Towards a knowledge operationalisation model for service learning in community projects in Higher Education

Hanlie Smuts[1][0000-0001-7120-7787], Martina Jordaan[1][0000-0003-0110-6600], Corlia Smuts[2]

Department of Informatics[1], Department of Humanities Education[2]
University of Pretoria, Pretoria, South Africa
hanlie.smuts@up.ac.za, martina.jordaan@up.ac.za,
U19264217@tuks.co.za

Abstract. Service-learning conjoins academic study with community service and provides a richer, more practical experience for students, while benefitting the community. Students are required to transform their prior knowledge or generate new knowledge through experience into competencies and operational know-how. However, current research indicates concerns such as transfer of homogenous, theoretical-based knowledge only and a low adoption of project-based learning activities. Therefore, the aim of this study was to design a knowledge operationalisation model for service learning in community projects at a higher education institution (HEI). We applied the model in a service-learning module from an HEI using the elements of the model as guide to identify knowledge operationalisation mechanisms. By using the knowledge operationalisation model, service learning may support the effective transformation of knowledge that students can access and apply.

Keywords: Knowledge Management, Service Learning, Knowledge Operationalisation, Knowledge in Education.

1 Introduction

Educational programmes in higher education institutions (HEI's) that connect a student's real life with prior knowledge, has the prospective to create meaningful learning milieus in which students could develop their creativity, problem solving and innovation skills [1]. One opportunity that combines a focus on curriculum outcomes, real-world engagement and high-impact learning, is HEI facilitated service learning, community projects (CPs) [2, 3]. CPs combine academic study with community service, focusing on fostering meaningful outcomes for communities while achieving academic goals for students [4, 5]. In addition, service-learning is regarded as a high-impact practice that improves student engagement [3, 6]. The aim of service-learning design in an HEI, is to ensure that academic course content and experiential learning create knowledge that students can access and apply in new situations [7]. Researchers established that service-learning and community-based experiences provide a rich context for learning [8] and that prior knowledge is reframed into new understanding through reflection and active experimentation [9, 10]. Therefore, service-learning solutions should enable the acquisition of abilities such as active

engagement, problem analysis, action orientation and reflection on the entire service-learning experience [7].

However, scholars have identified several difficulties regarding academic service-learning programmes such as; the transfer of homogenous, theoretical-based knowledge only, a lack of academic development measurement, a low adoption of deeper learning approaches such as project-based learning activities, and limited examination of the impact of reflection in service-learning programmes [4, 5, 8, 11]. Therefore, the primary research question that this study aims to address through the design of a model is: "*How can knowledge be operationalised for service learning in community projects in Higher Education*?". The aim of such a model is to ensure that the service learning module effectively transforms knowledge and generates new knowledge through experience into competencies and operational know-how. In addition, such a model enables the measurement of how successfully the module outcomes were met or alternatively, identify module optimisation opportunities.

The paper is structured as follows: the background in section 2 provides an overview of the essence of knowledge, Bloom's taxonomy of learning and knowledge conversion and education. Section 3 presents the research approach and the design of the knowledge operationalisation model (KOM) is shown in section 4. In section 5 we complete a mapping of a CP in higher education to the KOM for education in order to illustrate the proposed model's suitability for application. We summarise the findings and conclude in section 6.

2 Background

Service-learning addresses the theory and practical application of teaching and learning through mechanisms, such; as community and volunteer service projects, work-based learning, field studies and internship programmes [12, 13]. Community engagement is a complex, multi-faceted process that involves relationships in-, for- and with communities [1, 13] and service-learning, in this context, is "an educational methodology that combines community-based experiences with explicit academic learning objectives and deliberate reflection" [6:1]. The success of service-learning modules in HEIs depends on numerous aspects and interrelationships as these institutions consider module design, implementation and assessment while engaging the community [6, 14]. Some of these factors include the HEI context, the student group involved, the community involved, and the desired learning outcomes [13].

In the following sections we consider the nature of knowledge, as well as Bloom's taxonomy of learning and knowledge conversion in education.

2.1 Knowledge and student learning

Polanyi [15] was the first to articulate the concept of two different, mutually exclusive, dimensions of knowledge, namely tacit knowledge and explicit knowledge [15: 601]. *Explicit knowledge* refers to knowledge that has been articulated and formally recorded in handbooks, document databases, program code, manuals and knowledge bases [16]. *Implicit* knowledge, which is far less tangible than explicit knowledge, is knowledge in a person's internal cognition and refers to deeply embedded knowledge [17]. *Tacit* knowledge refers to implicit knowledge that is

difficult to articulate, reproduce or share and includes norms, values and relationships. In this context, the knowing is in the doing [18]. Therefore, learning of a procedural skill may access an explicit description, while knowledge on how the procedure is applied in a specific environment, may only be learnt through doing or socialising, pointing to implicit knowledge [19].

Students must be able to accomplish both the explicit-to-implicit knowledge and the implicit-to-explicit knowledge transitions [20, 21]. In the seminal work on learning objectives, Bloom's taxonomy was created by Dr. Bloom and his associates [22]. The purpose of Bloom's taxonomy was to transition from merely remembering facts to higher-order thinking in education by building up from lower-level cognitive skills. Such transitioning includes the analysis and evaluation of procedures, processes, concepts and principles, rather than just recollecting facts [23].

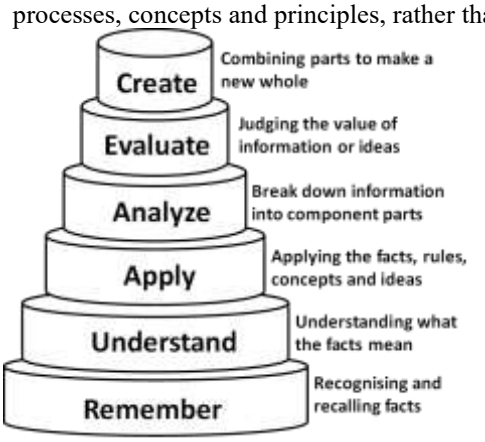

Figure 1: Bloom's taxonomy of learning [24]

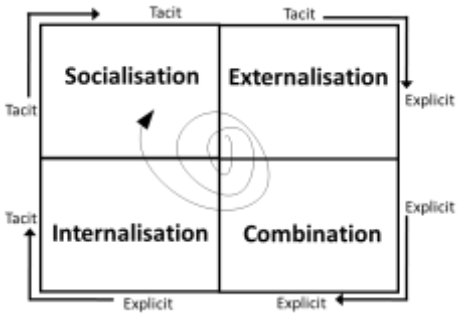

Figure 2: The knowledge conversion model [25]

Through increasingly more complex and abstract mental levels, Bloom's taxonomy identified six levels within the cognitive domain as depicted in Figure 1. The six levels, each of which is built on a foundation of the previous level, include: the recall of prior learning *(remembering),* comprehension of the meaning of facts *(understanding)*, using information (*applying)*, drawing connections among ideas (*analysing)*, justifying the merit of information (*evaluating)* and producing new or original outputs (*creating)* [23, 24]. Design, in this context, is an evaluation process outcome as a result of analysis. Therefore, evaluation leads to the main objective of the whole process which is to create [26].

2.2 Knowledge conversion and education

The aim of service-learning through experience is to increase knowledge and provide a service to the larger community [27, 28]. The role of an HEI in this instance includes the development of cross-boundary knowledge and requires new approaches to knowledge generation and transmission as students must be able to apply knowledge in and outside academic structures [9, 29]. The management of knowledge in this instance is intrinsically connected to knowledge sharing between individuals, as well as the collaborative processes involved [30]. However, personal knowledge

can only be created by the individual and in order to create knowledge, an individual needs to perceive a sufficient amount of information [20, 31, 32].

Nonaka and Takeuchi [33] defined a knowledge conversion model (SECI model) that is based on the fundamental assumption that knowledge is created and expanded through social interaction between tacit and explicit knowledge. The process of knowledge conversion advances through four different modes as shown in Figure 2. *Socialisation (tacit to tacit)* is the conversion of tacit knowledge among individuals through shared information and experiences by means of observation, imitation and practice. *Externalisation (tacit to explicit)* is the process whereby tacit knowledge is articulated as explicit knowledge through collaboration with others using conceptualisation and extraction by means of document management systems, e-mails, and education-, learning- and training interventions. *Combination (explicit to explicit)* is the enrichment of the collected information by re-configuring it or enhancing it by organising, combining or categorising it so that it is more usable. *Internalisation (explicit to tacit)* enables individuals to act on information and creating their own tacit knowledge. The process is closely related to learning-by-doing through studying documents or attending training in order to re-experience to some degree what others have previously learned [25, 33]. Learning actually results from a process in which individual knowledge is transferred, enlarged and shared and is characterised as a spiral of knowledge conversion from tacit to explicit [33, 34]. During this last stage, newly formed knowledge is considered and evaluated in the context of other existing knowledge and personal experience, hence forming an individual's own unique world-view [32].

In the next section we explore the research approach followed to design the KOM for education, and how it may support education in a HEI.

3 Approach followed to design the knowledge operationalisation model (KOM) for service learning in education

Our overall objective with this paper was to design a KOM for CPs in higher education. The purpose of such a model is to support the effective transformation of knowledge and generation of new knowledge, through experience, into competencies and operational know-how. The research approach that we followed was educational design, namely; "a genre of research in which the iterative development of solutions to practical and complex educational problems also provides the context for empirical investigation, which yields theoretical understanding that can inform the work of others" [35 : 7]. The outcome of educational design research is predominantly concerned with developing practical knowledge that aims to improve educational practices [35, 36] and yields theories and practical educational interventions as its outcomes [37]. Educational design research is guided by five features [35, 36]. The *theoretically orientated* feature frames the research and informs the solution through the use of scientific understanding. The *interventionist* nature of educational design research aims to bring about changes in practice through the design of transformative, real-world solutions. Educational design research entails *collaboration* among many stakeholders associated with the issue being investigated and necessitates *responsively grounded* assumptions anchored in literature, field testing and expert inputs, enabling discovery of the complex realities of teaching and learning contexts. The insights and

interventions of educational design research evolve over time through multiple *iterations* of investigation, development, testing and refinement, illustrating the iterative nature of the approach [35]. With these features guiding our research, we built upon prior literature about knowledge conversion and education through a qualitative process in order to create a KOM for the effective operationalisation of knowledge into know-how. The KOM for education is grounded in educational theory and knowledge conversion theory within a real-world context of higher education.

The study was conducted at an HEI in South Africa that offers a credit-bearing, undergraduate community-based project module. In order to evaluate the KOM for HEIs designed from the literature, the CP module was mapped to the proposed KOM (Section 4), corroborating the comprehensive nature of the model elements.

In the next section we discuss the KOM for education in detail.

4 Design of the knowledge operationalisation model in education

The aim of this paper was to design a KOM for CPs in higher education. In order to design the KOM, we considered Bloom's taxonomy (Figure 1) [24] and the knowledge conversion model (Figure 2) [25]. Knowledge is continuously converted and created (spiral of knowledge) as students practice, collaborate, interact, and learn. Students firstly acquire new personal knowledge when an overview of the topic of study is observed. An incoherent and disorganised mixture of data and information is formed in the student's mind while listening, watching, reading and sensing. Once different tasks are completed and actions performed in order to organize all pieces of information and connect them with each other and the outcome, initial knowledge is formed. A student's initial knowledge is then enlarged as own opinions are formed during discussions regarding the topic of study. Lastly, the newly formed knowledge is considered and evaluated in the context of other existing knowledge and personal experience, hence forming a student's own unique world-view [32, 38].

By considering each of these steps in the context of the knowledge conversion model (Figure 2), this process is depicted in Figure 3 as an expanded spiral with the learning stages indicated on the spiral and the knowledge conversion stages in the centre. In stage 1, *seeking*, the knowledge operationalisation cycle is initiated with prior knowledge held by a student. During stage 2, *absorbing*, conversion of tacit knowledge among individuals through shared information and experiences takes place. Stage 3, *doing*, facilitate the articulation of tacit knowledge as explicit knowledge through collaboration with others using conceptualisation and extraction. In stage 4, *networking*, collected information is enriched by re-configuring it or enhancing it by sorting, adding, combining or categorising it so that it becomes more usable. In the final stage, stage 5 *reflecting*, the knowledge operationalisation cycle is concluded with increased understanding through the process of creating the student's own tacit knowledge [38]. As the objective of this paper is a KOM in education, we considered Bloom's taxonomy (Figure 1) as it affords a pathway to guide the learning process. By applying the Bloom's spiral taxonomy to our proposed model, we were able to capture the complexity of learning in a more tangible manner within the context of experiential learning at a HEI [39].

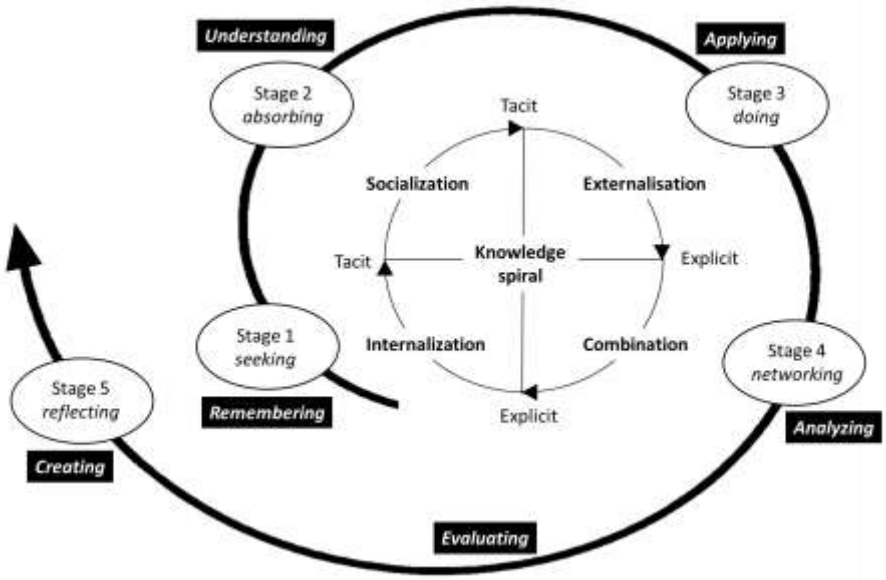

Figure 3: Proposed knowledge operationalisation model for education (adapted from [24, 25])

The first level of the taxonomy as proposed by Bloom, refers to the *recall* of information. This retrieval of information can refer to conceptual knowledge or recollections from previous experience. Within the context of the KOM, this taxonomic level would directly relate to Stage 1: *seeking,* seeing as the remembering of information would be the catalyst to the initiation of the cycle. Recall or remembering requires a framework of prior knowledge to already be established upon which can be drawn, and said framework is not necessarily complex, dense or sophisticated, or always relevant to the learning taking place. As the spiral develops and the cycle continues, the *seeking* and recalling of knowledge, transitions into the *absorption* of knowledge. Upon the first taxonomic level of *remembering*, Bloom anchored the next level of *understanding*, which is directly related to- and dependent on the *remembering* (and by extension the *seeking*) of information within the required prior knowledge framework. The successful *absorption* of knowledge is dependent on the level, or lack of, *understanding*. During this stage of the cycle, a lack of- or failure to *understand* can cause new knowledge to be lost as it fails to be properly *absorbed* and this will also impact the ability to effectively *recall* partial, prior knowledge at the beginning of the next phase or cycle of learning. However, should the *understanding* of newly acquired knowledge be qualitative in nature, the *absorption* (and later use or expansion) thereof will be all the more successful. Whether Stage 2 was successful or not, the transition into the third stage of *doing* continues when what was *understood*, now needs to be *applied* and articulated as explicit knowledge. The stage of *doing* therefore, also correlates with the third taxonomic level of *application* as identified by Bloom. It must be stressed that the application of knowledge through doing, is not a singular occurrence, but rather numerous events with which the new knowledge acquired through Stages 1 and 2 can be applied across a span of time in a multiplicity of ways. It must also be noted that

not all new knowledge will be applied/used, but only what is appropriate or applicable need be accessed. When transitioning into the fourth Stage: *networking*, of the KOM, what was *applied* previously can now closely be examined and compartmentalised. Knowledge that was not *absorbed* during Stage 2, or knowledge that was misunderstood, can also be corrected at this point. It is also within this phase of the KOM, that the related taxonomical level of *analysing* will add value to its process. In order for newly acquired knowledge that has now been *recalled, absorbed and applied*, to be re-applied or adjusted, the close analyses of its contents as described by Bloom, needs to take place. A wide range of information or related variables (whether they be tacit or explicit) should be utilised in order for the process of *analysing* to take place at optimal efficacy. We identified the fifth taxonomical level of *evaluation* as a transitional component rather than a counterpart of the fifth Stage of the KOM. Within this level, the careful evaluation of all new knowledge that has been acquired takes place. Although anchored, and dependent on, the analysis present in the previous level, the evaluation of knowledge seeks to closely inspect the results of the analysis and determine if any irrelevant, unnecessary or incomplete components need be discarded. With this process of *evaluation* acting as transitionary medium, the sixth Stage of the KOM: *reflecting*, ensues. It is at this point where the final taxonomical level of *creation* aids in the culmination of the KOM and the learning cycle. Now that learning has taken place across a variety of levels and dimensions, the creation of unique-, personalised- and tacit knowledge concludes one cycle and may initiate another and fulfil the initial requirement of prior knowledge needed in order to recall/seek as identified above.

It must be noted however, that learning is a vastly complex and personal process that manifests uniquely within each individual and context and is dependent on a myriad of variables. However, this model was constructed and integrated with Blooms' taxonomy to aid in the interpretation of the learning process of a specified situation within the context of service-/experiential learning. It must also be stressed that multiple learning processes can take place simultaneously and one can progress or digress at any point in the cycle. This approach also enabled us to design learning experiences in response to changes in the world students use information in. In this process, all students start at the same point and then progress through Bloom's taxonomy, with the *create* level providing a flexible ceiling that can stretch to meet the needs of even the most advanced understanding, while still acting as a goal for students that might be struggling. In addition, Bloom's spiralling can be used to frame a project-based learning unit [39].

In the next section we apply the model defined in Figure 3 to a CP module at a HEI.

5 Programme mapping to the knowledge operationalisation model for education

An HEI in South Africa presents a compulsory undergraduate module: Joint Community-based Project (JCP). The decision to create the independent course was motivated by the necessity to integrate community service and learning projects, including humanitarian engineering projects, in the curriculum of all the undergraduate programmes in addition to adhering to the University's strategic social

responsibility goal [40]. The module's primary objectives include benefit realisation for a relevant section of society by exposing groups of students to real-life challenges. Students do at least 40 hours of fieldwork, after which they reflect on their experiences through various assignments, including a final presentation, video and report. It is a macro community engagement course due to the substantial number of enrolled students and projects. Since 2011, more than 1600 students have registered for the course annually, with an average completion rate of 95%. Generally, the students work in 500 groups (4-5 students per group) each year to help more than 370 different community partners. A small budget of ZAR400 is awarded per student and students are allowed to raise additional funds that are required to complete their project. A profile of the 2018 and 2019 service learning projects and community partners are shared in Tables 1 and 2 respectively.

In 2018 more than half of the students (63%) delivered building, renovation and maintenance projects and this increased to 66% in 2019. Skills development and career related initiatives are a priority in SA and in 2018 28% of projects focused on educational resources, career guidance, computer training, skills development, etc., while 27% of projects contributed to this focus area in 2019. A second output from the analysis of the reports, was to apply the KOM and map the JCP programme to the proposed stages as shown in Table 3. Table 3 presents an overview of the stages of our proposed model and for each model element, we provide a brief description as well as the knowledge operationalisation mechanisms that the JCP programme utilises. There is a good spread of mechanisms across all the stages of knowledge operationalisation and the JCP module design is well positioned to achieve the learning outcomes of a service learning programme.

Project types	2018	2019
Building and renovation	59%	62%
Maintenance	4%	4%
Educational resources	1%	5%
Career guidance	7%	4%
Computer repairing	3%	2%
Computer training	3%	6%
Mathematics and Science	12%	5%
Inventory lists	3%	2%
Mentoring	2%	2%
Skills development	3%	5%
Adjudication	1%	1%
Website / Apps / Marketing material	2%	2%
	100%	100%

Table 1: Project types

Community partners	2018	2019
Animal sanctuaries / Zoo's	15%	18%
Libraries	1%	0%
Learners with special educational needs schools	4%	3%
Museums	3%	9%
NGOs	25%	11%
Old age homes	2%	1%
Pre-schools	10%	19%
Primary schools	7%	6%
Secondary Schools	22%	10%
Universities	5%	13%
Nature reserves	0%	2%
Children's Homes	2%	3%
Government	3%	3%
	100%	100%

Table 2: Community partner type

Model component and description	Knowledge operationalisation mechanism	
Stage 1 seeking: Initiate knowledge operationalisation cycle with prior knowledge	• Module description	• Service learning module enrolment
Stage 2 absorbing: Conversion of tacit knowledge among individuals through shared information and experiences	• Module study guide • Face-to-face briefing • Project guidelines document • Security guidelines document	• Learner management system content portal • Community project list • Project scoping and motivation document
Stage 3 doing: Tacit knowledge is articulated as explicit knowledge through collaboration with others using conceptualisation and extraction	• Community partner technical guidance • Community partner mentorship • Alumni mentorship • Alumni projector leader guidance • Project solution brainstorming	• Project meetings • Budget management report • Project progress report • Experiential learning • Project outcome measurement • Project-based learning
Stage 4 networking: Enrichment of the collected information by re-configuring it or enhancing it by sorting, adding, combining or categorising it so that it is more usable	• YouTube video production and upload • Facebook page content update	• Wiki update • Lessons learnt report • Community partner evaluation
Stage 5 reflecting: Complete knowledge operationalisation cycle with increased understanding through process of creating their own tacit knowledge	• Individual reflection report • Student module questionnaire	• Student increased knowledge

Table 3. Service learning module operationalisation mechanisms

In addition to the knowledge operationalisation mechanisms map presented in Table 3, we analysed 411 reflection reports of the class of 2018 and 442 reflection reports from the class of 2019 in order to establish if increased learning took place (difference between stages 1 and 5 of the proposed model). A summary of increased knowledge elements from the reflection reports is depicted in Table 4.

	2018	2019
Leadership	51.2%	60.2%
Project management	63.0%	74.3%
Time management	58.3%	73.5%
Group work / Team work	78.7%	85.4%
Building and renovation skills	50.0%	51.8%
Communication and interpersonal skills	61.8%	71.2%
Working with people from diverse backgrounds and cultures	41.7%	48.2%
Creative thinking	49.6%	54.9%
Computer related skills	16.9%	7.1%
Internet related skills	7.9%	7.1%
Other	5.1%	2.2%

***Note**: students could indicate more than one learning point*

Table 4. Increased knowledge extracted from 2018 and 2019 student reflection reports

In 2018 the "other" category included painting skills, financial management, self-confidence, listening skills and problem solving. In 2019 the "other" category included painting skills, problem solving, patience and humility.

Based on this mapping and evaluation of the KOM for CPs in a HEI, we believe that the model provides good coverage of considerations for the effective transformation of knowledge, as well as the generation of new knowledge, into operational competencies and know-how. In addition, Table 3 presents examples of

the application of the proposed KOM that may be referenced for service learning module design in order to ensure that increased understanding, learning and knowledge are achieved.

6 Conclusion

Research established that service-learning programmes in higher education provide more practical experience for students while providing benefits for the community. Furthermore, from an HEI perspective, a service-learning module must achieve certain learning outcomes, and classroom knowledge must be turned into practical knowledge and expertise. However, scholars highlighted concerns such as transfer of theoretical knowledge only, low adoption of deeper learning activities and limited consideration of the impact of reflection in service-learning programmes. Therefore, the aim of this study was to design a KOM for service learning in community projects at an HEI. In this study, we developed the model through an education design research process by considering Bloom's taxonomy, knowledge conversion, and learning processes in education. We applied the model to a service-learning module from an HEI identifying knowledge operationalisation mechanisms and highlighting the effective transformation of knowledge and generation of new knowledge, through experience, into competencies and operational proficiency. We established that the service-learning module that was considered aligned well to the elements identified in the KOM.

Future research opportunities include further optimisation of the KOM and testing the application of the KOM for service learning module design.

References

1. Bennett, D., et al., *Implementing and Sustaining Higher Education Service-Learning Initiatives: Revisiting Young et al.'s Organizational Tactics.* Journal of Experiential Education, 2016. **39**(2): p. 145–163.
2. Bedford, D., *A Case Study in Knowledge Management Education - Historical Challenges and Future Opportunities.* The Electronic Journal of Knowledge Management, 2013. **11**(1): p. 199-213.
3. Bennett, E., *A Simple, Practical Framework for Organizing Relationship-Based Reciprocity in Service-Learning Experiences: Insights from Anthropology.* International Journal of Research on Service-Learning and Community Engagement, 2018. **6**(1): p. 1-15.
4. Meyer, M. and L. Wood, *A critical reflection on the multiple roles required to facilitate mutual learning during service-learning in Creative Arts education.* Teaching in Higher Education 2017. **22**(2): p. 158–177.
5. Hébert, A. and P. Hauf, *Student learning through service learning: Effects on academic development, civic responsibility, interpersonal skills and practical skills.* Active Learning in Higher Education, 2015. **16**(1): p. 37–49.
6. Gelmon, S.B., B.A. Holland, and A. Spring, *Assessing Service-Learning and Civic Engagement: Principles and Techniques*. Second ed. 2018, Boston, Ma: Campus Compact.

7. Eyler, J., *Reflection: Linking Service and Learning—Linking Students and Communities.* Journal of Social Issues, 2002. **58**(3): p. 517-534.
8. Mitchell, T.D., et al., *Reflective Practice that Persists: Connections Between Reflection in Service-Learning Programs and in Current Life.* Michigan Journal of Community Service Learning, 2015. **Spring**: p. 49-63.
9. Kuklick, C.R., B.T. Gearity, and M. Thompson, *Reflective Practice in a University-Based Coach Education Program.* International Sport Coaching Journal, 2015. **2**: p. 248 -260.
10. Jones, S.R., et al., *The Meaning Students Make as Participants in Short-Term Immersion Programs.* Journal of College Student Development, 2012. **53**(2): p. 201-220.
11. Adams Becker, S., et al., *NMC Horizon Report: 2017 Higher Education Edition*. 2017, The New Media Consortium: Austin, Texas.
12. Halberstadt , J., et al., *Learning Sustainability Entrepreneurship by Doing: Providing a Lecturer-Oriented Service Learning Framework.* Sustainability, 2019. **11**: p. 1-22.
13. Bednarz, S.W., et al., *Community Engagement for Student Learning in Geography.* Journal of Geography in Higher Education, 2008. **32**(1): p. 87-100.
14. Bringle, R.G., P.H. Clayton, and M.F. Price, *Partnerships in Service Learning and Civic Engagement.* Journal of Service Learning & Civic Engagement, 2009. **1**(1): p. 1-20.
15. Polanyi, M., *Tacit Knowing: Its Bearing on Some Problems of Philosophy.* Reviews of Modern Physics, 1962. **34**(4): p. 601-606.
16. Freitas de Azeredo Barros, V., I. Ramos, and G. Perez, *Information Systems and Organizational Memory: A Literature Review.* Journal of Information Systems and Technology Management, 2015. **12**(1): p. 45-64.
17. Dalkir, K., *Knowledge Management in Theory and Practice*. 2005, Burlington: Elsevier Butterworth–Heinemann.
18. Clarke, T. and C. Rollo, *Corporate initiatives in knowledge management.* Education + Training, 2001. **43**(4/5): p. 206-214.
19. Bruning, R.H., *Cognitive Psychology and Instruction*. 3rd ed. 1999, Upper Saddle River, NJ: Prentice-Hall Inc.
20. Kutay, C. and A. Aurum, *Knowledge transformation for education in software engineering* International Journal Mobile Learning and Organisation, 2007. **1**(1).
21. Bhusry, M., J. Ranjan, and R. Nagar, *Implementing Knowledge Management in Higher Educational Institutions in India: A Conceptual Framework* Journal of Higher Education Research, 2012. **7**(1): p. 64-82.
22. Imrie, B.W., *Assessment for learning: Quality and taxonomies.* Assessment & Evaluation in Higher Education, 1995 / 2008. **20**(2): p. 175-189
23. Hakky, R., *Improving Basic Design courses through Competences of Tuning MEDA.* Journal for Higher Education, 2016. **4**(1): p. 21-42.
24. Krathwohl, D.R., *A Revision of Bloom's Taxonomy: An Overview.* Theory Into Practice, 2002. **41**(4): p. 212-218.
25. Nonaka, I., R. Toyama, and N. Konno, *SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation.* Long Range Planning, 2000. **33**: p. 5-34.

26. Anderson, L. and D. Krathwohl, *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. 2001, New York: Longman.
27. Harvey, M., et al., *Aligning reflection in the cooperative education.* Asia-Pacific Journal of Cooperative Education, 2010. **11**(3): p. 137-152.
28. Millican, J. and T. Bourner, *Student-community engagement and the changing role and context of higher education.* Education and Training, 2011. **53**(2/3): p. 89-99.
29. Smuts, H. and P. Kotzé, *Client-Vendor Knowledge Transfer Mechanisms in the Context of Information Systems Outsourcing*, in *Knowledge Management in Organizations*, L. Uden, M. Heričko, and I.H. Ting, Editors. 2015, Springer, Cham.
30. Edersheim, E.H., *The Definitive Drucker*. 2007, New York: McGraw-Hill.
31. Andreeva, T. and I.A. Ikhilchik, *Applicability of the SECI Model of knowledge creation in Russian cultural context: Theoretical analysis.* Knowledge and Process Management, 2011. **18**(1): p. 56–66.
32. Lebedeva, O. and N. Prokofjeva *The Use of Systems for Knowledge Search in E-Learning*, in *International Association for Development of the Information Society*, M.B. Nunes and M. McPherson, Editors. 2012, IADIS Press: Lisbon. p. 343-348.
33. Nonaka, I. and H. Takeuchi, *The Knowledge Creating Company*. 1995: Oxford University Press.
34. Nonaka, I., R. Toyama, and P. Byosiere, *A Theory of Organisational Knowledge Creation: Understanding the Dynamic Process of Creating Knowledge*, in *Handbook of Organizational Learning & Knowledge*, M. Dierkes, et al., Editors. 2001, Oxford University Press: New York. p. 491-517.
35. McKenney, S. and T.C. Reeves, *Conducting educational design research*. Second ed. 2019, New York: Routledge.
36. Wang, F. and M.J. Hannafin, *Design-based research and technology-enhanced learning environments.* Educational Technology Research and Development, 2005. **53**(4): p. 5–23.
37. Edelson, D.C., *Design Research: What we learn when we engage in design.* Journal of the Learning Sciences, 2002. **11**(1): p. 105-121.
38. Smuts, H. and M.J. Hattingh, *Towards a Knowledge Conversion Model Enabling Programme Design in Higher Education for Shaping Industry-Ready Graduates*, in *ICT Education*, S. Kabanda, H. Suleman, and S. Gruner, Editors. 2019, Springer, Cham. p. 124-139.
39. Ursula Fuller, U., et al., *Developing a computer science-specific learning taxonomy*, in *Working Group Reports on ITiCSE on Innovation and Technology in Computer Science Education*. 2007, Association for Computing Machinery. p. 152–170.
40. Jordaan, M., *Sustainability of a community-based project module.* Acta Academica, 2012. **44**(1): p. 224-246.

View publication stats