreted as being broader than the instructor's expertise. Instructors take on the role of facilitator and actively draw on this varied student expertise to strengthen the learning environment. The social aspect of learning is critical in these classrooms, and instructors facilitate conversations, dialogue and professional level interactions.

2.3.3. Online Education in Business: Instructor and Social Presence

Two elements of online learning in business have been identified in the literature as important for successful learning experiences – instuctor presence and social presence. The details of each of these as applied in the online business learning environment are discussed below.

2.3.3.1. The online environment

In the online environment in particular, course design for adult learners needs to be relevant, deeply engaging, and non-linear (Arbaugh 2014). This non-linearity is reflected in the UDL principles that emphasize multiple ways to engage students and ways for students to express themselves in the course. The use of relevant, authentic content is more motivating for adult students. Some examples of relevant, authentic content include modeling the decision-making process of professionals, assuming the role of spatial data analyst, or applying theory and practice to a case study.

In this course, a pre-work to synchronous session to post-workflow was established. This is sometimes called the flipped classroom. This project avoids the use of that phrase as it is educational jargon that has some baggage attached to it. Instead, the 'flipped' part of the class is referred to as pre-work or pre-class. This better reflects the intentionality of the continuity of the learning experience. This workflow asks students to engage in work ahead of class and bring the results of that work to the synchronous session. The synchronous session then builds on the pre-work by expanding on it and engaging in the concepts more deeply. In the post-work, students reflect on the pre-work and the synchronous sessions.

2.3.3.1. Instructor presence

The presence that an instructor has in a course is manifested in the design and the facilitation of student cognitive experiences. It asks professors to engage in the elements of instructional design which includes structuring the course and the interactions in the course – both student to student and professor to student (Arbaugh 2014). A combination of direct instruction, where a professor leads a course based on their expertise, and facilitating discourse, where an instructor supports students engaging in interactions with one another around the course content are essential activities where instructors establish their presence in a course.

In research, instructor presence has been shown to have the greatest effect on perceived learning (Arbaugh 2014). Perceived learning is used as the metric because in business schools in higher education there is rarely a mastery learning metric. Inconsistencies between courses and instructors in delivery, content and grading policies lead to inaccuracies when comparing the actual learning that occurs. Perceived learning is commonly used in studies of online business courses (Arbaugh 2014). Using this metric, the importance of instructor presence implies that a business school should be investing in supporting its professors' online teaching expertise, their

ability to bring their subject matter expertise to the classroom, and their ability to facilitate student to student discourse. In the context of this project, these findings imply that it is important for professors to establish their expertise in the classroom, both in their interactions in the classroom itself and in their planning and design of the course.

2.3.3.2. Social presence

Learner-to-learner interactions establish a social presence in the classroom. In particular, those that are designed and driven by the instructor are solid predictors of perceived learning by the students. In his research, Arbaugh (2014) cited three elements as contributors to social presence: 1) Affective expression, where students share their experiences and beliefs; 2) Open communication where learners develop and maintain a sense of commitment to the class and the group; and 3) Group cohesion where learners interact directly. These elements are important to establish at the beginning of the course. They tend to be the 'drivers' of the learning.

These elements loop back around to the instructor and their presence in the classroom. Interactions need to be deliberately designed into the curriculum by the instructor to help foster the social presence. In short, a strong instructor presence helps foster the social presence. The development of the social presence, in combination with the instructor presence, lead students to report a higher level of perceived learning (Arbaugh 2014).

2.3.4. Technology Pedagogy Content Knowledge (TPACK)

As technologies advance, it is particularly important to consider the use of a software, particularly industry standard software, in a transdisciplinary context. The TPACK framework provides a 7-part way of thinking about the integration of this kind of software, or technology, into a course (Figure 6). The seven parts are discussed individually below.

1) Content Knowledge (CK): CK is a professor's knowledge about the content in their discipline. For this curriculum, content knowledge from both marketing and spatial sciences was included.
2) Pedagogical Knowledge (PK): PK is a professors' knowledge about pedagogical practices. This knowledge comes from an understanding of how students learn. This is where the demographics and prior experiences of the students are considered. For the purposes of this course, the students are adults in a graduate level elective and so the principles of andragogy are being applied. The TPACK framework uses pedagogy to include both pedagogy and andragogy.
3) Technology Knowledge (TK): Professors need an understanding of how the technology that they are incorporating into their course will be applied in the workplace to best prepare students Additionally, they need to stay up-to-date on the use of technology. Professors need to understand and take advantage of the methods that students have independently developed to learn new technologies. An understanding of how students approach learning technology will inform the course delivery strategies.
4) Pedagogical Content Knowledge (PCK): PCK is applying pedagogical principles to the development of curriculum in the specific content area. This includes the professor developing multiple forms of representation of the content and reflecting on the students' prior understandings. This course, being co-taught by a marketing expert and a spatial sciences graduate student (the author) better informs the development of student understanding of both disciplines.
5) Technological Content Knowledge (TCK): The content for this course was informed by the application of the technology (GIS) to the subject matter (marketing). This is a

reciprocal relationship. The technology informs the development of how the subject is represented, and the subject matter informs how the technology is being used.

6) Technological Pedagogical Knowledge (TPK): Technologies are used differently with different pedagogical approaches. For adult learning, the intentionality of the technology use will guide the andragogical development of the course.

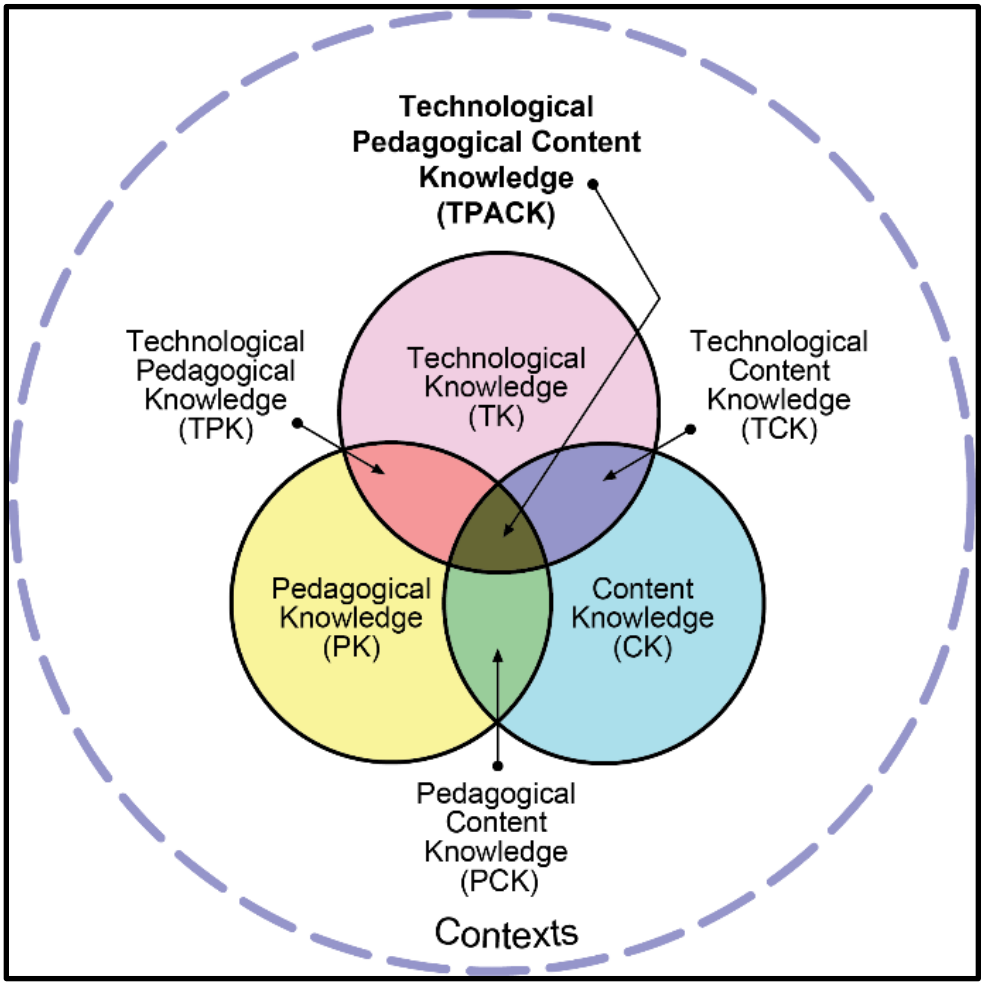

Figure 6. TPACK framework. Reproduced by permission of the publisher, © 2012 by tpack.org.

7) Technological Pedagogical Content Knowledge (TPACK): TPACK goes beyond each of these individual elements. The core of teaching with technology is the professor's ability to represent subject matter concepts with the technology that draw on students' prior knowledge and epistemologies. This provides a curriculum that, as a whole, provides students with new

epistemologies and strengthens their existing ones by expanding and deepening their understandings.

2.3.5. Transdisciplinary Andragogy

As has been discussed in much of this related work section, the intersection of transdisciplinarity and andragogy is at the core of the approach to this course. We have already established that transdisciplinarity involves students as active producers and creators of knowledge. This interacts with elements of andragogy which Houde (2006) delineates in the following.

Adult learners have a necessity of knowing. This leads to the realization that they are responsible for their learning. They are ready to learn, and they are clear about why they want to learn and what they want to learn. They bring their own experiences to the activities, becoming part of the generation of knowledge within the class environment. The combination of these factors leads the student to be self-motivated to engage in continuous learning for growth and professional development.

Learners engage in epistemological thinking such as systems thinking in this model. There are examples of systems thinking in business, such as self-organization and emergence. This is where andragogical transdiscipinarity intersects with the Cynefin framework. The third area of Cynefin is emergent thinking, and that is the area of the framework that this course curriculum is focused on culminating with. Best practices are not complex and not prominent in transdisciplinarity andragogy, although there are best practices when learning the software. Good practices are where the curriculum will start with the subject matter, however, most of the content will fall into the emergent practices category. This is how Cynefin, andragogy and transdisciplinarity together form a construct for thinking through the development of the course, as well as its activities and assessments.

McGregor (2017) posits three concepts: transdisciplinary learning, the transdisciplinary learning cycle, and transdisciplinary habits of mind. Transdisciplinary learning is new, co-created knowledge. The transdisciplinary learning cycle is the iterative and collaborative cycle of acting, observing, and interpreting. This is roughly equivalent to the Cynefin frameworks' third quadrant of complex thinking where probe, sense, and respond are posited to be iterative and emergent thinking is the result. Finally, McGregor posits that habits of mind when applied to the transdisciplinary environment involves integrative thinking across domains.

2.4. Research Method Thematic Ethnographic Approach

The thematic ethnographic approach was the core approach used to analyze the qualitative interviews. A thematic analysis identifies semantic and latent patterns or themes within qualitative data (Maguire and Delahunt, 2017). The semantic approach was used in this project. This approach looks for what has been said, after which the researcher interprets and explains the results. The latent approach digs deeper to identify what underlies the semantic approach and was not used in this project.

To be accepted as trustworthy and thus valid, the data analysis has to be conducted in a "precise, consistent, and exhaustive manner" (Nowell et al. 2017). By recording interviews, transcribing them, and analyzing them through the identification of precise constructs – such as the definition of disciplinary thinking – the analysis has a systematic approach that allows the reader to determine the credibility of the subjects.

Chapter 3 Methodology

This project used a transdisciplinary approach to influence the development of a marketing course in GIS and Decision Making in a business school. Using a transdisciplinary approach, the curriculum should integrate and transcend individual disciplinary paradigms (McGregor, 2017). For this to occur, the curriculum developer needs to have a meaningful and practical understanding of the academic thinking of the disciplines that are involved. This creates a two-phase process. Phase one is better understanding the criteria for disciplinary thinking in both spatial sciences and marketing. The methodology for establishing this is the primary consideration in this Chapter. The following sections discuss how these criteria were identified in each of the disciplines under consideration. Applying the results of this investigation to curriculum development is Phase two. This is discussed in Chapter 4.

3.1. Establishing the Criteria for Disciplinary Thinking

This study investigated the similarities and differences in disciplinary approaches with respect to how GIS is employed in each. The primary discipline investigated was marketing in a business school. The disciplinary approaches from Spatial Sciences were compared to marketing, as GIS technology is most strongly categorized as a tool in the spatial sciences. The nature of the questions asked of the interviewees were:

1. What defines disciplinary thinking in each of these fields?
2. How do these disciplinary thinking constructs manifest themselves in practice?

The result of this investigation informed development of curriculum for a course in the USC Marshall School of Business entitled GIS and Decision Making in Marketing.

This project used a qualitative thematic ethnographic approach, seeking to identify common themes and patterns. Each of the marketing and spatial sciences disciplines was

analyzed individually and then compared to find common and divergent elements. Four interviews were conducted including three marketing professors and one spatial sciences professor. Questions included disciplinary thinking, qualitative and quantitative thinking in their disciplines, and linear and non-linear thinking. Each was asked the same questions. The full list of question items can be found in Appendix A.

3.1.1. Institutional Review Board (IRB)

As this project involved research subjects, it was required, and is ethically prudent, to go through the IRB review and approval process. An exempt application was filed and approved. (case ID UP-21-00864.) It was determined to be exempt according to §46.104(d) category (2). Professors were provided with an informed consent form which was signed before they began the interview process. All IRB requirements were met.

3.2. Thematic Ethnographic Approach

The thematic ethnographic approach was used to analyze qualitative interviews. According to Nowell et al. (2017, 1), to be accepted as trustworthy and therefore valid, data analysis has to be conducted in a "precise, consistent, and exhaustive manner". By recording the interviews and analyzing that interview data through transcription and identification of precise constructs–such as the definition of disciplinary thinking–a systematic approach was constructed that allowed the reader to make their own determinations.

The requests for interviews were made through email. These interviews were recorded in Zoom and the audio track from the Zoom interviews was downloaded and transcribed using Google Transcribe. The transcriptions were then cleaned, coded and compared for similarities and differences in the discipline's approaches.

The interviews were designed to assess expert perceptions of various pre-identified concepts. There were three categories of questions – disciplinary thinking, qualitative vs. quantitative thinking in disciplinary practice and linear vs. non-linear thinking in disciplinary practices. A question about disciplinary thinking was asked first, after which subjects were asked to differentiate between thinking and practice. For this a definition of disciplinary thinking was elicited from the subjects, and then the practices that derive from that disciplinary thinking were discussed.

The next set of questions covered qualitative and quantitative thinking. These were designed to identify how these two kinds of thinking and practice contribute to the discipline. Disciplines tend to identify themselves as qualitative, quantitative, or a mix of both. This helps us understand how these two disciplines view themselves on the qualitative/quantitative continuum.

Finally, were questions on linear vs. non-linear thinking, which were asked with a different goal in mind. Spatial thinking is core to the spatial sciences. How much do spatial scientists see this element of spatial thinking as linear or non-linear? How do marketing professionals identify their thinking as linear or non-linear?

Taken together, the framework derived from the literature search and from the disciplinary thinking, including the results of the qualitative/quantitative and linear/non-linear questions, can inform the development of a transdisciplinary curriculum. This is addressed in the following sections.

3.2.1. Establishing the Criteria for Disciplinary Thinking in Spatial Science and in Marketing

A three-part methodology was developed to better understand what expert understanding of disciplinary thinking means in the fields of spatial sciences and marketing. First was a literature

review. Second were in-depth interviews with a spatial sciences professional and with three marketing professionals from USC to develop a deeper view of their understanding of disciplinary thinking. These interviews were analyzed using a thematic ethnographic approach. Third was analyzing the results and applying them to the curriculum for the marketing course.

This process (Figure 7) was linear, moving from the literature to the interviews to the application of findings. The literature review provided a perspective on what spatial sciences thinking has been historically, its grounding in geography and related disciplines, and what the current perspectives are in spatial sciences. It also provided a perspective on what marketing thinking has been historically, particularly since the 1990s when technology was introduced to this field as well.

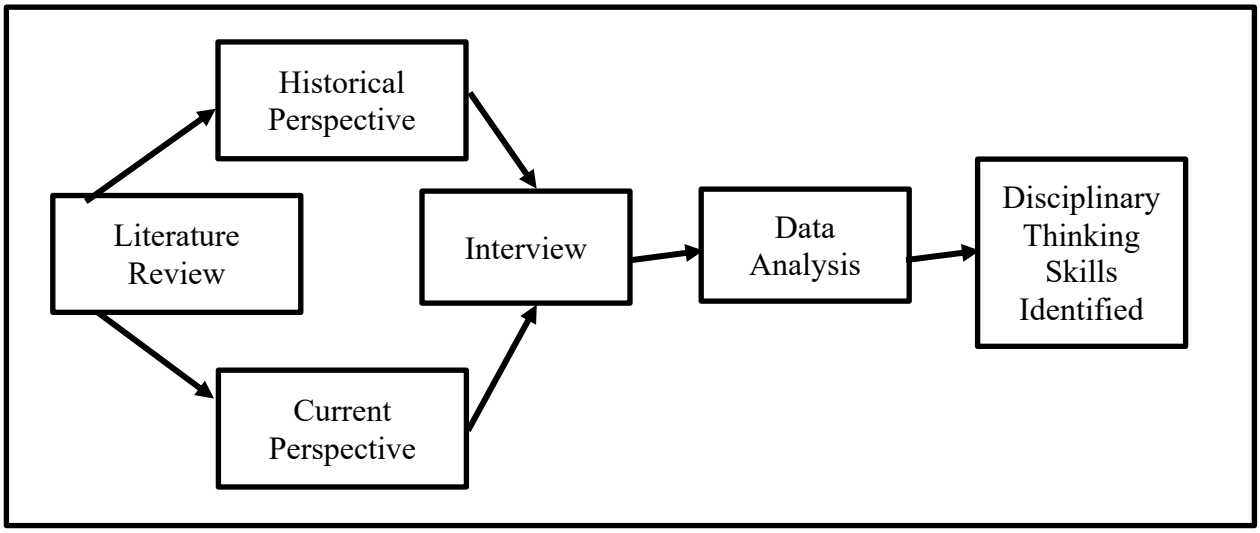

Figure 7. Process for investigating disciplinary thinking.

The interviews went into depth on the nuances of disciplinary thinking in spatial sciences and in marketing. The purpose was to ascertain the professor's understanding of disciplinary thinking and how the professors perceive them as specifically important to spatial sciences thinking and to marketing thinking. Once the data was analyzed using a thematic ethnographic

approach, disciplinary skills were identified. These identified disciplinary thinking skills were then integrated into the course curriculum.

3.2.2. Comparing SSI and Marketing Interviews.

These two sets of interviews – one set with a professor from spatial sciences and one set with three professors from marketing – were conducted with the same protocol and the same set of questions. This allowed for comparisons of the similarities and differences between spatial sciences and marketing.

3.3. Establishing The Research Method For The Interviews

As referenced, the thematic ethnographic approach to analyzing qualitative interviews was used with the data that was gathered. Braun and Clarke (2006) developed a six-step approach to conduct this kind of analysis and this was used for this project:

Step 1: Become familiar with the data

Step 2: Generate initial codes

Step 3: Search for themes

Step 4: Review themes

Step 5: Define themes

Step 6: Write-up

According to Nowell et al. (2017), to be accepted as trustworthy and therefore valid, the data analysis has to be conducted in a "precise, consistent, and exhaustive manner". This six-step process provided a procedure for doing just that.

3.3.1. Analysis of Interviews

The process that was developed to analyze the interviews incorporated several steps (Figure 8).

Interviews were conducted over Zoom and transcribed using the Voice Typing feature in Google docs. These transcriptions were approximately 85% accurate, determined by counting the words changed in the review and cleaning, divided by the total number of words. The process of review and cleaning also served as a familiarization process (Step 1). In Step 2, they were coded. Annotations (comments) were created in the word document of the cleaned transcripts when the concept was defined and when applications of the concept were presented by the interviewee (Figure 9).

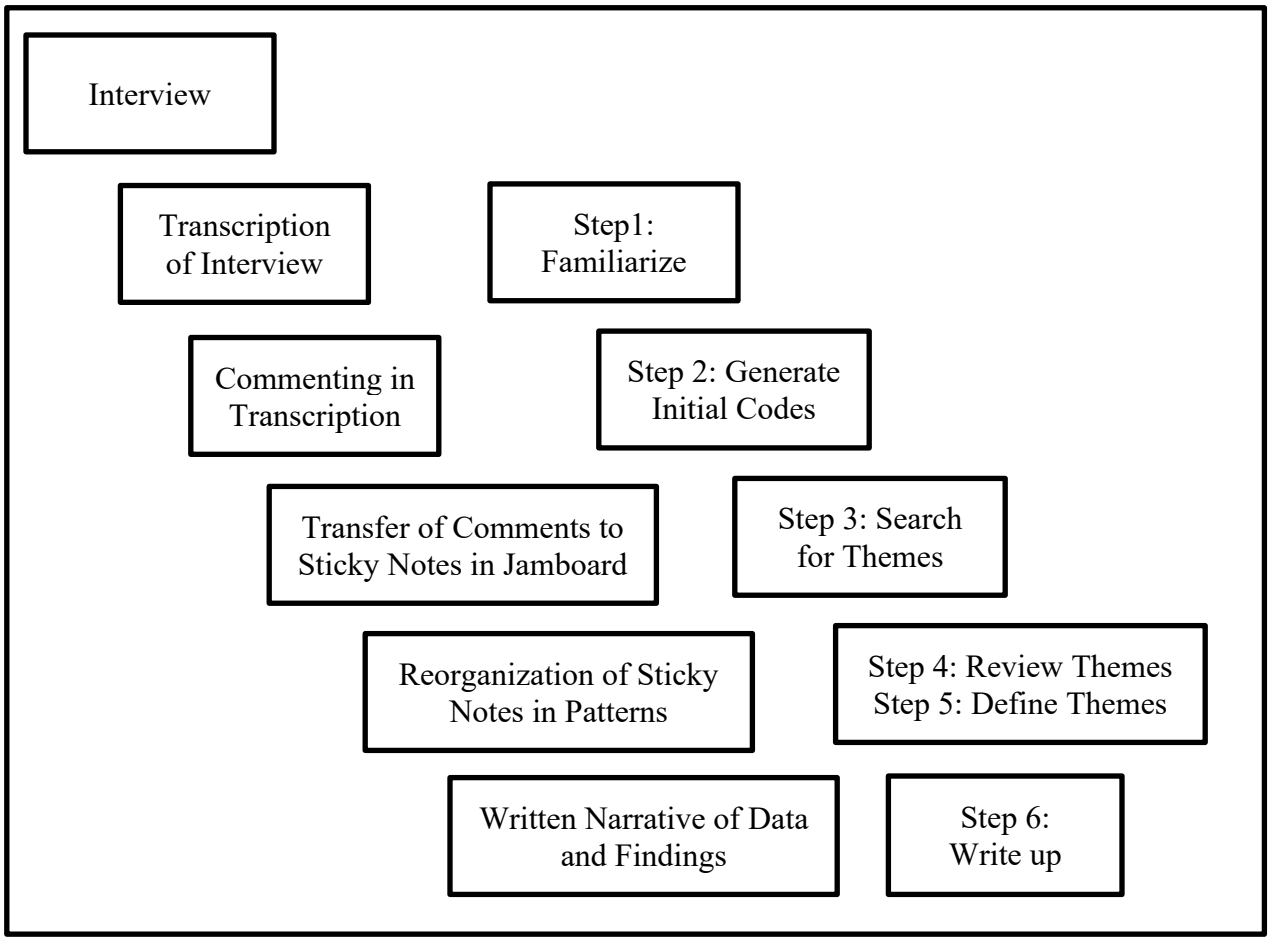

Figure 8. Multiple step analysis of interview and analysis process (Adapted from Braun and Clark 2006).

The second level of coding, Step 3, was transferring the annotations or comments in the Google docs to stickies on a Google jamboard. Google jamboard is part of the Google suite of

applications. It is an object-oriented interface where the user can create and pin electronic stickies. These stickies can then be moved around the board in an ordering and reordering process. This was done in a linear way with all the definitions and applications that each interviewee offered listed out on the jamboard as digital stickies (Figure 10). The green stickies are the responses from the marketing professors. The yellow stickies are the responses from the spatial sciences professor. It is important to note that each sticky is to be equally valued. The number indicated on the stickie is a coded reference to each interviewee. Google jamboard stickies automatically adjust font size when the size of the sticky is changed. Font size, therefore, is not an indication of the value of the information.

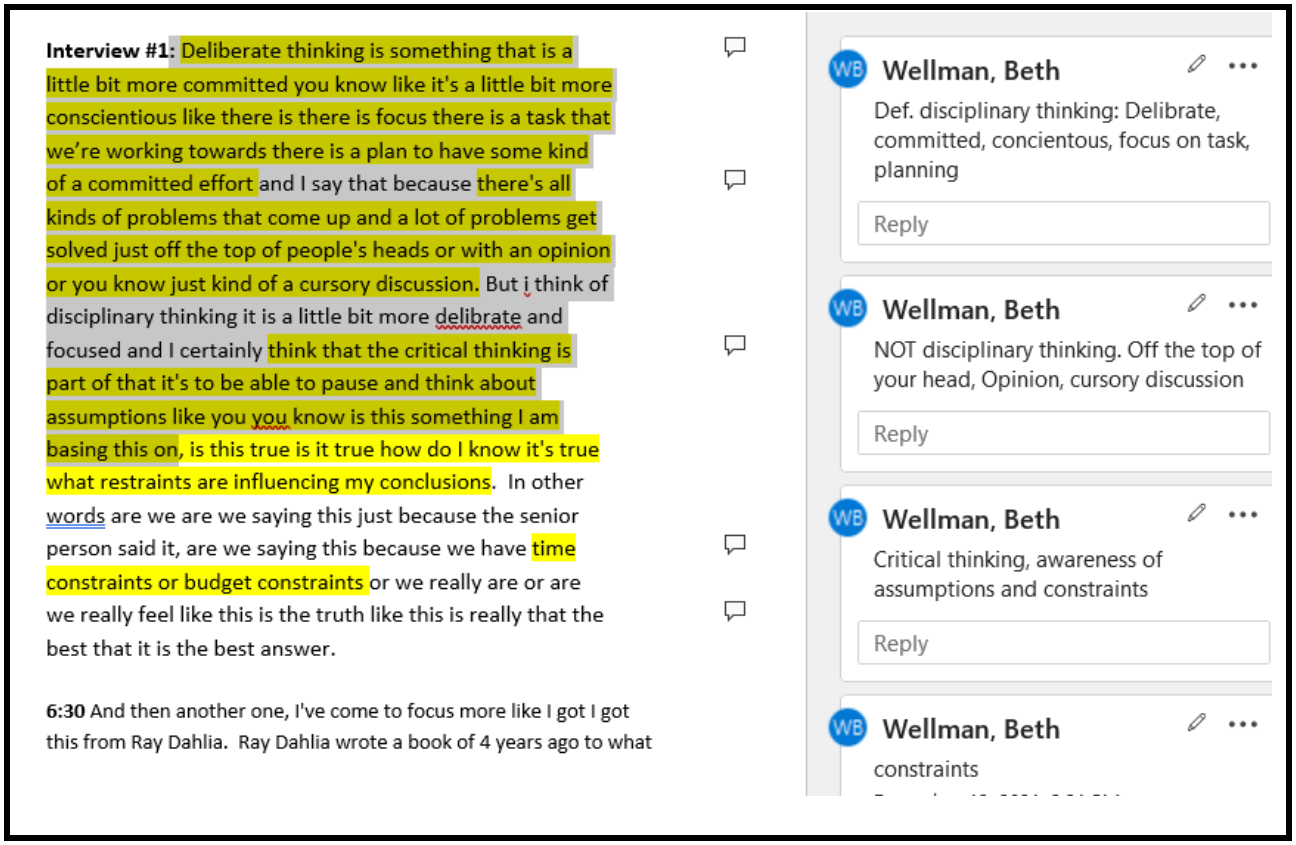

Figure 9. Coding of interview data: Annotating interview transcript.

When the transfer was complete, the stickies on the jamboard were rearranged in related patterns to reflect a related set of comments. Several iterations of sorting were completed by

searching, reviewing and defining themes and concepts that are related (Steps 3, 4 and 5). These comments were placed spatially to reflect the patterns and interrelationships. It is important to note that the number of times an interviewee mentioned a particular point was valued less than the degree to which there was agreement among the interviewees (Figure 11). This final version of the jamboard for each question was then used to create the narrative analysis in Step 6.

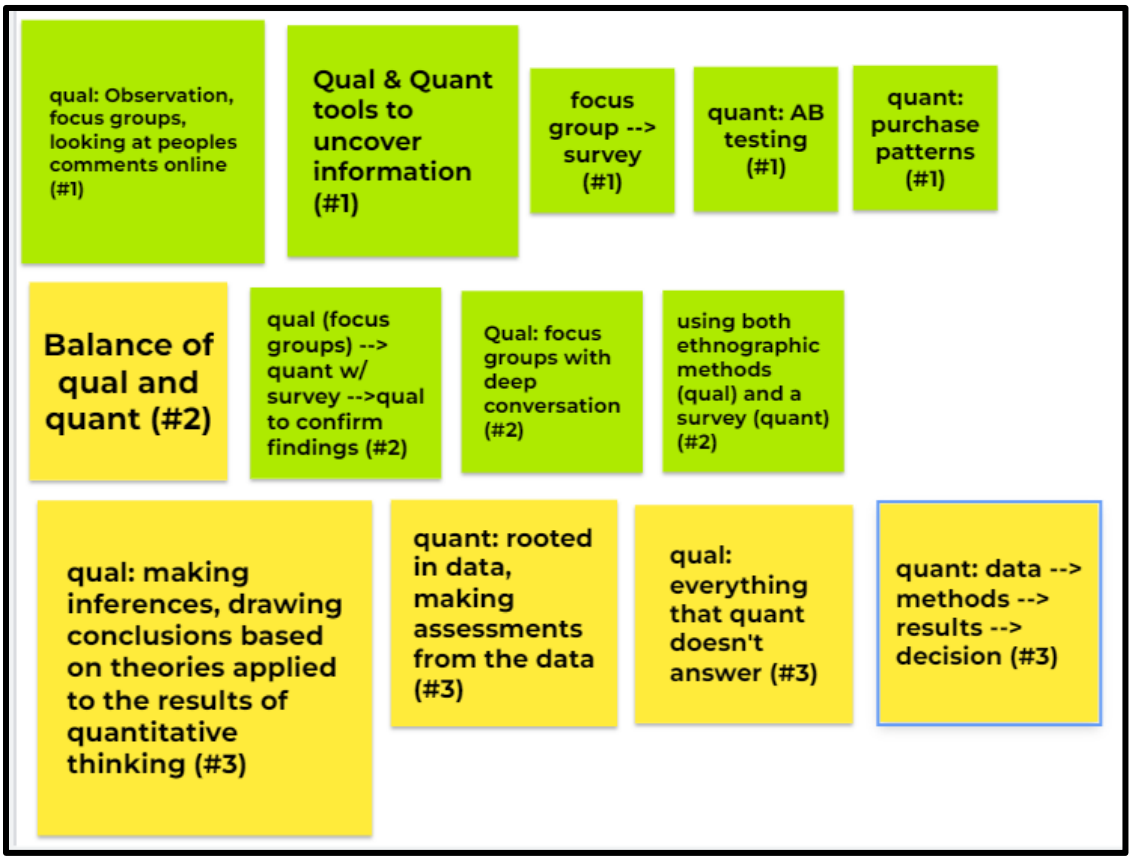

Figure 10. Movement of annotations to jamboard.

This process was repeated for qualitative vs. quantitative thinking, and linear vs. non-linear thinking. It was also used to analyze the interviewees responses to the question on multi-, inter-, and trans-disciplinarity.

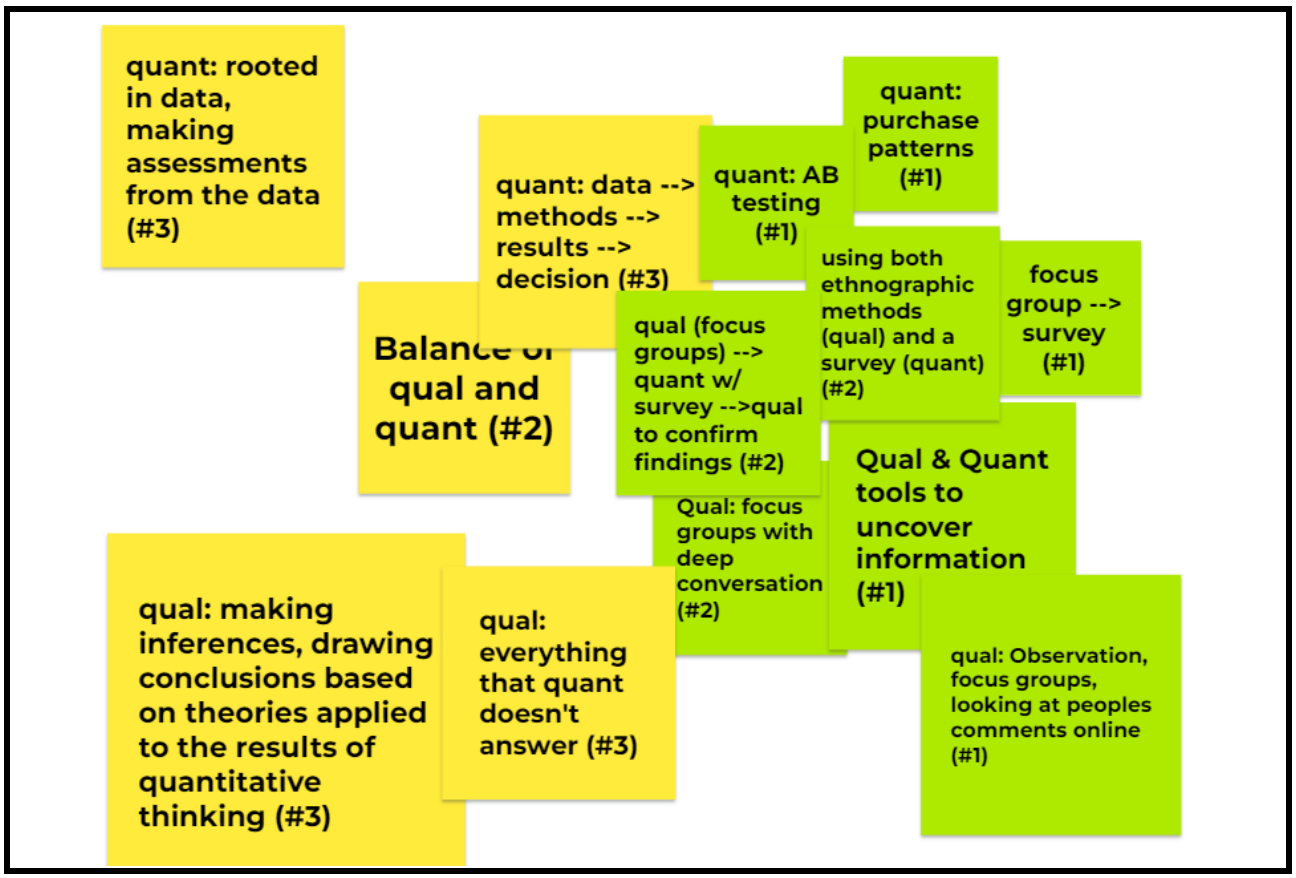

Figure 11. Reorganization of jamboard seeking patterns and relationships.

Chapter 4 Results

This study investigated the similarities and differences in how the field of marketing and spatial sciences use Geographic Information Systems (GIS) in their teaching and practice. The primary discipline investigated was marketing, housed in a business school. Phase one of the project investigated disciplinary approaches from spatial sciences compared to marketing, as GIS technology is most closely associated as a tool to implement many core methods in that discipline. The questions that were addressed, based on the interviews conducted, were:

1. What defines disciplinary thinking in each of these fields?
2. How do disciplinary thinking constructs manifest themselves in practice?
3. How is qualitative and quantitative thinking used in these disciplines?
4. How is linear and non-linear thinking used in these disciplines?

Phase two of the project applied the results of this investigation by informing the curriculum development of a course at USC entitled GIS and Decision Making in Marketing offered in the USC Marshall School of Business. The application of the results to curriculum development is discussed in section 4.6.

This project used a qualitative thematic ethnographic approach, seeking to identify common themes and patterns (Nowell et al. 2017). Each discipline - marketing and spatial sciences - was analyzed individually and then examined together to identify common and divergent elements. Four interviews were conducted, targeting three marketing professors and one spatial sciences professor, asking them the same questions. Questions included disciplinary thinking, qualitative vs. quantitative reasoning in their disciplines, and linear vs. non-linear thinking.

4.1. Results of the Literature Review – a Framework

The literature review identified 22 concepts as core to the disciplinary thinking in marketing and in spatial sciences. These concepts were used to develop a framework of evidence of disciplinary thinking. This framework is described in Table 2.

Table 2. 22-Concept framework for disciplinary thinking in spatial sciences and marketing

Categories	Concepts		
Disciplinary Thinking	Spatial thinking (Bednarz and Bednarz 2008)	Discipline specific habits of mind (Atit 2020)	
	Spatial literacy (Montello and Raubel 2013)	Quantitative thinking (Kumar 2013)	
	Spatial reasoning and communication (Bednarz and Bednarz 2008)	Qualitative thinking (Walker et al. 1998)	
	Creative thinking (Walker et al. 1998)	Critically engage with spatial data (Bednarz and Bednarz 2008)	
	Pattern recognition (Johnston 2001)	Metacognition (National Research Council 2006)	
Representations of Disciplinary Thinking	Symbolic representation (Montello and Raubel 2013; Bednarz and Bednarz 2008)	Disciplinary language (Prinsloo 2018)	Cynefin framework (Snowden 2011)
	Non-text representation of knowledge (Bednarz and Bednarz 2008)	Quantitative representations of knowledge (Perez-delHoyo et al. 2020)	
Tools of Disciplinary Thinking and Spatial Literacy	Geographic information systems technology (Perez-delHoyo et al. 2020; Montello and Raubel 2013)	Discipline specific tools of non-text representation of knowledge (Atit 2020)	Graphs, diagrams, flow charts and maps (Montello and Raubel 2013)
Application of Disciplinary Thinking	Real life problems (Prinsloo 2018; Bednarz and Bednarz 2008)	Problem solving (Walker et.al 1998)	
	Knowledge making (Snowden 2011; McGregor 2017)	Decision making (Walker et al. 1998)	

As there were 22 concepts, to provide a level of structure, four broad categorizations were derived from the literature, which were comprised of aggregations of these concepts. These four different categorizations – disciplinary thinking, representations of disciplinary thinking, tools of disciplinary thinking and applications of disciplinary thinking – were identified as critical in comparing practices between disciplines.

These constructs were used to compare the results of the interviews with the experts. The areas where the experts and the literature converged were areas to focus on and the areas where experts and the literature diverge were areas to explore further.

4.2. Results From the Disciplinary Thinking Questions

The disciplinary thinking questions comprised the first two questions. Question 1 (Q1) was "What do you think disciplinary thinking is?", and Question 2 (Q2) was "What do you think disciplinary thinking in marketing/spatial sciences is?". Question 1 was designed to establish a baseline of common understanding of the construct of disciplinary thinking with the subjects. Question 2 was designed to establish commonalities and contrasts between the disciplines. Interviewees #1, #2 and #3 were from marketing and Interviewee #4 is from spatial sciences, and they are referred to as such in the following section.

Two of the marketing professors and the spatial sciences professor saw disciplinary thinking as normative. For instance, Interviewee #3 responded about disciplinary thinking as "within a particular framework and … norms associated with that discipline" This is echoed in a slightly different way by interviewee #2 who saw it as "requiring specialized knowledge" and "habits of mind… or mindset." Interviewee #4 agreed, also using the term "normative". Consistent was the interpretation of disciplinary thinking as mindsets that are normative and broadly accepted across the discipline.

Interviewee #4 went into more detail in defining normative. He saw it as consisting of "shared methods and tools of inquiry" as well as "shared epistemology – the understanding of how we know what we know." This reinforces Prinsloo's (2018) view of hard, applied sciences, such as marketing and spatial sciences, as having a shared epistemological basis. It also brings up the perspective that there are tools that are shared within the spatial sciences discipline and tools that are shared within the marketing discipline. This is consistent with the work of Atit (2020), who discussed discipline-specific tools of representation of knowledge. In the case of GIS, this is a tool that not only is shared within spatial sciences but also between spatial sciences and marketing as well as many other fields.

Interviewee #1 had a different perspective, namely thinking of disciplinary thinking as metacognitive. They cited "critical and deliberate thinking" as elements of disciplinary thinking. This subject elaborated on critical thinking as, "pause and think about assumptions and restraints that are influencing my conclusions." Given that metacognition is thinking about your thinking (National Research Council, 2006), when this respondent reported pausing and thinking about assumptions, this would be considered a metacognitive process.

While three of the professors focused on normative and epistemological practices for disciplinary thinking, the fourth focused more on metacognitive practices, per the above. Taken together, these professors provided a general understanding-normative, epistemological and metacognitive-of what disciplinary thinking means in their respective disciplines.

With question 2 (Q2), two of the marketing faculty cited specific applications of disciplinary thinking using specific frameworks, namely the 4 Ps. The 4 Ps are price, position, product and promotion. Interviewee #3 stated, "the conventional, framework would be the 4 Ps." Interviewee #2 also invoked the 4 Ps framework, "for as long as marketing has existed as a

discipline, the 4 Ps model has been around." The implications of this model being widely accessible will be discussed later in this document.

The use of accepted analytic methods for evaluating customers' needs was also mentioned multiple times. Interviewee #2 listed several analytic methods, or tools, as disciplinary practices derived from disciplinary thinking. They included "conjoint analysis … price elasticity of demand. Break-even analysis. Cost, volume, profit analysis." These are all quantitative in nature and represent how quantitative thinking is core to marketing (Montello and Raubel 2013; Bednarz and Bednarz 2008). This was represented in the framework presented in Section 4.1. Interviewees #1 and #3 both mentioned knowing and evaluating assumptions, theories, and constraints as an application of disciplinary thinking. For instance, Interviewee #1 mentioned "what constraints are influencing my conclusions," which is an example of both disciplinary thinking and metacognition. Interviewee #1 was the only interviewee who also mentioned what was not disciplinary thinking. This included cursory, "off the top of your head" opinions. In summary, for these marketing professors, disciplinary thinking is normative, meaning that it requires specialized knowledge and mindsets (habits of mind) with frameworks accepted by the discipline. It is an approach, a way of thinking, that is shared among theoreticians and practitioners. The marketing professional habits of mind include evaluating assumptions and constraints, gathering and analyzing data, applying a framework (such as the 4Ps), and drawing conclusions needed for practical, applied decision-making. In a disciplinary framework, these are manifested as discipline specific habits of mind, metacognition, and quantitative thinking, tools and representations of knowledge.

Turning to spatial sciences, Interviewee #4 had a concise and comprehensive view of what disciplinary thinking was. This interviewee saw spatial sciences as a subfield of geography

that is based on an "epistemological revolution in geography." This participant reported that disciplinarity in spatial sciences was "how theories about space and place…can be tested, understood, and expounded upon through the use of improved computational tools." From this professors' point of view, this is based in spatial thinking. This is consistent with the literature that spatial thinking, reasoning and communication are core to the informed use of geospatial technologies-the tools of analysis and representation of spatial information (Bednarz and Bednarz, 2008).

Although there was consensus between the two fields as to what disciplinary thinking was- normative, epistemological, metacognitive- the manifestation diverged. For the marketing professors it presents as frameworks (the 4 Ps), evaluation of theories, assumptions and constraints within an environment of practical decision making with a focus on the customer. For the spatial scientist, it presents as spatial thinking, reasoning, analysis and communication. The marketing professors never mentioned spatial thinking, despite the fact that one of the 4 Ps is Place – an inherently spatial concept.

4.3. Results from the Qualitative and Quantitative Question

Question #3 was, "How do you use qualitative and quantitative thinking in your discipline?" This question did not ask for a definition of qualitative or quantitative thinking. All professors saw qualitative and quantitative as different forms of thinking. Two professors addressed what qualitative and quantitative thinking were and the differences between them. All the professors' provided examples of qualitative and quantitative thinking in their disciplines.

Professors saw qualitative and quantitative reasoning manifesting differently in their disciplines. Interviewee #3 described quantitative thinking as "rooted in data and what that data might tell us" and "making assessments that's reflected by data to make a decision." Quantitative

thinking then, for this professor, is examining data for decision making purposes. Interviewee #2, as already quoted, was more specific in citing the actual analyses – conjoint, price elasticity of demand, breakeven, cost volume profit – which result in quantitative information becoming a representation of knowledge that can be applied to decision making. Interviewee #1 added "surveys looking at purchase patterns" as another quantitative tool.

Without defining qualitative, Interviewee #1 listed observation, focus groups, and looking at people's comments online as qualitative tools. Interviewee #2 listed ethnographic research as qualitative in nature. Interviewee #3 mixes quantitative thinking with qualitative thinking to arrive at a position that qualitative thinking is, "making inferences based on theories applied to the results from the quantitative thinking." Interviewee #2 stated, "any marketing research expert will tell you, you have to balance qualitative with quantitative research."

All three marketing professors saw the application of qualitative and quantitative thinking as a process. For instance, Interviewee #2 said it succinctly- "first do focus groups, do qualitative research, then do quantitative research, then check your findings with more qualitative research". Interviewee #1 mentioned focus groups eleven times. Pertinent was when this person proposed "to test for statistical validity … this thing keeps coming up in the focus groups … we should do it with a survey to make it statistically significant." This delineates a qualitative (focus groups) to quantitative (survey) marketing process.

Summarizing the comments in the interviews, the following is a common practice and process as these marketing professors saw it:

Focus group (qualitative, ethnographic) → survey (quantitative)→ confirm (qualitative)

The spatial sciences professor, while acknowledging that spatial sciences is primarily quantitative, focused on one area of spatial sciences that they saw as particularly qualitative –

cartography. Cartography is representational and communicative in nature. As there is always more than one way of representing information on a map, the choices that the cartographer makes - "the way that we develop and use maps" - in their map building are frequently qualitative in nature while based on firm information design rules. This professor provided the example of how "political power is represented in our maps" as an application of the qualitative nature of critical GIS in representing "critiques of power". They acknowledged that many students are surprised by the qualitative nature of cartography and went on to posit one other area of spatial sciences that is qualitative-project management. However, project management is a skill set that applies to many disciplines. It is not unique to spatial sciences or to marketing.

Two of the (marketing) professors did not define qualitative and quantitative thinking. Rather, their responses went straight to the methodology of using these kinds of thinking rather than what these kinds of thinking actually entail. This may have been a result of the way the question was framed, however, because of their expertise in the application of these kinds of thinking, it could also be that they hold tacit understandings so deeply as to what quantitative and qualitative thinking are that they did not feel the need to define it.

4.4. Results from the Linear and Non-linear Question

Question #4 was "How do you use linear and non-linear thinking in your discipline?" The working hypothesis was that non-linear thinking is more equivalent to spatial thinking. All professors discussed quantitative and qualitative thinking. However, while the professors largely agreed with respect to linear thinking, they did not agree when discussing non-linear thinking.

Defining linear thinking was straightforward for all of the interviewees. They all saw it as a sequential process with a pre-defined order. "Through Step A B C D E in a very sequential way," said Interviewee #1, and "when I think of linear thinking in marketing I think of things

like critical path processes", said Interviewee #2. Critical path processes consist of the linear process of specifying activities, establishing dependencies, creating a network diagram, estimating completion time, identifying the critical path and updating the critical path (Kulakov 2020). The spatial sciences professor related linear thinking to "developing workflows". Their example was "getting from a messy data set… to some sort of useful output …that can inform a decision." (Interviewee #4). It is important to point out that the process of shifting between qualitative and quantitative techniques (namely the "focus group to survey to qualitative confirmation" process) is a linear workflow. For all respondents, the linear thinking process was conducted to better facilitate decision-making.

One professor acknowledged that a linear approach has received criticism from the marketing profession. Stated Interviewee #1, "one of the criticisms with very linear approaches for some industries is it's too slow" and that this may create a situation where, "we (marketers) will have trouble keeping up." This remark was unsolicited and points to one indication of the changing vision of what marketing is as a profession and a discipline. Thus, alternatives to linear approaches should be considered.

All the professors saw linear thinking as a step-by-step process manifested in generally accepted frameworks, which provides them a means for decision making. Although the examples that they gave were different, there was enough similarity for this conclusion to be drawn.

There was some consensus on what non-linear thinking is and how it manifests itself in marketing. Primarily the professors felt it was NOT step-by-step ("somebody doesn't feel like they have to go through every step", stated Interviewee #1). One professor emphasized the use of ethnographic research as an example of non-linearity being applied to marketing. "Non-linear thinking to me in marketing is more like if you use an ethnographic marketing research", stated

Interviewee #2. This professor also discussed observing a cloud of information as a form of non-linear thinking ("the quintessential example of non-linear thinking …you're just observing people in a cloud of information, there's no process … there's no steps, there's no order.").

Interestingly, the one activity that was cited by the marketing professors as a form of non-linear thinking was brainstorming. Referring back to the Cynefin framework (Snowden 2011), the third quadrant is emergent thinking. Brainstorming involves experts trying to find a solution or make a decision through emergent ideas being proposed during the brainstorming session. Emergent thinking in Cynefin (Snowden 2011) is seen as non-linear, subsequently, it can be inferred that brainstorming is inherently non-linear, supporting the professor's perception.

On non-linearity, the spatial sciences professor diverged from the marketing professors. This interviewee believed that non-linear thinking was more affiliated with the "pure work" as opposed to the applied work of the discipline. Two examples were presented. First, that "actually developing new spatial statistics" is "less linear" and that looking at a "raster view of the world vs. a vector view of the world" is not linear thinking (Interviewee #4). These two examples are specific to the spatial sciences.

These results indicate that although all the marketing professors saw some application of non-linear thinking, its specific uses were less part of the codified practices than linear thinking. In spatial sciences, it was seen as part of the "pure" science (see Prinsloo, 2018) as opposed to applied science. Even though this discipline uses Geographic Information Systems as a tool, there was not an articulated systems-based link between non-linear thinking, systems thinking, and GIS. If non-linear thinking was framed as systems thinking, the responses to this question may have been different.

4.5. Results From the Multi-, Inter- and Trans-Disciplinary Questions

Question 5 tried to ascertain how these interviewees defined multi-, inter- and trans-disciplinarity. The question was, "What are multi-, inter-, and trans-disciplinarity and what are the differences between them?" The professors found this question to be challenging, and only one interviewee made a clear distinction between these three constructs.

Starting with multidisciplinary, the marketing professors all had a similar perspective. At its core, they saw multidisciplinarity as involving people from different disciplines participating in a decision-making process that relies on each of their individual inputs, bringing the norms of their individual disciplines to the table. One of them framed this as "multiple disciplines brought under the team …to solve this problem with each one, contributing their expertise" (Interviewee #1). However, another professor saw multidisciplinarity as "bringing preconceived notions into the conversation" (Interviewee #2). This implies that in multidisciplinarity, expertise is brought to the table, but interactions do not necessarily occur. The spatial sciences professor shared this view but articulated it differently. Believing that "one member of the team creates an output of knowledge that is then picked up by the next link in the team" who then applies this to their output of knowledge for the team. This was termed as "outputs passed across a disciplinary chain". The primary difference between the marketing professors and the spatial sciences professor is that the spatial sciences professor framed multidisciplinarity as a linear process.

Interdisciplinary thinking was more difficult for them to define. One marketing professor simply passed on this question. The other two, however, were in close agreement. Interdisciplinary thinking involves those interactions between experts that were not present in multidisciplinary thinking, in the service of finding a solution to a problem. ("we have a problem that needs thinking, joint thinking", said Interviewee #3). One of them provided the example of a

doctor and a marketing expert sitting down together to design a better adhesive bandage (Interviewee #2). Elements of both fields of expertise would be needed to not just design a better adhesive bandage, but to design it so that it can be marketed successfully.

The spatial sciences professor focused primarily on interdisciplinarity in their response. They were quite specific that in true interdisciplinary work people with "deep training" are needed, but specifically people with deep training that work on the "outer edges" of those disciplines. Perhaps the clearest statement was "where the tools, methodologies, and epistemologies from one discipline are applied to a topic that is the province of another discipline." (Interviewee #4). The example they gave was behavioral economics, where the "methods of psychology (are) "applied to economics". They went on to discuss how spatial sciences is a blend of computer science and geography, and therefore interdisciplinarity.

All four professors indicated that they did not feel clear enough about transdisciplinary thinking to offer a definitive explanation. The spatial sciences professor passed on this question. The three marketing professors made an attempt. The same two who were confident about their definitions of interdisciplinary thinking agreed that transdisciplinarity involved persons with expertise in different disciplines coming together "to elevate thought so that the sum is more than the whole of the parts." (Interviewee #2) and the process is beyond either discipline. It is "a paradigm building approach that combines disciplinary thinking into a new framework." (Interviewee #3). These suggest transdisciplinarity is focused on creating knowledge and frameworks. The third professor offered an example of marketing professionals studying racetrack pit crews. The precision and speed at which racetrack pit crews work has informed marketing professionals about their practice. The common feature in transdisciplinary is that it is providing something 'new' – new thinking, knowledge, processes, and frameworks.

One professor, in an unsolicited comment, discussed the implications of transdisciplinarity for corporations. According to them, corporations have found that "people who had come through a given discipline…were often more limited in their solutions compared to people that had worked in a few different areas" (Interviewee #1). This is a real-world argument for facilitating transdisciplinary thinking in Higher Education.

4.6. Applying the Results to Curriculum Design

Phase two of the project is the curriculum development. This phase of the project brought together content from both disciplines and used the well-accepted instructional design principles that were discussed in Chapter 2. The results of the interviews were incorporated into the development of the content. Specifically, opportunities to engage in disciplinary thinking and applying disciplinary thinking by interacting with disciplinary representations and tools were developed. As discussed in Chapter 2, the instructional design principles are based on UDL, Backwards Design, and the TPACK framework of thinking. In developing the curriculum, instructor and social presence opportunities were considered, especially as they relate to adult learners. Finally, the curriculum was developed to provide opportunities for students to work in the second (good practices) and third (emergent practices) quadrants of Cynefin. In this section, the course design is explained and demonstrated using examples.

4.6.1. The Course

As previously stated, the course under discussion is MKT 599, housed in the marketing department of the Marshall School of Business at the University of Southern California. The purpose of this elective is to introduce utilizing GIS for marketing decision making. Although there is an entire department in Marshall dedicated to business statistics (Data Sciences and Operations), none of the courses in that department (or in marketing) have any curriculum which

supports students learning about the use of spatial data. The head of the marketing department views this as a gap in the curriculum and approved this course to fill that gap. He is interested in using this course to introduce students to geospatial data and marketing and to provide them with a level of comfort using GIS (Anthony Dukes, pers. comm., December 20, 2021).

From the beginning, this course was intended to be more applied than theoretical. Thus, the course was designed with multiple in-class workshops, two in-class projects, and a final group case project. There was also a mid-term, which was the only non-experiential evaluation of the course. The marketing frameworks used in the course, the 4 Ps and STP, are already part of these students' expertise.

4.6.2. An Example of Applying the Research to the Course Outcomes

The first step to designing a course is to initiate backwards design, otherwise known as backwards planning. A core principle of backwards planning is to create the learning outcomes first. In other words, one begins by establishing what the students should learn by the end of the course. Outcomes should be relevant, authentic, and span the entire course. Weekly outcomes should be able to be mapped back to the course outcomes. The original course outcomes (written before the research) for this course were the following:

- Develop models that support data-driven decision-making in marketing using spatial data.
- Create a data-driven marketing plan that leverages geospatial data.
- Develop and execute digital marketing plans based on spatial thinking and spatial data analytics.
- Segment consumers spatially using GIS methods and data.

- Address specific marketing challenges by leveraging geospatial data part of the STP (segmentation, targeting, and positioning) process.

Reflecting the findings gathered from the interviews, the outcomes were changed to better reflect disciplinary thinking in spatial sciences and in marketing. For instance, in the interviews, spatial reasoning (from Interviewee #4) and analyzing data (from all interviewees) were identified as disciplinary thinking. This result needs to be reflected in the learning outcomes as analyzing spatial data and reasoning with spatial data within the marketing context. This is manifested in Learning Outcomes (LO) #1, #2 and #3 below. Specifically, the following learning outcomes (LO) reflect the literature and the results of the interviews.

- LO#1: Employ spatial thinking and reasoning to create marketing plans.
- LO#2: Address marketing challenges by analyzing geospatial data using GIS.
- LO#3: Critically apply the analysis of geospatial data to marketing decision-making frameworks such as the 4 Ps (place, price, product, promotion) and STP (segmentation, targeting and positioning).
- LO#4: Contrast, connect, and correlate quantitative and qualitative thinking and representations, using geospatial data in marketing.
- LO#5: Effectively communicate a geospatial data-driven marketing plan to a target audience
- LO#6: Evidence transdisciplinary thinking in addressing marketing challenges with the use of geospatial data analysis tools.

4.6.3. An Example of Applying the Research Results to an Assignment

The second instructional design step was applying UDL principles to the development of weekly course activities. According to UDL, activities should involve multiple forms of engagement,

multiple representations of content and multiple forms of student expression. Both disciplines involve normative, broadly accepted mindsets, shared methods and tools of inquiry, and metacognition (Table 3). A transdisciplinary approach indicates that the content should involve aspects of both disciplines and, importantly, the interactions needed to connect these aspects.

The disciplines place different amounts of value on the theoretical versus the applied, which influenced the degree to which each was included in the course. Marketing involves the gathering and analysis of data. Spatial Sciences does as well, primarily with the use of GIS and related geospatial technologies to facilitate the gathering and analysis of data. Marketing involves frameworks. For this course two frameworks are used – the 4Ps of marketing and the STP (segmentation, targeting and positioning) framework. The analogy in spatial sciences, identified by Interviewee #4, is understanding, and applying theories. Other than Tobler's First Law, spatial science theory was beyond the scope of this introductory course. However, it is recognized that it is an important aspect within the field.

When working between disciplines, students must be able to clearly communicate their results to an audience. First, when analyzing geospatial data, marketing students evaluate the inherent assumptions and constraints of the data using spatial thinking and reasoning, a cornerstone of spatial sciences. Once the analyst draws conclusions, these are typically communicated in the form of a report, a presentation or both to a specific targeted audience. For students unfamiliar with spatial data, a section of the course that taught communicating with spatial data would prove valuable. This could be in the form of maps and infographics, tables, charts, graphs and other forms of spatial information representation.

The next section will discuss how the course designers attempted to use the findings from the interviews, as well as the educational frameworks articulated in Chapter 2, to create a single

course assignment. This is meant to provide an example, but also a template, for the development of more lessons moving forward.

Table 3. Disciplinary thinking in marketing and spatial sciences

Disciplinary Thinking consists of:							
Normative, broadly accepted mindsets Shared methods and tools of inquiry Metacognition							
Marketing				Spatial Sciences			
Gathers Analyzes Data	Applies frameworks	Evaluates assumptions constraints	Draws conclusions	Use of Improved computational tools	Knows theories	Spatial thinking & reasoning	Spatial communication

The case study is Project #1. It was preceded by the following 3 in-class workshops (worth 20 points each).

In-class Workshop #1: Esri Tapestry ZIP-code look-up is a free web based tool providing users with spatial segmentation data commonly used by marketers, displayed in a dashboard format. This workshop asked students to enter ZIP-codes, analyze the spatial data displayed, and reflect on the 4Ps in developing a customer profile for specific companies (Lime and Starbucks) in specific locations. It was completed in week 1 of the course.

In-class Workshop #2: Esri's ArcGIS Pro is a licensed desktop application providing users with the ability to choose, layer, analyze and display spatial data on a map. For the purposes of this course, business related, and customer segmentation data are the most relevant. This workshop asked students to explore the U.S. Census Bureau's American Community Survey (ACS) data by experimenting with layering the data using ArcGIS Pro. It was completed in week 3 of the course.

In-class Workshop #3: This workshop asked students to explore the features of the symbology pane in ArcGIS Pro to optimally represent spatial data for decision-making and communicating.

Project #1 was an in-class project, worth 75 points (the entire course is 1000 points), assigned in week 5 of the course. Project #1 asked teams of 4 or 5 to work together in ArcGIS Pro to accomplish the following:

1) Map the location of fast-food franchises for 8 different companies.
2) Add demographic data from the ACS.
3) Create a series of buffers around specific franchise locations.
4) Identify specific franchise locations that would benefit from a geofencing campaign. Geofencing is the practice of establishing a digital perimeter, or 'fence', around the location. When customers with an electronic device, usually a phone, enter the 'fence', an action, such as a push notification, is issued. This is intended to draw the customer to the franchise.
5) Identify specific franchise locations that will benefit from a geoconquesting campaign. Geoconquesting is a methodology for luring customers from a competitor to a franchise. A digital perimeter is established around a competitor's location. When a potential customer with an electronic device enters the perimeter around the competitor, an action, such as a push notification, is issued. It is intended to draw the customer away from the competitor and to the franchise. With geoconquesting it is common to provide a motivation to a competitor by offering coupons and discounts in in the push notifications.

6) Utilize point data in the form of franchise locations, with line data, in the form of TIGER/line files of major roads, and areal data such as ACS demographic data, to perform spatial analysis to inform marketing decision making around geofencing and geoconquesting interventions

As an example of how the research conducted for this thesis related directly to this assignment, the steps for Part 2 of the project (geofencing) were related to the four disciplinary thinking categories for each discipline that were derived from the research. Table 4 shows the ways in which the sub-tasks involved in Step 2 reflect themes from both disciplines. Gathering and analyzing marketing data is frequently done in conjunction with the use of GIS. This is indicated in Table 4 by Xs for those two constructs. There is also a relationship between applying frameworks (which are grounded in theory) and knowing theories. It is important to note that in this project there were almost no activities that required spatial sciences theory. This is addressed in the conclusions as something to further explore.

Throughout this exercise, students need to be aware of assumptions and constraints which for this project means applying spatial reasoning and thinking. One example of this might be the assumption that two fast food locations within 3 miles, as measured using Euclidian distance, of one another are direct competitors. The marketing constraint on this assumption is that fast food chains have more or less direct competitors – Chick-fil-A may not compete as directly with Burger King as it might with Kentucky Fried Chicken, for instance. The spatial sciences constraint on this assumption is geography and roads. Two competing franchises may have a geographic barrier between them (a river or a mountain, for instance) which would define their market area differently than if they are 3 miles apart on an interstate.

Table 4. Disciplinary thinking constructs applied to an assignment

	Disciplinary Thinking consists of:							
	Normative, broadly accepted mindsets Shared methods and tools of inquiry Metacognition							
	Marketing				Spatial Sciences			
Part 2: Geofencing (60 minutes) The assignment: Chick-fil-A wants to identify two places in the Maryland-Washington DC area (the full mapped area) as potential places for geofencing campaigns. Your job is to locate appropriate locations, recommend the geofence and justify your decisions. You will submit a final report answering the questions below with both maps and narrative.	Gathers & analyzes data	Applies frameworks	Evaluates assumptions & constraints	Draws conclusions	Use of improved computational tools	Knows theories	Spatial thinking & reasoning	Spatial communication
Use the point file data that is provided of the locations of 8 fast food restaurant chains in the Maryland, Washington DC area. Geocode them. Create a map in ArcGIS Pro of the locations.	X				X			
Do a visual reconnaissance of the map. Identify patterns/relationships that can be useful in decision making	X	X			X		X	
Decide on demographic variables to map that will be useful in decision-making. Some research on the company that you are looking at may be useful in these decisions.	X	X	X	X			X	
Find ACS data in the Living Atlas that will provide you with the demographic variables. Add to the map.	X				X			
View the attribute tables of the ACS data. Are the demographic variables that you are interested in there?	X				X			
Find the appropriate scale(s) for viewing your demographic and franchise data.	X		X	X	X		X	
Using the Contents pane and the Symbology pane: Experiment with the visualization of the data. 1) Primary Symbology: experiment with the 8 primary symbology choices to determine which ones would be best to use for analysis.	X	X	X		X		X	

2) Color scheme: Review different methods of colorizing the data. Explore the different methods with different primary symbology and color schemes. Check the Histogram to help inform your exploration.	X		X		X		X	
3) Decide on a visualization method. Justify your decision.		X	X	X	X		X	
4) Create your maps. Check the labels and clean them up as necessary.					X		X	X
Locate the TIGER/Line file for primary and secondary roads in the area. Add the TIGER/Line data to the map. Adjust symbology as appropriate. Justify your decisions.	X				X		X	
Choose two fast food restaurants that would benefit from geofencing. Justify your choice.		X	X	X	X		X	
Create geofencing buffers around these franchises. Justify your buffer distance and type.	X	X	X		X		X	
Decide on maps that provide visualization information that you think communicates. Justify your use of these maps.		X	X	X	X		X	X
Discuss your interpretation of the map – what information does the map provide you? How might this information be used in marketing decision making? Submit in a report.		X	X	X	X		X	X

Finally, drawing conclusions and communicating spatial data are closely connected. In the end a marketing professional will need to draw conclusions and clearly communicate them in spatial terms. The relationships between marketing and spatial sciences support the development of the transdisciplinary curriculum by demonstrating multiple opportunities where both kinds of thinking can be integrated. If there were no depth of relationship, the structure would be defined as multidisciplinary – each of the constructs would be invoked individually and addressed individually. As this example of competition demonstrates, these constructs are more effective in problem-solving when they are addressed together.

Quantitative and qualitative thinking were infused throughout this assignment. Although the results from the marketing interviews found a qualitative → quantitative → qualitative process to be core to marketing practices, in fact with the use of GIS a more integrated data

Table 5. Applying qualitative, quantitative, linear and non-linear constructs to an assignment

Part 2: Geofencing (60 minutes) Chick-fil-A wants to identify two places in the Maryland-Washington DC area as potential places for geofencing campaigns. Your job is to locate appropriate locations, recommend the geofence and justify your decisions. You will submit a final report answering the questions below with both maps and a narrative.	Qualitative	Quantitative	Linear	Non-linear
Use the point file data that is provided of the locations of 8 fast food restaurant chains in the Maryland, Washington DC area. Geocode them. Create a map in ArcGIS Pro of the locations.	X	X	X	
Do a visual reconnaissance of the map. Identify patterns/relationships that can be useful in decision making	X			X
Decide on demographic variables to map that will be useful in decision-making. Some research on the company that you are looking at may be useful in these decisions.		X		
Find ACS data in the Living Atlas that will provide you with the demographic variables. Add to the map.		X	X	
View the attribute tables of the ACS data. Are the demographic variables that you are interested in there?		X		
Find the appropriate scale(s) for viewing your demographic, franchise data.		X		X
Using the Contents and Symbology pane: Experiment with the visualization of the data. 1) Primary Symbology: experiment with the 8 primary symbology choices to determine which ones are best to use for analysis.	X	X	X	X
2) Color scheme: Review different methods of colorizing the data. Explore the different methods with different primary symbology and color schemes. Check the Histogram to inform exploration.	X	X	X	X
3) Decide on a visualization method. Justify your decision.	X	X	X	X
4) Create your maps. Check the labels and clean them up as necessary.	X	X	X	X
Locate the TIGER/Line file for primary and secondary roads in the area. Add the TIGER/Line data to the map. Adjust symbology as appropriate. Justify your decisions.	X	X	X	
Choose two fast food restaurants that would benefit from geofencing. Justify your choice.	X	X	X	
Create geofencing buffers around these franchises. Justify your buffer distance and type.		X	X	
Decide on maps that provide visualization information that you think communicates. Justify your use of these maps.	X	X	X	
Discuss your interpretation of the map. What information does the map provide you? How might this information be used in marketing decision making? Submit in a report.	X	X	X	X

approach was introduced. For instance, students needed to identify the appropriate ACS data to layer into their maps. This is qualitative as they have to decide on the appropriate demographic information they wish to include in the analysis, and quantitative as they have to codify the data in a meaningful way for the analysis. As the students progressed in this assignment, the treatment of the data involved both qualitative and quantitative aspects, as is indicated in Table 5. Exploratory work in the course was considered non-linear. As previously discussed, the interviewees reported that linear processes go step-by-step. Given these interpretations of linear and non-linear, Table 5 reveals areas of just linear work, just non-linear work and areas where the two are used together, usually with a linear process invoked inside a non-linear process.

It is important to link these processes to the Cynefin framework. Best and good practices in the framework involve essentially linear thinking for knowledge development. Emergent practices are a non-linear process. All three quadrants are essential for learning. However, in this research the emphasis on emergent thinking links the knowledge development framework of Cynefin to the transdisciplinary space. The transdisciplinarity of the course is a result of the students engaging with that third quadrant of Cynefin – emergent thinking.

As transdisciplinarity involves creating new thinking and frameworks, looking at Tables 4 and 5 allow speculation on where transdisciplinarity might emerge. It is most likely to appear in parts of the assignment which had the most marketing and spatial sciences, as well as quantitative and qualitative, and linear and non-linear components. This occurs at two points in the assignment completion process. The first is when the student is determining the variables to be used, how to use them, and how to map them. These activities direct the student to use spatial sciences thinking to determine marketing parameters. The other place in the process is in the

final interpretation of the map and the discussion as to how this information might be utilized. This is where the aggregation of work in marketing and spatial sciences can enable a student to both articulate and justify their analysis and interpretation processes. Framing decision-making through metacognition, including both marketing and spatial sciences, is demonstrated in the above example. This type of transdisciplinarity, influenced by the literature and expert opinion, was one goal in the development of this course.

Chapter 5 Discussion and Conclusions

This study examined disciplinary thinking in the spatial sciences and marketing fields at the University of Southern California within the context of introducing GIS into a course in the marketing program in the Marshall School of Business. The contention was that to effectively integrate GIS, students must also be able to engage in the disciplinary thinking of spatial sciences. In particular, the importance of spatial thinking in marketing must be more widely recognized. This study suggested that this result is best achieved when designing for a transdisciplinary environment.

5.1. Findings

The findings are based on the literature on disciplinary thinking, which guided the expert interviews, and influenced the development of the marketing course. In the interviews, professors from marketing and from the spatial sciences agreed that disciplinary thinking is normative, epistemological and metacognitive. What constitutes disciplinary thinking for each was different. The ways in which these elements of disciplinary thinking – and the knowledge representations, use of tools, and applications that are a result of disciplinary thinking – can support a transdisciplinary learning environment was then discussed.

From the perspective of the interviewee from the spatial sciences, the qualities of disciplinary thinking include spatial thinking, spatial reasoning, and communicating using spatial representations and quantitative thinking. These forms of thinking are represented in the discipline through non-text, symbolic representations of spatial data – frequently maps, but also graphs, charts and diagrams. The use of GIS and related geospatial technologies as a tool is integral to these disciplinary practices. The use of these representations to analyze, problem solve, contribute to decision making, and communicate is core to the discipline.

In the discipline of marketing, interviewees identified the qualities of disciplinary thinking as habits of mind, which can be formalized through qualitative and quantitative reasoning and frameworks. Marketers need theories and frameworks, such as the 4 Ps, to apply these to their work. Marketers need to evaluate assumptions and constraints as part of data analysis and use these analyses for practical decision making. This involves qualitative thinking embedded in more traditional ethnographic research methods, as well as break-even analysis and price elasticity of demand. These forms of thinking result in representations which span the continuum from symbolic and non-text representations to the appropriate use of disciplinary language.

These elements of the discipline of marketing, namely, the integration of qualitative and quantitative frameworks, are already established. When bringing in a tool such as GIS, developed outside of the field of marketing, the classroom environment becomes transdisciplinary. The elements of spatial sciences and marketing are both considered. To use GIS effectively, the marketer needs spatial thinking, reasoning, and communication skills. In the future, quantitative skills that are already a part of marketing need to be further developed to include spatial analyses and representations.

5.2. Conclusions

This project has demonstrated that transdisciplinary thinking, and subsequently transdisciplinary course design, is an ideal framework for integrating spatial analysis into the marketing curriculum. The findings from the expert interviews were used to inform the instructional approaches and content. Thus, spatial sciences theories and techniques were not simply inserted into a previously existing course. Rather, this research on transdisciplinarity informed the

instructional design from the beginning, integrating the disciplines rather than teaching material from each separately.

In this case, spatial thinking, representations of spatial thinking, tools of spatial analysis, and the application of spatial data to marketing problems are not generally prioritized by marketing professors. To optimize the use of GIS within the discipline, these elements must be included in the curriculum. The most common framework used in marketing – the 4Ps – has 'Place' as one of the 4 Ps, which is an inherently spatial concept. The other Ps – price, promotion, and product all can have spatial components, as they all vary depending on the 'place'. By including GIS in the marketing curriculum, the interrelatedness of the 4Ps and their spatial components become more apparent.

One way to accomplish this optimization would be a reframing of the 4Ps. This could include diving more deeply into the interrelatedness of the 4Ps and their spatial aspects, moving away from their compartmentalized application. Reframing the 4Ps in this way could provide more depth of understanding and provide a structure for marketing and business departments to better integrate concepts and methods from the spatial sciences, thus resulting in higher level student outcomes.

Further, introducing spatial sciences into marketing curricula could help integrate quantitative and qualitative approaches to research. In speaking with the marketing subject matter experts, an agreed-on framework of the researcher process was focus group (qualitative, ethnographic) → survey (quantitative)→ confirmation (qualitative). This process can be facilitated through the use of GIS, which makes quantitative analyses accessible. Through combining methodologies, the field of marketing becomes able to answer a wider range of questions using quantitative and qualitative methods.

Figure 12 shows the transdisciplinary outcomes possible in a learning environment that includes both spatial sciences (with a focus on GIS) and marketing.

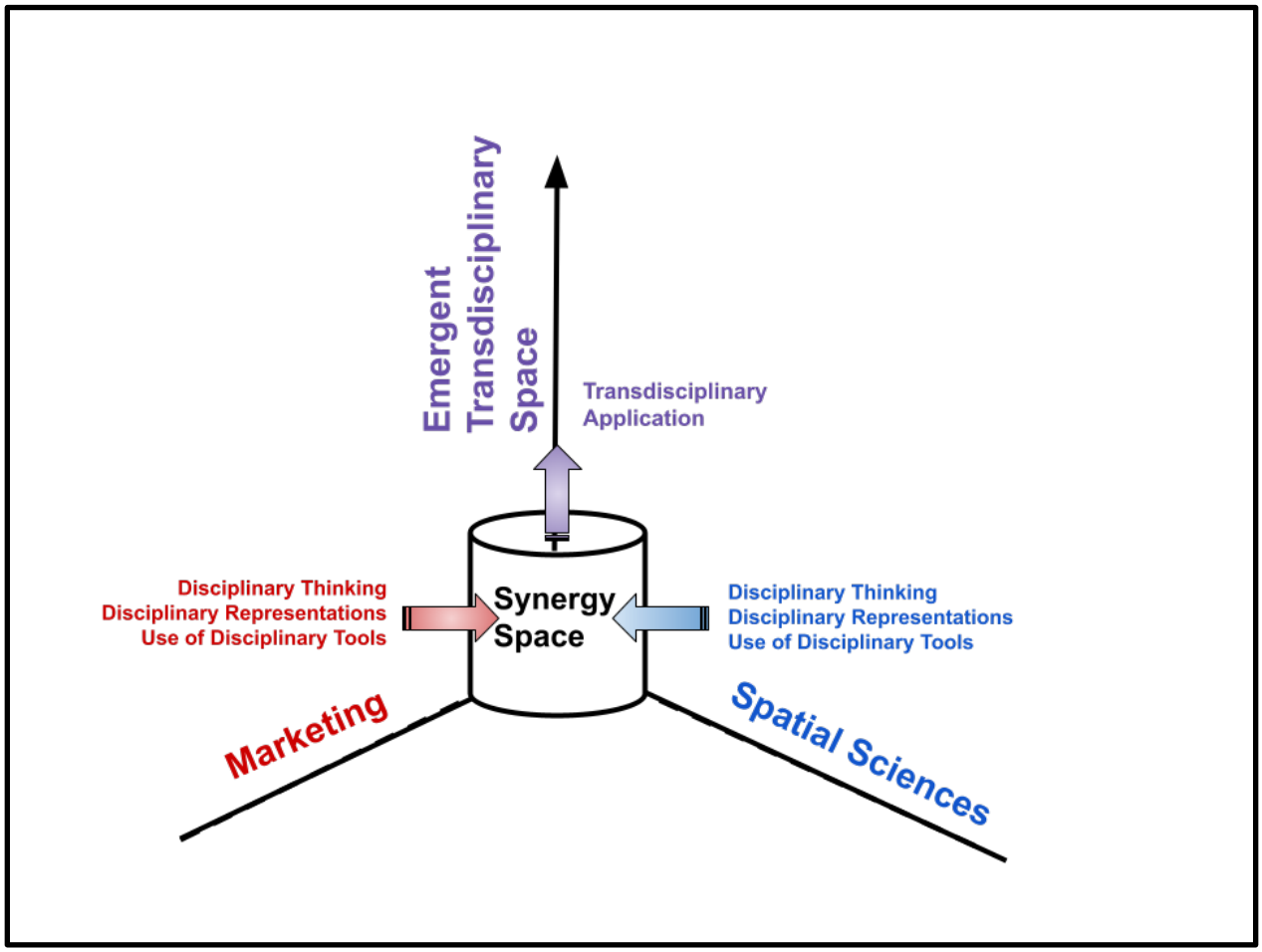

Figure 12. Relationship between disciplinary thinking and transdisciplinary thinking.

Two examples that show the interconnections between these disciplines are geofencing and geoconquesting. While these terms are specific to marketing, the concepts are likely familiar to spatial and other social scientists. A geofence is a virtual border set up around a business. When individuals with mobile devices enter the geofence, a 'push' is triggered on their mobile device, inviting them into the business. Geoconquesting is when individuals with a mobile device enter the geofence of a nearby competitor. A push is sent to draw them away from the competitor and to another business. Utilizing GIS, and visualizing the results spatially, can be

instrumental in deciding how large the geofence should be (1 km?, 3 km? 5 km?) and the geofence's parameters (walk time? drive time? drive distance?). Geofences can be visualized as concentric circles, or, especially with various mobility routes, geofencing appears as a jagged perimeter because pedestrians, bicycles and automobiles follow specific routes. The technical capacity of a GIS to visualize these parameters prove useful in making decisions about the implementations of these marketing strategies. More powerful and important than simply utilizing a built-in mapping function is supporting students to acquire a deeper understanding of how to interpret a map, as well as how that map was constructed.

This integration of disciplines provides a critical and deep way of thinking about these phenomena. A critical thinker might ask how the differences in a geofence's parameters help marketers think about marketing, and how this relates to the 4 Ps. A student might go on to ask how price is implemented in a geofence, as push notifications might provide a coupon or highlight a sale. Ideally, the student recognizes a connection between price, location/place, and product promotion. Also, products bought by people in an area can be highlighted in a geofence, which may dictate demographic analysis. Just by considering the phenomenon of geofencing, a student must recognize the interconnections between disciplines. More so, they utilize and integrate qualitative and qualitative tools to provide actionable conclusions.

5.3 Limitations

There were some limitations to this study. The primary limitation was the small sample size of the interviewees and the way the interviewees were identified. The sample size of four, even for ethnographic work, is limited, particularly as there was only one expert from spatial sciences that was identified. For future work, it could be useful for a larger number of experts to be recruited to participate in the in-depth interview process to better validate the results.

Additionally, all the experts were from academia – the Spatial Sciences Institute at USC and the Marketing Department in the Marshall School of Business at USC. For future studies, it would be important for the identified experts be from a wider field. For instance, academics from other institutions may have a different perspective on what disciplinary thinking is for their field of expertise. Also, it would be more robust to consider experts outside of academia. For marketing that could come from corporations. For spatial sciences there are experts in both government and private industry who could shed more light on the nature of disciplinary thinking and expertise in the field. As the students taking this course are primarily going to enter the corporate world, this expansion of the consideration of expertise could increase the validity of the research. Potentially, this additional research could also further refine our understanding of the results.

5.4. Recommendations

Spatial sciences should occupy a larger role in the business and marketing curriculum at USC and beyond. Spatial analysis provides a critical tool to help achieve the objectives of marketers, and thus should be a skill set all marketing students are familiar with. Although place is a cornerstone of marketing, marketing professors could foster and support the spatial thinking of their students. There is a tacit assumption that students have spatial thinking as a part of their skill set. However simply adding spatial analysis techniques such as GIS to a marketing course is not sufficient to provide students with the critical transdisciplinary skills needed to integrate the potential complementarity of these disciplines. Rather, the course itself must include spatial reasoning and interpretation to be able to use spatial analysis tools effectively.

From an educational psychology (learning and instruction) point of view, this research informs the instructional design of transdisciplinary courses which involve the introduction of

software from one discipline into another discipline. Specifically, the designer needs to leverage disciplinary thinking in both disciplines, not just as separate skills to be learned. Instead, transdisciplinary courses should engage students in emergent thinking which draws on both disciplines. Designing activities with this approach, the instructional designer can explicitly draw on the subject matter expertise of the disciplinary experts and apply the educational frameworks, such as Cynefin and TPACK, to create a transdisciplinary experience for the students.

And of course, spatial thinking can prove useful in a number of courses and disciplines, not just marketing. Everything happens somewhere, and place is an actor in nearly every field. Thus, there is the potential for spatial sciences to facilitate the goals of other disciplines. The approach used in the project could prove to be a template for how to conduct background research on the relationship between two disciplines and best integrate them to achieve disciplinary goals.

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Appendices

Appendix A: Interview Questions

Part 1: General Information

Q1: Faculty position

Q2: Date of Interview

Q3: Interview modality

a) In-person
b) By telephone
c) Over Zoom

Q4: How many years have you worked as a (marketing, spatial sciences) professional, in and out of academia?

a) 0 – 5
b) 6 – 10
c) 11 – 15
d) 16 – 20
e) 20 +

Q5: How many years have you been a professor?

Part 2: Interview Questions

Q1: What do you define as disciplinary thinking?

Clarifications – disciplinary literacy, disciplinary habits of mind

Q2: What do you identify as forms of disciplinary thinking in (marketing) (spatial sciences)

Probe: What do you find to be the most important types of disciplinary thinking in (marketing) (spatial sciences)?

Probe: Are there forms of disciplinary thinking that are unique to your discipline? If so, what are they?

Q3: How do you use qualitative and quantitative thinking in your discipline?

Probe: What is the balance between qualitative and quantitative thinking in your profession?

Probe: Please provide examples of how you use these two types of thinking in your discipline?

Q4: How do you define linear thinking? What about non-linear thinking?

Probe: What is the balance between linear and non-linear thinking in your profession?

Q5: Do you feel like you understand the definitions of multi-, inter- and trans-disciplinarity? If so, what do you think are the key differences between them?

Appendix B: Original Syllabus 599 GIS and Decision Making in Marketing

MKT 599 Geographic Information Systems (GIS) Application in Marketing Strategy

Spring 2022
January 10–April 29
May 2–May 5, Finals Week
3 units, **Wednesdays 6:30pm to 9:30pm**

Course Syllabus

INSTRUCTORS: Miriam Burgos
Email: miriam.burgos@marshall.usc.edu
Phone: (626) 627-3029
Zoom (for office hours): contact Professor Burgos for individual links

Beth Wellman
Email: lwellman@marshall.usc.edu
Phone: (424) 230-1603
Zoom (for office hours): contact Professor Wellman for individual links

OFFICE HOURS: Prof Burgos: By appointment
Prof Wellman: Monday 4pm – 5pm, or by appointment

EMERGENCY NUMBERS: USC Emergency Info Line: 213-740-9233
USC Emergencies: 213-740-4321
USC Information Line: 213-740-2311 or KUSC Radio (91.5 FM)

PREREQUISITES: 1 from (GSBA 509 or GSBA 509a or GSBA 528)

COURSE MATERIALS:
Readings: Links will be made available within the course for the readings.
You do not have to purchase a textbook or course reader/course pack.
Software: ArcGIS Pro with Business Analyst. Instructions for download are available in Blackboard.

COURSE DESCRIPTION
This course offers an introduction to the fundamentals of Geographic Information Systems spatial data as they relate to decision-making in Marketing Strategy. This course will be taught as a lab-based class, where students will experiment hands-on with GIS software to address specific marketing challenges. Students will learn the fundamentals of spatial thinking and will also explore specific applications of GIS platforms such as ESRI Tapestry and ArcGIS Business Analyst. This course will also cover how GIS data are gathered, predictive modeling for marketing decision-making using GIS data, and the relationship between digital/mobile marketing, social media, and GIS models. Students will have many opportunities to discuss real-world marketing applications of GIS data at various multi-national firms.

COURSE LEARNING OUTCOMES

Upon successful completion of this course, students will be able to:

1. Develop models that support data-driven decision-making in Marketing using GIS data.
2. Create a data-driven marketing plan that leverages spatial data.
3. Develop and execute digital marketing plans based on spatial thinking and GIS data analytics.
4. Segment consumers using GIS data.
5. Address specific marketing challenges by leveraging analysis of spatial data as part of the STP (segmentation, targeting, and positioning) process.

GRADING POLICY

The course grade is based on synchronous class participation, moderated discussion forums, pre-work and homework, projects, quizzes and exams. Unless otherwise stated, all readings, discussion forums, homework assignments, and quizzes must be completed prior to synchronous class sessions. For more information on grading policies, go to: http://www.usc.edu/dept/ARR/grades/gradinghandbook/gradingpolicies.html.

TOPIC AND ACTIVITIES	Points	% OF GRADE	DUE DATES
Participation and in-class workshops (5)	150	15%	weekly
Cases and In-class projects (3)	250	25%	As assigned
Midterm	300	30%	Feb 28 (in-class)
Final Project	300	30%	Final's week
Total:	1000	100%	

Class participation is an extremely important part of the learning experience in this course. A course such as this one, which incorporates the frequent use of case analyses to illustrate the practical application of concepts and practices, requires students to diligently and thoroughly prepare cases and actively offer the results of the analyses and conclusions derived as well as recommendations during each class session. Our expectation and that of your classmates is that you are prepared for *all* classes and will actively participate in and meaningfully contribute to class discussions.

In-class participation is also a critical part of this course's learning experience. Cold calling may take place to encourage active in-class participation and to gain multiple perspectives and points of view, thus lending itself to the richness of the learning experience. In-class participation grading will be based on students' demonstrated willingness to participate, and the quality of the comments expressed, rather than quantity. While some students are far more comfortable than others with class participation, *all* students should try to contribute meaningfully.

Students will offer their opinions in group settings many times in their careers; thus, class participation serves to prepare students for this business experience.

The evaluation of in-class participation is based on the following:

- *Relevance* – Does the comment or question meaningfully bear on the subject at hand? Irrelevant or inappropriate comments can detract from the learning experience.
- *Responsiveness* – Does the comment or question connect to what someone else has said?
- *Analysis* – Is the reasoning employed consistent and logical? Has data from course materials, personal experience, or general knowledge been employed to support the assertions/findings?

- *Value* – Does the contribution further the understanding of the issues at hand?
- *Clarity* – Is the comment concise and understandable?

To underscore the importance of participation, 15% percent of the course grade will be allocated to class participation.

General guidelines for class and lab participation:

Excellent Performance
- Initiates information relative to topics discussed
- Accurately exhibits knowledge of assignment content
- Clarifies points that others may not understand
- Shares personal experiences or opinions related to topic
- Offers relevant / succinct input to class
- Actively participates in class exercises
- Demonstrates ability to apply, analyze, evaluate & synthesize course material.
- Demonstrates willingness to attempt to answer unpopular questions
- Builds on other students' contributions
-

Average Performance
- Participates in group discussions when asked
- Demonstrates knowledge of course material
- Offers clear, concise, "good" information on class assignments
- Offers input, but tends to reiterate the intuitive
- Attends class regularly
-

Unacceptable Performance
- Fails to participate even when directly asked
- Gives no input to discussions
- Does not demonstrate knowledge of the readings
- Shows up to class: does nothing
- Distracts group / class
- Irrelevant discussion

CLASSROOM POLICIES – SPRING 2022

1. Active class participation is important in achieving the learning objectives for this course. Unless students provide an accommodation letter from USC OSAS or from Marshall detailing visa or travel restrictions, attendance and active participation is expected in the classroom.
2. Any student with such accommodations should submit their accommodation document to their instructor as soon as possible. Your instructor will then provide regular access to a recording of the class and an opportunity to regularly make up missed in-class participation.

CASES

Students will be expected to analyze, prepare, and discuss cases such as Walgreens and Starbucks in order to understand and master GIS applications as part of real-world marketing challenges. Further instructions and grading standards will be posted in Blackboard.

TEAM PROJECT

Students will self-select teams using a set of guidelines that will be provided in class by your instructors. Students will work in teams of 4 – 5 members. Upon completion of the team project, students will be asked to submit a peer-evaluation form, included in this syllabus. Additional project instructions will be posted in Blackboard and discussed in class. ArcGIS Business Analyst will be required resources for completion of the team project.

EXAM

MKT 599 will include one exam (midterm exam) which will count for 35% of the overall course grade. The exam will be taken individually, with no collaboration allowed among students. It will be open-book, open-notes, and will require use of certain web-based resources. Further details will be posted in Blackboard and discussed in class.

TECHNOLOGY REQUIREMENTS

Online lectures will take place via Zoom, with links provided via Blackboard. Therefore, you must have access to the Internet to view/hear lectures. No special software is required.
The lecture presentations, links to articles, assignments, quizzes, and rubrics are located on Blackboard. To participate in learning activities and complete assignments, you will need:

- Access to a working computer that has a current operating system with updates installed, plus speakers or headphones to hear lecture presentations;
- Reliable Internet access and a USC email account;
- A current Internet browser that is compatible with Blackboard (Google Chrome is the recommended browser for Blackboard);
- A working video camera with microphone for use on Zoom;
- Microsoft Word as your word processing program; and
- Reliable data storage for your work, such as a USB drive or Office365 OneDrive cloud storage.

SOFTWARE

The ArcGIS and Business Analyst software is available as a download. The resources to access the software and the instructions for download are available in Blackboard and will be discussed in class.

CLASS CONDUCT/NETIQUETTE

Professionalism will be expected at all times. Because the university classroom is a place designed for the free exchange of ideas, we must show respect for one another in all circumstances. We will show respect for one another by exhibiting patience and courtesy in our exchanges. Appropriate language and restraint from verbal attacks upon those whose perspectives differ from your own is a minimum requirement. Courtesy and kindness is the norm for those who participate in our class.

Our discussion boards are a way for you to share your ideas and learning with your colleagues in this class. We do this as colleagues in learning, and the Discussion Board is meant to be a safe and respectful environment for us to conduct these discussions.
Some Netiquette Rules:

- Dress respectfully. Video conference business meetings are and will be the norm, so practice your professional telepresence.
- Virtual background respectfully professional
- Display both your first and last name during video conferencing and synchronous class meetings.
- Respectfully minimize distractions with muting and video off when moving around
- Disagree respectfully
- Respectfully pay attention to classmates
- When sending an email, please include a detailed subject line. Additionally, make sure you reference the course number in the message and sign the mail with your name.
- Use proper grammar, spelling, punctuation, and capitalization. Text messaging language is not acceptable. You are practicing for your role as a business leader.
- Re-Read, think, and edit your message before you click "Send/Submit/Post." As a check, consider whether you would be comfortable with your email or post or text being widely distributed on the Internet.

COURSE OUTLINE AND ASSIGNMENTS

Reading materials and pre-work will be published on a weekly basis in Blackboard. For example, pre-work for our January 19th class session will be published in Blackboard at 8:00a.m. on January 13th, the morning after our January 12th session. We will follow this schedule every week.

Date (2022)	**Topic**	**Activities/Assignments (See Bullets for Deliverables)** *Please complete readings and watch assigned videos prior to class session. All readings will be in Blackboard. Class sessions may be moved around depending on the availability of guest speakers*
1/12 Wk 1	**Introduction to the fundamentals**	• Introduction to the Course • **Workshop #1 (20 pts)**
1/19 Wk 2	**The concept of spatial thinking, and related career paths**	
1/26 Wk 3	**Experimenting with ArcGIS**	• **Workshop #2 (20 pts.)**
2/2 Wk 4	**Lab: ArcGIS**	• **In-class Project #1 (75 pts.)**
2/9 Wk 5	**Background on GIS data: How it's gathered, updated, and validated**	
2/16 Wk 6	**Deep-Dive: Real-World GIS Marketing Applications at Walgreens**	• **Workshop #3 (20 pts)**
2/23 Wk 7	**Social Media, GIS and Marketing**	• **In-class Project #2 (75 pts)**
3/2	**Midterm Exam**	• **Midterm. In-class.**

Date (2022)	Topic	Activities/Assignments (See Bullets for Deliverables) *Please complete readings and watch assigned videos prior to class session. All readings will be in Blackboard. Class sessions may be moved around depending on the availability of guest speakers*
Wk 8		
3/9 Wk 9	**Predictive modeling using GIS data, pt. 1**	• **Workshop #4 (20 pts.)**
3/16	**Spring Break**	
3/23 Wk 10	**Student team conferences**	**Student-team conferences with Profs Burgos and Wellman to begin work on final team projects.**
3/30 Wk 11	**GIS Data-Modeling for team projects**	
4/6 Wk 12	**Geofencing The skill set associated with Nespresso**	• **Workshop #5 (20 pts.): A Geofencing exercise with Nespresso**
4/13 Wk 13	**Formal proposal presentations**	
4/20 Wk 14	**Improved customer communication**	• **In-class Project #3 (100 pts.)**
4/27 Wk 15		
5/4 finals	**Final Presentations**	**Final team presentations**

STATEMENT ON ACADEMIC CONDUCT

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own (plagiarism). Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. All students are expected to understand and abide by the principles discussed in the *SCampus*, the Student Guidebook (USC SCampus). A discussion of plagiarism appears in the University Student Conduct Code (section 11.00 and Appendix A).

Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: USC Student Judicial Affairs and Community Standards. Failure to adhere to the academic conduct standards set forth by these guidelines and our programs will not be tolerated by the USC Marshall community and can lead to dismissal.

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards". Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and USC policies on scientific misconduct.

SUPPORT SYSTEMS

USC Emergency Information USC Emergency

If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

The Office of Disability Services and Programs (213) 740-0776
The Disability Services and Programs(DSP) office provides certification for students with disabilities and helps arrange the relevant accommodations. Any student requesting academic accommodations based on a disability is required to register with DSP each semester.

Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. Go to: USC Engemann Student Health Center Website

National Suicide Prevention Lifeline -1-800-273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. Go to: National Suicide Prevention Lifeline

Relationship & Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. Go to: USC Engemann RSVP Services

Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the Website: Sexual Assault Resource Center

Office of Equity and Diversity (OED)/Title IX compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. Go to: Office of Equity and Diversity Website

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. Go to: USC Student Affairs - Bias Assessment Response and Support

Student Support & Advocacy – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. Go to: USC Student Affairs - Student Support and Advocacy

Diversity at USC–Diversity Matters
Tabs for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, Resources for Students

American Language Institute-ALI
Students whose primary language is not English should check with the *American Language Institute,* which sponsors courses and workshops specifically for international graduate students.

TECHNOLOGY SUPPORT
Additional Information on Support is in the Portal.

- Canvas

- Click the "Help" icon on the left side of each Canvas page
- Support via phone is available 24/7 at (+1) 844-408-6460

- Zoom Video Web Conferencing System (MarshallTALK)
  - Self-help is available at https://support.zoom.us/hc/en-us
  - Support via phone is available 24/7 at (+1) 888-799-9666 ext. 2 or (+1) 650-397-6096 ext. 2

- USC Systems(USC Login, MyUSC, USC Gmail, GoogleApps)
  - Support via phone is available 24/7 at (+1) 213-740-5555
  - Support via email is available atconsult@usc.edu

- Marshall Systems (MyMarshall, Marshall Outlook email, Office365, OneDrive)
  - Support via phone is available Monday-Thursday, 8:00am-10:00pm (Pacific) and Friday-Saturday, 8:00am-5:00pm (Pacific) at (+1) 213-740-3000
  - Support via email is available at helpdesk@marshall.usc,edu
  - Self-help is available in MyMarshall:
    - Login with your Marshall account at https://mymarshall.usc.edu
    - Click “Help” in the upper right corner

Note: Please refer to the resources listed above to report a problem or if you need assistance using these platforms.