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Curriculum Design of Interdisciplinary Undergraduate Degree in Digital Era

Yao Yao, Yizhen Zhou*, Jiangping Zhu

Hangzhou Normal University, Hangzhou, Zhejiang Province, 310058, China
dreamerzhou@hotmail.com
**Corresponding author*

Abstract: *As response to the demand of economic and social development in digital era, undergraduate interdisciplinary study could facilitate innovation and cultivate technological talents. The paper first analyzed objective and curriculum design of undergraduate interdisciplinary degree, and then elaborate the challenge and its corresponding strategy. A comparison analysis was conducted. The course structure, project based learning, academic qualifications and industrial experience of the staff, graduation and tuition fees are compared between interdisciplinary degree and mono disciplinary degree, as well as double degree. The effectiveness of interdisciplinary course is measured by final exam results, employment rate, start salary and admission to postgraduate program. The advantage of interdisciplinary study at undergraduate level is reflected in practical capability, critical thinking, innovation, initiative, and team cooperation. The prospect in career development and further study and research are more promising for interdisciplinary graduates. Future research and improvement is also discussed, which focus on long term development of the students, multilateral communication and systemization of curriculum improvement.*

Keywords: *Interdisciplinary Degree, Curriculum Design, Challenge and Strategy, Effectiveness*

1. Introduction

Defined as studies with characteristic of interaction and integration with more than one discipline in the traditional academic science, inter disciplinary studies is aimed to solve complicated issue in research field and industry application. Interdisciplinary courses have becoming prevalent in universities, both domestically and internationally, in undergraduate studies as well as postgraduate program. Organic integration and effective application of knowledge and methodology from various disciplines would equip students with capability and instruments to deal with many faceted real world problems in the ever changing digital era. [1] Previous research is mostly concerned postgraduate education. Extensive literature discussed existing interdisciplinary research. Undergraduate courses tailored for career opportunity and personal development are much less discussed. This paper is designed as a discussion and case study for interdisciplinary learning at undergraduate level, for the courses with the content of information science and financial service. The rest of the paper is structured as follows: the second part analyzes the objective of the interdisciplinary course and the corresponding curriculum structure; the third part analyzes the difference between interdisciplinary course and other courses through comparison studies; the fourth part assesses the achievement from interdisciplinary course, while the final part concludes.

2. Structural design and training objective

2.1 Mechanism, objective and structural plan

Integration of multiple disciplines with cutting edge nature, interdisciplinary course has the feature of scientific innovation and talent cultivation. The objectives of undergraduate interdisciplinary degree are: improvement of the disciplinary and professional system at university level in digital era; enhancement of the capacity to foster technology breakthroughs, scientific and theoretical innovation, in order to provide students with channels and platforms for better development interdisciplinary fields, in their future career and development, in the academic research, industry practice and the public, catering industry enterprises, for the benefit of social development and robust sustainable economic

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growth. [2]

To meet the need of the macro environment, interdisciplinary undergraduate degrees are developed. The role of interdisciplinary course lies on industrial contribution, academic research innovation, teaching method reform and personal value realization for students. As a response to digitalization in every aspect of life, as well as the up rise and application of artificial intelligence in almost every industry, the discipline of information technology is combined with various disciplines to enhance competitiveness of the undergraduate students. Some integrated courses are still in the engineering framework. [3-4] As part of the new engineering initiative, new interdisciplinary disciplines such as the Internet+ and traditional engineering fields are emerging one after another. Some interdisciplinary study combined different types of discipline, such as humanities, natural sciences, medicine and health care, agriculture, and social sciences such as education, economic, law and management.

The structural design of interdisciplinary curriculum should consider the issues of dynamic disciplinary development, interaction amongst disciplines, spatiality structure, integration organism. Unlike curriculum of traditional single discipline, the interdisciplinary degree is a multi modality issue. Excessive dismemberment of discipline boundary, which could be defined as un-discipline, could lead to disorder in course structure and shallow understanding of professional knowledge; while strict limit between disciplines could inhibit development of interaction and integration of knowledge, skills and practical capability. The computer science and finance major has an organic integration of the two major. The curriculum design has combined industrial requirement with scientific research field, integrate coding skills with investment acumen, designed different levels of courses to help students from different background.

2.2 Challenge and strategy

There are several crucial issues requires to be dealt with properly. Some intrinsic paradox is embedded in the nature and characteristic in the interdisciplinary studies. The pedagogy reform introduced overall planning in teaching and learning, which developed around team work and project based learning, instead of traditional lecturing and theoretical learning revolves individual student. The balance between overall problem solving and individual knowledge point is crucial in the success of interdisciplinary course. [5-6] In the major of computer science and finance, there is essential compulsory module consisted with five courses to ensure a sound professional knowledge foundation, while other elective modules could be applied to develop comprehensive capabilities with methodology from different discipline. In the case of computer science and finance, the compulsory module ensured basic knowledge in both disciplines, which included introductory and advanced courses in the freshmen and sophomore years.

The standardization in the integration process of different discipline should be developed. The contradiction between academic development in interdisciplinary research and personal development of the undergraduate students should be dealt with in the top down structure plan of the university. Two interdisciplinary degrees are provided by the School of Information Science and Technology, one is the combination of computer science and finance, the other is geo science and information technology. In addition to the supervisory compliance with the basic requirements from the Ministry of Higher Education, a standard concerning interdisciplinary degrees is enforced by the university. Constant supervision and in time monitoring is in place to ensure teaching quality. The committee carried out yearly advisement to the curriculum and teaching plan, according to student feedback and industrial update. [7-8] In the year 2023, ChatGPT had been included in the course. The generation, investment, transaction and price fluctuation of Crypto currency has been explored so that students could use their knowledge from two different disciplines.

The conflict interest between research and teaching is in accordance with the double role of university as the research institution and higher education institution. One type of interdisciplinary degree derived from existing research of the university, the students could work from the research background, which form is more suitable for research degree in postgraduate study. Another type is to tailor interdisciplinary degree in accordance with employer's demand, local industrial requirement and macroeconomic environment.

How to make the decision on the number of disciplines and their differences, is also a problem in overall design in the curriculum. [9] Efficient integration of disciplines should result in that the overall achievement should be higher than the individual components combined. Inefficient interdisciplinary degree could leave the graduate student with inadequate knowledge in all disciplines. For example,

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undergraduates in the year of 2012 from information science and financial engineering of a private college were not equipped with the proper skill set to work in the IT industry, neither obtain sufficient financial knowledge to work as professional investors. Some agricultural degree, with difficulty to recruit, offered interdisciplinary course combined with whatever discipline with highest demand in the market. However, the demand in the year of graduation differed from the year of admission. Inefficient combination of agriculture with internet+, Artificial Intelligence, education, biotechnology, proves to be unsuccessful, which could neither improve employment opportunity for the students, nor enhance research capability for the department. However, a successful example is the interdisciplinary course in Alibaba commercial college, which combined electronic commerce, software engineering, international trade, marketing and financial and accounting. It involved at least three fields of study, namely. information technology, management and economics. The curriculum tailored to the necessity of the local economy, the teaching plans is suitable for the capability of the undergraduate students, the career prospect for the students is significantly better than other degree program in the college.

3. Comparison analysis

3.1 The comparison with single discipline

The undergraduate course in computer science and technology with financial service, could not be simply divided into computer science and finance. Nor could it be understood and half of IT curriculum and half of finance curriculum combined. The financial courses could help avoid tunnel vision from monotonous studies in coding and technology, encourages critical thinking and ethics and financial value of technology in the New Engineering concept. [10] The computer science provides instrument and technology in the financial area, so as to adapt to digital era, and jump to opportunity for digital-financial reform. The curriculum of the interdisciplinary degree is well designed and balanced in courses from both computer science major and finance major. The course loan is divided evenly, with slightly higher proportion of computer science. Interdisciplinary courses are introduced, such as financial data mining, financial information security, financial information system. Moreover, practical learning courses, or rather, comprehensive projects are introduced to enhance interdisciplinary capabilities of the students, through team building and problem solving. Compared with mono disciplinary computer science major, the curriculum takes up only half of the course load in computer science. It brought some question about whether the students could master sufficient knowledge and technology in computer science. From the standard test for professional knowledge, which in organized by the College of Information science and technology, and compulsory for all students from difference major, the results indicate little difference between interdisciplinary students and computer science major students. Compared with students from finance major, the interdisciplinary students achieved much better performance in quantitative elements in financial courses, while has relatively weakness in details of specific financial transactions. The course structure is shown in Table 1.

Table 1: Core courses: a comparison

	Computer science and finance	Computer science and technology
Financial courses	48 credits	0 credits
Computer science courses	54credits	102.5 credits
Practical learning courses	26 credits	24credits
Interdisciplinary courses	18 credits	0 credit

3.2 The comparison with other forms of interdisciplinary studies

Double degree had been granted for over two decades in most universities, which requires minimum credits earned in both discipline, and covers most of the essential compulsory courses. Structure of double degree differs amongst institutions, most of which take in the form of a major degree and minor degree. [11] The major degree is accepted degree through National College Entrance Exam, while the minor degree is applied after registration. The minor degree is equivalent for curriculum studies. The two courses are taught in different departments or colleges, the teaching method are traditional, the two disciplines are irrelevant. Whether or not the interdisciplinary ability is developed, is completely decided by the individual student and is not organized. The double degree program could also increase course load, led to higher credit requirement, hence higher tuition fee, longer time to obtain degree and more time and effort spent to complete the degree. Compared with

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double degree, interdisciplinary degree provides interaction courses. Double degree, such as the form of computer science students with a minor degree of finance, would finish a traditional computer science degree curriculum, while studied part of the financial courses. The interdisciplinary degree covered comprehensive project based learning, while double degree did not. Constant supervision and support are provided by staff with professional background from various disciplines for interdisciplinary students, while double degree students would have supervisor from "major" degree, with little support from minor degree course. About half of the staff from interdisciplinary course have a background from two different field of study. Some of the staff hold degrees from different discipline, while other have years or even decades of industrial experience in both computer science and financial institution. The required credit for completion of interdisciplinary degree is identical with mono discipline undergraduate degree, around 160 credits, while double degree requires much more credits. The annual tuition fee is also much high in double degree scenario, while interdisciplinary degree costs no more than any traditional engineering degree. The degree requirement is shown in Table 2.

Table 2: Interdisciplinary course and double degree

	Interdisciplinary course	double degree
Interaction course	18 credits	0 credits
Comprehensive project	3 projects	0
Supervision and support	Weekly, monthly, semi-semester meeting	Under supervision of each department
Staff with background from both courses	42%	5%
Total credit requirement	160 credits	220 credits
Tuition fee (per anum)	6600	9000

4. Evaluation of effectiveness

4.1 Course assessment

The effectiveness of interdisciplinary course could not be evaluated by one single criterion, however, the final exam results could reflect the learning output objectively. Some of the courses in the interdisciplinary curriculum overlapped with traditional single discipline degree. The same course code ensures the same assessment through final written exam. It is objective to compare the learning results from the unified standard. Taken the compulsory course operating system as example, the exam result is shown in Table 3. The average result is only slightly better from computer science and financial service students. considering that the interdisciplinary students spend only half of the time on computer science courses, the performance is satisfactory. The standard deviation is also much lower in interdisciplinary students than mono disciplinary students. The teaching method of project based studies and team work has extended outside classroom, which embedded into the learning method and habit for the students to achieve much more unified results. [12] The learning habit of traditional single discipline students is individualized, passive learning, which could get more variant results. The passing rate is much higher, which could be explained by frequent team work and sufficient peer support. [13] The highest and lowest results show a slim advantage for interdisciplinary students, however, this could be explained away by the selective admission. The exam result is shown in Table 3.

Table 3: Final exam results

	Computer science & financial service	Computer science and technology
Mean	81.64	79.94
Standard deviation	9.2	16.01
Highest	98	94
Lowest	54	49
Fail	4%	11.07%

From the exam results, the students on interdisciplinary course have a generally better performance than students on traditional course. The significant achievement could be explained by the following reasons. Firstly, the critical thinking is encouraged and induced in the integration and interaction teaching methods in interdisciplinary course. Secondly, innovation and initiative thinking is encouraged and fostered in problem solving based interdisciplinary course. Thirdly, the broadening of vision from learning profession knowledge in different academic area enhanced academic capability.

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4.2 Future studies and career perspective

Although the capability, knowledge and general achievement of undergraduate students could not be generalized by their future studies and employment, the two indicators could be used relatively effectively and reasonably. The admission into postgraduate courses and employment rates are required to be recorded in detailed statistics, and the average salary level at half of year after graduation is also recorded. The employment rate is not significantly differentiated amongst students holding two different types of degrees. The students with information technology related degree would generally have advantage in employment market. The average starting monthly salary of interdisciplinary graduates is relatively higher than mono discipline graduates. The additional financial knowledge increased employment advantage, broadened potential employment channel. The team work and project based learning cultivate practical capability and problem solving skills, which could partly substitute industrial experience. However, some students from mono disciplinary degree choose their career in education, while school teachers generally have a lower start salary. The statistics is six month after graduate, which could not reflect dynamic career prospects. In the aspect of postgraduate learning, the interdisciplinary students have a much better performance. The undergraduate program of interdisciplinary course simulated enthusiasm of innovation. [14] The cutting edge knowledge discussion induced higher requirement for personal development. With higher inclination to explore the academic world and further development, interdisciplinary graduates are more likely to choose further postgraduate studies. Overseas master degree is also more appealing to interdisciplinary students. More interestingly, interdisciplinary graduates are inclined to participate in interdisciplinary post graduate course. Research degree is also preferred by interdisciplinary graduate. Mono discipline graduates with computer science degree are inclined to professional master degree in local university, either in computer science or education, which are employment oriented rather than academic research. The career choice of the graduates is shown in Table 4.

Table 4: Future studies and career perspective

	Computer science & financial service	Computer science and technology
Employment rate	98.0%	97.5%
Average start salary (monthly)	6721	6455
Postgraduate admission	22.7%	3.1%

Except for the quantitative evidence from the table above, the qualitative evidence also indicate higher level of achievement in career or research perspective. More students from interdisciplinary course are admitted into prestigious universities at home and overseas, and are admitted into more competitive and vigorous postgraduate program. Moreover, the students from interdisciplinary course are more likely to obtain employment in better institutions, with more promotion opportunities, held higher skilled positions, which generally has better development space and career opportunity. Most graduates works in fortune 500 companies, cutting edge technology corporations, or famous commercial banks and other financial institutions. Most of the positions are in accordance with their fields of study, which could put their computer science and financial skills into practical application in the industry.

5. Conclusion

5.1 Findings and conclusion

As response to the demand of economic and social development in digital era, undergraduate interdisciplinary study could facilitate innovation and cultivate technological talents. Taken computer science and finance interdisciplinary degree as an example, the paper first analyzed objective and curriculum design of undergraduate interdisciplinary degree, and then elaborate the challenge and its corresponding strategy. A comparison analysis was conducted. The course structure, project based learning, academic qualifications and industrial experience of the staff, graduation and tuition fees are compared between interdisciplinary degree and mono disciplinary degree, as well as double degree. The effectiveness of interdisciplinary course is measured by final exam results, employment rate, start salary and admission to postgraduate program. The advantage of interdisciplinary study at undergraduate level is reflected in practical capability, critical thinking, innovation, initiative, and team cooperation. The prospect in career development and further study and research are more promising for interdisciplinary graduates.

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5.2 Future improvement and further discussion

The dynamic improvement and update of curriculum needs improvement. At present, the adjustment of curriculum is determined by staff, experts from other universities and professionals from enterprises, as well as some student representative. The determination needs to be systemized and standardized, instead of subjective opinions. [15] The curriculum is divided evenly between two disciplines, in the future, more choice could be provided to students whom have inclination of focus on either discipline. In addition to the communication between teaching and learning, interaction amongst staff could be more active. Multilateral communication amongst staff with different academic field and students would enhance the depth and width of learning for interdisciplinary students.

In the future, a life time tracking of graduates could be possible to realize, so as to portrait their achievement in the long run. Feeds back from alumni could also attribute to advisement of curriculum. From the perspective of research methodology, the research could include more quantified evaluation of interdisciplinary graduates. The course has only been offered for limited amount of time, which indicates that the data is not sufficient to provide sample with statistical value. With more graduate over the years, the research could be more complete with systematic analysis method.

References

[1] Ciferri, Alberto; Soldi, Angelaurelio. Interdisciplinary education and authentic development. International Review of Education. Aug2021, Vol. 67 Issue 4, p533-549.

[2] Kowalski, Jennifer R.; Lineweaver, Tara T.; Novak, Katherine B. Developing Integrative Thinking in Undergraduate Students through an Interdisciplinary General Education Course on Mental Illness. College Teaching. Oct-Dec2022, Vol. 70 Issue 4, p493-505.

[3] Ashby, Iryna; Exter, Marisa. Designing for Interdisciplinarity in Higher Education: Considerations for Instructional Designers. TechTrends: Linking Research & Practice to Improve Learning. Mar2019, Vol. 63 Issue 2, p202-208.

[4] Christopher A. Craig, Elizabeth L. Petrun Sayers, Susan Gilbertz, Ismail Karabas. The development and evaluation of interdisciplinary STEM, sustainability, and management curriculum. The International Journal of Management Education, Volume 20, Issue 2, July 2022, 100652

[5] Solares-Rojas, Armando; Arellano-Aguilar, Omar; García González, Moisés Martín; López-Vargas, María del Rocío; Coles, Alf; Méndez Serrano, Alejandra. Mathematics education and social-environmental crises: an interdisciplinary proposal for didactic innovation with rural communities in Mexico. Research in Mathematics Education. Aug2022, Vol. 24 Issue 2, p202-223.

[6] Salmela, Mikko; MacLeod, Miles; Munck af Rosenschöld, Johan. Internally Incentivized Interdisciplinarity: Organizational Restructuring of Research and Emerging Tensions. Minerva: A Review of Science, Learning & Policy. Sep2021, Vol. 59 Issue 3, p355-377.

[7] Stephen Marcoux,Marie B. tobin, Shivani Kumar, Interdisciplinary Psychiatric Education: Enhancing Knowledge, Bridging Gaps, Improving Outcomes, Journal of the Academy of Consultation-Liaison Psychiatry,Volume 64, Supplement, November–December 2023, Page S97

[8] Lindvig, Katrine; Lyall, Catherine; Meagher, Laura R. Creating interdisciplinary education within monodisciplinary structures: the art of managing interstitiality. Studies in Higher Education. Feb2019, Vol. 44 Issue 2, p347-360.

[9] Yuqing Geng, Lingyan Chen, Jianyi Li, Kashif Iqbal. Higher education and digital Economy: Analysis of their coupling coordination with the Yangtze River economic Belt in China as the example. Ecological Indicators. Volume 154, October 2023, 110510

[10] Thomas K. F. Chiu. Future research recommendations for transforming higher education with generative AI. Computers and Education: Artificial Intelligence. Available online 27 December 2023, 100197

[11] Sytsma, Terin T.; Krause, David A.; Hollman, John H.; Leep Hunderfund, Andrea N.; Newcomer, Karen L. Qualitative and quantitative evaluation of an interprofessional workshop between physical therapy and medical students. Journal of Interprofessional Care. Jan-Feb2021, Vol. 35 Issue 1, p145-148.

[12] Ana M. Corbacho, Lucía Minini, Mariana Pereyra, Alice Elizabeth González-Fernández, Rodrigo Echániz, Lorena Repetto, Paula Cruz, Verónica Fernández-Damonte , Andrea Lorieto, Maximiliano Basile. Interdisciplinary higher education with a focus on academic motivation and teamwork diversity. International Journal of Educational Research Open, Volume 2, 2021, 100062

[13] Ross, Catharine; Nichol, Lynn; Elliott, Carole; Sambrook, Sally; Stewart, Jim. From chain to net: assessing interdisciplinary contributions to academic impact through narrative case studies. Studies in

ISSN 2663-8169 Vol. 7, Issue 1: 81-87, DOI: 10.25236/IJNDE.2025.070112

Higher Education. Nov 2021, Vol. 46 Issue 11, p2309-2324
[14] Imen OURAGINI, Lassaad LAKHAL. The Effect of an Interdisciplinary Entrepreneurship Education Program on Students' Entrepreneurial Intention. The International Journal of Management Education, Volume 21, Issue 3, November 2023, 100845
[15] Trinter, Christine P.; Hughes, Hilary E. Teachers as Curriculum Designers: Inviting Teachers into the Productive Struggle. Research in Middle Level Education Online. 2021, Vol. 44 Issue 3, p1-16.