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The Enhancement of Pedagogical Capital by Civil Technology Teachers when Engaged with Practical Assessment Task: A Curriculum Transformation Legacy

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ABSTRACT

Within the South African context, there are perennial curriculum reforms of technical subjects, for example civil technology, which is offered from grade 10 to 12 at secondary school level. Amidst these curriculum reforms there is a shortage of technical curriculum advisors to capacitate teachers for the implementation of the revised curricula and a paucity of studies on how to enhance pedagogical capital. This undermines teachers' efforts in giving learners adequate industrial skills. In this conceptual study, we learn that teachers are now having autonomy to prepare, implement and assess the self-made Practical Assessment Task (PAT) without close pedagogical guidance from their stakeholders. As such, this conceptual study brings strategies that will assist teachers in maximising their pedagogical capital to cope with the recent curriculum change. This study found that indeed there are far too many expectations that civil technology teachers must accomplish before their learners can be adequately equipped with hands-on skills. A pedagogical capital framework was proposed to assist curriculum advisors and implementors to engage positively with PAT whilst upholding a global quality standard. This study recommends that the proposed framework could be applied to other technical subjects like engineering graphics and design, electrical technology and mechanical technology as they are faced with similar pedagogical challenges.

KEYWORDS

Civil technology; practical assessment task; pedagogical capital; teachers; curriculum transformation.

INTRODUCTION

The purpose of this conceptual study is to provide guidance and create awareness on how civil technology teachers can enhance their pedagogical capital when engaged with practical assessment tasks. Within the South African schooling system there have been multiple revisions of the curriculum especially in technical subjects like civil technology. Civil technology is offered from grades 10 to 12 in South African schools and is the subject to which this research contribution pays attention. The revisions to the revised Curriculum Assessment Policy Statement (CAPS) for civil technology has granted teachers of civil technology the freedom to "plan, design and determine the content, skills and knowledge to be addressed; set clear criteria and give good instructions to guide learners; determine which resources will be required for PAT and how marks will be distributed" (Department of Basic Education [DBE], 2011, p. 28). Put simply this means that the curriculum granted to civil technology gives teachers the space to activate their pedagogical capital when planning, teaching, and developing the rubric for assessment and assessing the PAT. However, within the South African civil technology context not much is known about teacher's practice concerning the planning, teaching, and assessment of PAT, or on success and challenges facing teachers in schools regarding, designing and execution of PAT.

According to Bastola (2018) teachers' pedagogical capital is the concept which embraces teachers' content knowledge, instructional planning, teaching strategies, professional knowledge, assessment of PAT, professionalism, ability to motivate learners, create conducive learning environment and adopt new techniques and approaches as per the need and interest of the learners. Tracing back to DBE, we now know that for teachers to exercise their freedom in designing and implementing PAT, they need to be abreast with pedagogical capital, hence this study. Gumbo (2020) tells us that technology subject teachers in general, have not been adequately trained to teach PAT as a strategy for skills transfer, a clear loophole in technology teachers' pedagogical capital.

Before going deeper into how teachers can enhance their pedagogical capital and how this concept evolved, it is important to orientate our readers on how civil technology has transformed and what the legacies caused by that curriculum transformation are. In the sections to come, we will also shed light on civil technology teachers' Pedagogical Content Knowledge as it foregrounds pedagogical capital.

Purpose of the study

The purpose of this study is to provide guidance and create awareness on how civil technology teachers can enhance their pedagogical capital when engaged with PAT.

CIVIL TECHNOLOGY CURRICULUM TRANSFORMATION

To reiterate, civil technology is offered in a technical and vocational discipline and has experienced numerous curriculum transformations since its inception to the South African curriculum (Mokhothu, 2020). These curriculum reforms have ambitious goals for classroom practice. Initially, civil technology comprised of building construction, sheet metal work, bricklaying and plastering, woodwork, sewing and plumbing as part of the National Education (NATED) 550 curriculum (DBE, 2011). It was envisaged by Gumbo et al. (2012) that the skills and knowledge acquired in civil technology would produce specialised artisans in response to the critical skills shortages encountered by South Africa.

In 1998, civil technology was introduced in the Further Education and Training (FET) band (Grades 10-12) in schools via Curriculum 2005 (C2005) (DBE, 2011). The purpose of civil technology was to produce learners who will, after school completion enrol for apprenticeship and get trade test certificates from the Institute for the Development of Learnerships and Learnership Assessment (INDLELA) among others. INDLELA is a constituted body that assesses such learners and recognises them as artisans of various industries (Department of Labour, 1998). However, C2005 was engulfed with numerous challenges such as lack of proper content knowledge, weighting of topics, skills and focus (Pinnock, 2011) and needed to be revised.

The revision of C2005 gave rise to the National Curriculum Statement (NCS). Also, NCS policy was reviewed because it lacked sequencing of concepts, progression of knowledge development, clear teaching methods and knowledge focus (Du Plessis et al., 2015). It was inevitable to amend NCS on those grounds and this introduced civil technology to Curriculum Assessment Policy Statement (CAPS).

According to Grussendorff et al. (2014) the CAPS document (DBE, 2011) became prescriptive on the knowledge articulation, weighting of topics and time to spend on each topic. As a result, this afforded civil technology a chance to combine three specialisations namely, civil services (plumbing), construction and woodwork (carpentry) to integrate theory and practical skills together with the application of scientific principles (Pinnock, 2011). CAPS (released in 2011) promoted specifications in terms of knowledge depth, pace, timeframes and volume of work. This was explicit on how Practical Assessment Tasks (PATs) were conceptualised and espoused in FET Technology subjects like civil technology.

From grades 10-12 all PATs were standardised, meaning that all learners doing civil technology in South Africa, were given the same practical tasks, irrespective of the school context and resources. The 2011 version of CAPS regarded the various geo- political, socio-cultural and economic factors as homogenous and proposed a one- size- fits- all approach to curriculum implementation. The implication was curriculum implementation occurs uniformly in a vacuum (Singh-Pillay & Alant, 2015). Additionally, the 2011 version of CAPS construed all education settings and all teachers' pedagogical content knowledge to be equal and equivalent as all PATs were uniform. Thus, CAPS (2011) was construed as a specific decontextualized state-driven curriculum that restricts teachers' autonomy or agency as curriculum developers (Singh-Pillay & Samuel, 2017).

Mtshali (2020) asserts that those standardised PATs prescribed by the Department of Basic Education (DBE) hindered and impinged the promotion of creatively and critical thinking skills among teachers. This meant that teachers lacked autonomy and could not serve as local curriculum developers to plan, teach and assess PAT that were responsive to their local contextual needs and problems. The frustrations civil technology teachers encountered with prescribed PAT and their lack of autonomy was emphasised by Kola (2016). Subsequently in 2014, the civil technology CAPS document was re-envisaged granting teacher's autonomy with the PAT, particularly in grades 10 and 11.

In-line with the provisions by CAPS (2014), civil technology teachers have been developing their own PATs for Grades 10 and 11 learners since 2016. Literature is replete with discussions around the transfer of hands-on skills in the teaching and learning of civil technology in the Eastern Cape province (Maeko & Makgato, 2020); the impact of learning by doing in civil technology classroom (Mokhothu, 2020) and critical thinking skills for civil technology practical assessment tasks (Mtshali, 2020). These studies point to a narrow margin of issues that civil technology teachers face and amplify issues already known such as lack of financial support, fewer qualified teaching personnel and lack of hands-on practical resources. We argue that these contributions are but the tip of an iceberg and do not illustrate teachers' ability to enhance their pedagogical capital when engaging with PAT. Our argument is supported by Dempsey (2013) who states that there are far too many issues, such as PAT, that have not been fully explored in technical education. Similarly, the following section unpacks civil technology teachers' PCK.

CIVIL TECHNOLOGY TEACHERS' PEDAGOGICAL CONTENT KNOWLEDGE

Tracing from its origins, Pedagogical Content Knowledge (PCK) is a specific knowledge awareness required by teachers that involves the transformation of subject matter knowledge in the context of facilitating learners' understanding (Shulman, 1986). It is about effective teacher preparation where the teacher understands teaching and how to enact it for successful transfer of the subject matter (Grossman et al., 1989). Of course, PCK is context driven, that is, teachers need to understand their learners' learning norms so that they employ appropriate teaching strategies to deliver the subject matter. Williams and Gumbo (2012) support this claim by stating that because PCK differs from class to class and changes over time, teachers need to employ various strategies to suit the learning needs of individuals.

Also, there is evidence to point that PCK is conceptualised and applied differently by scholars. For instance, Neumann et al. (2019) assert that the relationship between Content knowledge (CK), Pedagogical knowledge (PK) and PCK is central to a combination of content and pedagogical knowledge. Meanwhile, Chai et al. (2019) claim that teachers' design beliefs are significant predictors of teachers' PCK. An interesting observation from Greefrath et al. (2022) reveals that whatever modelling, test or other facets designed to enhance PCK are redundant as they show no significant change to teachers PCK.

A fair assumption is that civil technology teachers have their own PCK, however this may not yet have been explored. Doyle et al. (2019) emphasise that technology subject teachers have different ways of treating knowledge across the subject disciplines. The high dependence on tacit knowledge when teaching the subject technology makes PCK a unique practice. A contention by Gumbo (2020) is that technology's PCK is reliant on the design process, as content and pedagogy. On the other hand, Jones and Moreland (2004) hint to us on strategies that can be used to enhance technology teachers PCK. They include:

- "Reflecting on classroom practice,
- using a planning framework,
- negotiating interventions in the classroom,
- involvement in workshops,
- providing classroom support,
- involvement in teacher agreement meetings,
- using learner portfolios and,
- summative profiling." (p. 126)

In thinking about these strategies and the way in which PAT has been taught, one is of the view that, little attention has been given in bringing civil technology teachers PCK into existing literature.

In the process of discovering civil technology teachers' PCK, Jo and Bednarz (2014) state that researchers should not neglect the four dimensions of teacher professional development dimensions which include development objective, development method, development content and development history. However, we argue that these dimensions are already incorporated by Shulman's PCK from which Jo and Bednarz (2014) draw their dimensions. Shulman (1987) submits the following knowledge basis as essential when exploring teachers PCK, which include knowledge of content, pedagogical knowledge, curriculum knowledge, knowledge of learners and their characteristics, knowledge of educational context and knowledge of educational history and philosophy (Shulman, 1987).

A correlation can be drawn between teachers' PCK and skills development. Part of the requirement for civil technology is to have a teacher who demonstrates understanding of the built environment (DBE, 2011). This means that besides knowing how to teach, civil technology's teachers' way of teaching should also be guided by the way in which skills are developed and enhanced. For instance, how a teacher teaches civil technology, should reflect habitual activities in the civil engineering industry. The design of activities, the interactions with learners and resources should become the essence of civil technology teachers' PCK. Haug and Mork (2021) subscribe to the idea that a 21st century classroom should become a mini-industry where unskilled and semi-skilled personnel learn and improve their skills.

This study comes at a point where vocational skills are in high demand and teachers are expected to contribute to producing skilled individuals. Industries are looking at technical and vocational institutions to produce skilled individuals for them (Buthelezi, 2018). Also, communities are expecting to benefit from the vocational skills training happening around them (Spinuzzi et al., 2019). The current Curriculum Assessment Policy Statement allows this to happen at the cost of the teacher. Accordingly, we argue that such a teacher must demonstrate pedagogical capital. This means that a teacher should know content, how to teach it and link it with industrial and community needs. However, Gumbo (2020) argues that technology teachers have not been adequately trained to teach PAT as a strategy for skills transfer. Clearly, there are loopholes in technology teachers PCK and studies pertaining to this have been inconclusive especially in the context of civil technology. It is for this reason that this study aims to provide guidance and create awareness of how civil technology teachers can enhance their pedagogical capital when engaged with PAT.

To reiterate, teachers should bear in mind that civil technology was designed to be responsive to this fast-changing industrial environment through the PAT approach (Maeko & Makgato, 2020). Thus, below we discuss why civil technology teachers should enact PAT. Also, this topic will assist this study to ascertain what the current discussions and debates on civil technology teachers' autonomy to design PAT are, how they enact it and why they enact it in that way.

WHY SHOULD CIVIL TECHNOLOGY TEACHERS ENACT PAT?

Apart from complying with normal progression standards and imparting knowledge and skills, PAT gives an opportunity for learners to understand the working environment outside school premises (DBE, 2011). It prepares learners to have basic understanding on why the built environment is operating the way it does and what has been its role in former and future industrial revolutions. Careful planning, teaching and assessment should be done by teachers as they feed to industries that are not involved in PAT design in schools. Ayentimi et al. (2018) postulate that schools, TVET colleges and Universities have not made visible efforts to involve industries in designing hands-on practical skills activities for their leaners. Consequently, teachers equip learners with skills mismatching those expected by industries (Nwosu et al. 2023; Yamada & Otchia, 2020).

There have been debates of whether PAT assists learners to transition into sub engineers, artisans etc. According to Baum and Krulwich (2016) practical activities are set out to ensure learners receive similar training to that of artisans. Supporting this claim is Fiebrink (2019) who posits that these practical activities assist learners to know how machines operate and how they can fix them should the need arise. It is for this reason why teachers need to plan, teach, and assess the Practical Assessment Task to prepare learners for occupation opportunities.

The model of PAT continues to be carried through design process in technology subjects. A design process usually consists of systematic steps that architects, designers, engineers, or artisans follow to solve technological problems in an authentic way (DBE, 2011; Kola, 2016). However, in a recent approach, teachers do not necessarily need to cover all technological processes, rather to focus on procedural knowledge to perform a specific skill. This requires teachers to carefully plan and indicate the procedures they will follow to complete those simulations. This study wants to explore how these teachers plan for such simulations.

METHODOLOGY

The purpose of this conceptual research was to provide guidance and create awareness on how civil technology teachers' can enhance their pedagogical capital when engaged with PAT, via a review of related literature. The review was limited to peer reviewed journal articles that focused on practice and pedagogies used by teachers of technical subjects. The following search engines were used to access the relevant articles Hotbot, Google, Bing and various institutional repository libraries. Key terms or phrases used to select article, which are available in a public domain, were pedagogy, pedagogical capital, teaching strategies, practical tasks, teacher agency and technical subjects. Thus, purposive sampling was used in the selection of articles to be reviewed. A total of 52 articles, book chapters and theses were sampled. These scholarly works were downloaded, numbered and filed in an electronic folder. The articles were subjected to content analysis. The articles were read and re-read before coding could begin to assist teachers in maximising their pedagogical capital to cope with the recent curriculum change. This study found that indeed there are far too many requirements for civil technology teachers to accomplish before their learners can be adequately equipped with hands-on skills,

GLOBAL MODELS TO ENHANCE THE TEACHING AND LEARNING PHENOMENA OF CIVIL TECHNOLOGY

There have been several theories and models that seek to assist technical teachers to capacitate learners with hands-on skills necessary for employment. The application of these theories has been globally considered relevant in enhancing technical teachers' pedagogy and helpful in understanding the teaching and learning phenomenon of civil technology. For instance, Newson and Delatte (2011) presented a case-based teaching model because civil technology is heavily reliant on deductive instruction and that it is one of the most efficient forms of learning of civil concepts. Newson et al. further state that the benefits of using this strategy are improved retention of knowledge, improved conceptual reasoning, analytical skills and the development of higher-order skills amongst others. Also, Durkheim's (1898) functionalist theory has been widely used to address education of social impact, thus discussed below:

Functionalist theory

The founder of this theory Durkheim (1898) suggests that education is a vehicle for social change, where education institutions are perceived as agents for socialisation and whose function are intended to prepare young people for adult economic roles (Durkheim, 1898). The relevance of this theory in civil technology is its emphasis on teaching for social change, whereby civil technology sought to equip learners with competitive industrial skills so they may become active socio-economic citizens. Durkheim also contends that education is underpinned by three roles, namely socialisation, skills provision and role allocation, thus discussed below:

Socialisation

This is where education helps to maintain society by socialising young people in to key cultural values, such as achievement, individualism, equality of opportunity, social solidarity and democracy. Through respect of school rules, teachers' instruction and authority prepares learners to respect societal hierarchy with its rules and laws.

Skills provision

This is where education teaches the skills required by a modern industrial society. These may be general skills that everyone needs such as literacy and numeracy or the specific skills needed for particular occupations. Durkheim suggests that the schools' function is to place people to do work according to their abilities. He further argues that society cannot function well if people were not doing different jobs according to their talents.

Role allocation

This is where education allocates people to the most appropriate jobs for their talents using examination and qualifications. Schools classify learners according to their abilities to avoid stifling learners' interests. Identifying learners' orientation and talents enables them to follow their passion and promoting excellence in areas of their ability.

Whilst this theory guides how teachers could make learners effective in hands-on activities, it fails to clarify how civil technology teachers can evoke their pedagogical capital to provide learners with equality of opportunities when there is no training equipment. This study argues that this theory is unable to completely explain society hence some areas of society remain mysterious to social norms. As a result, it could also fail to clarify how learners can learn about modern skills when they are not even exposed to industries that embrace modern skills. This theory could also fail to unpack how role allocation could be implemented by teachers without training learners with hands-on skills that are no-longer marketable. To this end, we believe that in a situation like South African technical schools, there needs to be a model that will assist teachers in how they need to improve their teaching and skilling techniques firstly other than blaming unavailability of training equipment and management. This is because Mtshali et al. (2018) argue that there are many technical schools that are well equipped and sponsored with skills equipment yet they produce poorly- skilled learners with good marks.

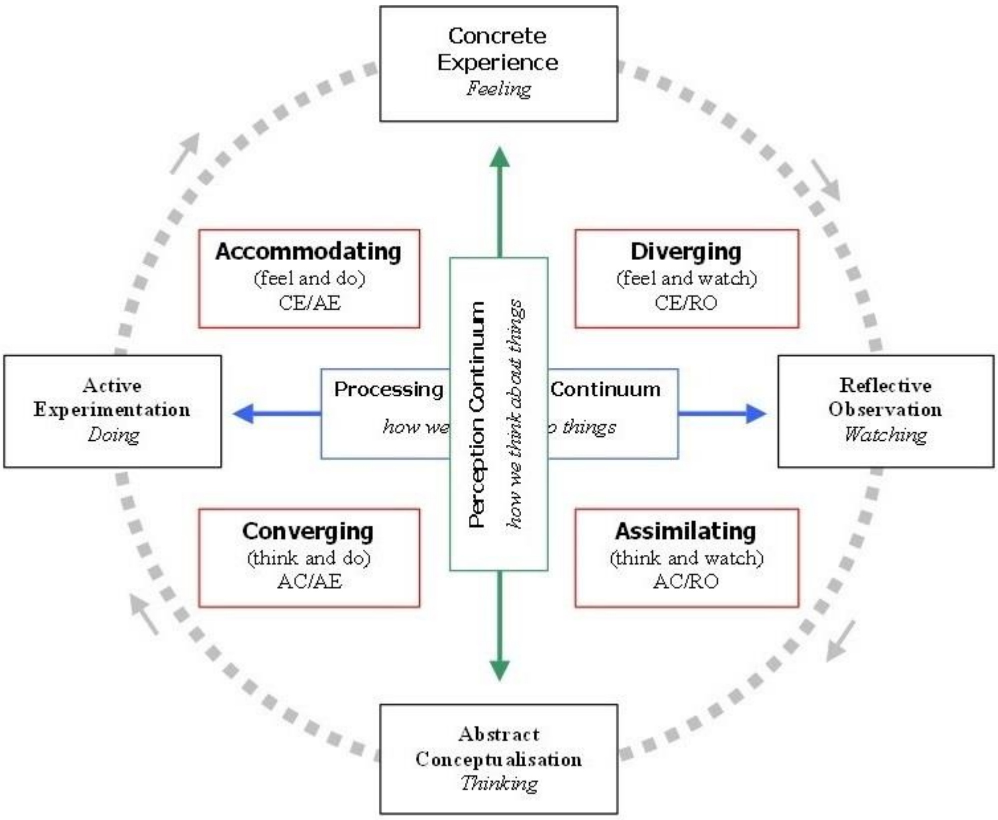
Kolb's Learning Theory

It is interesting that Maeko (2020) used Kolb's (1984) Experiential Learning Theory (ELT) theory to understand teaching and learning through hands-on activities in civil technology. Maeko (2020) states that Kolb's ELT allows teachers to pay attention to concrete experience, reflective observation, abstract conceptualization, and active experimentation. Besides, Kolb's (1984) Learning Styles Inventory model and Experiential Learning Theory provides a holistic model of how people learn, grow, and develop. Kolb (1984) developed a model for 'experiential learning' which could have a profound effect on work in the workplace when correctly applied. Kolb believes that learning is recurring and involves both practical and reflection where people do not learn by experience alone, but also by reflecting on what was experienced. He is also of the opinion that learning takes place by learners who are given opportunities to acquire and apply knowledge and skills. It also provides fundamental concepts towards the understanding and explanation of human learning behaviour and how they learn through action.

Kolb learning styles:

- ***Diverging (feeling and watching - CE/RO)***: These learners are those who can look at things from different perspectives and are sensitive. They prefer to watch rather than do, tending to gather information and use imagination to solve problems. They are best at viewing concrete situations from several different viewpoints.
- ***Assimilating (watching and thinking - AC/RO)***: The Assimilating learning preference is for a concise, logical approach. Ideas and concepts are more important than people. These people require good clear explanation rather than practical opportunity. They excel at understanding wide-ranging information and organising it in a clear logical format.
- ***Converging (doing and thinking - AC/AE)***: People with a Converging learning style can solve problems and will use their learning to find solutions to practical issues. They prefer technical tasks and are less concerned with people and interpersonal aspects.
- ***Accommodating (doing and feeling - CE/AE)***: The Accommodating learning style is 'hands-on' and relies on intuition rather than logic. These people use other people's analysis, and prefer to take a practical, experiential approach.

Figure 1. *Kolb's (1984) Learning Styles*

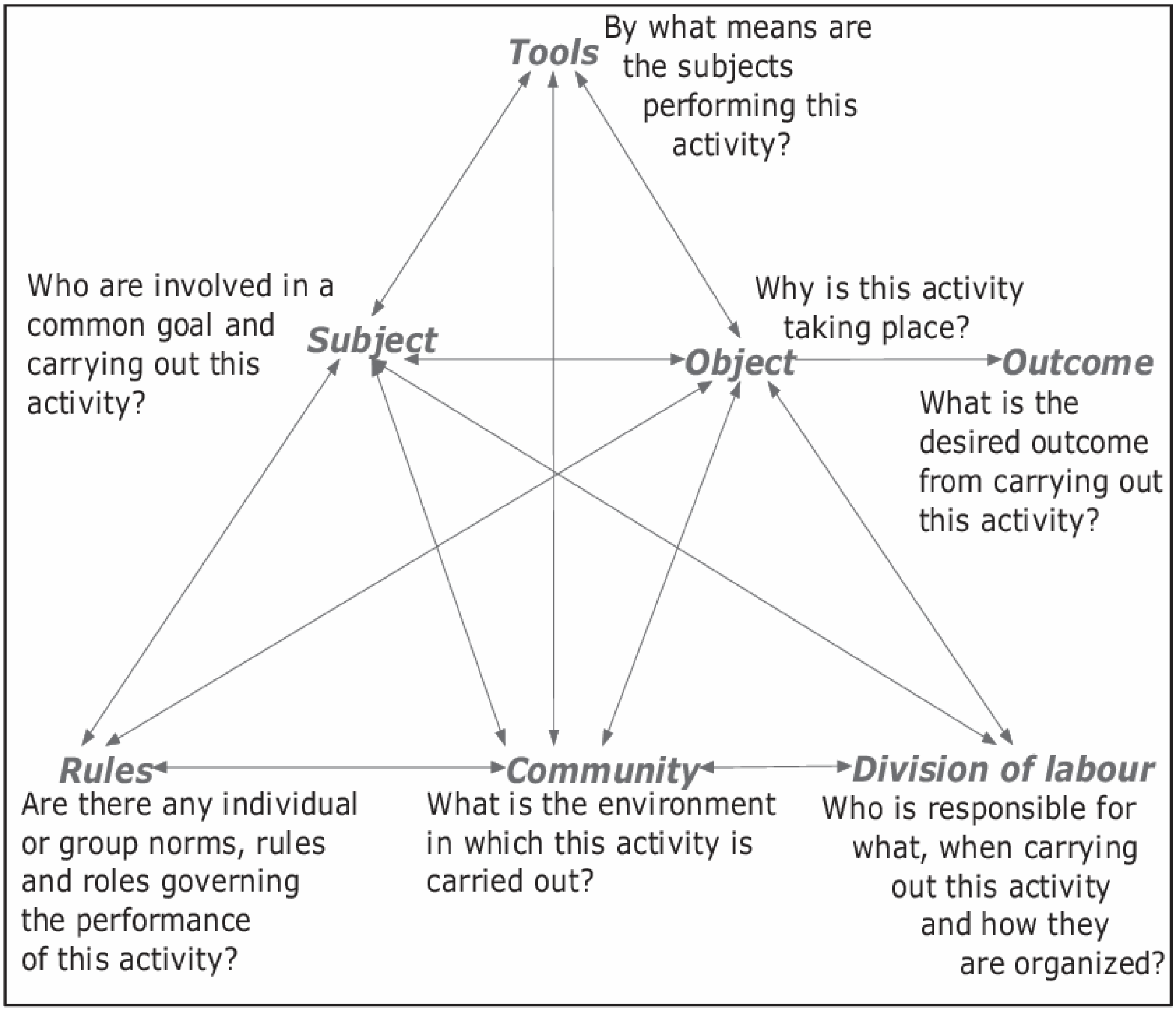


In critique of this theory, this study notes that this theory could not effectively assist teachers to enhance pedagogical capital and that it assumes that it does not assist in unpacking elements of reflection (Nkwanyane et al., 2022). All technical subject learners should learn through action and so, it will fail to account for situations where some members in groups are not active participants during hands-on practical lessons. Given the nature of civil technology PAT, it focuses on how learners learn and acquire skills but does not look at whether those skills are contemporary which lead to 4IR skills emancipation. To this end, this theory does not cover issues around industry orientated learning.

Activity theory

Even though activity theory was grounded by Vygotsky and his students such as Leontiev, in the 1920s, Engeström (1987) popularised this theory by using the concept of a “collective activity system”, expressing elements such as subject, object, tools, rules, division of labour and community. This model is about “who is doing what, why and how” to understand how a wide range of factors work together to impact an activity.

Figure 2. *Activity theoretical approach* (Engeström, 1987)



In the above model, Engeström (1987; 2001) details the existing relations of elements of the activity triangle. His argument is that community and subject are facilitated by the rules shaping the community and the object is facilitated by the division of labour practice among members of the community. He further explains the activity triangle elements in the following way.

Subjects

For clarification, Engeström (1987; 2001) stresses a need to know who are involved in a common goal and carrying out this activity. It is important to understand that whoever is involved in various activities, all bring previous experiences to the activity at hand, so it is important to discuss and know who is more relevant in tasks.

Object

Even though it is difficult to explain the concept of object in activity theory research, Engeström (1987) believes that it should be perceived as both the purpose of the activity and as a developmental object. Object can provide clarity on the need for the object to exist.

Tools

Tools are central to carry out an activity which depends on the subject to which the model requires. So, Engeström (1987) advises people who are engaged in the Activity Theory Model to ask themselves and understand with which tools they are going to carry out the activity.

Rules

Activity systems also have rules, they should rather not be understood as formal alone, but they are also explicit, tacit or unwritten rules that are often called habits, routines and values. The rules shape the interactions of subject and tools with the object.

Community and Labour Division

According to Bronkhorst (2013), "the subject is part of a larger community, which conditions all the other elements of the system. The student, lecturer and workplace supervisor are engaged in an activity of learning and they act together on an object with a common motive for students to qualify as artisans. In this activity, the community constitutes the students, lecturers and workplace supervisors, all of whom have a part to play in executing the activity" (p. 44).

This model focuses on understanding everyday practice in the real world. Furthermore, it emphasises that learners must learn about the rules in the classroom and must apply them in the workplace. However, this study finds this model insufficient because it lacks consideration about other factors that may influence the relationship between activity and life satisfaction such as personality traits. In this way, it will limit the understanding of pedagogical capital in civil technology PAT. It also does not look at how the teacher should impart the skills that must be applied in the workplace. However, this study is of the view that this model is more relevant in studying a group that exists largely in virtual form yet goes beyond electronic expertise.

Problem Based Learning model

Another globally acclaimed teaching and learning strategy in civil technology is that of problem based learning (PBL). According to Savery (2015), PBL is an instructional method in which learners acquire knowledge through facilitated problem solving. Complex problems are presented to learners so they may find multiple applicable solutions. This model is appreciated because of its ability to enhance critical thinking skills in learners. It may be matched with Shulman's PCK as he guides teachers on knowledge planning, acquisition and delivery.

We must remember that civil technology is one of the technical and vocational subjects that were developed in response to the scarce skills needed by built environment industries (Mzini, 2019). It covers the preparation, design, maintenance and organisation of construction projects. Such projects are concerned with the construction of buildings, airports, sport stadiums, roads, bridges and harbours (Tuncay, 2020). However, due to high costs and insufficient training equipment, Anindo et al. (2016) suggest that the DBE tend to focus on residential construction as it can be more cost-effective than other projects. Thus, it is assumed that most public technical schools' curricula focus more on residential building construction than on non-residential building construction. This therefore affects extensity of civil technology pedagogical capita.

ENHANCING PEDAGOGICAL CAPITAL

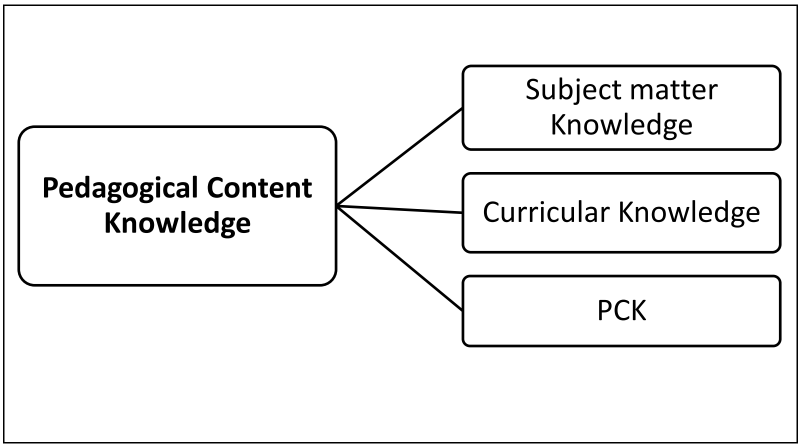
Concerning the above discussion, we conceptualise how civil technology teachers should enhance pedagogical capital when engaged with PAT. We have earlier argued that pedagogical capital is foregrounded by PCK. Thus, it is important to take our reader step-by step on the framework we are proposing. As such, we need to start with Shulman's (1986) ideas on pedagogical content knowledge. In terms of capital, we borrow from Bourdieu's (1986) notion of social capital. Cohen et al. (2018) maintain that a conceptual framework draws on theories and maps out key concepts that are intertwined with the topic, data generation method and analysis – we are aligned to this view.

As stated, that there are two notions from which we draw pedagogical capital concepts. In the next section we explain how teachers should enhance pedagogical capital starting with PCK.

Pedagogical Content Knowledge Framework

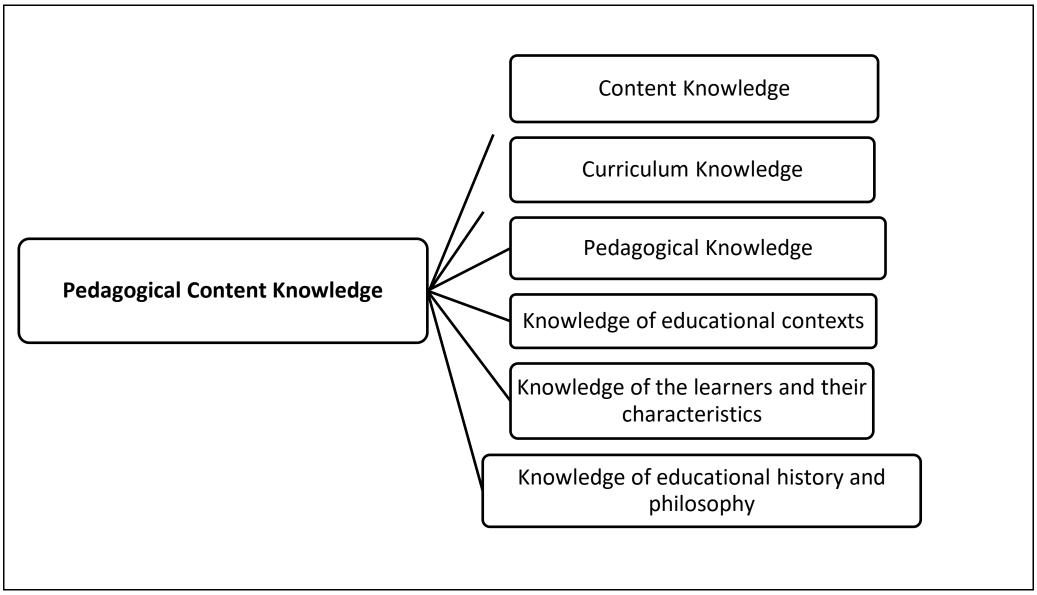
This study draws on Shulman's (1986) work on pedagogical content knowledge (PCK) to explore civil technology teachers' pedagogical capital when engaged with practical assessment tasks, to gain insights into teachers' pedagogy. PCK support teachers in transforming content knowledge into pedagogically effective forms such as knowing how to interpret content goals, how to listen and respond to learners and their questions, ability to explain clearly and to ask good questions. Shulman (1986) observed that teacher education and research into teaching concentrated largely on generic pedagogical knowledge which deserted the subject matter knowledge from which teacher's instruction is drawn. Thus, he introduced subject matter knowledge, curricular knowledge and PCK as basis for teachers to master content, know how to transfer content and how it links to other contents within the same curriculum.

Figure 3. *Shulman's (1986) Pedagogical Content Knowledge Framework*



Upon revision, Shulman (1987) expanded these categories to four more categories that constitute the knowledge base of teachers, general pedagogical knowledge, knowledge of learners, knowledge of educational context and knowledge of educational ends, purposes and values. Henceforth, Shulman (1987) classified seven types of knowledge bases for teachers namely: knowledge of content; general pedagogical knowledge; curriculum knowledge; pedagogical knowledge; knowledge of learners and their characteristics; knowledge of educational contexts; and knowledge of educational history and philosophy.

Figure 4. *Shulman's (1987) Pedagogical Content Knowledge Conception*



Content Knowledge

According to Shulman (1987) content knowledge (CK) includes knowledge of concepts, explanations, ideas, proofs, and practical examples along with processes and models for developing knowledge. Shulman regards content knowledge as the fundamental base that a teacher must possess. Therefore, teachers should use CK to understand the content that civil technology holds for the designing of the practical assessment task. This of course cannot be separated from how the teacher present it to learners since CK is conceived as an element of PCK.

Pedagogical Knowledge

Pedagogical knowledge (PK) refers to teachers' unfathomable knowledge about practices and methods of teaching and learning including how learners learn, classroom management skills, planning of lessons and learner assessment (Koehler & Mishra, 2009). Teachers should use PK to discover knowledge on how they view their autonomy to plan, teach and assess civil technology PAT.

Curriculum Knowledge

Curriculum knowledge refers to the demonstration of an understanding of the curriculum, subject content, pedagogical knowledge, and the developmental needs of learners by providing relevant learning experiences (Shulman, 1987). Teachers should use professional knowledge to understand their perspectives on their autonomy to plan, teach and assess PAT. This will include teacher's understanding of the way PAT topics are arranged and organised; linkage of the PAT to the subject theoretical contents; use of appropriate teaching strategy to explain the PAT contents and how the teacher links this to lived experiences.

Pedagogical Content Knowledge

Shulman (1987) identified pedagogical content knowledge (PCK) as one of the knowledge domains important for teachers. PCK is described as knowing what makes learning specific topics simpler or more difficult. It is also the knowledge that includes both subject matter and pedagogical expertise (Shulman, 1987). PCK is defined as the type of knowledge required of teachers to teach the subject, understand learners' methods of thinking, recognize learner errors and their sources plus express specific themes in several ways (Shulman, 1986). PCK entails offering learners tasks, using their existing ideas and prior knowledge, and providing suitable instructional support and guidance in the form of explanations, analogies, illustrations, and examples to help them grasp the topic. As a result, PCK is to be used to investigate how civil technology teachers enact their pedagogical capital when they engage with PAT.

Knowledge of the Learners and their Characteristics

The knowledge of the learners and their characteristics talks about the teacher's understanding of possible learners' ideas of the issue (Shulman, 1987). This is done to develop explanations that would either dispute or confirm preconceived notions. This knowledge includes teachers knowing the importance of acquiring core topic concepts and identifying the need-to-know approaches for assessing learners' comprehension. This study will use this category to learn why they enact their pedagogical capital the way they do.

Knowledge of Educational Context

According to Shulman (1987) knowledge of educational context refers to the broadest sense knowledge of all settings where learning takes place. It includes everything from an awareness of instructional situations to class and group social dynamics to broader aspects of school and community culture. This domain emphasizes the use of educational resources to instruction. Hence, teachers should use this domain to assess how the civil technology practical assessment task is aligned with the contextual needs of the community.

Knowledge of Educational History and Philosophy

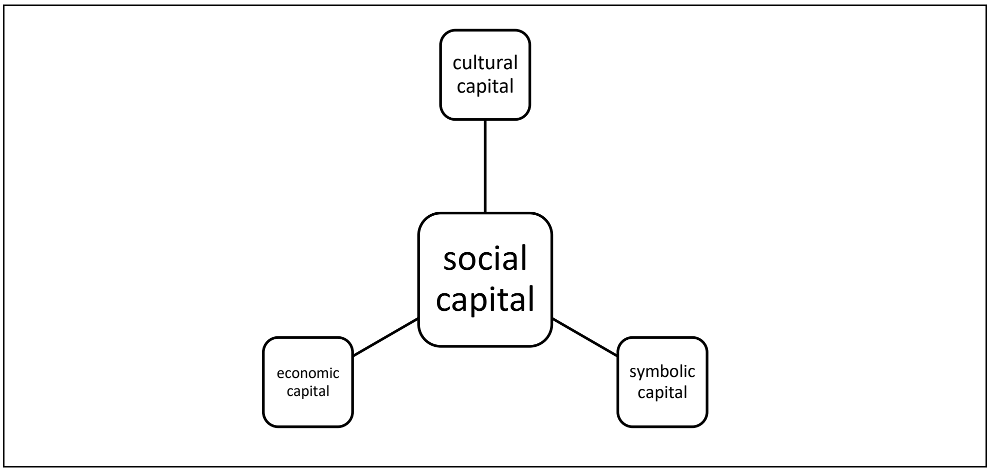
The knowledge of educational history and philosophy guides teachers to understand their learners' reasoning and way of doing things. This knowledge informs teachers exactly how they present themselves, and how instructions and resources are carried-out to develop learners (Krinn, 2011). To the great advantage of this study, this component should be used to determine how much civil technology teachers and learners know about why autonomy to design PAT was given to them.

To reiterate, PCK is used to explore the curricular saliency that civil technology teachers possess in terms of knowing content and how to teach it. However, the aspects lacking in the PCK model is the socio- cultural aspects associated with teaching (in this instance technology teachers' professional needs and reflection on their autonomy to design PAT). In other words, Shulman's PCK fails to "appreciate the interaction between people's values and attitudes, technology, society and the environment." [Department of Basic Education (DBE), 2011:8]. Bourdieu's (1986) concept of social capital, therefore, becomes a valuable inclusion in this study's conceptual framework.

Social Capital

While Bourdieu (1986) contends that social relationships are resources that can lead to the development and accumulation of human capital, it is worth noting that social capital is not readily or automatically available to individuals or members of a group. Instead, social capital is acquired by individuals or members of a group who make the effort to advance themselves, achieve positions of power and status by developing goodwill (Bourdieu, 1986). Simply put this means, social capital is an amalgam of the resources, networked relationships (personal and professional), influence, opportunities (or lack thereof), recognition and power that an individual has via social, economic or cultural structures. For Bourdieu, social capital is intrinsically connected to cultural capital, economic capital and symbolic capital as depicted in Figure 5 below.

Figure 5. *Components of social capital* (Bourdieu, 1986)



Each component of social capital is discussed next.

Economic Capital

According to Bourdieu (1986) economic capital refers to a measure of how much money a person or family has. It stems from the notion that when a person's economic capital goes up, more opportunities open for them because they can afford them.

Cultural Capital

It is composed of social assets like knowledge acquisition, physical appearance, automaticity, and competence. This capital is dependent on money as it can buy a head start on developing certain skills (Bourdieu, 1986).

Symbolic Capital

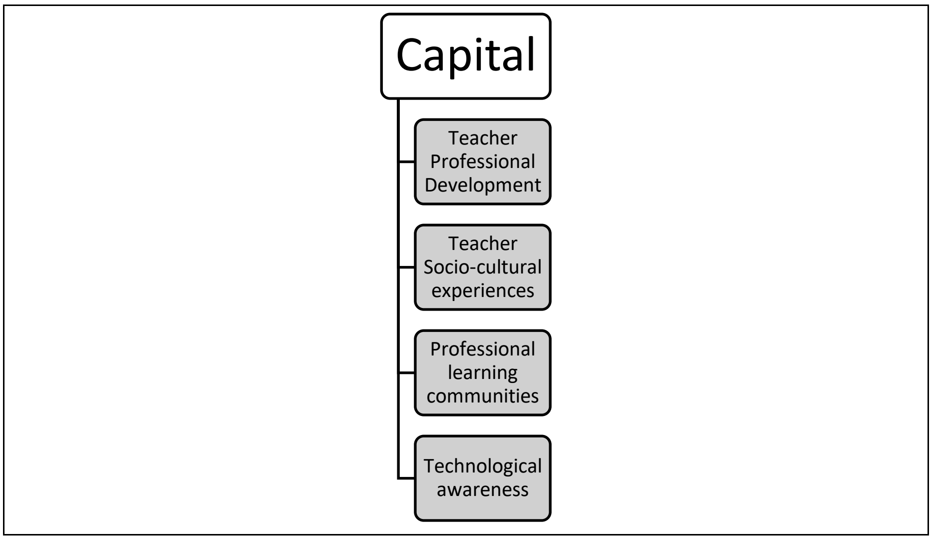
The roots of this capital can be drawn from that of social capital. This is because symbolic capital is a denotation of power of the dominant class, and it is instrumentalized for the legitimization of power (Bourdieu, 1986).

Judging from the above concepts, Bourdieu (1986) succeeded in grounding his theoretical contribution into a real-life context. However, the explanations on the forms of capital are based on sociology and would need further contributions to transfer them into education studies. Claridge (2018) supports this view by stating that social capital theory can be used beyond the ambits of sociology if the "capital" concept is understood.

PEDAGOGICAL CAPITAL MODEL

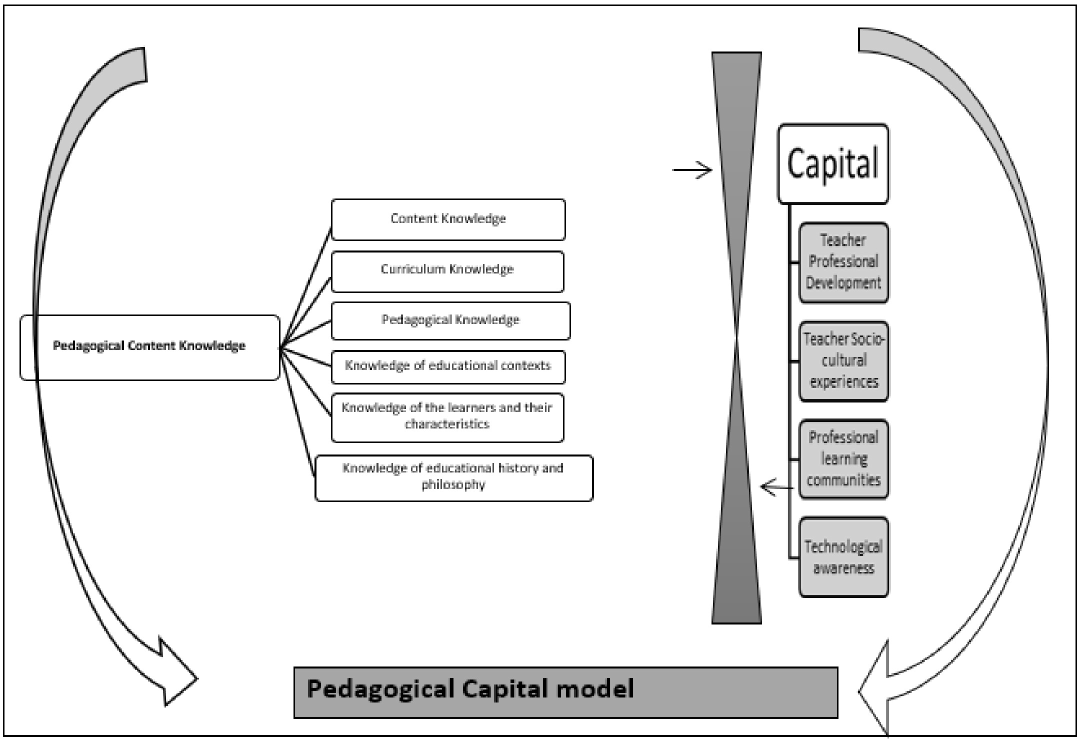
Based on the above, this study then used the term "capital" in the context of teachers using their lived experiences, connections, and resources to influence their pedagogy regarding practical assessment tasks. As indicated earlier, this study stems from the DBE's proclamation that Civil Technology teachers now have the autonomy to design PAT. We regard that as being given "Capital" to influence pedagogy pertaining to PAT. For this study we espouse the idea of capital as depicted in Figure 6 below.

Figure 6. *Components of Civil Technology Teachers' Capital*



We envisage civil technology teachers' pedagogical capital as teachers' ability to use their PCK for learners' conceptual understanding and the grasp of hands-on skills as well as the capital (depicted in Figure 6) they bring with them into their teaching. Teachers' capital will include their associations or networks in professional learning communities, social cultural experiences of teaching technology, professional development needs and technological awareness that directly influence subject matter knowledge and reasons for pedagogical choices. We have thus created a conceptual framework to explore civil technology teachers' pedagogical capital when engaged with practical assessment tasks as shown in Figure 7 below.

Figure 7. *Pedagogical Capital Model*



The abovementioned concepts are fundamental to understanding how civil technology teachers should actualise their autonomy to design and enact practical assessment tasks.

Gumbo (2020) opines that technology teachers need to be taught how to teach PAT. Similarly, Ward and van der Mars (2020) posit that teachers should always be current with the subjects' specialism and approaches to teaching and learning via teacher professional development. We argue that teacher's professional development sculpts teachers' pedagogical capital and impacts how they engage with PAT. Furthermore, the association, networks and professional learning communities' teachers learn from and with each other and focus on the implementation of new ideas and practices is an invaluable part of their pedagogical capital. This study uses this concept to understand how civil technology teachers should use their autonomy designing PAT that responds to technological problems facing their communities.

Central to teaching PAT in civil technology is the use of resources. Makhubele and Simelane-Mnisi (2020) advise that technology teachers should be aware of educational technologies (technological awareness) that can benefit them during instructional delivery. Thus, the concept of technological awareness is important in this study which focuses on how and why civil technology teachers enact their pedagogical capital the way they do when they engaged with PAT. Vygotsky (1987) emphasised that teachers experiences shape how they teach as this study seeks to explore why civil technology teachers enact their capital the way they do when engaging with PAT. It is quintessential for it to be included in the professional capital model.

CONCLUSION

As indicated earlier, the purpose of this study was to provide guidance and create awareness on how civil technology teachers can enhance their pedagogical capital when engaged with PAT. A framework was proposed to assist teachers as per conclusion that civil technology is a skill- rich subject, and teachers should understand how to prepare learners with contemporary industrial skills. Also, teachers need to stay intact with their pedagogical capabilities and the DBE should play its role in increasing the number of subject advisors. There are shortages in training resources in schools, however, the correct conception of pedagogical capital can maximise teachers' creative abilities and the art of compromise. With the shortage of subject advisors in schools, this study assists teachers to self-develop and understand where pedagogical improvements need urgent attention. We recommend that mechanical, electrical and engineering graphics and design teachers in schools, TVET colleges and universities buy into this ground-breaking guide.

Limitations of the study

This study was limited to peer reviewed theoretical accounts to propose a framework that technical teachers could use to enhance pedagogical capital when engaged with PAT. Like any machine, the framework will need to be regularly inspected, maintained and occasionally upgraded to ensure efficiency and longevity.

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