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The Review of Action Learning Approach Formulae Heutagogical Practice in Civil Engineering and Construction Studies

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ABSTRACT

The Action Learning Approach (ALA) is a teaching method that promotes learning by doing. ALA encourages full students' engagement through interaction with peers in groups and with lecturers. In Civil Engineering and Construction Studies, teamwork is emphasised in both theoretical (content knowledge) and practical learning processes. Heutagogy, on the other hand, is a learning strategy that fosters self-driven learning through active practical involvement. It aims to cultivate students' critical thinking, innovation, creativity, as well as their problem-posing and problem-solving skills. Within technical and vocational education, as well as engineering and technology education, the steps of the technological process play a central role in teaching and learning. The purpose of this study was to review existing action learning approach formulae and models to enhance the integration of theoretical (content knowledge) and practical work in Civil Engineering and Construction Studies. The main objective was to develop an action learning formula to support lecturers in applying action learning methods for quality teaching that integrates theory and practice. A systematic evaluation of available empirical evidence, along with a critical and comprehensive review of existing data, was carried out to inform the study. The review analysed the action learning approach through the lens of six steps of the technological process. Furthermore, the study recommends that heutagogy be adopted as the primary strategy for implementing action learning, in order to strengthen the integration of content knowledge and practical work in Civil Engineering and Construction Studies, and more broadly within the built environment disciplines.

KEYWORDS

Action learning approach; Heutagogy; Civil engineering and construction studies.

INTRODUCTION AND BACKGROUND

Action Learning approaches and their principles form the foundation for describing the teaching and learning processes that integrate theoretical (content knowledge) with practical work in Civil Engineering, Construction Studies, Civil Technology, and the built environment more broadly. Pedler (2011:21) cites the key claim, central to Professor Reginald Revans' writings and lectures that maintain that "learning begins with not knowing." Action Learning, therefore, serves as a method through which institutions can drive improvement and reforms, while also broadening the perspectives of individuals within them. From the outset, both students and lecturers recognise that the principle of human agency is fundamental to constructivism, humanism and both the theory and practice of heutagogy (Blaschke & Hase, 2015; Hase, 2014a). Bandura (1989) explains that human agency involves the ability of individuals to actively shape their actions through "freedom of action, encouragement, reflection, and creative thinking." This stands in contrast to deterministic perspectives that suggests that people are only products of external influences. Constructivists argue that individuals interpret their experiences in unique and personal ways. Consequently, this paper raises the main research question: how can lecturers be supported in applying Action Learning approaches to effectively integrate theory and practical work in Civil Engineering and Construction Studies? The discussion follows a sequence that traces the evolution of Action Learning, by exploring the six steps of the technological process, and highlighting the role of heutagogy and its principles in guiding this integration.

The evolution of the Action Learning Formulas

- Revan's Formula (the original first):

L= P + Q

L: Learning = P: Programming + Q: Questioning

Reginald Revans first introduced the Action learning formula in 1982 and 1989, calling it the Revans' formula. In Revans' model, L represented learning, P stood for programmed knowledge (knowledge derived from books or formal content), and Q represented questioning insight to get a deeper meaning of what the provided information is about. Therefore, Revans' formula emphasised that questioning information is the central driver of action learning, while acknowledging that in some contexts, structured knowledge is essential, as it has been for many decades. He argued that questions such as "What are we trying to do?" or "What can we do about this?" can encourage dialogue and critical thinking (Marsick & O'Neil, 1999; McNiff, 2013).

- Inglis (1994) Formula (second review recognised in this paper):

L = P + Q + I

L: Learning = P: Programme Knowledge + Q: Questioning + I: Implementation

In 1994 Inglis also created another formula, after identifying a limitation in Revans' original formula, noting that it included programmed knowledge and questioning but left out implementation. To address this, he extended the model by adding I for implementation, stressing that acquired knowledge and skills must be applied in practice. Without implementation, learning remains incomplete. Inglis (1994), therefore emphasised that effective problem-solving requires not only knowledge and inquiry but also concrete action (McNiff, 2013; Marsick & O’Neil, 1999; Inglis, 1994). Consequently, it can be said that Inglis's (1994) assertion that all skills and knowledge needed to be applied to provide convincing evidence of problem solving is accurate.

- Mumford (1995) Formula (third review recognised in this paper):

Q (1) + P + Q (2) = L

Q (1): Questioning + P: Programmed Knowledge + Q (2): Questioning = L: Learning

In 1995 Mumford revised Revans’ formula, therefore, suggesting that the learning process should begin with Q (1), which would encourage an interactive learning process, because it would be the initial questioning phase to identify the problems that need to be solved. This is followed by P, the acquisition of relevant knowledge, and then Q (2), a second phase of questioning that refines understanding and identifies further opportunities for problem-solving (McNiff, 2013; Marsick & O'Neil, 1999; Mumford, 1995). Scholars such as Koo, Lee, Yilmaz, Farsad, Eckford, and Chae (1999) supported this structure, noting that Q (1) directs problem identification, P supports knowledge acquisition, and Q (2) encourages deeper inquiry. In Civil Engineering and Construction, this approach helps students apply practical reasoning and common sense in problem-solving scenarios within their assigned sets.

- McGill and Brockbank (2004); Rimanoczy (2009,2008) formula (fourth review recognised in this paper):

L= P + Q + R

L: Learning = P: Programme Knowledge + Q: Questioning + R: Reflection

Building on Revans’ work, Rimanoczy (2008, 2009) and McGill & Brockbank (2004) developed a reflective model of action learning, adding R which stands for the process of reflecting or reflection, known as Action-Reflective Learning. The model highlights the dynamic interaction between action and reflection. Wagner, Castañeda, Bohman, & Sterr (2019) argue that this reflective element strengthens creativity, innovation, and problem-solving by encouraging learners not only to act but also to evaluate and refine their approaches. For Civil Engineering and Construction students, reflection reinforces the integration of theory with practice and deepens problem-solving capacity.

Six steps of Technological Process in Civil Technology, Engineering and Construction

Mokhothu (2019), Masoabi (2015), DBE (2011b:10), and Van der Walt (2007, 2008:26) describe the technological process' six steps as follows:

Step 1: Identify: Create a summary of the problem from the given or created scenario.

Step 2: Investigation: The design briefly describes a problem that must be solved with supplementary freehand drawings illustrating three potential solutions. Write constraints: scope, cost, and time, and requirements: standard, material, and quality.

Step 3: **Design**: Formal drawing plan with complete specifications, scale, and materials list.

Step 4: **Make:** Physically constructing your project in accordance with a formal plan.

Step 5: **Evaluation and Test:** Compile a checklist for the project.
Step 6: **Communication:** Presentation of the project (portfolio, project exhibition, and flow-chart) (Mokhothu, 2022:89).

All of the aforementioned problem-solving steps and six stages align with Bloom's Taxonomy, the Holistic Taxonomy, and Willson's Taxonomy, to ensure that practical, cognitive, and reflective aspects of learning are addressed. These are important since all of them are thought to address the fundamental concept of action learning review in civil engineering and construction studies.

Heutagogy

The concept of heutagogy comes from the Greek word *heuriskin*, meaning "to discover," which is also the root of the term *heuristic*. Heutagogy was introduced by Hase and Kenyon in 2000 to describe a self-determined learning approach (Hase & Kenyon, 2013). In heutagogy, the learner takes full responsibility for their own learning process, from choosing the topic to deciding on the methods and outcomes. It emphasises student agency, making the learner an active and central participant in shaping their education. According to Hase (2014), heutagogy fosters independence, creativity, and adaptability by encouraging students to explore, reflect, and apply knowledge in meaningful ways.

Table 1 (see appendix).

Table 1 illustrates how self-determined learning and heutagogy provide complementary perspectives on developmental balance in teaching and learning. Gerstein (2014) promotes the agile methodology, which highlights adaptability as a crucial factor across all six steps of learning. Hase (2014), meanwhile, emphasises on flexibility and involvement learning, arguing that new questions can open pathways to deeper understanding by integrating content knowledge with practical application through hands-on learning. The two perspectives therefore, view learning as a self-driven process aimed at achieving sustainable implementation goal. These concepts also align with the interactive role of both lecturers and students, as learning is developed through questioning and active engagement. Agile methodology, for example, consists of Heutagogies, which are; plan, design, develop, test, deploy, and review (Pócsová, Bednárová, Bogdanovská & Mojžišová, 2020; Laoyan, 2024). Similarly, one of the heutagogical impact cycles within the action learning approach is described by Knight (2018:50) as consisting of three developmental steps, which are; identify, learn, and improve. This cycle reinforces learner agency and reflection. Such approaches also lead to the development of a higher level of competence, referred to as "holistic shaping." This occurs when occupational tasks are performed with awareness of broader operational and social contexts, resulting in solutions that are both innovative and valuable to the workplace. This competency also considers the influence of technological advancements and evolving occupational specifications (Brown & Papier, 2023; Rauner, 2017).

Purpose and Objective

The purpose of this study was to review existing action learning approach (ALA) formulae and models in order to strengthen the integration of theoretical (content knowledge) and practical work in Civil Engineering and Construction Studies. The primary objective was to develop an action learning formula that supports lecturers in applying ALA methods effectively, thereby enhancing the integration of theory and practice. Another objective of this study was to develop a model that demonstrates the link between the technological process and Mokhothu's review of action learning, providing a structured framework for integrating theoretical content with practical work.

METHODOLOGICAL CONSIDERATIONS

According to Imenda (2014), methodological considerations are defined as the study design and procedure used to solve a particular issue in the study, comprising the type of data to be gathered, analysed, and interpreted, as well as the approach to literature review. Considering the kinds of research problems to pursue and the methods of study used, these discussions eventually also reflect on a wider scope of studying model development.

This study conducted both systematic and historic review to become acquainted with previously conducted studies on action learning approach formulae and models, as well as technological processes in the teaching and learning area. According to Pollock and Berge (2018), systematic reviews are valuable for avoiding research waste, since they ensure that new primary research is conducted with complete knowledge of what has previously been researched and that new research evidence is interpreted in the context of what has already been reported. However, a historic review lacks the rigorous, bias-reducing rigour of a systematic review, concentrating more on narrative synthesis and comprehensive understanding while tracing the evolution of concepts or theories throughout time and providing context (Hong & Pluye, 2018).

There were several purposes of conducting both systematic and historical review in this research. Firstly, it was to search for comprehensive literature, the evolutions, transparent and rigorous methods for validity of reviews from multiple databases addressing action learning approaches. Secondly, to review the scope of heutagogy, technological process uses and findings. Thirdly, was to look at the nature and the purpose of civil engineering and construction studies or building environment studies in general and lastly, but not least, to recognise the importance of the integration of theory and practical work. The relevant data extracted was processed and analysed for interpretation and conclusions, and the finding has influenced the development of the integrated reviewed action learning formula by Mokhothu with six steps of technological process to build a conceptual model.

Mokhothu's (2022) Review of ALA formula and Justifications of the review (fifth review recognised in this paper):

L: is a learning process.

$$L= Q_1 + P + Q_2 + I + E + C$$

Q_1: Questioning of the problem (What, When and How)

P: Planning and programme knowledge via Set, Meetings, Generation of ideas and facilitation role

Q_2: Questioning or interrogation of ideas, solutions and provide alternatives

I: Implementation to test or simulate solutions

E: Evaluation period (reflect) via assessment (theory + practical= community engagements)

C: Communicate final implementation via confirmation of competency and certifying

The above ALA formula was developed by Mokhothu (2022) in his doctoral thesis to enhance and promote meaningful and relevant pedagogical and heutagogical practices in Civil Engineering and Construction Studies. This formula is shaped by the distinctive six steps of the technological process, which add further components of specialisation. Mokhothu's thesis advanced earlier ALA models by integrating the technological process into action learning, building on previous reviews and origins. The formula was specifically developed to meet the objectives of this study, which aims to develop an action learning formula that supports lecturers in applying ALA methods effectively, thereby enhancing the integration of theory and practice. A further objective was to develop a model that demonstrates the link between the technological process and Mokhothu's review of action learning, providing a structured framework for integrating theoretical content with practical work.

KG Mokhothu's model of Action Learning Formular integrated in Technological Process the Graphical Analysis: Theory and Practical work.

The model (see appendix) illustrates how the ALA formula and the technological process are integrated to explain the first step of learning (L), which is learning as a general programme, or the problem summary:

Step 1: Identify = L. At the second step of the research question, however, the formula questioned the problem to be solved or learnt by asking how much ALA use would be entwined with (**Q1**) in the formula (what, when, and how) also start to introduce **P** through draft graphical possible ideas:

Step 2: Investigation = Q_1 + P. The additional research question is more open-ended and focuses on the practical assessment and knowledge content that are imparted. It also addresses the (**P**) from the formula, which gravitates planning and programme knowledge through prearranged meetings, idea generation, and the role of facilitator (for flexible knowledge generation) which is linked to Q2 on the horizontal investigation. (**Q2**), wherein ideas, solutions, and the provision of alternatives will be questioned or examined before to adoption:

Step 3: Design = P+Q_2. While (**I**) use implementation to demonstrate or model solutions in order to further comprehend the solutions to the difficulties before final implementation, giving me the opportunity to make any necessary amendments:

Step 4: Make = I. When **(E)** in which the evaluation stage (reflect) is carried out through community engagements through a combination of theory and practical work, which is then combined to create integrated work (theoretical and practical):

Step 5: Evaluation and Test = E. Then (**C**), verify the final execution through certification and competency validation. At this point, delivering high-quality work and determining the extent of the product's ultimate execution are the main priorities:

Step 6: Communication.

This model demonstrates that while Steps 2 (Investigation) and 3 (Design) are interdependent and cannot function in isolation, the other steps follow sequentially toward the final stage. It also shows why heutagogy, rather than pedagogy or andragogy, is more suitable for guiding action learning in Civil Engineering, Construction Studies, and Civil Technology. As Buthelezi (2016) notes, understanding and validating students' behaviours and goals is only possible by examining the ways in which these elements are interdependent. Therefore, this model can be understood as a mechanism that enables the integration of theoretical (content knowledge) and practical work through action learning underpinned by heutagogy. Each of the six steps creates opportunities for problem-solving by fostering critical thinking, innovation, and creativity. At the same time, the material forms of teaching, learning, and assessment in Civil Engineering and the built environment provide the basis for combining theory and practice. Ultimately, this model advances the pathway of action learning and heutagogy, simplifying what is often a complex series of processes into a flexible, hands-on learning approach that remains open-ended and adaptable.

CONCLUSION

In conclusion, this reviewing paper has answered one of the popular phrases by action learning scholar Koo (1999:89) in his paper titled Learning Action Learning, when answering the question, what is action learning? The answer was, "*I hear, and I forget, I see, and I remember; I do, and I understand.*" He further explained it in a simple form: *"What we learn to do, we learn by doing."* In this paper, similar conclusions were drawn from the evolution of the action learning approach, in which all formulae emphasise that learning should involve all who are engaged in it and be afforded a space to question and voice out their thinking to bring solutions to the teaching and learning process. Several educational practices were reviewed to provide a comprehensive analysis of action learning formulae and to develop a model for integrating theoretical content and practical work in Civil Engineering, Construction Studies, and Civil Technology more broadly. Therefore, the model was achieved through the combination of Mokhothu's review and the six steps of the technological process, which explain how to integrate theoretical (content knowledge) and practical work through the heutagogical method. A simple base definition of heutagogy is to make teaching and learning flexible by allowing students freedom to determine their learning outcomes, which aligns well with the six steps of technological process and action learning that emphasise learning by doing. The key closing recommendation of this paper is that action learning approaches underpinned by heutagogy should be formally adopted as the primary operational mechanism for integrating theory and practice in Civil Engineering, Construction Studies, Civil Technology, and building environments more generally, with a view to preparing learners for future skills and the world of work. It is also recommended that subjects be reviewed in terms of organisation, teaching methods, and assessment practices to better support this integration.

The study provides significant new information about heutagogical methods and formulas for action learning approaches in the fields of construction studies and civil engineering. Using a longitudinal research approach, future studies should examine the cumulative impact of KG Mokhothu's action learning formula, which is incorporated into the technological process, on the successful concurrent implementation of theory and practical work in civil engineering, construction studies, and technical subjects related to the built environment. More significantly, future research could examine how the results can be applied in a variety of technical, engineering, and technological fields as well as in educational settings.

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APPENDIX

Table 1.

Self-determined learning vs Heutagogy principles (Gerstein (2014) and Hase (2014))

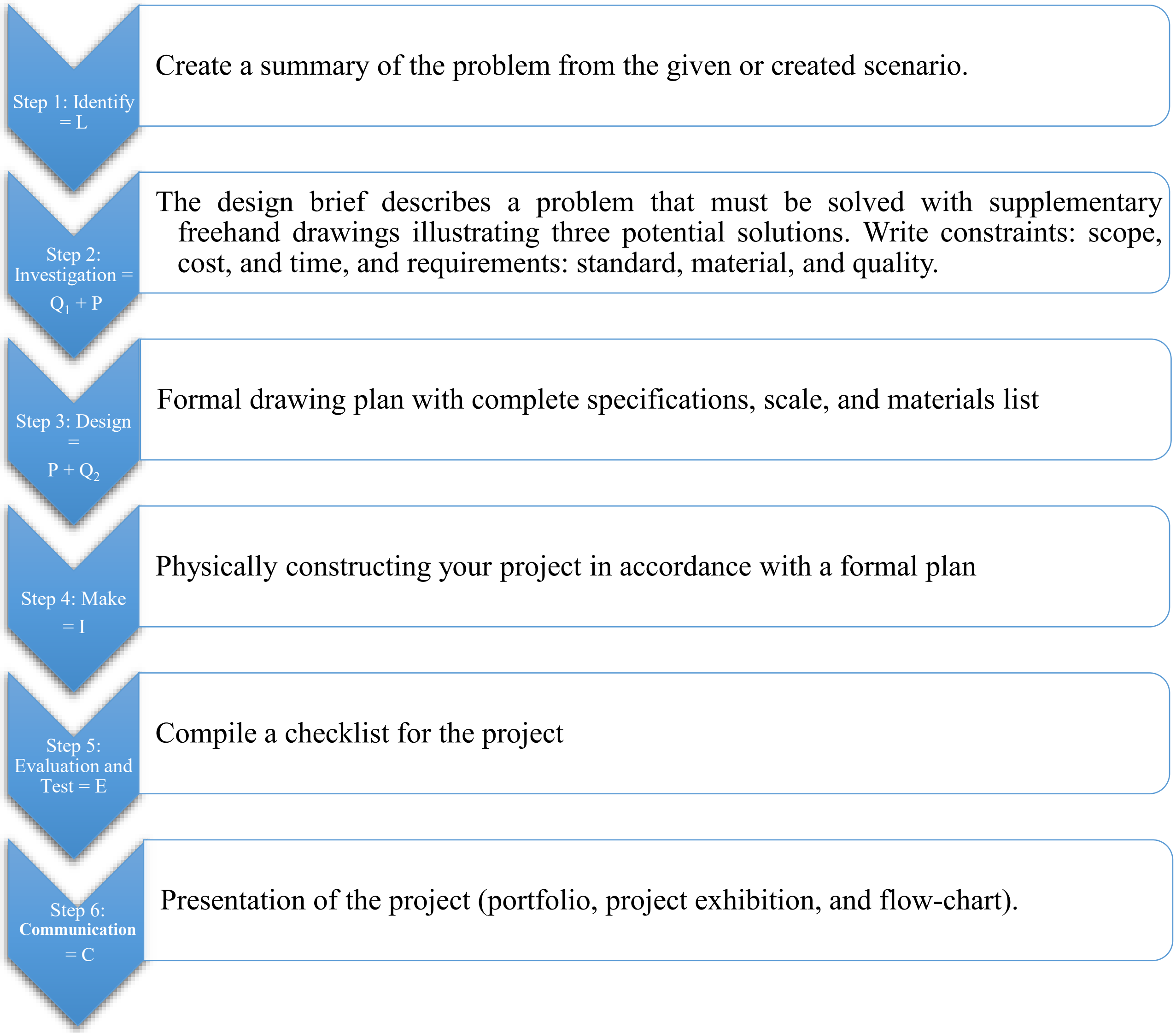
Principles of Self-Determined Learning (Gerstein, 2014)	Principles of heutagogy (Hase, 2014:13)
• Be agile and adaptable, • Have good oral and written communication skills, • Be able to collaborate across networks, be curious, and be imaginative, • Be optimistic- • Have the capacity to frequently scan the external environment • Ability to foster participative democracy/collaboration decision-making and process • A capacity to work in a team as leader and member-Ongoing internal and external	• Involve the students in designing their own learning content and process as a partner; • Make the curriculum flexible so that new questions and understanding can be explored as new neuronal pathways are developed; • Recognise that learning is non-linear; • Individualise learning as much as possible, • Provide flexible or negotiated assessment; • Enable the learner to contextualise concepts, knowledge and new understanding; • Use experiential learning techniques; • Facilitate collaborative learning; • Facilitate reflection, and double loop and triple loop learning (metacognition);

• Analysis of effectiveness (continuous improvement) • Be able to filter information (research skills) • Have critical thinking and problem-solving skills, • Demonstrate initiative, • Be entrepreneurial, • Have vision, • Be resilient, and • Have empathy and a sense of global stewardship.	• Provide lots of resources and let the learner explore; • Develop research skills including how to be discerning about ideas and content; • Differentiate between knowledge and skill acquisition (competencies) and deep learning; • Recognise the importance of informal learning and that we only need to enable it rather than control it; • Have confidence in the learner; and • Recognise that teaching and teacher control can become a block to learning.

Source: Hase (2014:13)

Figure 1.

KG Mokhothu's model of Action Learning Formular integrated in Technological Process the Graphical Analysis



Source: Author's Own (KG Mokhothu)