



**Proposal Defense**  
***Doctor of Philosophy in Information Science***

**“Explainable Course Recommendation: Connecting College Education to Future Careers Through Skills” by Hung Chau**

**Date:** July 8, 2021

**Time:** 3:30PM – 5:30PM

**Place:** [https://pitt.co1.qualtrics.com/jfe/form/SV\\_a2TjVXu53T7PBGe](https://pitt.co1.qualtrics.com/jfe/form/SV_a2TjVXu53T7PBGe)

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**Abstract:**

Workers need to acquire certain skills through education to be qualified for jobs and advance careers, and many new high and middle-skill jobs resulting from the growth of automation and artificial intelligence require education beyond high school; for instance, those jobs in the tech industry, financial tech, and bio-medical tech, which require employees to have strong background in machine learning and statistics. However, there is a disconnect between work and learning in the US; higher education can fail to meet the skill demands of the labor market thus creating ‘skill gaps’ across the country. Colleges attempt to prepare students to enter the workforce but, despite their efforts, students struggle navigating through their educational pathways; e.g., decisions on course selection which is high stakes and complex, leading to high drop-out rates and unsatisfactory career outcomes (graduates are unemployed or underemployed). A labor market information system where work skills are shared across entities, connecting education to work, could help students know what skills they need, educators know what skills to instruct for, employers know what skills workers have, and policy makers more effectively impact workforce development.

In this dissertation, I will approach this problem from two different perspectives. On a macroscopic level, I first explore how detailed work activities (DWAs) used by the Department of Labor to describe the US workforce could frame the knowledge offered in a course, field-of-study and university. I will investigate the role of work skills in explaining the underlying knowledge structures of field-of-study and their relationships, and differences in terms of offered skills between different universities and groups of universities. Ultimately, I will use this knowledge framework to explain skills trends and occupational trends such as graduate incomes. Altogether, it could help to strengthen the labor market information system, informing all the involved stakeholders, from macro perspective (e.g., policy makers) to make appropriate changes for their institutions adapting to skill changing and evolving in recent labor market, to micro level: guiding students to specific courses they could take to obtain the skills they need for their future careers. Consequently, in the second part, I focus on supporting students to navigate better through their educational pathways and trajectories to achieve their career goals. We recently observed that wage differences are well captured by DWA differences in a few fields of study, but not all. This suggests that “skill” differences impact the effectiveness of college education (in terms of wages) but the DWAs may not be the most precise taxonomy to describe the granular level of knowledge expressed in courses; especially, in the domain of personalized and adaptive education systems where we need to know the precise knowledge students have learned from classes to perform recommendations. Hence, I will propose an approach to automatically extract knowledge and skills from educational documents using deep learning without hand labeling and then use the extracted concepts along with the existing workplace activities taxonomy and course enrollment histories as core components to drive the course recommendations and skill-based explanation mechanisms to help students to select better courses for their skills towards their future careers.