2018 HAWAII UNIVERSITY INTERNATIONAL CONFERENCES
STEAM - SCIENCE, TECHNOLOGY & ENGINEERING, ARTS, MATHEMATICS & EDUCATION
JUNE 6 - 8, 2018 PRINCE WAIKIKI, HONOLULU, HAWAII

ACADEMIA - INDUSTRY ENGAGEMENTS FRAMEWORK FOR THE COMPUTING UNDERGRADUATE DEGREES

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Academia - Industry Engagements Framework for the Computing Undergraduate Degrees

Synopsis:

Future of academic learning and teaching is becoming increasingly shaped by successful partnerships between the academic institutions and business corporates. Through the retrospective scenario analysis, this research develops a framework for the implementation of industry engagements to three-year undergraduate university courses.

ACADEMIA – INDUSTRY ENGAGEMENTS FRAMEWORK FOR THE INFORMATION SYSTEMS UNDERGRADUATE DEGREES

Academic learning and teaching is becoming increasingly shaped by successful partnerships between the academic institutions and the business corporates. Through the retrospective scenario analysis of industry – academia partnerships that are now a part of the Information Systems degree at the Western Sydney University, Australia this research develops a framework for the implementation of successful industry – academia partnerships. Findings highlight, that for the successful partnerships, it is essential to first understand the Domain, the field in which the activities are taking place, field studied and course objectives, so scaffolding and progressive learning can be implemented. Such implementations are highly dependent upon the Context that specifies the cohort, skills cohort is lacking and processes required for the successful outcomes. Progression and outcome achievements require carefully mapped teaching opportunities such as class activities, site visits, simulations, industry projects and internships that are supported by continuous academic and industry feedback, so students can improve and gain the skills required for the future jobs.

Introduction

eTransformation studies demonstrate that for businesses to transform successfully and implement innovative business operations, it is essential for them to clearly define their Strategy. Strategy as defined by the eTransformation model is define as company's goals, aims and objectives. Strategy for businesses is aimed at a specific Domain (usually the operations, products or services within the specific industry sector and market) and the Context (the nature of the environment, the customers and business opportunities) (Hol, 2017). Therefore, to study the new changes in the specific industry sector, in this case the education, it is essential to identify what defines the sector and ensures positive outcomes. To do so, it is vital to define the Context – the environment, the place and time where learning and teaching activities are taking place, the students, their past experiences and their current needs and requirements as well as take a note of the Domain, the industry itself, the field – a topic that is being taught as well as the requirements needed for the effective delivery and learning to take place. The Domain is often further defined by current needs ranging from the requirements of individuals, business owners, Small to Medium organisations to the requirements of the large cutting-edge corporates which require and demand cutting edge skills. For education institutions or in this case the Universities, this means that careful consideration is required to ensure knowledge is well delivered and students can learn the needed skills. This study focuses on Information Systems / Computing discipline at the Undergraduate level. Deliveries for the undergraduate degrees are often shaped by market and industry needs and requirements. This is in Australia done via regular industry – academia meetings and reviews where Industry Advisory Bodies provide feedback.

Studies by Koppi et al 2010 supports the notion that the reviews in Computing disciplines should be undertaken every two years to ensure the currency status of the content being delivered by businesses. Furthermore, for Information Systems / Computing degrees that are accredited by the Computing body, in Australia – Australian Computer Society, regular accreditation requirements need to be satisfied, that support yearly industry reviews and regular five-year cycles of the content, its currency as well as the suitability of the assessments, marking and delivery. This also ensures content covered is taught progressively, students are trained for specific job roles and there is appropriate scaffolding implemented to ensure students can gain the required skills.

As a part of their Information Systems / Computing degrees, students in Australia are required to complete industry capstone projects where they often work with industry to meet the required outcomes. In more recent times, emphasis is being placed on identifying opportunities for students to undertake a range of industry supported and run activates. Such activities are often defined as WIL (Work Integrated Learning) that may be seen as projects, shadowing, career placements and industry observation studies (Orrell, 2011). Furthermore, University Australia 2018 defines engagements that enable industry – academia partnerships as: placements, projects, volunteering, simulations, case studies, study tours, reflective study, work shadowing, virtual learning, industry-based project, industry driven projects and internship.

Therefor with the aim to produce industry ready graduates and incorporate active industry – academia engagements as those defined by the Universities Australia, this paper reviews a variety of scenarios that have been implemented at the Western Sydney University in Australia to teach undergraduate Information Systems. Based on a detailed case analysis undertaken, this study identifies characteristics that enable students to gain knowledge and feedback not just from the academics but also from the industry representatives. To be able to identify specific industry – academia engagement characteristics, researcher as the main facilitator of the activities undertaken, wrote the scenarios with the aim to summarise activities and identify key characteristics that have at various levels of student education allowed for industry- academia engagements to be formed.

Scenario Descriptions

Scenario data for this study was collected and aggregated based on the industry – academia partnerships and supporting activities that have over the past two years been implemented in teaching and learning of three core Information Systems subjects. These subjects as well as the supporting extra curricula activities have given students opportunities to engage with industry. Data for this study was collated and written utilising the scenario analysis with the objective to allow for the comprehensive categorisation of presented data, so that the parameters required for the successful academia – industry partnerships can be identified.

Scenario 1. – Case Study Analysis

Industry case studies are often used to study organisational decision making as well as specific system implementations and scenarios. With case analysis, students are required to reflect upon the actual organisations, their processes, staffing, resourcing and technology implementations and based on it comment and identify actions that might have prevented certain cases to happen or those that might have even further improved the scenarios. Students also via cases can learn about the organisational structures, natures of decision making process and factors that may impact how decisions within the organisations are made. While doing so, students also reflect upon industry collaborators, the supply chain operations, the environmental factors as well as the industry as a whole.

Such activities have been implemented in a first-year subject where students via a presented case learn about the types of the organisational information systems (this activity is implemented in Information Systems in Context – subject). In second year subject students learn how to reflect upon the presented case scenarios. Such activities are implemented in Information Systems Deployment and Management. As a part of this unit students reflect upon the implemented case technologies and based on this learn how to assess their own proposals. In a third-year subject, Emerging Trends in Information Systems students learn about the novel cutting edge research cases and implementations and based on this learn how to propose new system developments.

Scenario 2. Simulation Activities

It has been identified that new simulation technologies, such as for example Pearson Labs (ie myIt Lab, myMIS Lab), have started to be utilised as complimentary sets of the teaching materials. Labs allow students to progress through case based simulated activities. They also give students opportunities to make mistakes, review their actions and based on data identify how best to achieve the required outcomes. Cases are often set within the organisational settings which give students the opportunity to go through the activities individually or review them in a class as a group activity. In both cases, students learn about the effects certain decision activities have and are consequently becoming more equipped to deal with real organisational scenarios. Labs allow students to progress through scenario, specify their responses and gain instantaneously feedback. Such activities are currently being implemented in a first year unit, Information Systems in Context.

Scenario 3. Group Projects – Simulated and Industry Based

With the aim to mimic activities in organisations, some assessments have group projects where students are required to rely on one another to complete the activities. Often, this is the first time when students start to learn about the group dynamics, negotiation skills, note taking and meetings. Such projects can be set by the academic or the industry partners. In both cases, students are required to meet specific subject learning objectives. In both cases projects are seen as current by the industry. In second year subject Information Systems Deployment and Management students get the opportunity to meet the industry-based team. Such team can be from the University's Information Technology team, a group of Small to Medium Business owners with specific technology requirements or a group of team managers from specific Information Technology companies. In each case students receive a problem from the industry and are based on it required to come up with the solution. Solution feedback is provided by both industry and academies. In a third-year subject, Emerging Trends in Information Systems, students have three potential scenarios in which they can complete the assessment. In a first case student work in a similar way to how they worked in Information Systems Deployment and Management subject, however in this subject they focus on novel cutting edge solutions. As a second component student are able to undertake industry-based projects and undertake short duration internships either locally or internationally. As a part of such engagements students are immersed in teams of employees and work on achieving set goals with the view to future improvements. Such engagements can be undertaken both locally and internationally. In both instance careful planning is required to ensure students meet the set unit objectives.

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Scenario 4. Industry Visits

With the aim to portray how industry works and functions, industry-based visits to both small and large organisations are now organised for students. Here students get the opportunities to learn about the true organisational set ups, speak to the employees across levels and department areas. Students within such settings also get the opportunities to speak to the interns and learn about their individual journeys. Students also get the opportunity to sit on some corporate meetings and interact with team members. This way students learn about the industry dynamics as well as the industry expectations. Such engagements are organised as extracurricular activities both locally and internationally. To such activates students across all years are invited as it is expected that their learning experiences will differ. First year students would learn about the industry jobs, second year students would have the opportunities to expand their networks and third year students often identify opportunities for internships.

Scenario 5 Overseas Study Tours and Exchanges

It is increasingly seen that it is essential for students to learn about the local industry engagements as well as those that are international, as much of computing developments is often outsourced. It was also seen that having the skills to live overseas for a duration of the engagement and learn about different cultures and customs can to a great extent assist student so in the future they can be true world citizens. While overseas students get the opportunity to network, engage with businesses, work on projects, collaborate with university students and also have the opportunities to embrace local cultures and habits (Hol et al 2016). This activity is available for students undertaking the third year Emerging Trends in Information Systems subject. Furthermore, as a part of the New Colombo Scholarship projects second and third year students have the opportunities to undertake overseas study exchanges.

Scenario 6 Internships (Local and International)

Internships for many Information Systems degrees in Australia are not compulsory, however it has been identified that they are assisting students and helping them become job ready. Academic staff and the Career's Office at Western Sydney University assist students in identifying potential opportunities. There are also New Colombo Project scholarships now available for students to undertake internships internationally that assists them in gaining international exposure and in some cases even gain key work experiences. Such activities are currently available for both second and third year Information Systems students.

Supplementary Findings

It is important to note that following the engagements described as scenarios many students have become more independent. They were eager to share their experiences with the younger generations of students and keen to share their skills. They were also proactive about looking for new opportunities. Some found jobs overseas and continued to further learn and explore. It is important to note that since internship engagements have been incorporated as the optional component for students to undertake and complete one of the assessments based on it, student, now many graduates, have now gained full time industry based positions.

Data Aggregation and Analysis

Data presented via cases has been aggregated and presented based on the activities conducted. It is apparent that some activities are specific to certain study years (data is based on a three-year Information Systems degree), however that very much depends on the nature and the type of the activity being implemented. It is also possible to see that there is a clear progression and scaffolding as such activities are aimed to allow students to progressively grow and build theory and practice.

Scenario	Activity	Year	Learning
1	Case study	1, 2, 3	Link theory to practice, learn soft skills
2	Simulated activities	1, 2	Apply knowledge to simulated environment, gain feedback, learn soft skills
3	Group project	2, 3	Work in simulated and work-based environments, gain academic and industry feedback, learn and apply soft and industry specific skills
4	Industry visits	1, 2, 3	Get a feel for industry, identify potential, look for opportunities, network, learn and apply soft skills, identify internships and jobs
5	Study tours, Exchanges	2, 3	Develop network, learn, apply industry skills learned, identify opportunities, apply soft and hard skills, learn how to live and engage overseas
6	Internships	3	Work in a field, get feedback, learn, identify future opportunities

Table 1. Activities mapped to years of study

Based on the data presented in Table 1, it can be identified that at each year, there are certain skills that needs to be achieved and also appropriate support activities introduced. Studies indicate that many Science, Technology, Engineering and Mathematics fields graduates require improvements in how they deal with soft skills in particular how they negotiate, attend to details and communicate both in a written form and face to face (Dishman 2016). To demonstrate how this is achieved in Information Systems at Western Sydney, table below (Table 2) highlights how such support activities can be embedded and further allow for the industry-academia partnerships to be formed.

Year	Learning Focus – Skill Application	Industry Engagement Opportunity	Activity	Communication
1	Opportunity to learn about the industry, jobs, projects, activities undertaken, roles, company structures, identify possible opportunities, learn soft skills required for the role	Attend business visits, Attend career events Attend industry events	-Simulations -Industry visits -Case study analysis	-Face to face and written, online communication -Greetings and meetings -Group discussions -Presentations -Facts writing
2	Start to apply knowledge to practice via simulations and real projects. Learn how to work in a business team and prepare for the job role. Look for internship opportunities. Learn and	Write resume Master interview skills Apply for jobs Attend industry events Attend business meetings Attend study tours	-Simulation projects -Industry visits -Case study analysis -Study tours	-Negotiating -Problem solving -Attention to detail -Business meetings -Team discussions

	apply both soft and hard skills.	Attend career events Apply for internships		-Interview skills CV writing -Analytical and descriptive writing
3	Master work in a project environment, apply skills gained to industry run projects, gain internship opportunity. Utilise both soft and hard skills.	Look and apply for graduate opportunities Create a video portfolio Update resume Undertake local / International study tours Undertake Internships	-Industry projects Industry visits -Case study analysis -Internships -Study tours	-Team management -Project Management -Critical thinking -Complex problem solving -Analytics -Client discussions -Client negotiations -Client delivery presentations -Communication cross cultures

Table 2. Contextual industry engagements by year

Table 2 data furthermore highlights that the engagement work that is co-run with the industry needs to be Contextually well planned and integrated and also build with the specific purpose (ie. so students can meet specific course outcomes) (Edwards et. al 2015). Furthermore, the focus activities at each mastery level are those that that allow students to apply skills they have learned up to the specific stage. Furthermore, within the activities students are also encouraged to utilise problem solving and analytical thinking (Tankersley, J. 2013). This is evident for example in Information Systems Deployment and Management subject where students are required to analyse presented scenarios and identify based on their knowledge and research possible solutions. Students as a part of industry engagements are required to communicate, negotiate, manage projects and present findings. This is in particular evident in a third year subject Emerging Trends in Information Systems where students have the opportunity to engage in simulated industry project or in some cases real industry projects where in both cases they are required to closely communicate with team members, manage project, negotiate and also present to the industry representative.

Research by Ryken in 2001, states that when learning and teaching it is very important to give examples that are closely aligned to real business scenarios, so that students can easier make associations, learn and progress. Initial skills students need to learn often come from specific industry sub domains such as for Computing or Information Systems, Analysis and Design, Programing, Database Development, Networking and Web Development. Such skills are seen as basic building component blocks of the generic computing field. Such concepts are often at the university delivered within specific subjects. To solve simple single filed related problems, sub domain data may be sufficient, however to solve industry-based problems, it is essential students are able to abstract, contextualize and utilize the advanced levels of reasoning and analytics (Paus et al 2009). Therefore, abstraction and reasoning are initially taught via the case study analysis and later via industry simulated projects. To apply the knowledge within the

Domain, it is essential for students to understand the environment in which theoretical concepts are to be applied (Lykke et al 2014). Consequently, in later years, second and third students are able apply concepts to industry projects and fully integrated internships (Information Systems Deployment and Management and Emerging Trends in Information Systems subjects).

Preparations for the work environment starts from the first year of the University education. During this time students are exposed to work and life in the industry. They learn about the work structures, job roles, positions, they gain the opportunities to speak to the manages as well as interns and gain the opportunities to learn more about the current projects. Consequently, from very early stages of their degree, students are invited to attend industry visits.

During the industry visits, students also get to learn about the company operations. First year gives students the ability to taste various specializations and activities while during the second-year students learn to build industry networks and look into opportunities to apply for internships and work on simulated projects. Second year also often provides the opportunity for the skills learned to be applied within the controlled environments where both industry and academic representatives are present and can provide feedback. During the second part of the second year and through the third-year students often have the opportunities to engage in international activities such as overseas study programs and internships (Hol et al, 2016).

It is important to state that all projects, internships and simulated work is closely aligned to overall course objectives and the learning outcomes, so that following the degree completion students are job ready.

Therefore, to be able to holistically review framework requirements Good WIL (Work Integrated Learning) Practice identified by Edwards et al 2015 was studied in detail. Such practice states that for the successful industry engagements, WIL Practice requires strong integration of both practice and theory. It also stresses the importance of the progressive building of the content covered which allows it to be applied via subject area, case studies, simulations, projects and internships. Furthermore, this design takes into the account that each stage of students' learning needs to be clearly defined. This also means that feedback needs to be timely delivered and students given opportunities to via different scenarios meet the required learning outcomes.

Framework for the Implementation of Industry Engagements for Undergraduate Courses

Taking into the account the data gathered via the case assessments, it was identified that for each industry update and the new implementation, it is essential to know and understand the Domain – Industry. The industry definition is determined by current business operations, knowledge and skills required for the operations within the industry as well as the skills deemed essential by the industry professionals. For students to be able to achieve and complete particular subjects and have the skills required to address the industry demands they need to be able to meet the requirements and the objectives of the set degree they are undertaking.

Therefore, to successfully implement industry engagements in academia, it was identified that it is essential to first determine the required content that is to be delivered. Once this is done, it is essential to define the Context in which such material can be delivered, online, offline, face to face and who the audience or the students for the delivery are. This in turn is defined by the cohort type (as nature of delivery may differ based on past student experiences). Next, it is important to identify which activities can be implemented as a part of the industry engagements and at which level of study, so that a selected cohort can gain the required knowledge, meet the learning objectives and consequently gain the skills required as identified by the learning objectives.

Consequently, it is essential to define the progress. Progress is often determined by the type of cohort as well as cohorts' previous knowledge and experiences. As specific cohort learns and progresses through the set curriculum, cohort students are able to attend to a larger variety of activities. Initial industry inputs while students are learning content, provide opportunities for the company visits and the understanding of the field. In addition, industry also provides the opportunities for students to meet interns, managers and later in second and third year to engage with project leaders, so they can learn about the tasks required once they are to join the field (as a part of industry visits, study tours and later projects and internships).

Furthermore, simulation techniques may be employed to allow students to assess their knowledge and gain 24/7 feedback. This would be similar to activities implemented in Information Systems in Context subject. As students learn they gain new skills and in second year become ready to explore new opportunities (study overseas, New Colombo Project engagements).

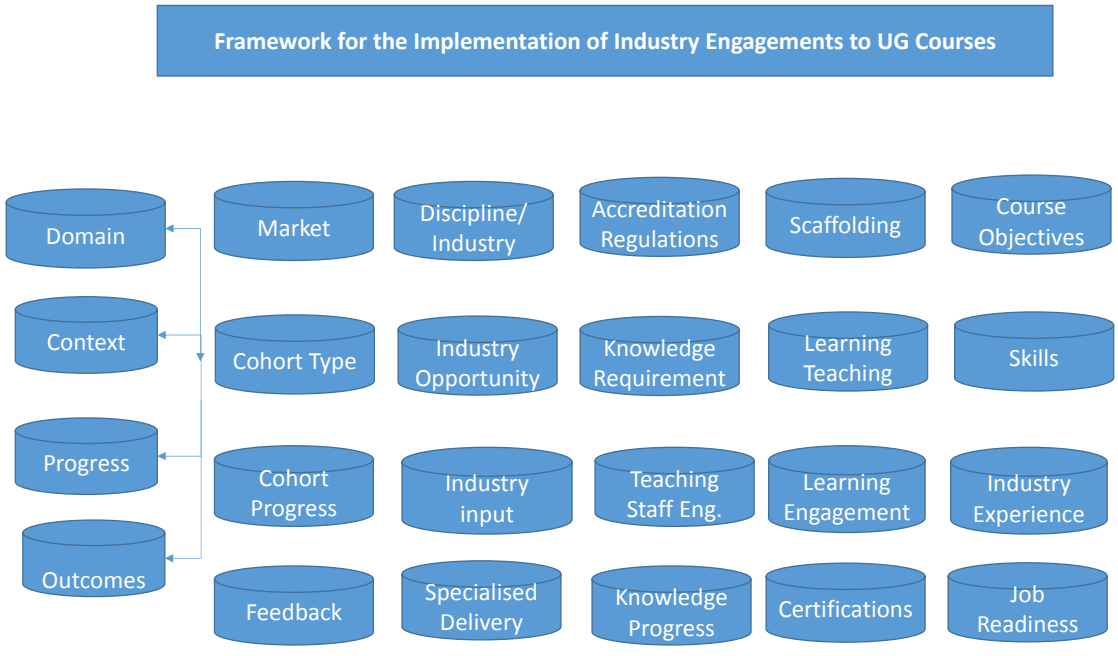

Figure 1: Partnership Academia - Industry

During the third year, students gain opportunities to engage in industry led projects, internships and undertake placements which gives students opportunities to experience real work-based environments. This is similar to activities students undertake as a part of the Emerging Trends in Information Systems subject.

As students learn, they also gain feedback across multipole domains. Feedback they receive is often provided by the academic staff, via simulated industry activities (as in Information Systems Deployment and Management subject) and later also by the industry for the engagements in industry led projects and internships (as in Emerging Trends in Information Systems subject). Also, some industry engagements that are implemented as a part of the curriculum, may give opportunities for certifications such as Cisco CCNA and also lead into completions of units, majors, degrees (students undertaking Networking major are able to do so at Western Sydney University) Figure 1. Presents the framework that enables the synergies between industry and academia.

Smith et al, 2014 support the notion that industry-based activities should be implemented throughout the curriculum and that to achieve so authenticity, preparation and continuous supervision should be incorporated. It is also evident that this model allows for the continuous reviews and industry inputs to be provided, so that teaching and learning activities can be guided by both industry and the academics.

Having now industry engagements and visits implemented from very early within the degree, allows students to develop soft skills, which previously researchers have identified was lacking (Dishman, 2016). As a part of Information Systems degree students are required to present, work in groups, write reports, create videos, prepare resumes and engage with industry members via meetings, visits, projects and internships. Furthermore, this model allows students to test skills learned in the safe settings first as a part of the integrated theory and simulation projects. Later, once students have gained the confidence and have tested the initial knowledge, they are then able to test their skills and engage in industry led projects and internships.

Conclusion

In conclusion, this newly proposed framework for academia – industry engagements can be used to assist in embedding industry experiences as the components throughout the three-year curriculum. The model also highlights the importance of the continuous industry – academia partnership that is evident from the time degree is planned and proposed to the time degree is running, students are completing subjects and are engaging in industry run projects and internships. This study also identifies the importance of the Domain and the Context that determine the subject matter that is to be studied as well as who is studying content, what their experiences in the Domain are and what they need to learn to be job ready. The framework also ensures that knowledge is gained through scaffolding, so that at each learning stage a variety of methods can be employed to assess skills learned. The assessments at each stage of learning, take into the account the theoretical concepts, the communication mode required within the industry to execute the specific skill and the knowledge required to solve an industry-based problem, think critically and identify potential solutions. Such approach allows students to be assessed via case-based analysis, simulations, projects, industry engagements and internships as well as via standard assessments and exams. Consequently, the framework can assist in assuring students learn the theoretical concepts, gain the skills required for the industry-based tasks and are capable of solving complex industry problems that have so far not been encounter.

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