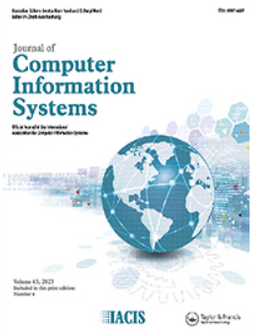

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Achieving Industry-aligned Education through Digital-Commons: A Case Study

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ABSTRACT

Aligning student skills with industry practices in the current fast-changing digital economy is one of the many challenges faced by higher education institutions. In this paper, we present a novel approach in which we developed a digital commons to serve as a bridge between emerging industry practices and academic curricula. In a digital commons, knowledge is created and shared online. This case study describes the motivation for, and the design, development and evaluation of, an industry practice digital commons (IPDC) to assist students in developing industry relevant knowledge. The target students were pursuing a course on IT Governance and Service Management (IGSM) at an Australian university. The development of the digital artifact followed the design science research (DSR) paradigm. Feedback from 78 students and 26 practitioners, and the visitor analytics totaling 122,360 users, indicated that both student and practitioner communities considered the IPDC to be valuable.

KEYWORDS

Employability; industry-aligned education; digital commons; connectivism learning theory; knowledge commons theory; design science research (DSR); case study

Introduction

One of the challenges of higher education institutions is to prepare students for jobs that do not yet exist to solve the problems that we do not yet know are problems.[1] At the same time, universities should also offer courses that are aligned with employers' current needs.[2,3] Research on employability is an emerging area that is of interest to policy-makers, industry and academia.[4] Equipping students with relevant industry knowledge and skills is an aspect of employability.[5]

The digital economy demands the development of new skills to contribute to and innovate in the workplace.[6,7] Hence, information systems (IS) programs need to maintain up-to-date curricula[8] to align with the changing needs of the digital economy. However, continually revising the curricula to stay current is a challenge for IS faculty.[9] Ideally, the IS curriculum should be revised as often as needed. However, the academic update cycle is effort/cost-intensive, and the release cycle is much longer than industry change cycles. As a result, the academic curriculum often ends up in a catch-up mode with industry changes. If students enroll in the latter part of the academic refresh cycle, there is a likelihood of larger misalignment with industry knowledge and skills.

Taking inspirations from connectivism learning theory[10–12] and knowledge commons theory,[13,14] we questioned whether an online knowledge repository that is shared between industry practitioners and students could help to address these problems. Knowledge commons refers to sharing of all type of knowledge resources by a group of people.[13] The knowledge resource includes all type of cultural and intellectual resources including but not limited to data, information, intellectual property, opensource materials.[14] The digital platforms that are used to share scientific data and knowledge during the Covid pandemic are examples of knowledge commons.[15,16] As we elaborate below, connectivism learning theory can be characterized as a network theory of knowledge and learning with an emphasis on the use of digital technology.[17] The principles of connectivism[10] guided the conceptualization of pedagogical design in this study. On the other hand, the knowledge commons theory provided a framework for the principles to design a successful *commons*, a shared knowledge repository between the industry practitioners and the students' community. Creating/sharing online knowledge is a sub-type of knowledge commons theory known as a digital commons.[13,18,19] We developed a purpose-built online knowledge repository – a digital commons – by collaborating with industry practitioners and the academic community. The digital commons that we developed is referred to as an "industry practice digital commons (IPDC)" as the knowledge contained in the repository captured established and emergent IS industry practices. Thus, this paper addresses the

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research question, *"How can we design and evaluate a purpose-built digital commons that is useful and relevant to both students and industry practitioners?"*

The case study university discussed in this paper is an Australian university with over 25,000 students. A course on IT Governance and Service Management (IGSM) provided the base for the case study. The IGSM course covers IT Service Management (ITSM) and IT Governance principles. IT Service Management is an industry practice that enables IT services to be customer-centric and aligned with business needs.[20] IT Governance principles include the definition and implementation of processes, structures and relational mechanisms in the organization that enable the board and senior management to execute their responsibilities.[21] ITSM and IT Governance are competencies within the IS2020 model curriculum.[22] Aligning with industry practices is one of the challenges of offering an ITSM course.[23,24] Since the design of the ITGM curriculum required ongoing alignment with industry practices, it was considered as an appropriate target course for an IPDC.

The IPDC was launched to the public in February 2019, and since then it has been used in more than 45,200 practitioner transactions from 22 countries. This paper describes the motivation to develop an IPDC, the design of the artifact and the evaluation of the IPDC by the student and practitioner communities.

The remainder of the paper unfolds as follows. The background section provides an overview of current research in university-industry alignment and how this research fits within the research landscape. We introduce the pedagogical design using connectivism learning theory in the following section. The IPDC was developed following the design science research (DSR) paradigm. The research methods section describes how DSR was applied in developing the IPDC. A detailed description of the evaluation strategy and an analysis of the evaluation results are presented in the evaluation section, followed by a discussion of the findings. The paper concludes by acknowledging its limitations and presenting future opportunities. Overall, the authors contend that the IPDC's development, instantiation and evaluation constituted a case study of the pedagogically authentic application of connectivism learning and knowledge commons theories, which in turn contribute toward lasting educational outcomes for both students and practitioners in this digital learning enterprise.

Background and literature review

The background section provides the research context covering the existing research landscape to address employability improvement, industry collaboration mechanisms, the role of digital commons and an overview of the case study.

Employability improvement through industry-aligned curriculum

One of the important goals of higher education is to improve the employability of students.[4] Employability is modeled based on three competencies – viz., *know-why, know-how* and *know-whom*.[5] Know-why competencies relate to career motivation and personal identity. Know-how competencies refer to job-related knowledge and skills, and underpin how the student contributes to the organization's overall capabilities. Know-whom competencies refer to the individual's ability to network professionally with others. This research focuses on the know-how competencies related to knowledge and skills.

The importance of developing industry-relevant student skills is acknowledged by many researchers, who have used different methods to achieve desired outcomes.[25–28]

One such method is to introduce a capstone subject in the final year of the degree.[25] The characteristics of capstone units are integrating and synthesizing knowledge across topics, consolidating graduate capabilities, fostering industry and professional connections, and facilitating work-integrated learning.[25,29] Some academic programs incorporate internships as a way of bridging the IS skills gap.[26,30] Other methods involve other types of collaborations, as described below.

For industry collaboration, Grebski and Grebski[31] proposed a continuous quality improvement (CQI) process, with the CQI loop closing on the program level and the course level. The CQI process advocates collaboration with the external partner to make continuous adjustments to an academic program to ensure that the program is always aligned with the industry needs.

Commons theory and digital commons

Commons theory is an influential economic theory that studies the governance of shared resources, including knowledge.[13,14,32] There are many applications of knowledge commons theory, including but not limited to innovation commons, industry commons, digital commons, learning commons, academic commons and knowledge cities.[32] The knowledge commons theory provides a solid foundation to develop the governing arrangements among the student community, the industry practitioner, and the academic community. Knowledge commons theory has been successfully used for fostering university–

industry partnership for research technology transfer.[33] In this study, we applied the knowledge commons theory to education. The knowledge commons framework was deployed to develop a participatory governance model to govern knowledge in the IPDC as it provided a flexible pathway to collaborate with industry practitioners without the need for formal partnerships. Besides, the digital commons approach enabled us to reach the global community of practitioners.

The IGSM course – an exemplar candidate

The IGSM course was used as a case study to validate the efficacy of the IPDC approach. Focusing on IGSM gave a good starting point for the following reasons.

- IGSM is an industry-driven practice.
- That practice encompasses many complementary frameworks that offer the potential to scale up to other IS domains in the future.
- We had access to a case study university that was an early adopter in offering the IGSM courses in their curricula.
- The researcher developing the digital commons was an experienced ITSM practitioner.
- There was a tactical need to upskill the students in ITSM since a major update in the framework was introduced in the industry.

The key motivation to introduce the IGSM course was the demand from the industry to have graduates who are skilled in IGSM practices. The IGSM course was designed based on ITIL v3 and COBIT, and was offered at both undergraduate and postgraduate levels. In a typical cohort, it is normal to have more than 100 students.

One of the challenges that the course delivery faced in early 2019 was the release of ITIL 4, the new version of the framework. There were significant changes between ITIL v3 and ITIL 4.[20] ITIL 4 introduced various new concepts, including value co-creation and Service Value System (SVS), as well as updated practices.[34] The IPDC presented an opportunity to use the repository as a complementary learning resource for the students to introduce ITIL 4. The pedagogical design was conceptualized through connectivism learning theory, as described in the next section.

Applying connectivism learning theory to the pedagogical design

Connectivism learning theory is characterized as social learning through knowledge networks underpinned by technology,[17] including specifically in digital learning contexts. Since connectivism was introduced as a learning theory by Siemens,[10] there have been many applications, ranging from primary school to higher education.[11] An exemplar of connectivism as pedagogy is massive open online courses (MOOCs).[35] The first MOOC was entitled "Connectivism and Connective Knowledge" to acknowledge its roots in connectivism learning theory.[17]

Connectivism learning theory is based on eight principles.[10,11] These principles emphasize the need for: 1. Diversity of opinions; 2. Connecting knowledge nodes; 3. Capacity to learn more; 4. maintaining knowledge connections; 5. Continual learning, 6. Currency of knowledge; 7. decision-making; and 8. learning through non-human appliances.[10,11]

The attributes of the IPDC can be aligned to these connectivism principles, as follows:

Diversity of opinions

As the IPDC is a shared digital space between practitioners from different backgrounds and the students, the knowledge contained in the IPDC is diverse, representing unique perspectives on each practice. Thus, by accessing the IPDC, students gain a holistic view of the problem and an appreciation of complementary practices.

Connecting knowledge nodes and capacity to learn more

The IPDC is conceptualized as a meta-knowledge node that connects to different leaf nodes, as shown in Figure 1. The leaf nodes represent the different practice domains. For example, IGSM encompasses the practices of project management, governance, enterprise architecture and service management. The bi-directional arrow depicts that the knowledge flows from the practice to the IPDC, and that the IPDC provides pointers to the practice for further research. Thus, as a meta-knowledge node, the IPDC encourages students to explore different pathways to research and to learn more.

Maintaining knowledge connections

According to connectivism theory, the student's ability to see connections among fields, ideas and concepts is a core skill.[10] The IPDC facilitates the knowledge connection by presenting a hierarchical view of the domain comprising lifecycle, processes, tools and skills. The student can connect the relationship between a life cycle phase and the underpinning processes, and how the processes relate to the tools.

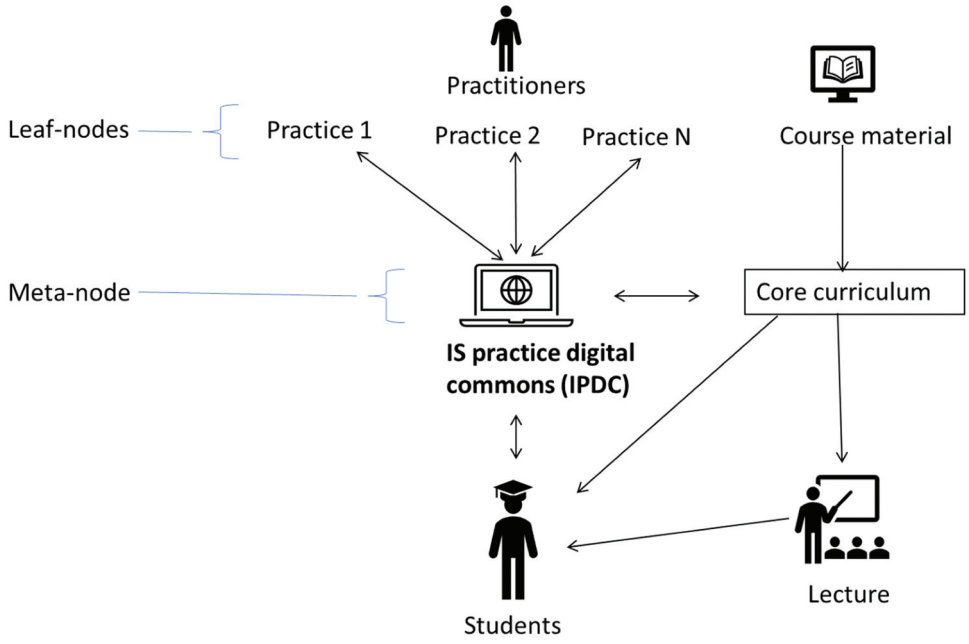

Figure 1. Conceptual model of the industry practice digital commons (IPDC).

Continual learning – Achieving lasting educational outcomes

As a public domain platform, learning through the IPDC can continue even after the student graduates. Thus, the IPDC facilitates continual learning. As the knowledge contained in the IPDC is current industry knowledge, the student is expected to find it useful for her or his day-to-day job. Thus the IPDC contributes toward achieving lasting educational outcomes.

Currency of knowledge

As a self-managed system, the objective of the IPDC is to maintain the currency of knowledge. Exposing complementary knowledge empowers the students to make informed decisions about the solutions to a business or technical problem.

Decision-making

By presenting a wide range of complementary practices, the IPDC can encourage students to find the right practice or a combination of practices. For example, we might ask students to develop an innovation management process in their organization by combining different best practices. Carefully designed assignment questions, complemented by the IPDC, can be used to hone the students' decision-making skills.

Learning through non-human appliances

Being a digital platform, the IPDC presents a wide range of instruments to impart knowledge to the students, including using videos, quizzes and action learning through participation.

Research method

For designing and evaluating the IPDC, this research adopted the DSR paradigm.[36,37] DSR addresses three core aspects of building the IS artifact: relevance, rigor and design.[38] The Relevance Cycle connects the target user environment with the design of the artifact. The scientific knowledge base is leveraged in the rigor cycle. The design of the artifact bridges the relevance and rigor cycles through multiple iterations. The three-cycle view is presented in Figure 2 with reference to this research. All the data collected were gathered after obtaining the parent university's ethics approval (approval number . H18REA268).

This research followed a six step approach, comprising: (1) Problem identification and motivation; (2) Objectives of the solution; (3) Design and development; (4) Demonstration; (5) Evaluation; and (6) Communication.[37]

Problem identification and motivation

The motivation for the research primarily came from observing and interacting with IGSM practitioners.

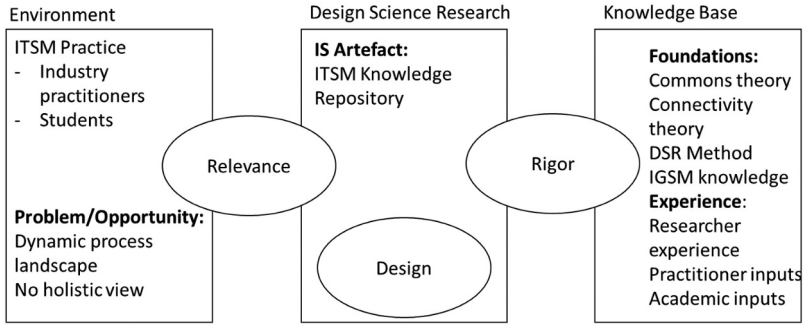

Figure 2. Three cycle view of DSR with annotated research content (adapted from [38]).

When IGSM practice came into prominence, the practice was identified with the ITIL framework, which was considered as a "de-facto standard."[24,39] Owing to changes in the business and technology landscape, the IGSM practice expanded to comprise multiple complementary practices.[40–43] Discussions with industry practitioners led to an opportunity to develop a knowledge repository that presents a holistic view of contemporary process frameworks.

wide range of complementary practiceIt was realized that the problem was impacting the academic curriculum as well. The problem of multi-process complexity and changes to the frameworks were not limited to industry practitioners. As future industry practitioners, students could be better prepared in their candidature. In this context, the IPDC was introduced to the undergraduate and postgraduate IGSM courses as a complementary learning resource.

Objectives of the solution

wide range of complementary practiceMeta-requirements describe the goals of the design artifact to address the class of problems.[44–46] The development of a digital commons that contains IS industry practices is considered as the meta-problem. Though there is not a single accepted way to elicit meta-requirements, these requirements can be derived from kernel theory and stakeholder inputs.[47] We derived the meta-requirements from the knowledge commons theory, connectivism theory and inputs from the practitioner and student communities.

wide range of complementary practiceThe knowledge commons theory advocates sharing a common pool of resources – i.e., knowledge, information and data – between communities.[13,48] The pre-requisite for sharing the knowledge with an IPDC is that it should be available to all the target communities, which leads to the first meta-requirement (MR).

MR1: An IPDC should be accessible to practitioners and students

The knowledge commons theory has its roots in the commons theory that captured the essence of the successful collaboration of communities. In her research studying commons, Ostrom [49] noted that successful commons have well-defined boundaries. For the IPDC, defining the boundaries of the knowledge domain is important to design the repository, which leads to the second meta-requirement.

MR2: The knowledge boundaries of an IPDC should be defined

The commons theory also advocates the constructs of participatory governance, appropriation and sanctions. Participatory governance implies that there should be a governance function implemented to monitor the participants' behaviors and to manage conflicts by imposing graduated sanctions. The appropriation refers to the equitable nature of the knowledge commons to ensure that all participant groups attain equal benefits. Accordingly, we defined the third meta-requirement.

MR3: There should be a participatory governance mechanism implemented to monitor the performance of an IPDC

Mindel, Mathiassen and Rai [48] pointed out that the knowledge commons should provide value to the stakeholders. Our interactions with the stakeholders highlighted the need to compare different frameworks. The stakeholders highlighted a requirement to compare different frameworks and how they related to one another. We considered each framework as a knowledge type, which led to the fourth meta-requirement.

MR4: The user should be able to compare different knowledge objects within the knowledge domain in an IPDC

In the following subsections, we describe how the artifact was designed to address these meta-requirements.

Design and development

To address MR1, the IPDC was hosted in the public domain so that both students and industry practitioners could access the repository. The IPDC was developed using an open-source content management system (CMS). The application development used a configurable platform approach that considerably eased the application development process.[50]

MR2 stipulates that the boundaries of the knowledge commons should be defined. For our IPDC, the knowledge boundary was IGSM and complementary practices. Although some researchers have considered ITIL as a de facto standard of ITSM [51,52] we interpreted IGSM as a practice that encompasses multiple, complementary process frameworks. COBIT and ITIL provide an end-to-end view of the IT lifecycle. The IPKR user interface, that serves as an entry point to all the frameworks is shown in Figure 3.

MR3, related to a participatory governance mechanism, was implemented through the formation of an expert panel, which consisted of five members from the practitioner community. All the members had over 20 years of industry experience. The profile of the expert panel was as follows:

- One member was from a consulting background.
- One member was a Chief Information Officer of a government organization.
- One member was from the private sector. This member held a PhD in IT Service Management, and had taken up a full-time teaching position.
- Two members were nominated by the IT Service Management Forum (ITSMF), Australia.

Participation in the expert panel was voluntary. While engaging with the panel members, the researchers acknowledged the panel members' busy professional and personal lives. This engagement followed the Agile development model. The IPDC was developed in fortnightly sprints, and feedback was invited after each release. In each sprint, at least a few members would respond to what was incorporated.

The information architecture of the IPDC supported MR4, whereby the user should be able to compare different knowledge objects within the knowledge domain. While architecting the information in the IPDC, we considered the following search goals. The user should be able to search:

- across all frameworks, lifecycle, processes, tools and skills
- within specific granularity (for example, within a process level)
- within a specific framework (for example, within ITIL v3)
- within a specific framework and granularity (for example, within ITIL 4 process/practices)
- and should also be able to:
- browse and access any specific process area directly without the need for searching
- conduct side-by-side comparison of specific frameworks.

The knowledge repository thus addressed all the meta-requirements. The design was completed, and the IPDC was launched in February 2019. The demonstration and

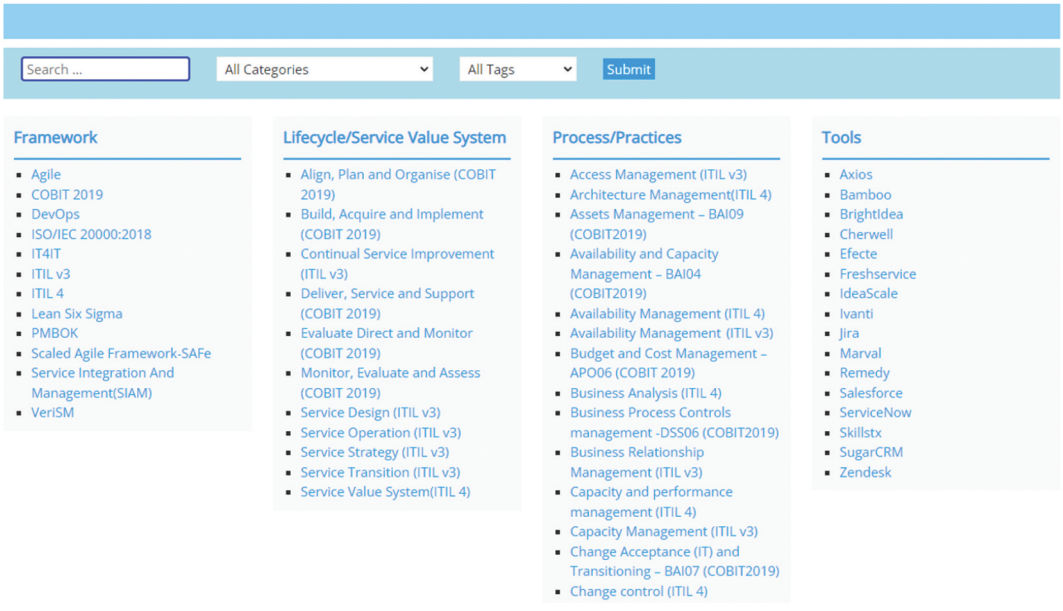

Figure 3. The IPDC user interface showing the knowledge boundaries.

evaluation of the IPDC are discussed in the next two subsections.

Demonstration

The objective of the demonstration is to validate the efficacy of the artifact to solve the problem.[37] The demonstration was carried out throughout the development to the expert panel to validate that the artifact was aligned with stakeholder needs. Once the artifact development had been completed, it was demonstrated to industry practitioners at a state seminar organized by a professional body.

Evaluation

DSR advocates the rigorous evaluation of artifacts.[53,54] Venable, Pries-Heje and Baskerville [54] proposed a Framework for Evaluation in Design Science Research (FEDS). Our evaluation strategy followed the "Human Risk & Effectiveness" path as the major design risk of the IPDC is social or user oriented. The Human Risk and Effectiveness path is ideal when it is feasible and cost-effective to evaluate the artifact with actual users. The objective of the evaluation is to establish that the identified benefits will continue in the long run.[54]

Communication

Communication is an important step in DSR.[37] The objective of the communication step is to articulate the importance of the artifact, its utility and novelty, and the research rigor. As part of improving the visibility, we submitted a nomination to a national professional body in the "business innovation award." Our nomination was successful, and the IPDC was awarded a "business innovation award" in 2019. This award served as a communication tool to improve the visibility of the problems and the utility of the artifact. The communication to students was primarily handled by the course coordinator of the IGSM course. The students were introduced to the IPDC and asked to evaluate its efficacy. Communication to the academic community was achieved through scholarly publications in high-quality journals and conferences.

The IPDC's evaluation strategy

The evaluation strategy had five components:

(1) Formative, naturalistic evaluation based on qualitative, unstructured e-mail feedback from the expert panel (n = 5)
(2) Summative, naturalistic evaluation of students (n = 14) and practitioners (n = 26) for analyzing product quality
(3) Summative, naturalistic evaluation of students (n = 14) and practitioners (n = 26) for analyzing the Net Promoter Score (NPS)
(4) Summative, naturalistic evaluation of students involving written feedback (n = 78)
(5) Summative, naturalistic evaluation of all users using Google Analytics (n = 122,360).

The evaluation strategy of the IPDC is shown in Figure 4.

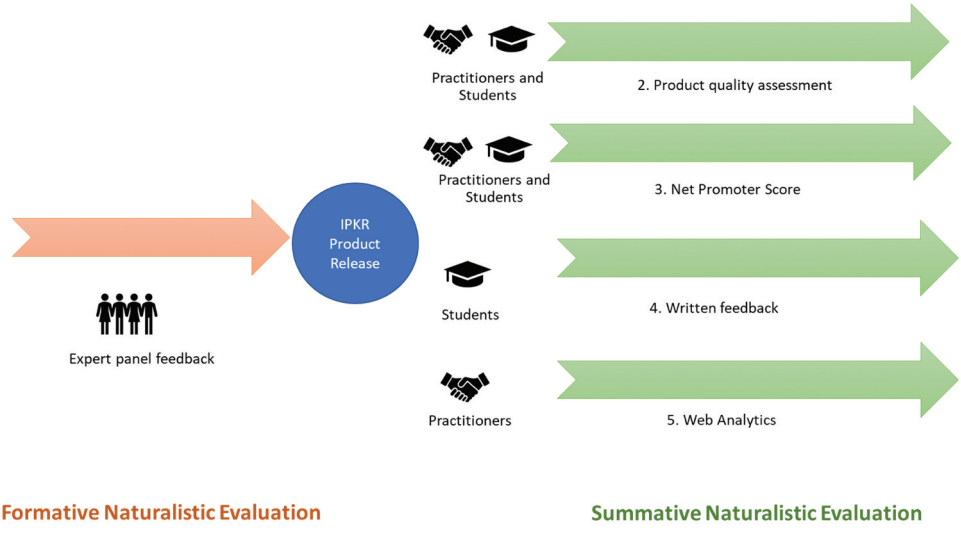

Figure 4. The evaluation strategy of the IPDC.

Table 1. Formative evaluation of the IPDC by the expert panel.

Category	Feedback
Product Feature: User feedback	*"Just having a look at the latest additions, and the first thought that popped into my mind is that users probably also need the ability to "not like" it and well as "like" it. But if there is a thumbs down option, there should also be a facility for them to leave feedback.*
Additional Knowledge	*"The site looks good. Brace yourself for changes in ITIL. The lifecycle model will cease to exist in ITIL4 (well . . . . the principles still apply, but the overarching meta model is going to be value stream based). Time for more listings of tools, especially in the DevOps space (continuous testing, release orchestration, provisioning, CI/CD, etc)."*
Knowledge Presentation	*"The graph mapping ITIL 4 elements onto COBIT: I'd extend CSI coverage a little bit into governance. I've always felt that CSI touches on governance (it is not the same but several aspects are similar, should work together and serve some similar goals)."*

Formative-naturalistic evaluation by the expert panel

The feedback was focused on the quality of the content, the features of the knowledge platform, the additional complementary knowledge and the overall usefulness. The expert panel used e-mail as the channel for providing feedback.

Some of the examples of the feedback received from the panel are shown in Table 1.

As Table 1 demonstrates, the feedback was diverse covering a wide range of dimensions of the IPDC. The fortnightly sprints were useful in maintaining the momentum of the development. Forming the expert panel early in the development cycle was beneficial to align the features and content of the IPDC with the industry practitioners.

Summative–naturalistic evaluation by students and practitioners

The IPDC was intended to be used by students studying the IGSM courses and industry practitioners. One of the evaluation instruments was a survey. The survey was used to evaluate the perceptions of both practitioners and students.

The researcher demonstrated the IPDC in an industry seminar in front of practitioners and asked them to complete a survey. The survey did not include any personally identifying questions, and the responses were fully anonymous. There were 26 responses from the industry practitioners. During another episode, the students studying the IGSM course at bachelor's and master's levels were encouraged to participate in the survey. There were 14 responses from the students.

Besides the survey, the students provided written feedback through their assignments that had 78 responses. The audience profile in Figure 5 shows the aggregate of all the feedback instruments. The prominent group of respondents was from large government and defense organizations with more than 2000 employees and had more than 20 years of experience.

The survey questions were aligned to the dimensions of the product quality standard specified by ISO/IEC 25000.[55] The ISO/IEC 25000 series, known by the abbreviation "SQuaRE" (Software product Quality Requirements and Evaluation) series, includes standards that define characteristics for internal and external quality and quality in-use (reference removed). The quality in-use characteristics are Effectiveness, Productivity, Safety and Satisfaction. The survey posed questions about these quality in-use characteristics, and additional questions that were aligned with the epistemic design principles. The questions were responded to using a Likert scale of strongly agree, agree, neutral, disagree and strongly disagree. Table 2 shows the comparison between students' perceptions and practitioners' perceptions . Z-test is used to determine the statistical signficance. Z-test is typically applied to compare the statistical significance between proportions/percentages.[56] If the Z-score is outside the range −1.96 to 1.96 and p value is <0.05 the difference is considered as significant.[56]

Both practitioners and students agreed that the IPDC was useful and relevant to them. All the student respondents agreed with its usefulness compared to 85% of the practitioners. There were no ratings given to "disagree" or "strongly disagree" by any participant. The visual appeal was the only question in which the students' ratings were lower than the practitioners' ratings. The students indicated in the written feedback that they would like to see the visual interface being more appealing and interactive. The practitioners seemed to accept the minimalist visual design, and were possibly more interested in the content.

Statistically significant differences in the ratings (Z-score < −1.96, p value < .05) were observed in "trust" (Z = −2.02, p =.04)and "usability" (Z = −2.68, p = .01) ratings. The lowest rating by the practitioner group was Trust, which was rated only at 54%. This rating indicates that the practitioners, on average, were not able to agree (or strongly agree) that the IPDC is trustworthy.

One of the comments provided suggestions about improving trust:

"It would generate more trust if there was: 1). Further information on the about page that included reference to the principles adhered to as part of the research. 2). A uni logo included on that page. 3). Reference to IGSMF and a Logo."

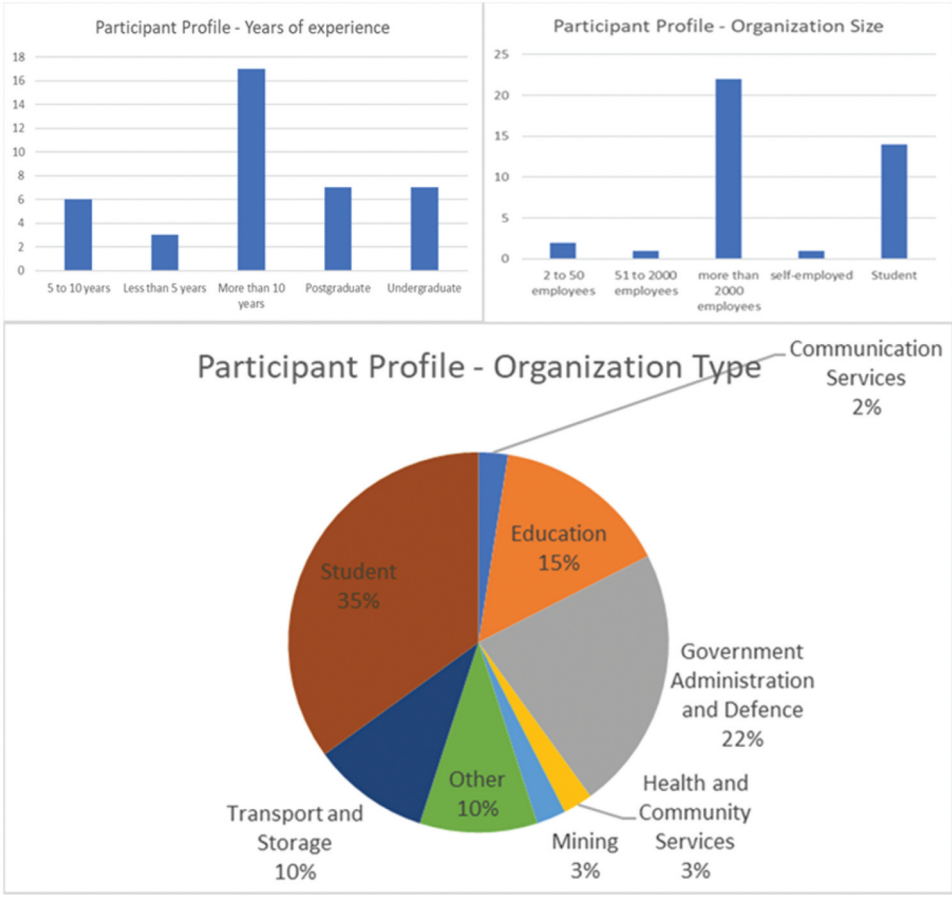

Figure 5. Naturalistic summative evaluation participant profile.

Table 2. Naturalistic survey response comparison between practitioners (n = 26) and students (n = 14).

Quality In-Use Characteristics	Survey questions	Practitioners – Strongly Agree/ Agree	Students - Strongly Agree/ Agree	Difference	Z-score	p-value
Relevance	The IPDC is useful and relevant to me	85%	100%	15%	−1.55	0.12
Ease of finding	It is easy to find the relevant knowledge article	69%	86%	17%	−1.15	0.25
Visual appeal	The knowledge is visually well presented	85%	71%	−14%	0.99	0.32
Readability	The content is easy to read and understand	88%	93%	5%	−0.44	0.66
Trust	I trust the information presented in the IPDC	54%	86%	32%	−2.02	0.04
Coverage	The knowledge coverage is well distributed between multiple process reference frameworks and supporting tools	96%	100%	4%	−0.74	0.46
Currency	The knowledge reflects the current state of IGSM practice	77%	100%	23%	−1.95	0.05
Structure	The content is well structured	77%	86%	9%	−0.66	0.51
Usability	I am able to read the contents properly on my device's screen	62%	100%	38%	−2.68	0.01
Security	I feel comfortable and secure to browse the IPDC	77%	100%	23%	−1.95	0.05

The students seemed to trust the IPDC more than did the practitioners. This could have been due to the fact that the IPDC was suggested as complementary learning material, or that the practitioners were more critical, given their more mature knowledge base. From a research perspective, it was instructive to see the different ratings of Trust between the practitioners and the students. This finding warrants further investigations in future research.

The other area where the practitioners and the students differed was in their responses to the question "I am able to read the contents properly on my device's screen." The students rated 100% on this question, whereas the practitioners' rating was 62%. This discrepancy could have been because not all practitioners had used the IPDC on their devices. The practitioners had responded after participating in the demonstration.

Summative-the net promoter score (NPS) by students and practitioners

The NPS is derived from responses to a single question that queries whether the user would recommend the product to a friend or a colleague.[57] The NPS has been used as an evaluation method in various domains, including IS.[58] In NPS terminology, promoters include anyone who responds with a score of nine or ten. Promoters are more likely to buy products, stay loyal to the brand and spread positive brand awareness to others. Detractors are those who score between zero and six – they are the most likely to have a negative perception of the brand. Passives score between seven and eight. The passives exhibit behaviors that fall between a detractor and a promoter. The NPS is determined by subtracting the percentage of detractors from the percentage of promoters.[58]

In this study, the NPS scores from the practitioners and the students followed a similar response pattern to the product quality questions. The students recommended the IPDC to their friends and colleagues. The practitioners were not still convinced that they would recommend it to their peers. Figure 6 presents the NPS scores. Among the practitioners, there were more detractors than promoters, which resulted in a negative score. There were more promoters in the student community, which resulted in a positive score of 29.

Summative–naturalistic–written feedback by students

The IGSM curriculum at the case university includes two assignment reports. The evaluation is included as part of the second report, carrying a 25% weight. The evaluation question was "*What is your experience of using the IGSM knowledge repository to learn about ITIL 4? Identify at least one improvement opportunity for the repository. Reflect on your experience.*" The evaluation was conducted in June 2019. To maintain privacy, the student feedback was anonymized by the course team before it was sent to the primary researcher for data analysis.

The prominent feedback theme was that the repository helped the students to learn about ITIL 4. Some students appreciated the fact that the repository is non-commercial and advertisement-free. The students noted that they had benefited from the side-by-side comparison of ITIL v3 and ITIL 4.

Summative-naturalistic evaluation using google analytics

Web analytics tools enable businesses to monitor visitor profiles and behaviors.[59,60] For monitoring the performance of the IPDC, we integrated Google Analytics, which is a service offered by Google that generates detailed statistics about the visits to a website.[59] This tracking application, external to the website, records traffic by inserting a small piece of code into every page of the website. Google Analytics provides insights about the visitors' geographical location, browsers, referral source, the pages visited and behavior statistics. The dashboard for the IPDC is shown in Figure 7.

The dashboard shows that 122,360 users accessed IPDC from March 2019 to May 2022. The top numbers of visitors were from the United States, India, Australia, Germany and the United Kingdom. From the dashboard we conclude that IPDC is visible in the online space to the target community and attracts initial interest. The profile of the geographic spread is representative of the interest in ITSM practice in the geographic regions. The dashboard was further analyzed that showed that 15.2% of the visitors were repeat users. The repeat users spend nearly more time (4:07 minutes) than the first time users and visit more pages (2.29 pages per session). The

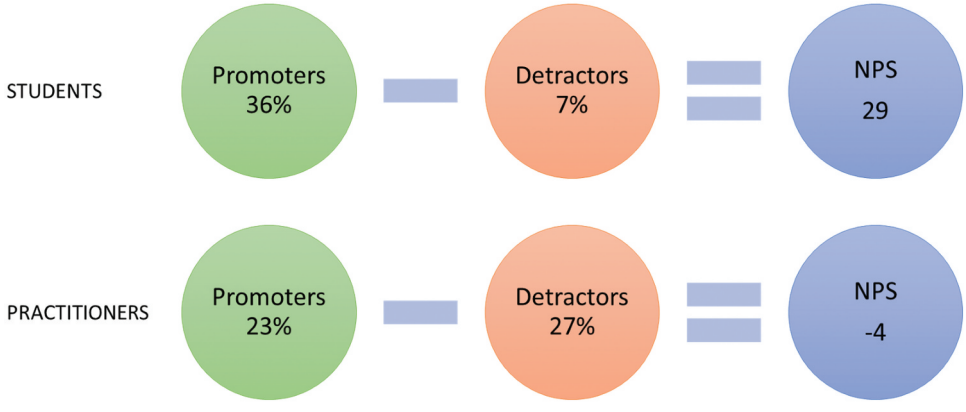

Figure 6. Comparison of the Net Promoter Score (NPS) between practitioners and students.

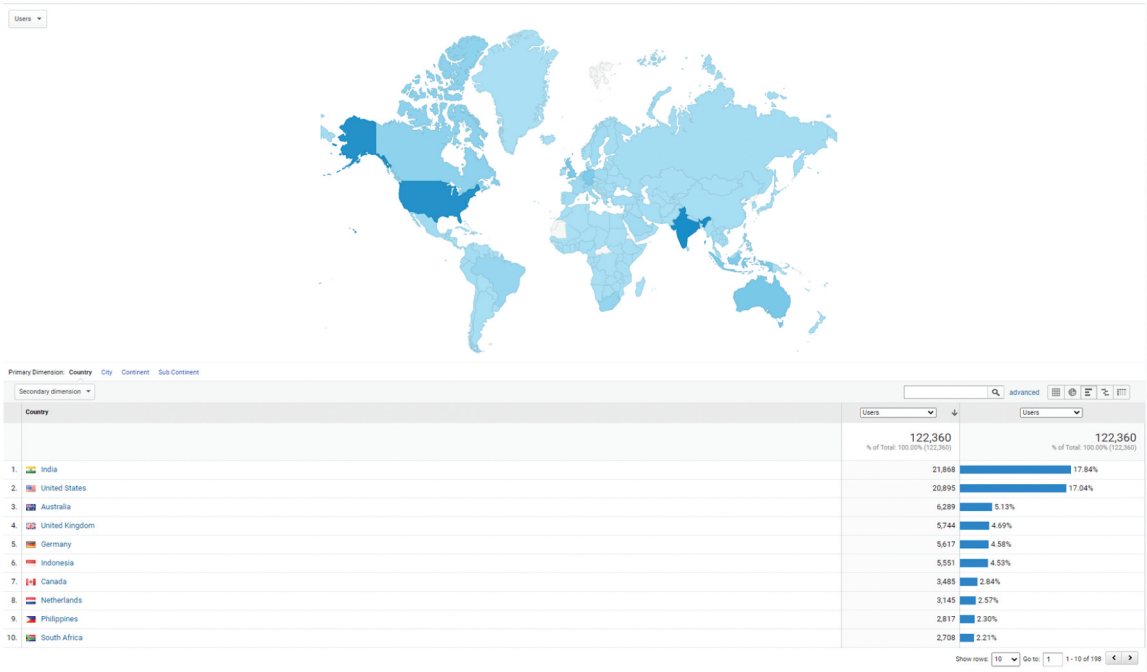

Figure 7. Google analytics dashboard of the IPDC.

summary of the behavior differences between the new users and repeat users are shown in Figure 8.

Further analysis of the user behavior to identify "power users" who use IPKR effectively will be presented in the future research.

Discussion

We developed the IPDC in consultation with practitioners through the expert panel. The meta-requirements that were derived described the objectives of the problem class of a "shared knowledge repository for students and practitioners." The design of the IPDC addressed these meta-requirements. Using different instruments for the evaluation and measures demonstrated the approaches in gaining a balanced view of feedback. The Google Analytics monitoring showed an effective way to monitor the engagement of practitioners. The students were asked to participate in a survey and to provide descriptive feedback as part of their academic assignments. The students' responses indicated that the repository was relevant to their studies and enabled them to understand the relationship between frameworks.

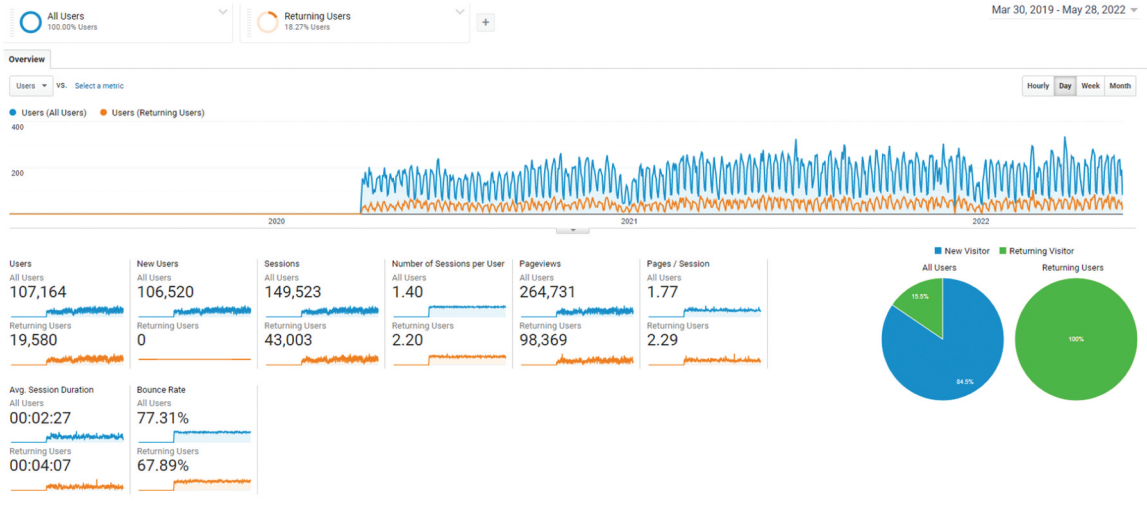

Figure 8. User behavior summary dashboard.

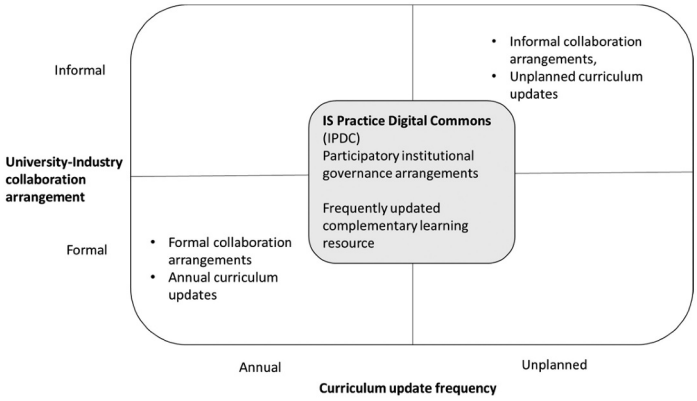

Figure 9. The IPDC approach to aligning student skills with industry.

Aligning student skills with the current and emerging industry knowledge is a problem faced by universities. There are different approaches such as introducing a capstone subject, collaboration through an internship, the joint development and delivery of specific subjects, and introducing business subjects that represent attempts to address the issue. These techniques do not directly address how the curriculum can be updated to align with current industry practices.

We considered two dimensions of this problem – viz., curriculum update frequency and collaboration arrangements, as shown in Figure 9. The X axis represents the curriculum update frequency. The CQI framework [31] recommends that the curriculum should be updated annually. The annual updates could be resource-intensive and may not be feasible for many universities. On the other hand, updating the material in an unplanned manner could result in obsolete student skills that are detrimental to the students. The collaboration arrangements are shown on the Y axis in Figure 9. Collaboration arrangements with industry are typically formal or informal. The formal arrangements could involve drafting a Memorandum of Understanding (MoU) and being bound by its legal contractual terms. The IPDC approach provides a middle ground between the extreme options in the curriculum update frequency and the collaboration arrangements, as depicted in Figure 9.

Conclusion

This research aimed to answer the question "How can we design and evaluate a purpose-built digital commons that is useful and relevant to both students and industry practitioners?." To answer this question, we conceptualized and implemented an industry alignment approach based on knowledge commons and connectivism learning theories. The alignment approach was realized through the development of the IPDC. The feedback from students and practitioners indicated that the IPDC was relevant and met the needs of the student and practitioner communities. The analytics indicated that there was a steady increase of visitors to the IPDC all over the globe. Further, our research was awarded a Business Innovation award in 2019 by an IGSM professional body for our contribution to the practitioner community, which is a testament to its industry relevance.

One of the limitations of the study is not getting feedback over an extended period. A longitudinal study involving students' feedback over a period extending to their employment could reveal additional insights about the efficacy of this approach. The longitudinal study could also be extended to measure employment performance/evaluations between those who used the IPDC and those who did not. The web analytics presented in this research was limited to showing the volume of visits and demography. A detailed behavior analysis will be explored as part of future research publications. Similarly, the current application of the IPDC was limited to one university for a single course. In future, the researchers are planning to expand the scope to include other courses, and to invite other universities to participate in shaping up the IPDC.

There are opportunities to improve IPDC to be more engaging for the users. Lack of engagement is a challenge to online education and we could consider interventions such as creating a social media environment with chatbots [61] in future.

Although this research focused on a specific case study, the conceptual model and approach can be extended to any curriculum that needs to align with the industry. This novel concept paves exciting new pathways to develop the IPDC between multiple educational institutions and industries.

More broadly, we assert that this contained case study of the IPDC's development, instantiation and evaluation reflected a wider significance, which related to the IPDC's foundation on the pedagogically authentic principles of connectivism learning and knowledge commons theories. Despite the noted differences between their responses to the different data gathering instruments, it was clear that both the students and the practitioners derived distinctive and diverse benefits from participating in the IPDC. For us, this helped to contribute toward lasting educational outcomes in the contemporary digital learning world. We observed that those outcomes moved beyond the confines of their technological affordances to signify even more profound and significant educational truths for IPDC designers and participants alike.

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