

# A Brief Narrative and Survey of Interdisciplinary Learning and the Corporatization of Skills

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## History.

Some scholars argue that interdisciplinary learning's medieval roots arose during the Middle Ages in Western Europe. Like contemporary university undergraduates/graduates with interdisciplinary majors who must now work in science-policy-management-business interfaces, the Renaissance Person excelled in a large number of subject areas during late Middle Ages Italy (and later Europe). It was polymath ideal that combined culturalism with humanism (a belief in the limitless human capacity for continual development) and the pursuit of universal knowledge, as opposed to the "hyper-specialist". Some argue that the modern roots of interdisciplinary studies date back to the 1930s. Proponents at that time advocated curriculum integration through joint teacher planning and block scheduling.<sup>1</sup> In December 1958, Wesleyan University President Victor Butterfield and the university educational policy committee advocated eliminating traditional departmental structure of the US university system into semi-autonomous interdisciplinary colleges/divisions to facilitate fields like literature, philosophy, art, and science to "shed light" on each other.<sup>2</sup>

From the 1960s, the proliferation of interdisciplinary teaching/studies empowered formerly marginalized subjects like women's studies, African American studies, etc. to challenge the established disciplines that neglected their contents and systematically legitimized themselves through strong scholarship/curriculum/teaching with their own journals, monograph series at university presses, and professional associations with annual field meetings.<sup>3</sup> Fusion and

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1 Jones, Casey, "Interdisciplinary Approach - Advantages, Disadvantages, and the Future Benefits of Interdisciplinary Studies" dated 2009 in ESSAI: Vol.7, Article 26 [downloaded on 1 Jan 2019], available at <http://dc.cod.edu/essai/vol7/iss1/26>, p.76.

2 Kleinberg, Ethan, "Interdisciplinary Studies at a Crossroads" dated Winter 2008 in Liberal Education Vol.94 No.1 [downloaded on 1 Jan 2019], available at <https://www.aacu.org/publications-research/periodicals/interdisciplinary-studies-crossroads>

3 Ibid.

hybridization between traditional-traditional, traditional and formerly non-traditional (now established), traditional-non-traditional, disciplinary-multidisciplinary courses and modules started taking place by the end of the 20th century. The concept of contemporary Renaissance Person education was first broached by tertiary education in the West in the 1990s. The early conceptual idea then was to create one unified community of international academicians connected by the nexus of a common language across inter-disciplinary subjects.

By the 21<sup>st</sup> century, they also come with their own niche markets and student consumers who take these classes like American studies, Asian studies, cultural studies, European studies, gender studies and distinguishes themselves from other disciplines.<sup>4</sup> A Google search for “interdisciplinary major” today churns out more than six million sites with a great diversity of programs from funded stand-alone faculties to loose partnerships between faculties/departments, a sign that it has attained institutional status in the ascendancy and some may even argue a dominant educational paradigm.<sup>5</sup>

### **Moving away from single discipline programmes.**

Compare inter-disciplinary perspectives with other terms. Cross-disciplinary analysis looks at issues typically associated with one discipline through the lens of another discipline while multi-disciplinary analyses look at issues from multiple perspectives without systemically integrating disciplinary perspectives.<sup>6</sup> On the other hand, inter-disciplinary analyses look at an issue from multiple perspectives with a systematic effort to integrate the alternative perspectives into a unified coherent framework.<sup>7</sup> The feature of integration is found in almost all definitions of interdisciplinary approach to teaching, studies and research. The interdisciplinary approach is classically defined by William H. Newell (Executive Director of the Association for Integrated Studies) and William Green as “inquiries which critically draw upon two or more disciplines and which lead to an integration of disciplinary insights”.<sup>8</sup>

The objective of interdisciplinary learning is to avoid linear explanations for causes/outcomes in temporal and spatial terms but to further develop explanations rooted in multiple mechanisms and agencies, including patterns of intertwined feedback loops.<sup>9</sup> Single disciplinary

4 Ibid.

5 Ibid.

6 Pedagogy in Action, “What is Interdisciplinary Teaching?” dated 7 May 2018 in the Science Education Resource Center (SERC) Portal for Educator Carleton University [downloaded on 1 Oct 2020], available at <https://serc.carleton.edu/sp/library/interdisciplinary/what.html>

7 Ibid.

8 Jones, Casey, “Interdisciplinary Approach - Advantages, Disadvantages, and the Future Benefits of Interdisciplinary Studies” dated 2009 in ESSAI: Vol.7, Article 26 [downloaded on 1 Jan 2019], available at <http://dc.cod.edu/essai/vol7/iss1/26>, p.76.

9 Mansilla, Veronica Boix, “Interdisciplinary Learning: A cognitive-epistemological foundation” dated 2016 in Project Zero Harvard Graduate School of Education [downloaded on 1 Jan 2020], available at <http://www.pz.harvard.edu/resources/interdisciplinary-learning-a-cognitive-epistemological-foundation>, p.12.

perspectives are limited by the normative framework of a specific discipline without considering alternative views, preventing critical assessment of different perspectives and obstructs a deep and comprehensive understanding of complex challenges for students to synthesize more than one discipline to resolve them.<sup>10</sup> For some scholars, the re-examination of disciplinary limits is more important than successful integration of a number of discipline-based knowledge because it can develop new understandings and build bridges across disciplines.<sup>11</sup> Interdisciplinary instruction integrates methods and analytical frameworks from more than one academic discipline to analyse a theme/issue/question/topic; and then synthesizes contributions from relevant disciplines into complete and coherent framework of analysis.

In order to qualify for real and lived experience and recognize one's own way of thinking cannot comprehensively understand a complex problem, one has to look at any issues in life and real-world problems from multiple perspectives and show scepticism about one's own singular expertise and be agreeable to listen to diverse perspectives.<sup>12</sup> Limiting conversations and academic enquiries to within a single discipline appears to be at odd with contemporary problems facing the world healthcare provision, poverty alleviation, climate change cannot be comprehended through a single way of thinking.<sup>13</sup> In addition to connecting between different fields, interdisciplinary learners can also leverage perspectives by comparing and contrasting different forms of discipline-based applications with a critical eye to challenge existing knowledge and appreciate human tendencies for errors in the interest of deeper, broader and meaningful learning processes.<sup>14</sup>

In fact, some scholars believe that the very idea of synthesis is inherent in human development itself. For them, synthesis is a basic human capacity that turns up at a young age when kids participate in symbolic play, dabble in artistic compositions or study the regulations of a new game.<sup>15</sup> From the point of view of cognitive psychologists, they have documented domain-specific learning processes in subjects like maths, biology, physics, history, etc. and identified foundational learning principles across different domains.<sup>16</sup> They discovered that individuals start learning

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10 Pedagogy in Action, "What is Interdisciplinary Teaching?" dated 7 May 2018 in the Science Education Resource Center (SERC) Portal for Educator Carleton University [downloaded on 1 Oct 2020], available at <https://serc.carleton.edu/sp/library/interdisciplinary/what.html>

11 Bryant, Lauren H., Kim Niewolny, Susan Clark and C. Edward Watson, "Complicated Spaces: Negotiating Collaborative Teaching and Interdisciplinarity in Higher Education" dated 2014 in *The Journal of Effective Teaching*, Vol.14, No.2 hosted by Education Resources Information Center (ERIC) US Department of Education website [downloaded on 1 Jan 2019], available at <https://files.eric.ed.gov/fulltext/EJ1060430.pdf>, p.85.

12 Benkler, Ari E., "Real Life Is Interdisciplinary" dated 3 September 2019 in *Crimson Harvard University* [downloaded on 3 September 2019], available at <https://www.thecrimson.com/article/2019/9/3/benkler-real-life-interdisciplinary/>

13 Ibid.

14 Mansilla, Veronica Boix, "Interdisciplinary Learning: A cognitive-epistemological foundation" dated 2016 in *Project Zero Harvard Graduate School of Education* [downloaded on 1 Jan 2020], available at <http://www.pz.harvard.edu/resources/interdisciplinary-learning-a-cognitive-epistemological-foundation>, p.14

15 Ibid., p.1.

16 Ibid., p.3.

with prior “theories” about the topic/subject matter which frame and provide meaning to new information/knowledge; but learning become robust when knowledge is organized around higher order concepts before learners set objectives and track progress.<sup>17</sup>

Not all agree that synthesis is a natural human instinct inherent from young. Students must play a part in the interdisciplinary integration of knowledge and not all are prepared to do so as they have been used to being passive receptors of knowledge and not proactive builder of them so teachers may have to educate them on how to be active learner.<sup>18</sup> If interdisciplinary learning and teaching involves more than one teacher, some students may also feel an extra burden is placed on them if they are graded by two or more lecturers (and student relationships with multiple lecturers may also be diluted).<sup>19</sup> Thus, constructing consistent expectations from students about their interdisciplinary requirements, learning through trial and error, willingness for experimentation and exploratory spirit may be helpful for a smooth implementation of interdisciplinary teaching.<sup>20</sup> The lecturers themselves may also feel that teaching with other lecturers is time-consuming having to coordinate with other instructors.<sup>21</sup> Thus, lecturers/teachers should be asked if they are comfortable with the time commitment if they are requested to co-teach in interdisciplinary curriculum where time is invested in curriculum development as well as coordination issues, trust-building and interpersonal relationships with fellow instructors.<sup>22</sup>

The private sector is also aware of the volatile, uncertain, complex, and ambiguous business environment today and enhancing leadership skills and organizational capabilities to facilitate collaborative problem-solving platforms and digital “adhocracies” that focus on individual initiative, and this requires a multifaceted and inter-disciplinary mix of technical, relational, and communication skills.<sup>23</sup> Interdisciplinary learning can enrich the analytical experience by augmenting the awareness of the limits in conventional interpretations and this can function as a pathway toward revising one’s existing comprehension of the subject/topical matter, re-calibrating the objective of learning, attain unique disciplinary insights or/and innovate improved system of thought.<sup>24</sup>

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17 Ibid.

18 Bryant, Lauren H., Kim Niewolny, Susan Clark and C. Edward Watson, “Complicated Spaces: Negotiating Collaborative Teaching and Interdisciplinarity in Higher Education” dated 2014 in *The Journal of Effective Teaching*, Vol.14, No.2 hosted by Education Resources Information Center (ERIC) US Department of Education website [downloaded on 1 Jan 2019], available at <https://files.eric.ed.gov/fulltext/EJ1060430.pdf>, p.85.

19 Ibid., pp.87-88.

20 Ibid., p.88.

21 Ibid., p.87.

22 Ibid.

23 Moldoveanu, Mihnea and Das Narayandas, “EDUCATING THE NEXT GENERATION OF LEADERS” dated MARCH-APRIL 2019 in *Harvard Business Review* [downloaded on 30 April 2020], available at <https://hbr.org/2019/03/educating-the-next-generation-of-leaders>

24 Mansilla, Veronica Boix, “Interdisciplinary Learning: A cognitive-epistemological foundation” dated 2016 in *Project Zero Harvard Graduate School of Education* [downloaded on 1 Jan 2020], available at <http://www.pz.harvard.edu/resources/interdisciplinary-learning-a-cognitive-epistemological-foundation>, p.11.

In promoting interdisciplinary courses, the Institutes of Higher Learning (IHL) can motivate students to uncover analytical insights in new or associated disciplines that was not even on the radar screen without interdisciplinary approaches and such approaches can bring about as myriad ways of thinking as possible. Interdisciplinary training hybridizes information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines to create products, explain phenomena or solve problems pressing issues with better performance/outcomes than single disciplines.<sup>25</sup> For example, chemist Willard Libby who discovered radiocarbon dating combined his findings in Chemistry with the discipline of Archaeology and won the Nobel Prize for the discovery in 1960.<sup>26</sup>

Single-disciplinary programs may not be able to satiate such needs, thus explaining some trends amongst universities in moving away from completely single-disciplinary programs. Rather than strict discipline-based training, business schools for example will be required to reconsider their courses. They will substantially rethink and reconfigure courses to match the individual department/faculty's specific capabilities for designing teachable/impart-able and learnable/acquirable content and tracking/monitoring individual learning outcomes, becoming competent curators and designers of reusable content and epistemological/pedagogical experience to guide private sector organizations on developing and evaluating/testing new skills.<sup>27</sup>

Some scholars have also argued that it is important for the faculty member or school instructor to do some background work. They need to check if her/his organizational culture supports interdisciplinary teaching, offers incentives to do so, recognition for such initiatives, the sort of market value that school attributes to such pedagogy, shoulder extra costs associated with interdisciplinary teacher and/or whether the department has the openness needed to support interdisciplinary teaching.<sup>28</sup> Teachers and instructors may become demoralized with constant justification of interdisciplinary courses, the need to prove fiscal viability based on student enrolment, laborious solicitation of funding, bureaucratic red-tape, constant improvisation, resistance against innovative teaching, time-consuming distraction from research, exclusion from teaching load requirements, etc.<sup>29</sup>

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25 Ibid., p.4.

26 Jones, Casey, "Interdisciplinary Approach — Advantages, Disadvantages, and the Future Benefits of Interdisciplinary Studies" dated 2009 in ESSAI: Vol.7, Article 26 [downloaded on 1 Jan 2019], available at <http://dc.cod.edu/essai/vol7/iss1/26>, p.79.

27 Moldoveanu, Mihnea and Das Narayandas, "EDUCATING THE NEXT GENERATION OF LEADERS" dated MARCH — APRIL 2019 in Harvard Business Review [downloaded on 30 April 2020], available at <https://hbr.org/2019/03/educating-the-next-generation-of-leaders>.

28 Bryant, Lauren H., Kim Niewolny, Susan Clark and C. Edward Watson, "Complicated Spaces: Negotiating Collaborative Teaching and Interdisciplinarity in Higher Education" dated 2014 in The Journal of Effective Teaching, Vol.14, No.2 hosted by Education Resources Information Center (ERIC) US Department of Education website [downloaded on 1 Jan 2019], available at <https://files.eric.ed.gov/fulltext/EJ1060430.pdf>, p.85.

29 Ibid., pp.94-96.

### **Inter-disciplinary learning deployable for deep learning or conversant insights.**

“Deep learning” refers to the transfer and utilization of newly-acquired knowledge/information in a novel situation with learning principles, quality benchmarks to provide a strong generic foundation for interdisciplinary cognition/learning.<sup>30</sup> On the other hand, an important objective of pedagogy is the study of complex issues in conversation with others in other disciplines who have already researched/studied/examined those challenges. IHL have started re-designing/re-thinking their curriculum. Some ingredients include a common curriculum (e.g. core curriculum) that is interdisciplinary (defined as courses taught by more than one instructor, industry-based learning and matrix programme structure). Interdisciplinary may not always mean deep integration of different disciplines. It can only simply refer to being conversant in the research methods and analytical insights of complementary disciplines at some rudimentary levels as a pedagogical approach.

### **Programmes and courses that are interdisciplinary that are in demand: nudging programmes/courses closer to being interdisciplinary.**

From different perspectives, medical practitioners’ assignments can be made more applicable through hybridizing with the research of policy experts; environmental scientists and engineers need to collaborate with earth/climate scientists and economists to climate proof the earth’s future; biology majors may be interested in medicine; economics major may be interested in public policy.<sup>31</sup> In putting together the package of skills and courses to be trained in multidisciplinary, interdisciplinary and transdisciplinary format, it must be determined with greater precision the needs of the private sector.

Interdisciplinary synthesis can be observable through communicative efforts such as a reflection of an artwork or an explanatory paper and an investigative process (describing problems, formulating enquiries, forming theoretical frameworks, combining methodologies, creating analytical categories and evaluating its usefulness).<sup>32</sup> While doing all these, the process sheds light on common cognitive processes while upholding the idiosyncrasies of disciplinary approaches.<sup>33</sup> Recognizing the limits of existing knowledge, comprehension of the subject matter must withstand

30 Mansilla, Veronica Boix, “Interdisciplinary Learning: A cognitive-epistemological foundation” dated 2016 in Project Zero Harvard Graduate School of Education [downloaded on 1 Jan 2020], available at <http://www.pz.harvard.edu/resources/interdisciplinary-learning-a-cognitive-epistemological-foundation>, p.3.

31 Benkler, Ari E., “Real Life Is Interdisciplinary” dated 3 September 2019 in Crimson Harvard University [downloaded on 3 September 2019], available at <https://www.thecrimson.com/article/2019/9/3/benkler-real-life-interdisciplinary/>

32 Mansilla, Veronica Boix, “Interdisciplinary Learning: A cognitive-epistemological foundation” dated 2016 in Project Zero Harvard Graduate School of Education [downloaded on 1 Jan 2020], available at <http://www.pz.harvard.edu/resources/interdisciplinary-learning-a-cognitive-epistemological-foundation>, p.3.

33 Ibid.

the test of competing interpretations of the subject matter, thus reflection about the nature of one's knowledge, learning, and thinking—correlates with understanding preparedness for independent learning (defined as meta-cognition capacity) is very important.<sup>34</sup>

In the US, corporate universities try to marry their course packages and skills training with the companies that need them. Capabilities to precisely specify the skill sets to enhance, and capabilities in quantifying the augmentation of students' learning and private sector firms' capabilities can shape the financial foundations of a corporate university to tailor fit the organization that uses its services and to adapt the cost structure and syllabus accordingly.<sup>35</sup> Education programs and instructors are building an expanding ecosystem covers a broad array of skills including functional skills (e.g. big-data analytics) that emphasizes cognitive thinking (reasoning, calculating) and algorithmic practices and then apply these skills in case studies that represent the challenges that students face on their future jobs/internships/current jobs (for mature students).<sup>36</sup> These skills can be mixed and matched, combined and integrated and/or hybridized to form multidisciplinary, interdisciplinary or transdisciplinary courses/platforms. These platforms are likely to be featured increasingly in online platforms. More individuals are using the COVID19 lockdown period to augment their skillset by relying on internet-based learning platforms like EdX, FutureLearn, Coursera and MOOCs courses to prepare for their post-COVID19 career advancement (and increase self-satisfaction too).<sup>37</sup> And these include courses for millions of users doing free courses taught by professors from Harvard and other top universities.<sup>38</sup>

### **Creating the Renaissance Person.**

Interdisciplinary learning (sometimes defined as interdisciplinary studies) is a planned methodology to education that utilizes connections a diversity of subjects/disciplines to augment learning and promotes its application in innovative ways.<sup>39</sup> Sometimes, interdisciplinary interpretation of subject matters is meant to provoke the imagination for new interpretations of different subject matters/topics but it can also be used to develop an empirically-based and clear explanation of the topics under study. It intensifies learning through looking at an issue, solving or finishing a final project by finding the commonalities between disparate subjects and then

34 Ibid., p.11.

35 Moldoveanu, Mihnea and Das Narayandas, "EDUCATING THE NEXT GENERATION OF LEADERS" dated MARCH — APRIL 2019 in Harvard Business Review [downloaded on 30 April 2020], available at <https://hbr.org/2019/03/educating-the-next-generation-of-leaders>

36 Ibid.

37 Robson, David, "Online learning: how to acquire new skills during lockdown" dated 1 July 2020 in The Guardian/The Observer [downloaded on 1 July 2020], available at <https://www.theguardian.com/education/2020/apr/19/online-learning-how-to-acquire-new-skills-during-lockdown>

38 Ibid.

39 CfE Briefings, "A Guide for Practitioners CfE Briefing Interdisciplinary Learning" dated September 2012 in the Scottish Government website [downloaded on 1 Jan 2020], available at <https://education.gov.scot/Documents/cfe-briefing-4.pdf>, p.2.

hybridizes their ideas/concepts/theories/methodologies.<sup>40</sup> In constructing complex explanations for different topical matter, learners need to connect factors drawn from various disciplines that may be distant in time and space as part of comprehending multiple non-linear causal factors.<sup>41</sup> Scottish educators argue that effective interdisciplinary learning is based a handful of big ideas that integrate, in an interdisciplinary manner, a number of curricular contents.<sup>42</sup>

An interdisciplinary studies major in the US is sometimes called a 'general studies major' at some university that comes with the choice for students to tailor their own degree by choosing what they want to study with the requirement that they must still choose the concentrations/main fields that you want to study.<sup>43</sup> US universities often need bachelor's degree students to study minimally 30 credits of general education classes, including classes like higher level math (college algebra/statistics), minimally one English composition class, life sciences classes, a research course and some universities may go further and require students to take a class on communications/public speaking and a course on emerging technology.<sup>44</sup> Some credits are covered in mandatory courses within the student's major/general education courses and they are topped up with electives to reach the required number of credits for graduation (including studying modules from other disciplines as electives).<sup>45</sup>

The re-flowering of a Renaissance Person approach from the 1990s to the 21st century took place against the backdrop of applied knowledge linking the institutes of higher learning (IHL) with private sector companies. Private sector internships and students must also coordinate well with more interdisciplinary perspectives on fields of expertise coupled with enhanced communication, teamwork and collaboration. The latter three are considered human soft skills that are much valued in an age of A.I. and machine learning. These human-oriented skills can be tapped on to handle complex issues which routinized machine applications cannot fully replace. The idea is for pedagogy to be inter-disciplinary, the design of acquisition learning modules multi-disciplinary and the thought process transdisciplinary. There are traditional and non-traditional ways of teaching interdisciplinary subjects. The traditional way is to explain each aspect of discipline-based instructions first in study units or project work in order to learn specific principles with synthesis

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40 Ibid.

41 Mansilla, Veronica Boix, "Interdisciplinary Learning: A cognitive-epistemological foundation" dated 2016 in Project Zero Harvard Graduate School of Education [downloaded on 1 Jan 2020], available at <http://www.pz.harvard.edu/resources/interdisciplinary-learning-a-cognitive-epistemological-foundation>, p.12.

42 CfE Briefings, "A Guide for Practitioners CfE Briefing Interdisciplinary Learning" dated September 2012 in the Scottish Government website [downloaded on 1 Jan 2020], available at <https://education.gov.scot/Documents/cfe-briefing-4.pdf>, p.3.

43 Staff Writers, "What Is An Interdisciplinary Studies Degree?" dated 4 September 2020 in Best Value Schools website [downloaded on 4 September 2020], available at <https://www.bestvalueschools.com/faq/what-is-an-interdisciplinary-studies-degree/>

44 Ibid.

45 Ibid.



coming in at the end of the instructional format.<sup>46</sup> On the other hand, the non-traditional way may try to enrich learning by providing a preliminary sense of the subject matter as a whole while guiding learning intuitively to a clear cognitive destination.<sup>47</sup>

Besides English as a common working language (now made easier by digital tools for language translation), scholars and teachers can speak across disciplines. The idea was to create a “broader education” for students at large. The Renaissance concept was not to pigeonhole each student into specialized individuals but to treat each disciplines they come across in their configuration of modules as stand-alone units of educational experience. Students working in communities must now learn to compromise rigid disciplinary orthodoxy and tap into each other’s skills, communicate effectively with varying vocabularies/theories/worldviews. They are trained to become “skilled collaborators”. Universal knowledge acquisition is no longer possible by one person alone. A team is needed in most jobs functions and problem solving scenarios today. Supporters of interdisciplinary learned that students picked up tolerance for their peers in a democratic environment that allowed voices to be heard and experienced learners-empowerment as well as exhibited collaboration skills.<sup>48</sup>

The basic tenet of the Renaissance Person is to think critically and creatively, possess good communication skills and have flexible deployability in careers they aim for. With globalization, the Renaissance Person is now expected to peer into community, state and global issues and develop skills that can tackle these issues. Outside the narrow specialization of these graduates, there is now a need for them to communicate their thinking to a wide broader audience in tackling contemporary complexities. Students are now confronted with key interdisciplinary questions from complex scenarios and societal challenges. Hard science students must be able to communicate to non-scientific audiences and social science graduates must communicate research to policymakers and decisional elites.

### **Critics and rebuttals.**

Criticisms of the Renaissance ideal include the sacrificing depth for breadth of knowledge base, but advocates argue that this may be what is needed in an age of fast-changing technologies and complex changes. It may just be what is needed for an inquiry-based approach to problem-solving and sometimes open-ended questions may just be what is needed to probe for more

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46 Mansilla, Veronica Boix, “Interdisciplinary Learning: A cognitive-epistemological foundation” dated 2016 in Project Zero Harvard Graduate School of Education [downloaded on 1 Jan 2020], available at <http://www.pz.harvard.edu/resources/interdisciplinary-learning-a-cognitive-epistemological-foundation>, pp.13-14.

47 Ibid.

48 Jones, Casey, “Interdisciplinary Approach — Advantages, Disadvantages, and the Future Benefits of Interdisciplinary Studies” dated 2009 in ESSAI: Vol.7, Article 26 [downloaded on 1 Jan 2019], available at <http://dc.cod.edu/essai/vol7/iss1/26>, p.77.

understanding of the issues at hand. This flexibility in inter-disciplinary thinking affords students flexibility at a time of technological flux with Industry 4.0, internalize the necessity to change their professions continually in their career paths, fit/adapt quickly to career opportunities, assignments and gigs, and graft a number of careers onto a single career path. Adaptability is the name of the game in this concept.

As an example, the University of California Berkeley program Interdisciplinary Studies Faculty (ISF) is a research-based liberal education program giving students the chance to craft an inter-disciplinary research program that includes a senior thesis with modules drawn from the social sciences, the humanities, and/or the professional schools/colleges and prescribed mandatory courses.<sup>49</sup> The academic thesis component demands rigour research and a 40-page senior thesis based on original interdisciplinary research and the application process requires a conceptualized research program with interdisciplinary methodological/theoretical approaches from at least three disciplines, proposed course of study and academic justification of their proposal.<sup>50</sup>

The honors course component require the student to identify senate faculty members as second readers and their grades will be an average of grades by the faculty instructor and the second readers and other committee members using the criteria of originality, methodological sophistication, inter-disciplinarity, interpretation quality, and excellence in writing/argumentation.<sup>51</sup> Other rules of the faculty are that interdisciplinary work may be comparative, historical, regional, thematic, or problem-focused and should not replicate a pre-existing structured program and faculty members outside ISF can be advisers if approved by the ISF director.<sup>52</sup>

The Wesleyan University College of Letter interdisciplinary program is based on a broad, cohesive theme that covers multiple disciplines with students taking five colloquia over 3 years from antiquity to the present (European literature, philosophy, and history but no fixed canon) and each taught by two instructors from different disciplines/perspectives without a single authority/approach.<sup>53</sup> Some academicians argue that co-teaching must go beyond simply sharing teaching burden or division of labour.<sup>54</sup> Co-teaching is one way to engage interdisciplinary teaching

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49 University of California, Berkeley, "Interdisciplinary Studies" dated 2020 in the Berkeley Academic Guide 2020-2021 [downloaded on 1 October 2020], available at <http://guide.berkeley.edu/undergraduate/degree-programs/interdisciplinary-studies/>

50 Ibid.

51 Ibid.

52 Ibid.

53 Kleinberg, Ethan, "Interdisciplinary Studies at a Crossroads" dated Winter 2008 in *Liberal Education* Vol.94 No.1 [downloaded on 1 Jan 2019], available at <https://www.aacu.org/publications-research/periodicals/interdisciplinary-studies-crossroads>

54 Bryant, Lauren H., Kim Niewolny, Susan Clark and C. Edward Watson, "Complicated Spaces: Negotiating Collaborative Teaching and Interdisciplinarity in Higher Education" dated 2014 in *The Journal of Effective Teaching*, Vol.14, No.2 hosted by Education Resources Information Center (ERIC) US Department of Education website [downloaded on 1 Jan 2019], available at <https://files.eric.ed.gov/fulltext/EJ1060430.pdf>, p.88.

by having two or more faculty members actively integration their respective disciplinary expertise, sharing perspectives, and shift from individualistic to interdependent curriculum planning.<sup>55</sup> Some may even treat it as a professional development experience and use it as an exercise to get valuable feedback for teaching style/performance or/and a self-reflective session.<sup>56</sup> The traditional collaborative teaching involves a small team (typically 2 instructors with equal coordinative powers) highly coordinated in syllabus design, teaching and student evaluation, and so transparent and open communications and complementarity/good chemistry between the two instructors is crucial.<sup>57</sup>

Other universities structure co-teaching using the leader-based model. It encompasses a lead faculty member mentoring less experienced junior colleagues (or new recruits or teaching assistants) and the lead acts as a quality control for the other team members while becoming the cohesive “glue” for the entire team as she/he has oversight (or big picture or overarching theme) of the entire process.<sup>58</sup> The lead as mentor would facilitate team discussion and forge consensus on the materials that would be taught to the student while ensuring the curriculum was being properly taught and disseminated.<sup>59</sup>

Another model that have emerged is known as the modular model of collaborative teaching. It consists of a big instructor team with 3 to 6 lecturers and course are divided into multiple sections with one instructor each and they would individually develop lessons, teach, design assessments and evaluate their own performance autonomously of each other.<sup>60</sup> Some studies showed that some instructors felt in-cohesion in coordination and intellectual limitations in working with a big group, inability to evaluate overall student acquisition of knowledge and absence of freedom in trying out different pedagogies but this model is often useful for smaller departments/faculties without sufficient lecturers to cover all courses.<sup>61</sup> Traditional collaborative works well when there is effective open communication between the lecturers; modular model was most cost-effective and ideal for a stopgap solution when there is limited departmental resources; leader-based model had the advantage of upgrading novice lecturers.<sup>62</sup>

There is a disruptor element to interdisciplinary studies when it compels established professors and instructors to revise their approaches/methodologies/assumptions and disrupt/destabilize the authority of the faculty and the disciplines to distance themselves from disciplinary-

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55 Ibid., pp.86-87.

56 Ibid., p.87.

57 Ibid., p.93.

58 Ibid., p.92.

59 Bryant, Lauren H., Kim Niewolny, Susan Clark and C. Edward Watson, “Complicated Spaces: Negotiating Collaborative Teaching and Interdisciplinarity in Higher Education” dated 2014 in *The Journal of Effective Teaching*, Vol.14, No.2 hosted by Education Resources Information Center (ERIC) US Department of Education website [downloaded on 1 Jan 2019], available at <https://files.eric.ed.gov/fulltext/EJ1060430.pdf>, p.92.

60 Ibid.

61 Ibid., pp.92-93

62 Ibid., pp.96-97

based past successes/formulations and push beyond the confines of their authority/expertise in favour of innovation.<sup>63</sup> Conservatives advocating traditional disciplinarity attacked interdisciplinarity for becoming more and more like discipline-based subjects/course/modules/department: secluded, self-legitimizing, and backward-looking fields without rigor, theoretical foundation, methodology and autonomy.<sup>64</sup> Critics ask at what stage do they become new disciplines or present themselves as superficial scholarship or draw resources away from traditional disciplines or holed up as interdisciplinary niches.<sup>65</sup>

Opponents of interdisciplinary departmental/program autonomy argue that if intellectual goals are greater than desire for autonomy/control, they should avoid fragmentation of traditional majors and opt for idea-driven connections in the university environment.<sup>66</sup> An interdisciplinary studies alternative model is a project-based approach that gathers different disciplines and their interested faculty members together to address a specific issue like “Science in Society”, “Feminist, Gender, and Sexuality Studies” while without becoming another discipline, thus avoiding dilettantism and giving all stakeholders a chance to return back to their main disciplines to share these new ideas/approaches.<sup>67</sup>

Like students, academics also face challenges when they engage in interdisciplinary studies as well. Professors who focus on interdisciplinary studies are marginalized from their specialized field and this lowers their reputation in the eyes of their peers and affect chances for tenure because the system is still very much predicated on disciplinary majors with interdisciplinary studies rare in traditional fields of study.<sup>68</sup> Dilettantism is cited when interdisciplinary programs become beholden to the disciplines that feed/make up their faculty and some of these professors may be hostile or frustrated with their host disciplines and thus treat their disciplinary and departmental affiliation only as a convenient vehicle to get methodological credibility.<sup>69</sup> Critic Bill Readings argues that liberal arts education and universities have been transformed from facilities instilling unified national culture into corporate entities selling marketable skills which is the institutional support for interdisciplinary studies to create niche markets and student-consumers.<sup>70</sup>

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63 Kleinberg, Ethan, “Interdisciplinary Studies at a Crossroads” dated Winter 2008 in *Liberal Education* Vol.94 No.1 [downloaded on 1 Jan 2019], available at <https://www.aacu.org/publications-research/periodicals/interdisciplinary-studies-crossroads>

64 Ibid.

65 Ibid.

66 Ibid.

67 Ibid.

68 Jones, Casey, “Interdisciplinary Approach - Advantages, Disadvantages, and the Future Benefits of Interdisciplinary Studies” dated 2009 in *ESSAI: Vol.7, Article 26* [downloaded on 1 Jan 2019], available at <http://dc.cod.edu/essai/vol7/iss1/26>, p.79.

69 Kleinberg, Ethan, “Interdisciplinary Studies at a Crossroads” dated Winter 2008 in *Liberal Education* Vol.94 No.1 [downloaded on 1 Jan 2019], available at <https://www.aacu.org/publications-research/periodicals/interdisciplinary-studies-crossroads>

70 Ibid.

### **Concluding remarks: Continuous learning.**

Continuous or lifelong learning is paramount in interdisciplinary learning. The core idea is that understanding and comprehension of a subject matter/discipline/topic is never-ending and cyclical, thus need to challenge conventional informed conclusions with unique novel contexts, insights and experiences without any false assumptions of final infallible truths.<sup>71</sup> The core of interdisciplinary learning is an intellectual pursuit for complex explanations and the pedagogical format is adjusted to create products that may include anything from graphic designs to narratives with the continuous syntheses of both small and substantial content matter along the learning process.<sup>72</sup>

An interdisciplinary studies degree may be useful for students who have not made up their mind on what to study at the university and/or their future careers but they can also assist other students to sharpen focus and facilitate preparations for their future career by studying modules that are tailored to their future career choices.<sup>73</sup> Interdisciplinary studies programs can also be a solution for students who are keen to study subjects that their universities do not offer as a major but can be studied as electives, enabling them to get a degree while deepening knowledge in the subjects of interest.<sup>74</sup>

Sustained institutionalization. Many administrative heads may not have sufficient knowledge about pedagogy or have insufficient teaching experience, thus interdisciplinary instructors may be best positioned to design, manage and operate the courses.<sup>75</sup> This leads to the outcome that such courses are better originated from a bottom-up approach rather than a top-down project where department heads may lead the charge but leave execution to the lecturers.<sup>76</sup> Julie Thompson Klein advocated the following for interdisciplinary institutionalization in a university: economic capital, full-time appointments, center/departmental rights; a place in the organizational hierarchy of the university, human resource functions like faculty tenure, leeway to build bridges across disciplines while opponents insist they must avoid becoming fortresses with their own methodology, ideology,

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71 Mansilla, Veronica Boix, "Interdisciplinary Learning: A cognitive-epistemological foundation" dated 2016 in Project Zero Harvard Graduate School of Education [downloaded on 1 Jan 2020], available at <http://www.pz.harvard.edu/resources/interdisciplinary-learning-a-cognitive-epistemological-foundation>, p.11.

72 Ibid., p.14.

73 Staff Writers, "What Is An Interdisciplinary Studies Degree?" dated 4 September 2020 in Best Value Schools website [downloaded on 4 September 2020], available at <https://www.bestvalueschools.com/faq/what-is-an-interdisciplinary-studies-degree/>

74 Ibid.

75 Bryant, Lauren H., Kim Niewolny, Susan Clark and C. Edward Watson, "Complicated Spaces: Negotiating Collaborative Teaching and Interdisciplinarity in Higher Education" dated 2014 in *The Journal of Effective Teaching*, Vol.14, No.2 hosted by Education Resources Information Center (ERIC) US Department of Education website [downloaded on 1 Jan 2019], available at <https://files.eric.ed.gov/fulltext/EJ1060430.pdf>, pp.98-99.

76 Ibid.

or canon.<sup>77</sup>

For university professors in the 21st century, with growing institutional status, interdisciplinary programs are becoming disciplines with their own canonical bodies of work and, like traditional disciplines, less open-minded to new ideas with their own self-assured confidence, autonomous institutional support and less beholden to the traditional disciplines which they draw from.<sup>78</sup> When interdisciplinary understanding of the world becomes widespread, there is a well-informed and critical public where the marketplace of ideas has no single discipline or method privileged over another and all disciplines are connected so students can be original thinkers who question academic gatekeepers to locate the optimal answers.<sup>79</sup>

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<sup>77</sup> Kleinberg, Ethan, "Interdisciplinary Studies at a Crossroads" dated Winter 2008 in Liberal Education Vol.94 No.1 [downloaded on 1 Jan 2019], available at <https://www.aacu.org/publications-research/periodicals/interdisciplinary-studies-crossroads>

<sup>78</sup> Ibid.

<sup>79</sup> Ibid.

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