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## Assessment Of Online Accreditation Of Engineering Programs: A Cultural-Historical Activity Theory (CHAT) Analysis

Kasongo Didier NYEMBWE

*University of Johannesburg, South Africa, dnyembwe@uj.ac.za*

Tajudeen MOJISOLA

*University of Johannesburg, South Africa; Air Force Institute of Technology, Nigeria,*

*mojisolatajudeen@gmail.com*

Zach SIMPSON

*University of Johannesburg, South Africa, zsimpson@uj.ac.za*

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# **A Theory of Change for Online Accreditation of Engineering Programs: Cultural-Historical Activity Theory (CHAT)**

**KD Nyembwe**

University of Johannesburg  
Johannesburg, South Africa

**T Mojisola**

Air Force Institute of Technology  
Kaduna, Nigeria

**Z Simpson**<sup>1</sup>

University of Johannesburg  
Johannesburg, South Africa  
0000-0002-1263-3812

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## **ABSTRACT**

This paper shows how Cultural Historical Activity Theory (CHAT) can provide a practical framework for online accreditation of engineering programmes in South Africa. Far from being inaccessible, CHAT can provide engineering accreditation bodies with a conceptual framework and theory of change for online accreditation of engineering programs. Within the context of program accreditation in South Africa,

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<sup>1</sup> Corresponding author: Zach Simpson  
zsimpson@uj.ac.za

the paper leverages CHAT to comprehend the dynamic interplay of digital technologies as deployed during online accreditation including, amongst others, video conferencing, social media and cloud storage, and how these affect online accreditation of engineering programmes. It is concluded that theory-based research and practice need not remain at a conceptual level but can be used to create concrete solutions to problems, such as the adverse effect of COVID-19.

## 1 INTRODUCTION

Due to the emergence of COVID-19 in early 2020 and its adverse effect on all facets of human endeavor, there has been a growing quest for the adoption of online platforms for knowledge acquisition and dissemination, of which online accreditation of engineering programs is included. The COVID-19 pandemic has challenged orthodox practices and shown how online platforms can be used in myriad ways (Mentz and De Beer 2021). In today's world of engineering and technology, quality assurance and accreditation is increasingly important. Hence, a strategy needs to be deployed to ensure that the quality of engineering and technology programs is maintained (Trow 1973).

The accreditation of engineering programmes is a critical quality assurance process to ensure that engineering programs meet the global standards developed by the International Engineering Alliance (IEA). In South Africa, accreditation of engineering programmes is carried out by the Engineering Council of South Africa (ECSA) as part of its statutory mandate through its Education Committee (ECSA 2021a). The Engineering Council of South Africa (ECSA) is a signatory of various IEA agreements, including the Washington, Sydney and Dublin Accords (IEA 2021).

Typically, ECSA accreditation of engineering programs involves physical visits to engineering departments at universities over two to three days. During this period, a panel of academic peers and industry representatives scrutinize and evaluate learning materials, visit laboratories, and interview students and staff of the department to be accredited. The objective of the accreditation visit is to assess the compliance of engineering programs with a set of well-defined accreditation criteria, including program structure, graduate attributes, quality of teaching and learning and availability of resources to offer the programs (ECSA 2021b). The Engineering Council of South Africa (ECSA) also makes provision for provisional accreditation of new engineering programs to serve as a developmental exercise to correct any concerns or deficiencies ahead of regular accreditation once a program has produced a first cohort of graduates (ECSA 2021a).

Unfortunately, the onset of the COVID-19 pandemic worldwide in early 2020 disrupted the accreditation of engineering programs by ECSA due to national lockdowns imposed by the government and the enforcement of health and safety protocols that restricted in-person interactions. Consequently, South African universities closed their campuses and moved to emergency online teaching and learning. In addition, most universities requested that scheduled accreditation visits be cancelled or postponed so that the institutions could concentrate on saving the 2020 academic year (Salmi 2020).

To avoid backlogs of accreditation visits to local universities in 2021 and subsequent years, and prevent putting at risk ECSA's credibility and obligations to the IEA, the Education Committee adopted online accreditation of engineering programs, starting in 2021 (ECSA 2021b). A range of requirements and initiatives were proactively put in place by ECSA to enable online accreditation, and this includes developing new

policies, implementing digital technologies, and training of stakeholders. As a result of these interventions, engineering programs in a dozen South African universities have been accredited by ECSA using the online modality.

On this premise, this paper aims to study the South African higher education context under the COVID-19 pandemic to critically reflect on ECSA's online accreditation process using Cultural Historical Activity Theory (CHAT). The paper makes a theoretical, rather than empirical contribution and aims to demonstrate how CHAT can be productively employed as a theory of change in a technologically-advancing context. To this end, this contribution is a position paper, where the practice of accreditation is reviewed analytically and then mapped to the CHAT framework to give a system-level understanding of all the elements of the process that can have an impact on its overall success.

Cultural Historical Activity Theory (CHAT) also known as Activity Theory (AT) is a theoretical framework introduced to the West by Michael Cole and popularized by Yrjo Engeström (Nussbaumer 2012). The theory can be adapted and applied to many disciplines in engineering, science, and the humanities. CHAT offers a way of understanding imagined, simulated and real situations that require personal engagement with material objects and artefacts (including other human beings) that follow the logic of an anticipated or designed future model of the activity.

The use of CHAT has increased in educational research over the last two decades. For example, Sumbera (2021) posits that utilizing this activity-based framework to analyze current course structures will allow collective research projects to increase the effectiveness of action-driven justice-centered leaders. In another study, Lupu (2011) found that comparative analysis and diverse ideologies arising from different activity systems appears to be a relevant factor affecting participation in European reform and development processes. Lupu argues that collaborative work is essential for participation and that bringing to light differences makes identities visible, which is an important generative resources for systemic expansion at any level. Also, Patchen and Smithenry (2014) demonstrate how a teacher can link elements within and between a diverse set of participant structures in ways that systematically create real opportunities for student-directed inquiry and collaboration while assuring students learn to act with disciplinary authority.

Like any theory, CHAT is not without its critics. Some have argued that the framework is inadequate for investigating human culture and psychology. Others cite arguments that CHAT is too difficult to learn and not worth the effort to do so (Koszalka and Wu 2004). Yet CHAT remains a popular theory that is currently being employed for different facets of human endeavor such as mobile tool usage, English language teaching and learning etc. (Paskevicius and Knaack 2018).

Engeström posits that CHAT is a model that organizes systems-level thinking and analysis in order to understand an activity occurring within a particular context (Engeström 2007). This paper analyzes ECSA's online accreditation process through the lens of the CHAT activity triangle concepts as depicted in Fig. 1. The approach

adopted in this study leverages the power of CHAT to comprehend the dynamic interplay of digital technologies deployed during online accreditation including, amongst others, video conferencing, social media and cloud storage, and how these affect online accreditation of engineering programs.

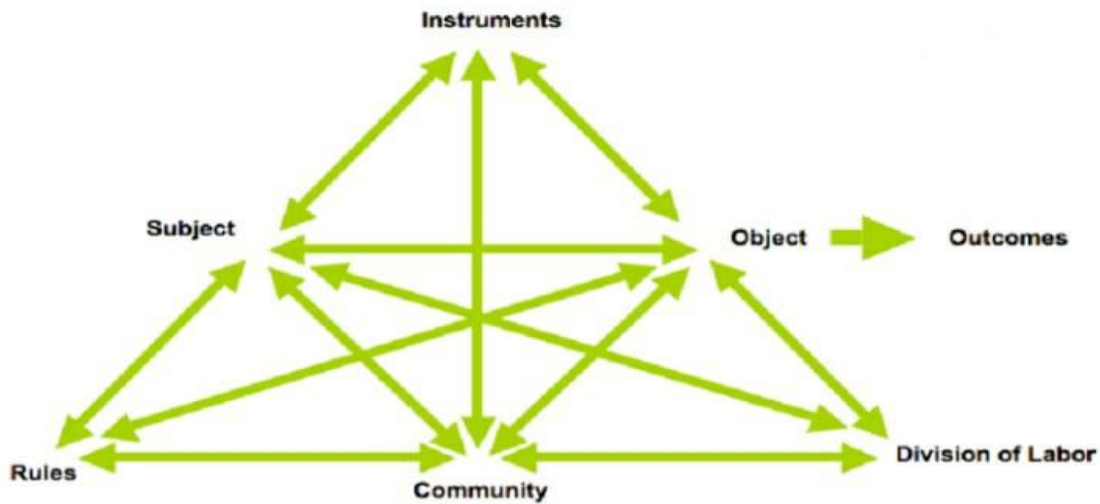


Fig. 1. Cultural-Historical Activity Theory (CHAT) 'triangle' model (Engeström 2008)

In actualizing ECSA's roles and responsibilities in accreditation of engineering programs in South African universities, this paper uses the second-generation CHAT framework proposed by Leontiev (Radford 1998), in which collective activity is the cornerstone of the analysis. The CHAT model, as depicted by Engeström (2008), and as shown in Fig. 1 entails six activity theory concepts as follows:

- Subject
- Instruments
- Community
- Rules
- Division of labour
- Outcome

In the next section, each of these concepts is explained and discussed in the context of the online accreditation of engineering programs by ECSA. The available policies and legal framework as applicable at ECSA or as related to Higher Education in South Africa are invoked for this discussion.

## 2 APPLICATION OF CHAT TO ONLINE ACCREDITATION OF ENGINEERING PROGRAMS

According to Engeström, the *subject* is the individual or group of individuals involved in the activity (Batiibwe 2019). Within the CHAT activity triangle as applied to online accreditation, the university (or faculty) in which the accredited program resides is the subject of the accreditation activity. This subject performs several tasks (Policy E-12- REQ), including preparing the required documentation, hosting the

accreditation panel, providing clarification during interviews, guiding the visitation team during the tour of the available infrastructure, etc.

Engeström defines the *object* as the motivating influence behind subjects' participation in the activity (Engeström 2001). From a CHAT perspective, engineering programs are the objects in this regard, although, the students whom the target programs are meant for could also be included as part of the object of the activity.

*Instruments* are the mediating artifacts used either as physical or psychological tools between the subject and the object (Cole and Engeström 1993). Fig. 2 shows a variety of artifacts used by ECSA in their accreditation of engineering programs. These tools (particularly as stated in E-24-StA) are used in the online accreditation of programs and include cloud file storage systems and video conferencing software. Other examples of digital tools used during the COVID-19 pandemic included Microsoft OneDrive and Teams, Zoom, Google Meet etc. There is a wide array of conferencing and interactive media that could be used as part of the process.

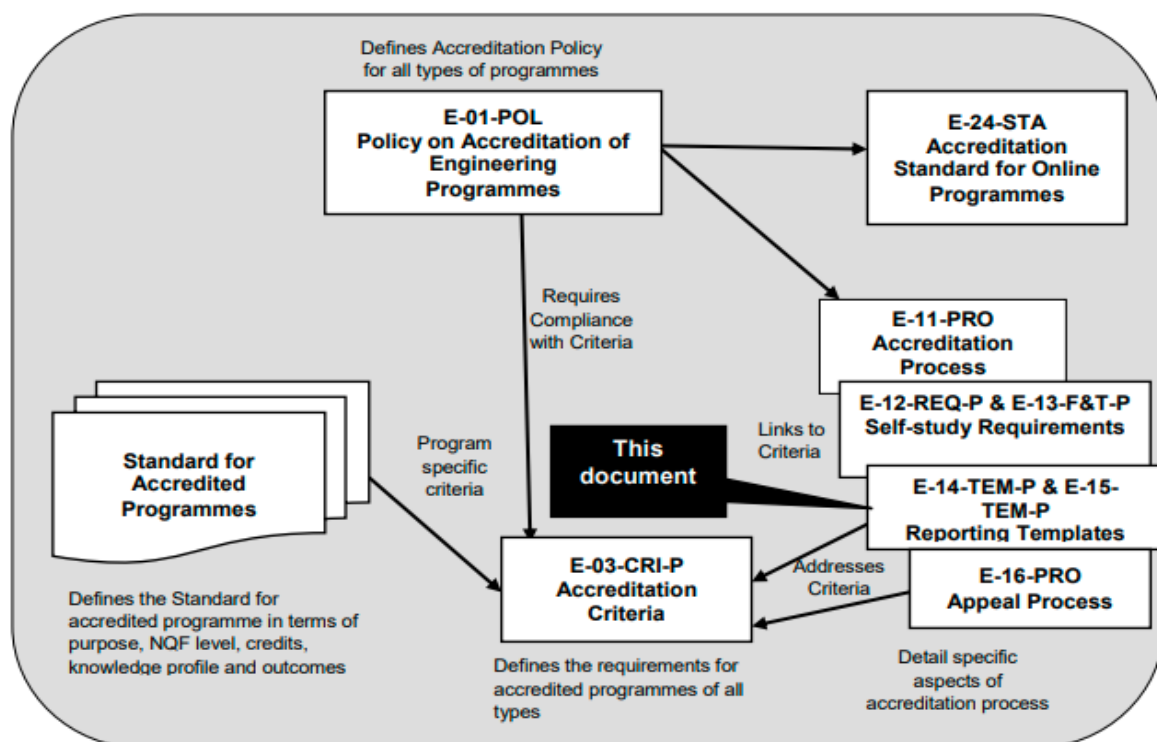


Fig. 2 Documents defining the ECSA requirements for accreditation (ECSA 2021a).

In addition to the ECSA Education policies, the providers developed and adopted several innovative engineering education strategies during the COVID-19 pandemic to assess the Graduate Attributes required by the International Engineering Alliance (IEA) accords. Examples of accepted engineering education strategies to consider ECSA competencies included online assessment and virtual laboratory projects, and simulation technologies, to mention a few. Collectively, the ECSA education policies,

the IEA accords and the various engineering education interventions constitute the *instruments* within the CHAT framework to ensure successful accreditation of programmes.

A *community* is the social and cultural group that subjects are a part of, with explicit rules or social norms that regulate and influence its behavior (Engeström 2008). As far as ECSA accreditation is concerned, the stakeholders and organizations actively involved in the accreditation include the accreditation panel, the ECSA administration, the University students, the Council of Higher Education (CHE) and other Engineering fraternities. Also included in the community are supporting staff in the university (or faculty) in which the accredited program resides.

The *rules*, explicit and implicit, vary among the participating units in terms of their specified norms and expectations. In the lens of the ECSA policies, the terms of engagement during accreditation referred to the arsenal of E-series policies available for implementation. Of particular importance are the E-03-CRI and the E-24-STA reviewed and, where necessary, developed from scratch, to prepare for online accreditation during the COVID-19 pandemic.

According to Engeström, *division of labor* defines how tasks and responsibilities are shared among system participants as they engage in the activity. Each participant in the accreditation visit has a specific role. From the ECSA standpoint, E-01-POL (see Fig. 2) describes the responsibilities of the Universities, the accreditation panel, the team and members, and ECSA Administration.

The successful accreditation of engineering programs by ECSA via a virtual medium (online) together with the standardization of engineering programs in South African universities is the desired *outcome*. Through the lens of the accreditation of engineering programs, the product is the recommendation of the accreditation panel to the Education Committee of ECSA, this being the committee of the ECSA council mandated to make the accrediting decision, which the ECSA Council is then required to ratify.

### **3 USEFULNESS OF CHAT FOR CONSIDERING ONLINE ACCREDITATION**

The usefulness of CHAT for considering online accreditation resides in its conceptualization of contradictions. Contradictions transform an object, in this case, the successful accreditation of engineering programs, into a “moving, motivated, and future-generating target” (Engeström and Sannino 2010, 89). Finding contradictions in activity systems reveals opportunities for system-wide improvement. Through CHAT analysis, these contradictions offer the potential for new practices for achieving “what is not yet there” (Engeström 2018, 14). An activity system, including one such as the online accreditation of engineering programs, is continuously navigating contradictions within and between the various elements.

Primary contradictions exist within individual elements of the activity system (or triangle). For the purposes of this paper, primary contradictions will not be discussed further, as they do not arise in circumstances of *change*, as is the case when



considering secondary, tertiary and quaternary contradictions. Secondary contradictions result when a new element, such as a new instrument, is introduced into an activity system. When this happens, in the form of the adoption of new technologies for example, this may disrupt traditional elements, such as the rules or the division of labor. In the online accreditation of engineering programs, therefore, tools such as E-24-STA (see Fig. 2) make clear how the processes involved are impacted by the new technology – including how the rules and division of labor are affected. In so doing, they are a crucial aspect of the introduction of, in this case, a move to online accreditation. Analysis of secondary contradictions allows for consideration of how the introduction of new tools affects the other elements of the activity. In the case of the move to online accreditation, new *rules* in the form of new and/or revised policies needed to be introduced to resolve these contradictions.

When re-designing an activity system, it is important to avoid tertiary contradictions. These refer to a situation where the object of an older version of an activity system conflicts with the object of a more advanced activity system. In other words, in such an instance, the activity ceases to fulfil the objectives for which it was designed. Use of CHAT as a guiding theory allows for recognition of this potential and reflection on the extent to which the intended object of the accreditation activity continues to be met, even with the introduction of new instruments and rules.

Lastly, quaternary contradictions occur when elements of an activity conflict with elements of neighboring activity systems (Engeström 2005; Mukute 2010). In this instance, it is possible that the online accreditation of engineering programs may align favorably with neighboring activity systems: it may improve the workload imposed on the institutions being accredited, and it may lessen the resource requirements imposed on these institutions. In so doing, CHAT analysis enables consideration of how the online accreditation of engineering programs can better support the engineering education ecosystem and become a “driving force of change” (Engeström 2001, 133).

It is worthwhile, as a last point on the usefulness of CHAT, to mention that the analysis of online programme accreditation through the lens of CHAT also allows an understanding and appreciation of engineering education strategies to ensure the successful accreditation of engineering programmes as the outcome of the framework. The revised ECSA policies, theorised as elements with the CHAT framework, enabled programme accreditation during the COVID-19 pandemic, but also provide a fertile environment to advance engineering education, especially concerning the assessment of the IEA graduate attributes. This is made possible by theorising the particular role that accreditation plays in fostering quality engineering education practices.

#### **4 CONCLUSION**

Although CHAT as a theoretical framework for online accreditation as adopted by ECSA was successful, it should be noted that CHAT is an analytical framework (rather than a theory per se) that maps the social influences and relationships

involved in networks of human activities. Online accreditation of engineering programs in South African universities using the lens of second-generation CHAT has been proposed in this paper. The exercise revealed the potential of CHAT to provide avenues for improvement of online accreditation processes. Use of CHAT helped to guide the integration of technology into an activity system's content, structure, organization and fundamental characteristics. It also helped to ensure that the outcome of the revised activity remained in line with the original outcome of the accreditation process – and more clearly situated this outcome as being to foster quality engineering education.

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