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USING ACTIVITY THEORY TO ENHANCE RIGOR IN QUALITATIVE LITERATURE SYNTHESIS

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ABSTRACT

Aim/Purpose	This study presents an alternative use of the activity theory methodology as a tool and lens for synthesizing and evaluating qualitative data in scholarly articles. This research offers particular value for methodology experts and researchers by introducing a novel analytical framework that links theoretical frameworks with practical literature review techniques, providing a structured approach to demonstrate analytical rigor in qualitative research synthesis.
Background	Many doctoral and other scholars find it challenging to synthesize the literature under review for part of their studies and subsequently fail to demonstrate rigorous analysis and interpretation.
Methodology	This methodological research paper introduces a new approach to scholarly literature synthesis and evaluation. As such, no particular methodology is deployed.
Contribution	This study proposes a novel method to guide doctoral, master's, and other scholars in adding and demonstrating evidence of rigor to their work. We do this by showing how the concept of code and theme identification as part of the grounded theory method of inquiry and the elements of activity theory and grouped viewpoints can be used as a lens to examine the literature. We practically demonstrate our suggestion using two straightforward examples.
Recommendations for Practitioners	Employing the suggested method and approach as an analytical instrument can benefit doctoral and other scholars by showcasing a substantial degree of conceptual interconnection among the various theories under review and providing evidence of rigor.
Impact on Society	Presenting doctoral students and scholars with an alternate approach to assist with the literature review process.

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Future Research	The practical application of the suggested approach and method can further be investigated, demonstrated, and evaluated in future studies.
Keywords	methods in literature review, qualitative coding, evidence of rigor, analytical synthesis, activity theory

INTRODUCTION

The review and analysis of the literature form an integral part of any research endeavor, especially that of postgraduate students and even more so for doctoral students (Ridley, 2012). In a thesis, a doctoral student must arguably and convincingly demonstrate his or her engagement with the theory and theoretical perspectives that underpin the research (Walter & Stouck, 2020; Wisker, 2015). In addition, a doctoral student must be able to make contributions to the established knowledge domain available in the existing literature on the subject of study (Hancock & Walsh, 2016). Various classical definitions of the term literature review (LR) contain references to actions that involve the synthesis of the existing body of knowledge (Fink, 2019; Hart, 2018; Onwuegbuzie & Frels, 2016). It also outlines seven tasks that encompass an LR, of which tasks six and seven consist of reviewing and synthesizing the results. In task six, data abstraction from the selected articles comes into play, and in task seven, descriptive synthesis could also include a meta-analysis.

The synthesizing of academic literature and identifying patterns, themes, and trends are often difficult for postgraduate students (Posselt, 2018; Shook, 2018). This challenge resonates particularly with methodology experts and researchers such as doctoral, master's, and other scholars who seek frameworks for demonstrating analytical rigor in qualitative synthesis. The approach presented here offers specific value for qualitative methodologists, research methods educators, and doctoral supervisors who guide others in systematic literature analysis. Building on this need, this paper offers a novel approach to qualitative data synthesis and evaluation by employing Activity Theory (AT) as a methodological tool and lens. By utilizing this alternative perspective, the research aims to overcome the common challenge of doing a superficial literature review, which often lacks rigorous analysis and interpretation. For methodology experts, this framework provides both a theoretical grounding and practical tools to advance qualitative synthesis techniques while enhancing analytical precision in literature review methods.

An additional essential contribution lies in identifying contradictions within scholarly articles. Applying AT to examine and synthesize existing research enables the detection of inconsistencies between different studies. This contradiction analysis process can generate new insights and knowledge.

This research presents a methodological framework rather than an empirical investigation. The study develops and examines a new approach to conducting literature reviews using AT as an analytical lens. The investigation first establishes the theoretical foundations of AT and literature review requirements, followed by the presentation of the methodological framework, and concludes with practical demonstrations through worked examples. This structure enables both a thorough examination of the methodology and a clear illustration of its implementation.

The rest of the paper is organized and structured as follows. First, the notion of the literature review process as foundational support for any piece of scholarly work is highlighted. This is followed by a discussion on the importance of demonstrating research rigor and comprehensive analysis and a detailed discussion on using the literature as a descriptive data source with the metaphor of a lens. A discussion on the evolution of activity theory highlights its evolution in terms of the various generations and its application as a research methodology.

Following this, the role of AT is discussed using a literature analysis, exploring how AT aids in understanding human activity and interaction. We then present the metaphor of reviewing literature through a lens and discuss the systematic approach to qualitative data analysis. In the section on the Requirements of a Doctoral Literature Review, the necessity for a critical, rigorous, and

comprehensive analysis of existing knowledge, which provides insights into the structure and function of the literature review is underscored.

The section, Application of Activity Theory as a Methodological Tool, delves into the practical application of AT for analyzing and synthesizing literature, offering examples and recommendations for scholars and practitioners. Finally, the Implications and Review section and the Conclusion summarize the essential findings and contributions of the paper, highlighting the potential impact and future research directions related to the proposed methodological approach.

LITERATURE REVIEW AS FOUNDATIONAL SUPPORT

The Queensland University of Technology (2023) outlines the purpose of the literature review process as presenting a critical analysis of the currently published sources on a particular topic, assessing the literature, and providing a summary classification and comparison. A robust literature review functions as the foundational element of a research endeavor, influencing its trajectory, approach, and analysis (Ellis & Levy, 2008). It also serves as a foundational component in doctoral research, providing a synthesis and evaluation of existing research and scholarship related to the topic of study (Paré & Kitsiou, 2017). According to Oates et al. (2022), the purpose of the literature review is to support the researcher's claim in creating and presenting new knowledge and constructively add meaning to the thesis argument by building upon a solid foundation.

The literature review is a recognized method of inquiry that involves a systematic, comprehensive analysis and synthesis of existing knowledge on a particular topic. Onwuegbuzie and Frels (2016) describe it as a methodology that can stand alone or inform primary research. It incorporates diverse research techniques and considers cultural, ethical, and contextual factors within a cyclical process of exploration, interpretation, synthesis, and dissemination (Onwuegbuzie & Frels, 2016).

Four definitions from the literature receive attention next. Fink (2019, p. 6) defines a literature review as "a systematic, explicit, and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners." Secondly, Hart (2018, pp. 3-4) presents a more condensed definition as "the analysis, critical evaluation, and synthesis of existing knowledge relevant to your research problem, thesis, or the issue that you are aiming to say something about." Thirdly Hofstee (2006, p. 91) explains that "A good literature review is comprehensive, critical and contextualized. That means that it will provide the reader with a theory base, a survey of published works that pertain to your investigation, and an analysis of that work. It is a critical, factual overview of what has gone before." Finally, Becker and Denicolo (2012, p. 127) emphasize that the literature review entails "critical evaluation of the most relevant documents (published and unpublished) on an issue in relation to a particular piece of research."

Based on the above, a literature review is a crucial aspect of research. It provides a foundation for further research by synthesizing existing knowledge, which involves critically analyzing published sources, identifying gaps, and informing the research direction either as a standalone method or a precursor to primary research. Through a thorough literature review, researchers can effectively develop a compelling thesis statement that contributes new insights to the academic discourse.

THE ROLE OF ANALYSIS IN DOCTORAL LITERATURE REVIEWS

A doctoral literature review requires a critical, rigorous, and comprehensive analysis of existing knowledge (Boote & Beile, 2005; Mitchell & Willetts, 2009). This in-depth analysis involves effectively synthesizing the extracted evidence (Bandara et al., 2015). One approach to achieving this is by identifying seminal and impactful work from leading scholars in the field (vom Brocke et al., 2015).

For the purposes of a doctoral thesis, the function and format of the literature review, according to Hart (2018), should show the following:

- Evidence of rigor and analytical synthesis, covering all known literature about the topic.
- A high level of conceptual linking within and across the different theories.
- A summative and formative evaluation of previous work.
- Depth and breadth of relevant philosophical traditions and ways in which they relate to the problem (Hart, 2018).

In their criteria relating to the synthesis process of the literature, Boote and Beile (2005) stress that a doctoral candidate should:

- Show evidence of differentiated progress made in the field from areas that still require improvement.
- Integrate and place the subject or issue into the larger body of scholarly literature.
- Position the research within the field's historical framework.
- Successfully acquire and improve the subject vocabulary.
- Describe and articulate significant variables and phenomena pertinent to the subject matter.
- Acquire and present new literature viewpoints through synthesis (Boote & Beile, 2005).

Boote and Beile (2005) and Hart (2018) have stressed that evidence of rigor in the literature review is crucial for a doctoral thesis. It demands comprehensive engagement, analytical synthesis, and fresh perspectives, ultimately positioning the research within the broader scholarly discourse. Next, we discuss the requirement for rigor and analytical synthesis.

The Need for Rigor

In research, rigor refers to the robustness, credibility, and trustworthiness of the research conducted and its findings (Johnson et al., 2020). It also includes providing evidence of being thorough, accurate, and reliable, which involves using appropriate methods and techniques to collect and analyze data, as well as ensuring that the findings are valid and reliable (Rogers, 2016).

Maintaining rigor in research entails meticulousness and precision throughout the entire process, including theory development, study design and execution, reporting of results, and derivation of implications (Gnyawali & Song, 2016). The significance of rigor is multifaceted (Ravitch & Riggan, 2016). At its most fundamental level, rigor is required to lay the groundwork for future researchers to build their research upon a solid foundation (Gnyawali & Song, 2016).

According to Gnyawali and Song (2016), rigor consists of three key aspects: (i) a conceptual aspect (the theoretical lens, constructs, and logic used to understand a phenomenon), (ii) a methodological aspect (how data are collected and analyzed to capture a phenomenon), and (iii) an empirical aspect (how findings are organized, distilled, and related to the theory). These three aspects are essential for conducting rigorous research.

The Application of Analytical Synthesis of Qualitative Data

The literature review step requires the researcher to go beyond presenting a simple summary of the various studies reviewed. It should present a synthesized understanding of the existing knowledge on the topic, not just a collection of disparate findings (Snyder, 2019). This is achieved through the collation, aggregation, organization, and comparison of the extracted data in ways that reveal patterns, connections, and overarching themes (Paré & Kitsiou, 2017; Templier & Pare, 2018). Various methods and techniques exist for synthesizing both quantitative and qualitative data. For quantitative data, options include frequency analysis and meta-analysis, which allow for rigorous statistical comparisons across studies (Dixon-Woods et al., 2005). Qualitative data, on the other hand, can be effectively synthesized through approaches like grounded theory, narrative analysis, and meta-ethnography, each offering unique ways to interpret and weave together subjective experiences and perspectives (Thomas & Harden, 2008).

One of the simplest ways to analyze qualitative data is to perform some coding in sorting the collected data, where the code may be used to summarize a sentence, paragraph, or even a whole text (Myers, 2019). Coding is a cornerstone of many qualitative research strategies (Braun & Clarke, 2006; Charmaz & Thornberg, 2021; Creswell & Poth, 2016). It allows researchers to

categorize data (thematic analysis, grounded theory), analyze narratives (narrative analysis), understand language use (discourse analysis), and quantify content (content analysis). Each method deploys some form of data abstraction to develop generalizable theories from specific contexts. Researchers first code their data, which means assigning labels to segments of text that capture key concepts or ideas. This systematic approach helps extract meaning from qualitative data (Hsieh & Shannon, 2005; Riessman, 2008). These codes are essentially abstractions of the raw data, as they represent a simplified and more manageable way of organizing and understanding the information. This allows the researcher to identify essential features and patterns, moving beyond the specifics to focus on broader concepts (Strauss & Corbin, 1998).

It is pointed out that there is no universal set of terms to describe the various stages of qualitative coding. Still, in the review of the various methods, the disparate terminology often refers to similar coding concepts (Hahn, 2008).

LITERATURE AS A DESCRIPTIVE DATA SOURCE VIEWED THROUGH A LENS

The metaphor of reviewing the literature, as seen through a lens, is not uncommon. Four typical metaphors describe the concept of 'digging into' the literature – the 'funnel,' 'concertina,' 'courtroom,' and 'lens' metaphors (Levy & Ellis, 2006; Metcalfe, 2003).

The literature review presented in a piece of scholarly work, according to Paré and Kitsiou (2017), should act as a coherent lens to make sense of extant knowledge on a given topic and to provide state-of-the-art evidence. The lens metaphor presents the researcher with a focus point and may be regarded as a signpost that could point the researcher in a new direction (Metcalfe, 2003). Doing this points the researcher to specific aspects of previous research that could be examined and evaluated (Torraco, 2005).

USE OF AT TO COMPARE AND CONTRAST DIFFERENT VIEWS ON ACTIVITIES

Activity theory (AT) is commonly used as a lens to examine human activity and activity systems (Buchem et al., 2011; Hasan & Kazlauskas, 2014). Deploying AT as a lens transforms the analysis of a strategy practitioner's actions from a merely empirical inquiry into an ontological investigation of the social nature of doing (Jarzabkowski, 2010). Doing so enables researchers to grasp how the very act of performing certain tasks constitutes individuals as strategic actors (Jarzabkowski, 2010).

In this article, our main proposition is that AT and all its forms (in terms of its evolution) may each be deployed as an active mechanism to assist with the analysis and synthesis of the literature, presenting and supporting evidence of research rigor. We base our proposition on two premises, namely that:

- the research is conducted and reported by means of an academic piece of work constituting some form of activity, and
- the research presented is done within the context of an environment that frequently (but not always) constitutes a larger system.

To clarify, most literature and research within the social, management, and information sciences pertain to human activity. These disciplines and their associated articles frequently comprise reference components of typical activity systems. This aligns with the assertion of Maxwell (1998) that qualitative research often seeks to understand participants within the context of their actions, situations, and events.

Figure 1 depicts how AT could be used as a lens to examine and assist with synthesizing the literature. Using each of the elements of AT as a lens presents a researcher and scholar with the opportunity to search for and compare the various actions and operations described within the various sources examined. This process is described later on.

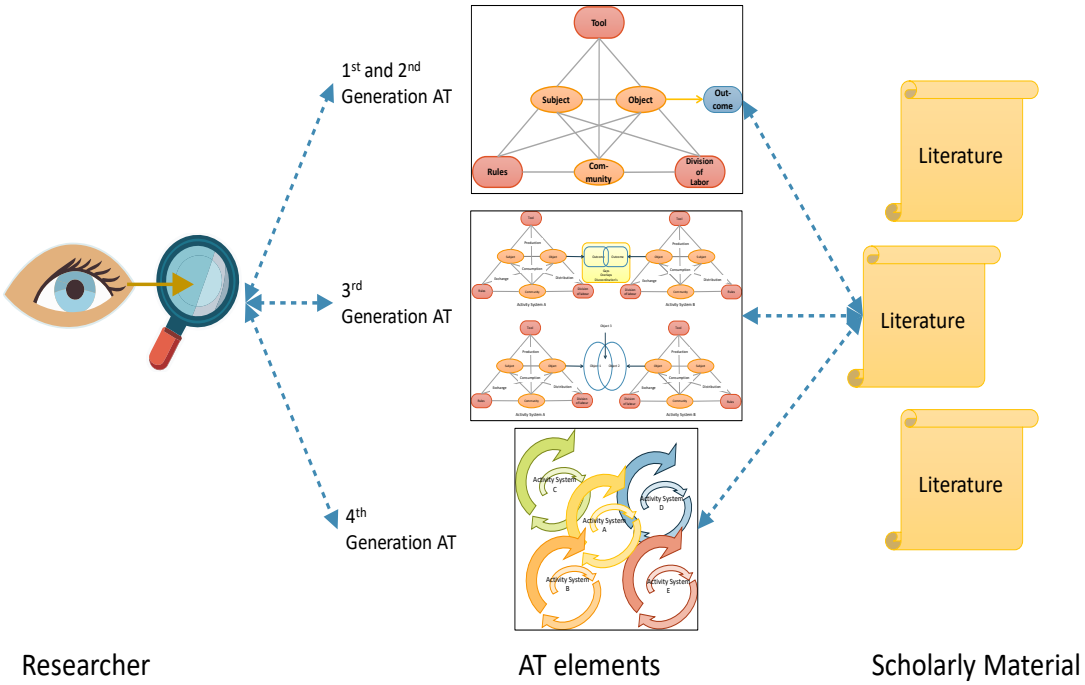


Figure 1. Using the elements of AT as a theoretical lens

ACTIVITY THEORY PRACTICE AND EVOLUTION

Activity theory (AT) is an approach to research that focuses on the activities and interaction strategies of the diverse user groups involved in the pursuit of a common objective (Kuutti, 1996), that:

- is introduced and regarded as a conceptual framework that facilitates the examination and comprehension of human interaction via the utilization of artifacts and tools within their social surroundings to arrive at an outcome (Engeström, 1987; Hashim & Jones, 2007); and
- as a framework, has gone through several generational enhancements, with the fourth generation of enhancement presented and motivated by Engeström and Sannino (2021) in their work, *From mediated actions to heterogeneous coalitions: four generations of activity-theoretical studies of work and learning.*

We briefly cover each of these generations to outline their evolution and highlight the elements, aspects, and perspectives included in each generation. These enhancements and elements form the basis of our premise that AT can be used as a lens to synthesize the literature.

FIRST GENERATION AT

The inception of activity theory can be attributed to the contributions of Lev Vygotsky, who initially introduced the notion during the early 20th century as an element of his cultural-historical psychology framework (Cole & Engeström, 1993; Miller, 2014). AT arose from Vygotsky's emphasis on the significance of cultural and social influences on human development and cognition (Gauvain, 1995). Historically, AT looks at artifacts (tools) and people as embedded in dynamic activity systems (Engeström, 2006). The initial description of AT was presented as a framework for studying different forms of human practices as development processes (Kuutti, 1996).

In a discussion on AT, it is imperative that the basic mediational model described by Vygotsky (1978), is revisited (Engeström, 2000). Vygotsky's (1978) model (depicted in Figure 2) consists of four basic elements, namely the tool (or instrument of work), subject, object, and an outcome (based on the work done) which remain foundational in work on AT and systems. The activity relates to a particular action or form of doing, which is directed at an object. An important aspect in relation to AT is that a fundamental transformation process takes place.

As portrayed in Figure 2, in terms of the model:

- a subject is an individual or group of individuals involved in a common activity;
- the subject undertakes an activity directed to a particular object in order to achieve an outcome; and
- activities comprise working with tools or mediating artifacts.

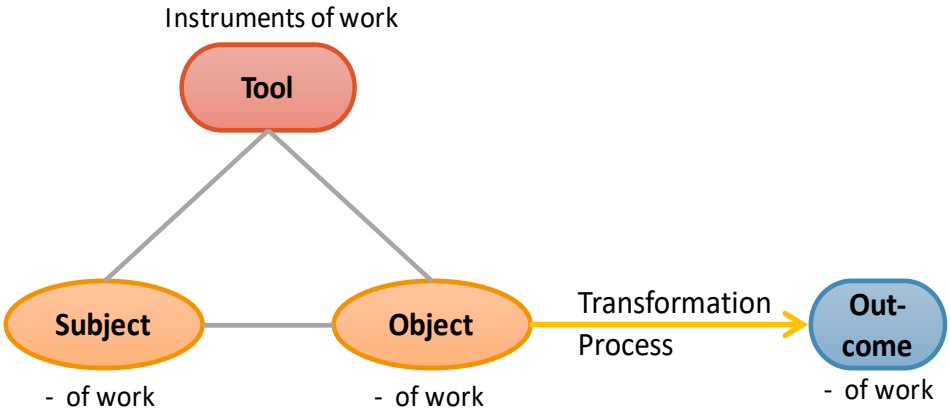


Figure 2. AT core elements and mediated relationships

In relation to the elements depicted in Figure 2, the tool represents mediating artifacts; the subject represents the designer and the user of the object. The object in itself could relate to an idea, which, if often ambiguous, requires some interpretation and conceptualization (Engeström, 2006). Kuutti (1996, p. 27) explains that "the tool is at the same time both enabling and limiting: it empowers the subject in the transformation process with the historically collected experience and skills *crystallized to it.*"

Second Generation AT

The foundation of the second generation of activity theory can be traced back to Leontyev's (1981) research, which expanded the emphasis from individual to collective action (Makino, 2006). The notion of collective action also relates to that of a system, as presented by Groleau (2014). Later applications and investigations regarding the interrelated actions and interactions between the tool, subject, and object necessitated new viewpoints and considerations, with a need to focus on the individual subject and the person's community (Cole & Engeström, 1993; Engeström, 2001).

When looking at the community, new two-way relationships are created between the subject-community and community-object (Kuutti, 1996). This relationship is depicted in Figure 3, which represents the second-generation activity system from Cole and Engeström (1993) that includes:

- the rules, that refer to the applicable norms and sanctions that regulate the operations and procedures as well as the interaction between the participants (Cole & Engeström, 1993; Sweeney, 2010);
- the community, which shares the same general object with the subject, as the subject is normally constituted as part of a community (Cole & Engeström, 1993; Sweeney, 2010); and
- the division of labor, that relates to how the tasks are divided between the various participants as well as the powers and responsibilities of all the community members (Cole & Engeström, 1993; Sweeney, 2010).

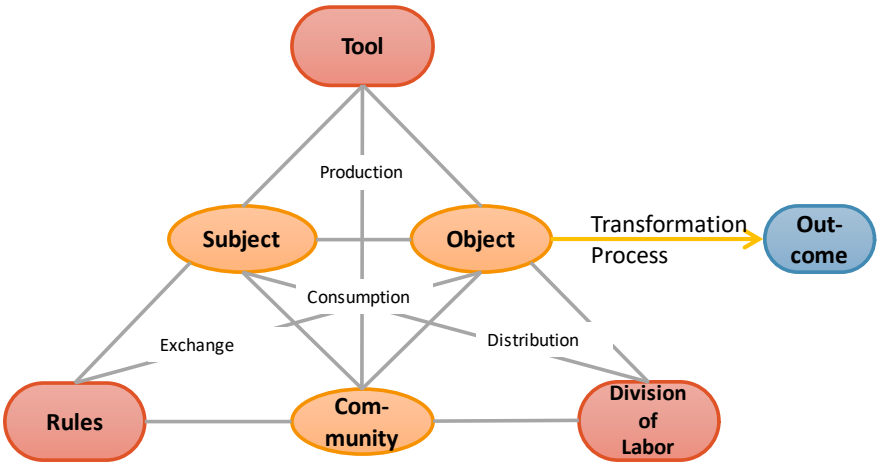


Figure 3. Basic structure of a 2nd generation activity system

Also presented in Figure 3 is the concept that AT considers the way in which objects are produced, exchanged, distributed, and consumed by the applicable community (Dodds et al., 2017; Engeström, 1987). In addition, Er and Lawrence (2011) also relate the concept of the object used to the notion of object orientation, whilst Nicolini et al. (2012) argue that the object could also be of an epistemic nature.

Third-Generation Activity Theory

The internationalization of AT necessitated the development of a third generation of activity theory equipped to confront the challenges of diverse perspectives and inter-systemic dialogue through enhanced conceptual tools for understanding multifaceted and networked activity systems (Engeström, 2001). One important viewpoint considered in this thesis is the idea that "[t]he third generation of activity theory needs to develop conceptual tools to understand dialogue, multiple perspectives and voices, and networks of interacting activity systems" (Engeström, 1999). In research relating to project-based teams and work, Jones (2014) notes that each of the elements of AT has the potential to influence the outcome of the activity concerned intrinsically.

In the third adaptation and extension of the AT model, Engeström included the notion to "represent multiple perspectives and dialogues between several interacting systems" (Carvalho et al., 2015). These multiple perspectives highlight the inherent contradictions that drive and act as sources of change and development (Engeström, 2001). The contradictions often reside and apply to the 'objects' of the interacting activity systems (Reid et al., 2015) but could also reside in the way in which the 'tool' is used by the 'object' (Roussou et al., 2008).

Engeström (2015) identified four levels of contradictions, which are primary, secondary, tertiary, and quaternary contradictions entailing the following:

- Primary contradictions are inner contradictions within each constituent component of the activity system.
- Secondary contradictions are contradictions between the constituents of the central activity system.
- Tertiary contradictions are contradictions between the object of the dominant form of the central activity system and the object of a culturally more advanced form of the central activity system.
- Quaternary contradictions are contradictions between the central activity system and its neighboring activity systems.

The scope of contradictions between different activity systems is portrayed in Figure 4, which also highlights the principle behind the third generation of AT consisting of two interacting activity systems where the object moves from an initial state to a collectively meaningful object or a shared jointly constructed object (Engeström, 2001).

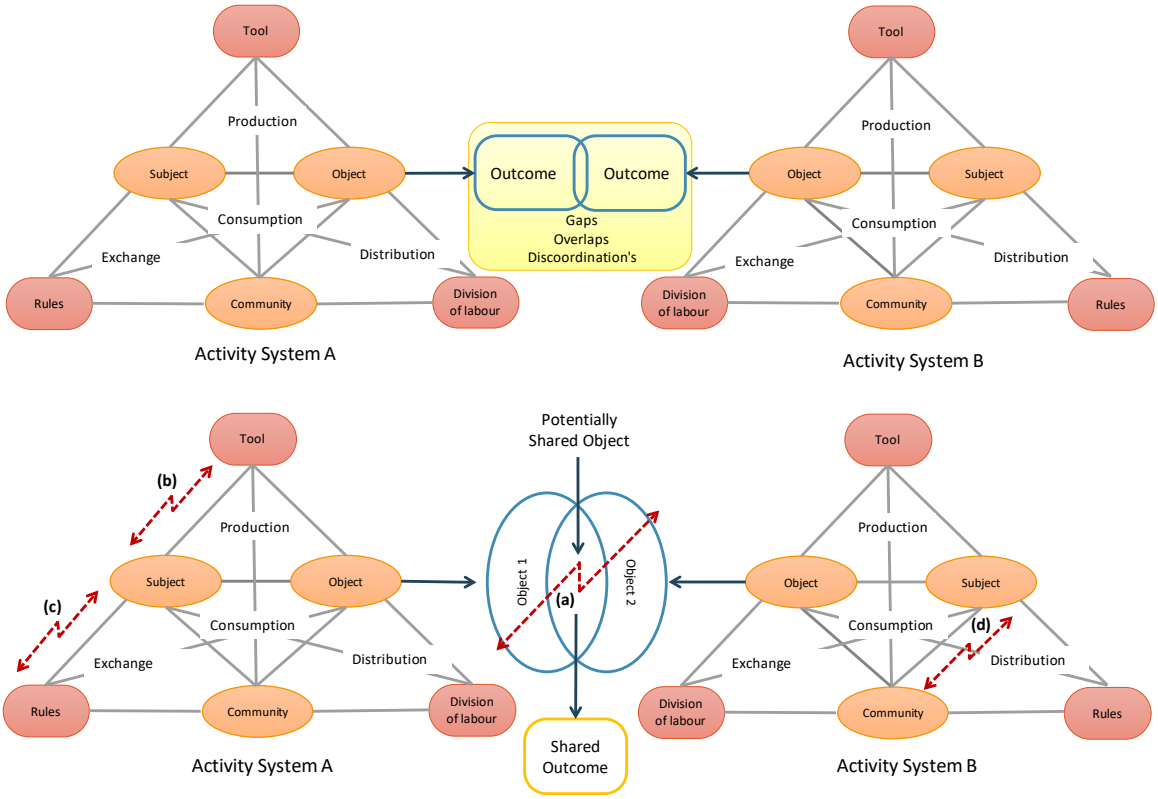


Figure 4. Scope of contradictions between different activity systems

Another viewpoint also included in Figure 4 is the contradictions between the various objects and their intended outcomes. Examining the contradictions could reveal gap overlaps and discrepancies between the intended outcomes and the outcomes themselves.

In their research, Marwan and Sweeney (2019) indicated examples of potential contradictions between the elements of the activity system labeled (a) to (d), which we included in the bottom part of Figure 4, where the label (a) is an example of a quaternary contradiction (conflicts between adjacent activities and a neighboring system. Labels (b), (c), and (d) are examples of secondary contradictions.

In practice, the analysis of a real-world context using AT could be proceeded with in three steps to identify:

- various significant activities of the system to be studied in conjunction with the applicable 'activity's subject (or subject itself), the applicable object, and the purpose of the activity;
- actions and the applicable tools (which include secondary and tertiary tools) required and used as part of the activity; and
- dynamics, tensions, and the possible contradictions between the various activities (Hasan & Kazlauskas, 2014).

Fourth Generation Activity Theory

The need for the fourth generation of AT has been identified and discussed in the literature (Engeström & Sannino, 2021; Klen-Alves, 2021). The elements and perspectives that the fourth generation of AT will entail and comprise are not yet established. In an interview with Yamazumi (2020), Engeström highlights his notion that the fourth generation of AT should include aspects that confront capitalism's contradictions by crafting rigorous, clear theoretical models of analysis beyond individual activity systems and that further experimentation with diverse units of analysis is crucial (Yamazumi, 2020). One such attempt is presented by Engeström and Sannino (2021), noting that "fourth-generation activity theory focuses on the multiple coalescing cycles of

expansive learning involved within and across the activities involved, their relatively independent dynamics and their interdependency."

Figure 5 is based on our interpretation of the work of Engeström and Sannino (2021), which shows various activity systems with multiple coalescing cycles. As portrayed in Figure 5, the concept of coalescing cycles entails multilevel activity systems that revolve around some grand challenges society faces within various overlapping domains of a similar or diverse nature, such as education and healthcare. As part of the examination, recurring patterns, including their contradictions, which are typically involved in third-generation activity systems, can lead to new areas of transformative learning and development in areas where experiences and reflections merge (Mukwambo, 2021; Winberg et al., 2023).

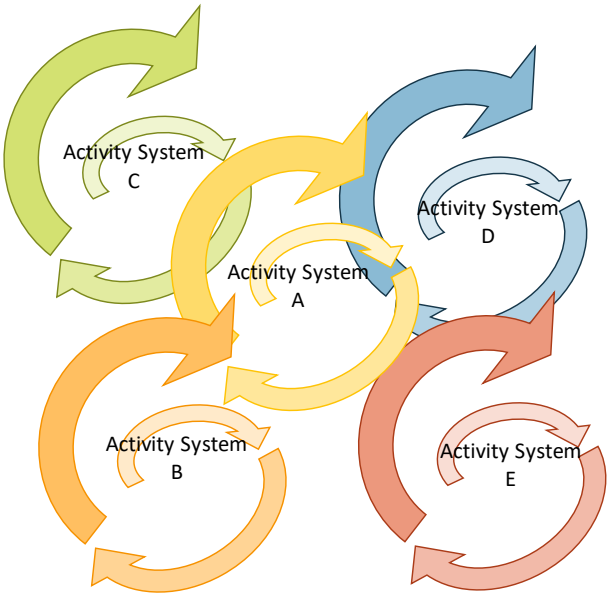


Figure 5. Coalescing cycles of expansive learning

Potential Additional Units of Analysis

In the preceding subsections, we presented what the literature reveals as the common evolution of the AT research approach and framework. Within the contextual reference to the 2nd generation of AT, the expansion and inclusion of additional elements have been suggested. Khayyat (2016) motivates the inclusion of the element of *motivation* as the subject's driver to achieve the objective/s as part of the activity system.

Based on our own practical experience and our general research focus that generally relates to the design and practical application of living labs (LL) to support community advancement, we also suggest potential additional elements for consideration that could be included as part of the 2nd AT framework. The potential additional elements to the 2nd generation of AT Culture are portrayed in Figure 6 as opposed to Figure 3, which depicts the second generation of activity theory as presented by Cole and Engeström (1993) with the inclusion of three additional elements. We also included the element of '*motivation*,' as described by Khayyat (2016).

The additional elements we propose are indicated in the rounded rectangles in Figure 6, namely the '*Ability*,' '*Impact*,' and the '*Culture*' concerned. Based on our experience, we frequently found that these elements influence and impact an activity system's operation. We believe that including these additional elements can further enhance the analytical power of the second-generation activity theory. It creates a more comprehensive framework for studying human activity by emphasizing individual abilities, the influence of culture on the activity system, and the importance of evaluating the long-term consequences of the actions taken.

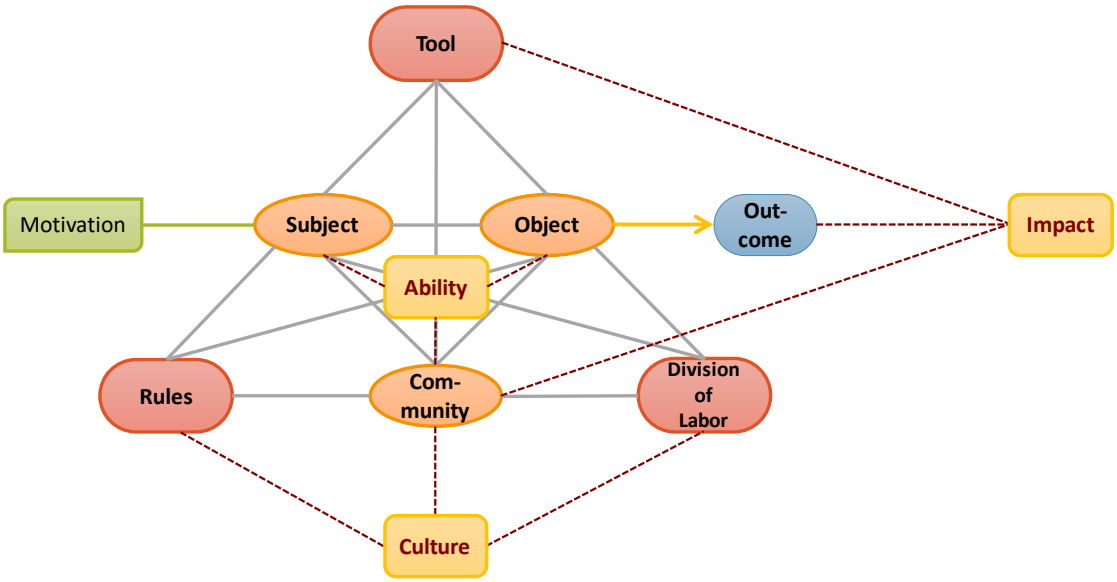


Figure 6. Potential additional elements to the 2nd generation of AT

We briefly elaborate on each of these additional elements within the larger context of the activity system, as positioned in Figure 6.

Ability

Ability refers to the community's knowledge, capacity, and experience, and it is argued that this will directly influence how a particular tool is used. Adding the subject's "ability" as an additional element of consideration explicitly acknowledges the individual's skills and knowledge that influence their interactions with tools and their overall performance within the activity system. This may facilitate a more nuanced understanding of the ways in which variations among individuals influence results and may contribute to possible contradictions or expansions within the activity system. This element may be additionally linked to theoretical frameworks such as Vygotsky's Zone of Proximal Development (ZPD), which underscores how external assistance and scaffolding can serve as a means to connect an individual's current capabilities with their potential capabilities (Fani & Ghaemi, 2011; Kazemi et al., 2020).

Culture

Also to be considered is the cultural background of the community concerned, which rules and governs the community's cultural considerations, particularly in the African context. This plays a significant role in how actions are performed and perceived within a particular community of practice or network of knowledge as an activity system. By incorporating 'culture' as an additional element, its direct impact on the community's regulations – that is, its rules and labor distribution – is highlighted. This correlation enhances the understanding of how interactions among subjects are influenced by the context of the activity and are shaped by shared values, beliefs, and practices of the applicable community.

Impact

The long-term impact that an activity and/or the use of a tool could have over and above the outcomes should also be considered. Including the concept of 'impact' as a specific element encourages the active monitoring and evaluation of the activity's long-term effects. This goes beyond the immediate outcome and allows for a broader understanding of the activity's lasting consequences for the subjects, the community, and potentially even the wider environment. Analyzing the impact could also help to connect the activity system to broader societal issues and goals, allowing for reflection on the activity's contribution to sustainability, equity, or other relevant values. For instance, implementing certain pesticides recommended by agricultural experts a few years ago had the intended outcome. However, it could also have had a negative impact on society as a whole.

APPLICATION OF AT AS A LENS TO SYNTHESIZE THE LITERATURE

One particular characteristic of AT as a qualitative approach is that it presents the possibility of being used as a lens through which the learning and the activities of the people that are involved could be studied in relation to the envisaged outcome (Zurita & Nussbaum, 2007).

In this section, we discuss and demonstrate how the various generations of AT and, where applicable, a combination thereof can be used as a theoretical lens to examine qualitative literature sources. Highlighted is coding as the simplest form used to analyze literature. Typical instances of the coding process involve:

- Open coding is used to present a key code to paragraphs, sentences, and other terms included in the scholarly articles examined.
- Axial coding is used to define, identify, and refine various categories of data in the form of code groups, which could be further analyzed using meta and frequency analysis, where the results are often portrayed in network diagrams showing the relationship between the various codes and categories.
- Selective coding is used to present the core categories and code groups based on the density value of each of the categories and the relationships between the various code groups (Charmaz, 2006; Strauss & Corbin, 1998).

Each generation of AT presents its own opportunity for investigation and can be used as a lens. In essence, the first and second generations of AT could be considered together, as all the elements of the first are also contained in the second.

USING THE FIRST TWO GENERATIONS AND THE POTENTIAL ADDITIONAL UNITS OF ANALYSIS AS A LENS

We propose that the elements of the second generation of AT can be used as a lens to explore, analyze, and make sense of scholarly work. Applying AT as a coding framework to search for, identify, and capture key concepts, ideas, or themes can offer rich insights into the dynamics of human activity within the context of scholarly literature. In doing so, it intrinsically forces and requires the researcher to ask questions concerning the various components of the AT model in the context of the scholarly source under examination.

In the Figure as presented in Appendix A, we outlined some potential questions shown in bold that the researcher could pose as part of the examination. The sub-questions indicated as part of each element are based on the work by (Engeström, 2001; Lin et al., 2013; Zurita & Nussbaum, 2007). The sub-questions present context and clarification to each of the main questions, representing the elements not only toward its identification in an activity system but also concerning what is being reported when viewed in terms of the literature.

We believe it is possible to include the additional elements as codes of analysis outlined previously and summarized in Figure 6 as a lens. An example of a leading question in terms of each element is listed as follows below:

> **Motivation**: What are the driving forces behind the study or the subject undertaking the activity?
>
> **Ability**: What skill level is deployed by the subject when using the tool, or what is the perceived ability of the object in the subject in the study?
>
> **Culture**: What are the cultural contexts, belief systems, or norms at play as part of the study?
>
> **Long-term impact**: What is the long-term impact of the study or mediated artifact deployed, reported, observed, or perceived?

In addition to using each element as a code, we also offer that it is possible to consider the interrelationship between the various elements, the activity, and the activity as a whole as part of the

literature analysis process. Appendix B depicts these additional viewpoints and interrelationships as codes between element groups based on the work of Engeström (2001) and Kuutti (1996).

Each of the six viewpoints, as presented in Appendix B (from top to bottom and left to right), entails the following:

The activity in relation to the tool deployed

For this relationship, the researcher or evaluator could examine the literature to determine if anything is reported about the fit of the activity and the tool deployed. Possible questions to ask are:

- What is reported on the tool's effectiveness in completing the task?
- Are there any limitations or additional biases reported or potentially introduced by the tool?
- How does the subject use the tool; is it used for its intended purpose, or is it an adaptation (e.g., the creative use of the tool)?

These questions could shed new light and provide insights for the researcher on the use and deployment of the tool, especially if articles describing the same activity in the same context are reviewed. For instance, in an educational research effort about playful learning as a tool, the literature could be examined for results on examples that were successful and not successful in terms of study.

The activity system as a whole

Here, the article or scholarly source is viewed as a whole, and the focus shifts to the research being conducted as part of the activity system. In essence, any scholarly article constitutes research with the aim or outcome of knowledge creation and dissemination. The research is typically done within a certain context with evidence of the subject, applying a research method (i.e., tool) and or within a larger system. This premise is in line with the notion of Hosier (2019, p. 44), who states, "Research is both an activity and a subject of study." Questions of importance that the researcher could pose here can include:

- What is the study about?
- What is the subject of the study, and the outcome reported?

One example could be a study of a community of practitioners and how they report and disseminate their operations and knowledge contributions to other practitioners within their larger operational domain. Such a community could be of a scholarly nature.

Relationship between the tool, subject, and object

This relationship, in essence, encapsulates the classic nature of activity theory. Here, the researcher reviewing the source can examine how the tool proposed in the method or action is facilitated and used. An example could be an investigation into the effectiveness of playful learning in early childhood development. The researcher can also present an analysis of how the tool deployed can become an object itself.

Relationship between the subject, tools, and the community

Attention is given here to uncovering the negotiation or the rules, standards, and norms between the subject and the community. Questions that the researcher can pose in this regard could include:

- How does the subject navigate the existing rules while pursuing their goals, either from the perspective of the research setting itself or from that of the research method deployed?
- Does the research challenge or propose new rules within the community?

Relationship between the subject, object, and the community

To examine this viewpoint, the researcher attempts to determine and uncover the negotiation of meaning between the subject and the community. Questions that can be posed are:

- How do the community norms and expectations form and influence the subject's understanding of the object as a whole?
- How does the research inform, or what challenges are presented regarding the existing knowledge?
- What research objectives or questions drove the research agenda?

Relationship between the object, community, and the division of labor

This relationship relates to the direct influence the object has in the community. Questions that may be posed include:

- What influence did the community have in the use of the object?
- Were there any conflicts in the division of tasks?
- How did the object shape the community?

It should be noted that each of these considerations, in essence (as we presented in our premises earlier), can also be regarded either from the perspective of the research being reported (i.e., the scholarly source as the object, the method deployed as the tool, and the researcher as the subject) or from the viewpoint of the subject under investigation within a setting or environment that constitutes a system in itself.

Potential Further Method of Analysis

In this section, we describe how the grounded theory method of analysis can be applied to using our proposed set of codes and conceptual viewpoints from the description above.

The generation of concepts, categories, and themes as part of the grounded theory method of inquiry begins with identifying codes (Chun Tie et al., 2019). According to Qureshi and Ünlü (2020), concepts are interpretive words that group codes sharing similar ideas, while categories are higher in level and more abstract than the concepts they represent. Comparison and contrast among the concepts generate categories, the primary guide through which themes are the final step in the coding sequence. Themes are the highest level of abstraction.

Both Appendix A and Appendix B illustrate how the use of the elements of AT, either in single or in a grouped form, can be analyzed to lead to the generation of themes and ultimately aid in providing evidence of rigor and meticulous analysis. In Appendix C, the two approaches described above are depicted in a grid format for analysis purposes. The grid on the left depicts the use of the elements as presented in Figure 6 (and Appendix A), while the one on the right shows the elements and viewpoints of Appendix B. Every cell per column can represent a condensed analysis of the researcher's interpretation of the particular literature source under scrutiny based on the code for each row.

Comparing several sources of data based on the analysis itself may result in the researcher identifying patterns and trends if viewed from the grid perspective. Potential areas and aspects emphasized in certain related studies may not feature in others. It would also be possible to identify elements of intense discussion revealing potential synergies and contrasting views on a particular aspect.

When considering the second interpretation in Appendix B, as represented in the right-hand side grid (see Appendix C) where the codes of analysis are viewpoints, new perspectives could be gained from critically analyzing what the scholars of each study state or mention concerning the elements under review. For example, studies on using playful learning in teaching the concepts of coding and robotics could present different dynamics and observations when viewed from the relationship between the subject, object, and community involved. We believe this will also hold for the other viewpoints described above. Considering the viewpoints of several studies from the same perspective could present further insights and avenues of inquiry.

Using the Third and Fourth Generations of AT as Lenses

The third generation of activity theory, as introduced by Engeström (1999), focuses on networks of interacting systems, allowing for the analysis of collaboration, conflict, and "quaternary

contradictions" (Ash & Ward, 2023; Engeström & Sannino, 2017). Engeström (2001) argued that understanding dialogue, diverse viewpoints, and interconnected activity systems necessitates the development of specialized conceptual frameworks. Engeström (2015) elaborated on this, explaining that organizational change stems from hidden tensions (contradictions) that build over time. These tensions only become apparent through disruptions and conflicts in daily activities. Historical analysis is vital to understanding them. Insights from such analysis inform research using specific data on these disturbances, enriching our understanding of the applicable practice within a more extensive activity system (Engeström, 2015).

This notion allows the researcher and reviewer to regard a piece of scholarly work as a description of an activity system (based on our second premise, which we presented earlier). Examining and synthesizing scholarly articles from this perspective has the potential to help identify contradictions for each or combinations thereof from the different sources under review. For example, different research papers using the same tool in the same context with the same subject and object could render fascinating contradictions and, when further evaluated, result in new insights and or knowledge gained.

Figure 7 represents our interpretation of how the third generation of AT could be utilized to examine and review the literature based on similar studies using specific questions.

In evaluating each source and related study, as portrayed in Appendix C, the researcher could pose questions and attempt to find the answers from the literature, such as: What were reported as outcomes? Are there common areas of tension mentioned? Are any ideas, premises, or notions presented in conflict, or are they aligned? What were the results? To which extent do the results differ or concur? Were there any patterns and or trends observed in these sources?

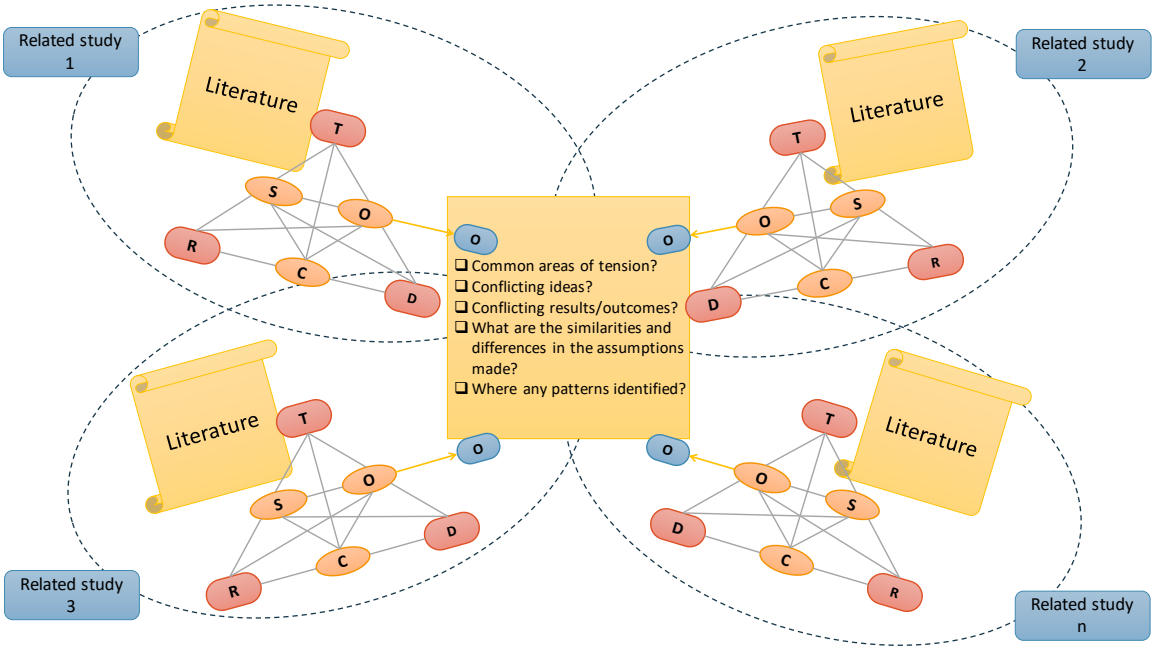


Figure 7. Synthesizing related studies through the 3rd generation of AT as a lens

Further investigation by the researcher could include determining the roles each of the subjects played in the study. In addition, the researcher could attempt to review what position and role each of the objects had in the study and what, if any, noticeable differences are there between each of the studies. DeJulio (2024) emphasizes that determining the motives of different actors in a system plays a role, especially in terms of congruent and incongruent systems. Revision and determination of the potential motives in each of the related study's intrinsic systems could also reveal potential insights and unique perspectives.

Regarding the fourth generation of activity theory, coalescing cycles, which entail multilevel activity systems, may be present in some forms of literature and studies from different environments

with the focus of examination over time. Such studies and literature must be scrutinized for recurring patterns and potential contradictions.

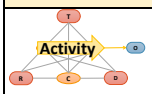
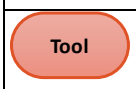
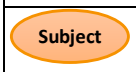
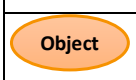
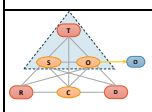
EXAMPLES OF APPLYING AT AS A LENS

This section provides more insight into using the elements of AT as a lens to examine the literature based on two examples. In the first example, we highlight how the elements of AT can be used as codes to analyze and interpret four scholarly works. In the second example, we show how the elements of AT and the viewpoints highlighted in Appendix A can be used to examine and review related literature to determine the design requirements and specifications for the activity of knowledge support in a network of knowledge environments. These examples demonstrate practical applications and offer methodology experts a framework for evaluating and teaching qualitative synthesis techniques. The systematic approach shown here provides methodologists with concrete tools for assessing analytical rigor in literature reviews.

EXAMPLE 1 – INITIAL STUDY ON PLAYFUL LEARNING AND CODING AND ROBOTICS

In order to demonstrate how the elements of AT can be used as a lens to examine the literature, we decided to do a simple literature survey on the concepts of Playful learning and Coding and Robotics using both as inclusive search terms in Google Scholar. Articles published within the last seven years focusing on practical implementation or experiment were selected. Four articles were reviewed, each using the elements described in Figure 6, and two viewpoints, as shown in Appendix C. Following the analysis approach forced the researchers to focus on specific elements of analysis within the text, as diligent examination is required to identify each element regarding questions (see Figure 6 and Appendix A). It also necessitates the reader to constantly compare the different sources under review regarding the elements. A careful review of the concepts of Table 1, even in simplistic form, allows and presents the opportunity to identify themes and overarching concepts.

Table 1. Analysis of articles using the elements of the 2nd generation of AT

Viewpoint  Element	**Article 1** ***Debugging in programming as a multimodal practice in early childhood education settings*** (Heikkilä & Mannila, 2018)	**Article 2** ***Exploring the effects of "productive children: coding and robotics education program" in early childhood education*** (Canbeldek & Isikoglu, 2023)	**Article 3** ***Investigating Children's Programming Skills Through Play with Robots (KIBO)*** (Lee et al., 2023)	**Article 4** ***Playful Computer Science for Girl Scout Juniors*** (Yun et al., 2020)
	Teaching programming, coding, and debugging	Teaching coding and robotics	Teaching robotics as an interdisciplinary pedagogical approach to support STEM-based education.	Teaching programming in a playful manner
	Educational robots and playful learning	Educational robots, unplugged tools, and blocked-based learning	KIBO Educational block-based tangible programming tool	Educational programming using block-based coding using aspects of playfulness as a guideline
	Preschool teachers	Kindergarten teachers	Early childhood educators	Educators and policymakers
	Preschool children	Kindergarten children	Pre-kindergarten children	Fourth and fifth-grade girls (Junior Girl Scouts)
	Coding is a multimodal activity. Teachers are facilitators who aim to help children develop coding and debugging skills.	The use of tangible technologies, including robots and electronic toys, has become a part of developmentally	Playful learning with educational robots actively engages pre-kindergarteners, effectively promoting STEM skills and programming	Playfulness as a tool can positively impact young girls' interest in computer science when used with challenges

Viewpoint  Element	**Article 1** ***Debugging in programming as a multimodal practice in early childhood education settings*** (Heikkilä & Mannila, 2018)	**Article 2** ***Exploring the effects of "productive children: coding and robotics education program" in early childhood education*** (Canbeldek & Isikoglu, 2023)	**Article 3** ***Investigating Children's Programming Skills Through Play with Robots (KIBO)*** (Lee et al., 2023)	**Article 4** ***Playful Computer Science for Girl Scout Juniors*** (Yun et al., 2020)
	Children interact socially through speech, pointing, and gazing.	appropriate coding activities for young children.	through engaging station activities	involving peer work and educational robots.
Rules	Professional teacher development	Educational policies	Operational procedures following the correct pedagogical approach	Educational decision-makers and approaches
Community	Early childhood development educators	Early childhood development educators	Early childhood development educators and policymakers	Educational advisors and teachers, including girls.
Division of Labor	Multimodal learning and interaction	Pair-based teaching and learning	Station-based rotational activity approach	Collaboration workshops encourage teamwork using a playful approach.
Outcome	Successful grasping of the concept of debugging through interaction	Children can naturally engage in meaningful and appropriate coding activities, which gives them various opportunities to discover coding skills in a playful environment.	Promote basic programming skills in pre-kindergarten curriculums using programmable robots as station activities.	Implementing playfulness as a tool in workshops can positively impact young girls' interest in computer science, addressing the gender gap in the field

We present some of these themes and overarching concepts to support our notion:

Theme 1 - Use of Technology

Three articles (Articles 2, 3, and 4) advocate integrating technological tools, such as block coding tools and robots, in early childhood coding education. These tools can facilitate the learning of coding concepts in a concrete and interactive manner.

Theme 2 – Benefits of Early Exposure

Two articles (Articles 2 and 3) discuss the beneficial effects of early coding exposure on young children's language proficiency, creativity, and cognitive development.

Theme 3 - Importance of Teachers/Facilitators

Three articles (Articles 1, 2, and 3) emphasize the critical significance of educators or facilitators in guiding young children's coding experiences. This encompasses establishing a positive learning environment, offering assistance, and delivering instruction.

Theme 4 - Focus on Playful Learning

All four articles emphasize the value of playful activities and engagement in teaching coding to young children. This includes using robots, block coding, collaborative tasks, tangible objects, and interaction to make learning fun and stimulating.

Theme 5 - Promoting Computer Science Education

Two articles (Articles 2 and 4) emphasize the broader theme of promoting computer science education, particularly among underrepresented groups. This includes initiatives like workshops for girls and ensuring adequate resources for educators to stimulate playfulness in the learning process.

All these themes present a common thread that could be used by a scholar (i.e., a doctoral student) to present an informed theory in terms of the subject matter and or topic, which, for this example, could be the statement that:

> Facilitated by competent educators, playful, technology-supported learning experiences can effectively introduce young children to coding and cultivate its potential benefits while promoting more comprehensive access and inclusivity to computer science education.

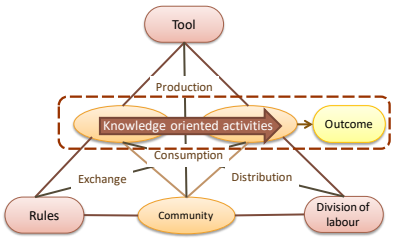
Although elementary, the development and construction of the statement above are founded on evidence of analytical synthesis and the linking of theories and include both a summative and formative critical evaluation of previous work. All of these conform to the criteria presented by Hart (2018), Boote and Beile (2005), and Mitchell and Willetts (2009). For research methodologists, this example illustrates how Activity Theory can be operationalized as a coding framework, providing a theoretically grounded approach to demonstrate systematic qualitative analysis

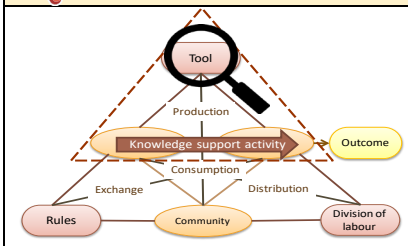
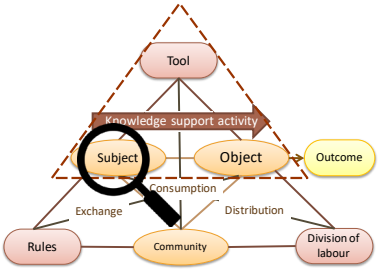
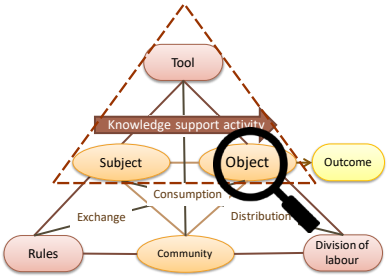
Example 2 – AT Elements as Reference Point in a Literature Survey and Analysis

In this example, we show how the viewpoints and elements described previously (see Figure 6, and Appendix B) can be used to determine what the literature states about a particular concept and activity within a larger organization. The concept and activity in this investigation are that of Knowledge Support (KS) against the backdrop of a Network of Knowledge (NoK) in the application field of a Living Lab (LL). A NoK is a shared community of interest that functions as a dynamic system that leverages existing knowledge-sharing structures to connect knowledge holders and users (Carmen et al., 2015).

An LL is a research and innovation environment where users actively participate in co-creating and testing new products, services, and technologies in real-life settings (Buitendag et al., 2013; Kalinauskaite et al., 2021). The activity of KS, therefore, is encapsulated within the provision of answers to knowledge requests and joining the correct knowledge holders with the knowledge seekers (Buitendag et al., 2013). In Table 2, we briefly demonstrate how the viewpoint of the activity system as a whole and the first three elements of AT can be used to search for and derive themes and statements supported in the literature. The first row focuses on knowledge-oriented activities where knowledge is produced and disseminated to knowledge seekers. Using this approach allowed the researcher to present grounded activities that encapsulate and describe the concept of "knowledge activity." In the second, third, and fourth rows, the focus is placed on the tool, the subject, and the object concerning the activity of knowledge support.

Table 2. Surveying the concept of knowledge support through the lens of AT

Viewpoint/Perspective	What the literature state
Knowledge-oriented activities within a NoK 	The literature on this concept revealed various applicable knowledge-related activities within an LL as a NoK. This includes the activities of knowledge: - acquisition (Pallot et al., 2013; Scozzi et al., 2017), - validation (Cavillier & Wieser, 2018), - engineering (Conruyt et al., 2015), - creation (Tripathi, 2010; von Wirth et al., 2019), - consolidation (Tripathi, 2010), - communication and sharing (Ghahtarani et al., 2020; Kop, 2010; van Baalen et al., 2005), - storage (Zhao et al., 2021), - brokering (Konsti-Laakso, 2018; Mládková, 2011), - integration (Zakaria, 2011), - valorization (Del Vecchio et al., 2017; Van Geenhuizen, 2011); and - management (de Jager et al., 2012; Lehmann et al., 2015).
The knowledge support activity as the predominant activity within the NoK.	The tool deployed to enable knowledge support is a Knowledge Object (KO). A Living Lab, as a network of knowledge, thrives on knowledge support (Buitendag & Hattingh, 2020), which includes the act of providing accessible and applicable knowledge. Knowledge Objects (KOs), encompassing raw data and processed resources, mediate this crucial activity. These KOs bridge the gap between raw information and usable knowledge, empowering participants in co-creation, innovation (Clausen & Gunn,

Viewpoint/Perspective	What the literature state
	2015), and problem-solving, solidifying the Living Lab's mission as a collaborative knowledge network (Buitendag et al., 2013).
The subject in relation to the Knowledge Support (KS) activity 	The literature exposes knowledge workers as the subject in the NoK (Fallatah, 2021) in relation to the KS activity (Eardley & Czerwinski, 2007). Knowledge workers drive knowledge creation through knowledge sharing and maintaining current knowledge within the LL environment (Buitendag & Hattingh, 2020; Mládková, 2011; Schuurman et al., 2015).
The object in relation to the Knowledge Support (KS) activity 	The object denotes the motivation behind why the activity is taking place and its applicable goals and intentions (Engeström, 1987; Zurita & Nussbaum, 2007). The goal of this sample review is to present mechanisms to facilitate the KS operations of the members of the LL to assist the LL to become a viable entity and thrive as an outcome. Having adequate KS (including decision support) mechanisms would enable the knowledge workers to be able to make good strategic, tactical, and operational decisions (Chen & Edgington, 2005; Lindblom et al., 2016) to mitigate possible negative impacts (McCullough & Matson, 2016).

Examining the concept and presentation of the sample analysis as presented in Table 2 (although elementary) clearly shows that the researchers had to critically engage with the literature through analytical synthesis and link concepts and theories. This, not only demonstrates the researcher's ability to synthesize the literature but also the ability to articulate concepts and views from different sources. This application particularly benefits methodology experts by showcasing how theoretical frameworks can be transformed into practical analytical tools whilst maintaining analytical rigor.

IMPLICATIONS AND REVIEW

Both activity theory and the grounded theory method of inquiry are well-known and accepted research methods. AT has also been used successfully to investigate the requirements for information systems development and related human-computer interactions and designs.

The methodological framework presented in this study addresses a critical gap in qualitative research practice by providing systematic tools for literature synthesis. While considerable attention has been given in the literature to data collection and analysis techniques, the need for rigorous approaches to literature review and synthesis remains an important area for methodological development. This research demonstrates how Activity Theory can be operationalized as an analytical framework, providing researchers with practical tools for demonstrating rigor in qualitative literature synthesis.

For methodology experts, these examples provide a template for teaching advanced literature synthesis techniques. The structured nature of the approach offers methodologists clear criteria for evaluating the depth and rigor of qualitative literature reviews while maintaining flexibility in the application thereof.

Utilizing AT as a lens, as part of a literature review, offers several potential benefits, aiding in a more comprehensive and nuanced understanding of the existing research by:

- Encouraging the researcher to view the phenomenon of a study holistically, considering the interactions and relationships among different elements.
- It intrinsically forces the researcher to focus on the interactions of the subject and the object and their relationship to the artifact or tool deployed.
- Promoting a contextual understanding of the literature domain in the study. It can help the researcher analyze how different studies consider and address various issues at hand. A better contextual understanding will also assist the researcher in presenting more nuanced and comprehensive interpretations.
- Assisting with identifying contradictions and tensions between different scholarly articles where the researcher may find contrasting or conflicting findings, theories, and perspectives. This would intrinsically force the researcher to dig deeper to gain further insight.
- Assisting with developing theories and thesis statements based on a systematical analysis of the sources.
- Demonstrating research rigor through evidence of applying the methods and their derivatives, as presented on three levels: conceptually, methodically, and empirically, in this study.

We are confident that our approach will help doctoral candidates and other scholars fulfill the literature review requirements for their doctoral studies, as outlined by Hart (2018) and Boote and Beile (2005), which we outlined earlier. Our proposed methods and approaches require and enforce analytical synthesis, which intrinsically also contributes to evidence of rigor. They also require the conceptual linking of concepts and theories and provide opportunities to formally evaluate previous research in the field, integrating and placing the subject and object of the study in the larger body of scholarly literature.

LIMITATIONS

This study demonstrates how the elements and viewpoints of AT and the coding process can be used to analyze the literature based on two examples. The first example focused on an educational theme, and the second on the knowledge support activity of a network of knowledge. More research is required to demonstrate the suitability of the proposed analysis method in other fields or topics. We consider our approach to be a means to assist and initiate doctoral students and other scholars with their literature reviews and research endeavors rather than a rigid, prescriptive method.

CONCLUDING REMARKS

We contend and have shown that Activity Theory can be used to analyze academic literature. AT offers a more thorough and nuanced comprehension of current qualitative research by shifting the emphasis from individual actions to the broader "activity system," which includes subjects, objects, tools, and community rules. This comprehensive viewpoint can unveil linkages between diverse studies and the contextual factors that influence research findings.

The Activity Theory analysis approach presented in this paper was successfully applied by Buitendag and Hattingh (2024) to evaluate agricultural knowledge management frameworks and develop a smart agricultural knowledge management framework.

Our suggested methodological approach aligns with current trends in qualitative research that seek to enhance analytical rigor and precision. We believe that qualitative research theorists

would welcome innovative approaches to enhancing rigor and precision, as reflected in recent studies suggesting artificial intelligence (AI) applications (Hitch, 2024).

Our approach contributes to the vibrant qualitative research community's ongoing efforts to develop robust, systematic methods for knowledge synthesis while maintaining the nuanced understanding that characterizes qualitative inquiry (Bernauer, 2024; Denborough, 2024).

Overall, using AT as a lens in a literature review can lead to a deeper understanding of the research landscape, unveil hidden connections and contradictions, and generate new insights and questions for future research. It promotes a critical and holistic approach to knowledge synthesis, enriching the research process and contributing to the advancement of the chosen field. It will also add evidence of rigor.

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APPENDIX A: COMPONENTS OF 2ND GENERATION AT DESCRIBED BY QUESTIONS

What tool or process or mediating artefacts are described in the source?
What methods and tools are used to conduct the research?

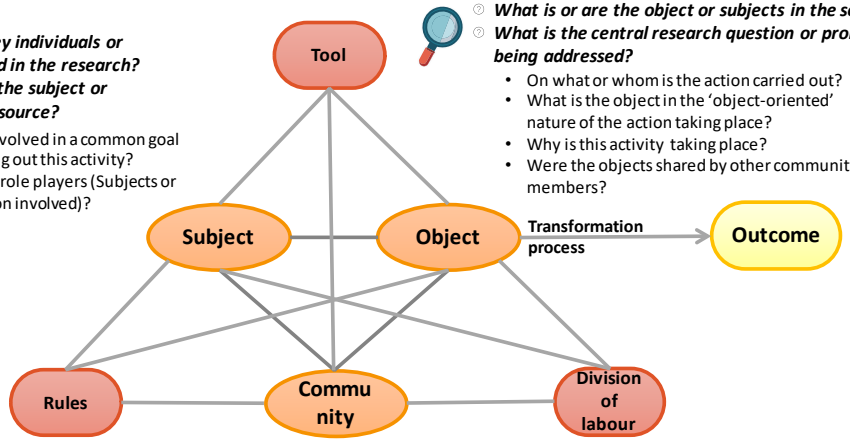
- By what means are the subjects performing this activity?
- How did the tools influence the activity and related processes?
- Were there problems identified while the tools were being used?

Who are the key individuals or groups involved in the research?
What is or are the subject or subjects in the source?

- Who are involved in a common goal and carrying out this activity?
- Who is the role players (Subjects or organisation involved)?

What is or are the object or subjects in the source?
What is the central research question or problem being addressed?

- On what or whom is the action carried out?
- What is the object in the 'object-oriented' nature of the action taking place?
- Why is this activity taking place?
- Were the objects shared by other community members?



What is the reported outcome or result of the study in the source?

- What is the desired outcome from carrying out this activity?
- What did the subjects aim to achieve?

What rules guided the study?
What are the underlying assumptions and methodological norms within the field of study?

- What is the typical patterns of behaviour?
- What is the typical routines, guidelines, policies and criteria?
- Are there any individual or group norms, rules and roles governing
- the performance of this activity?

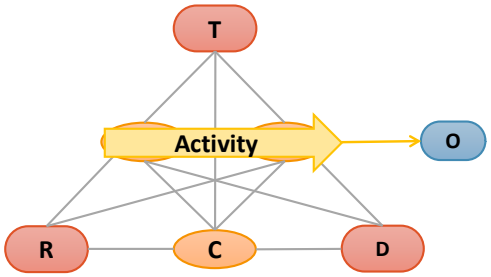
Who is the actors or study group in the source?
Who are the key players or communities involved in the research?

- Who has an interest in the activity taking place?
- Who else is involved in the activity?
- What is the environment in which this activity is carried out?

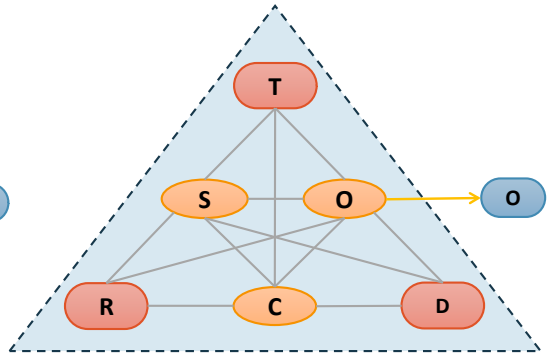
What has been done by whom?
How are tasks and responsibilities divided within the research process?

- What is the positions of each of the participants in the group?
- Who is responsible for what, when carrying out this activity and how are they organized?
- What were the roles and responsibilities of each?

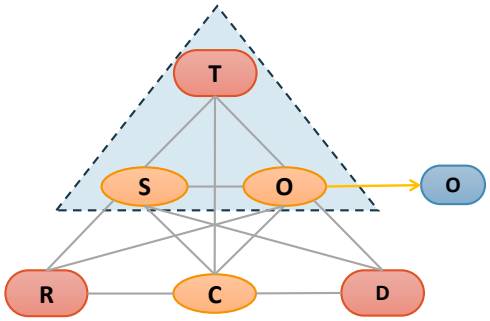
APPENDIX B: ADDITIONAL VIEWPOINTS AS CODES



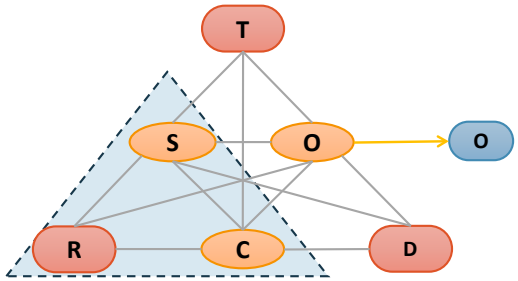
The activity conducted, by the subject using a tool



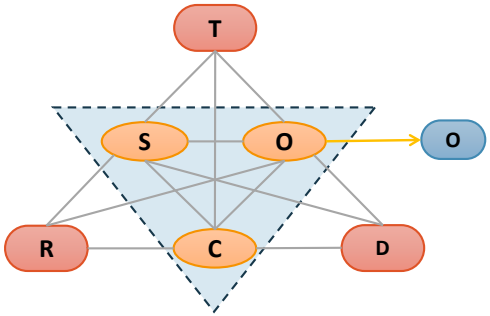
The activity system as a whole



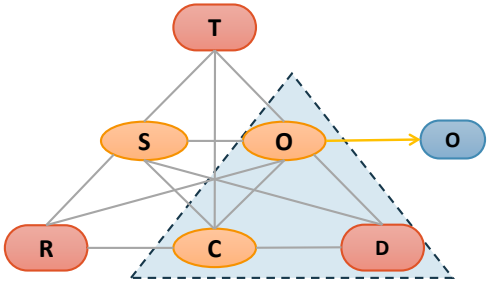
The relationship between the tool, subject and object



The relationship between the subject, rules and the community

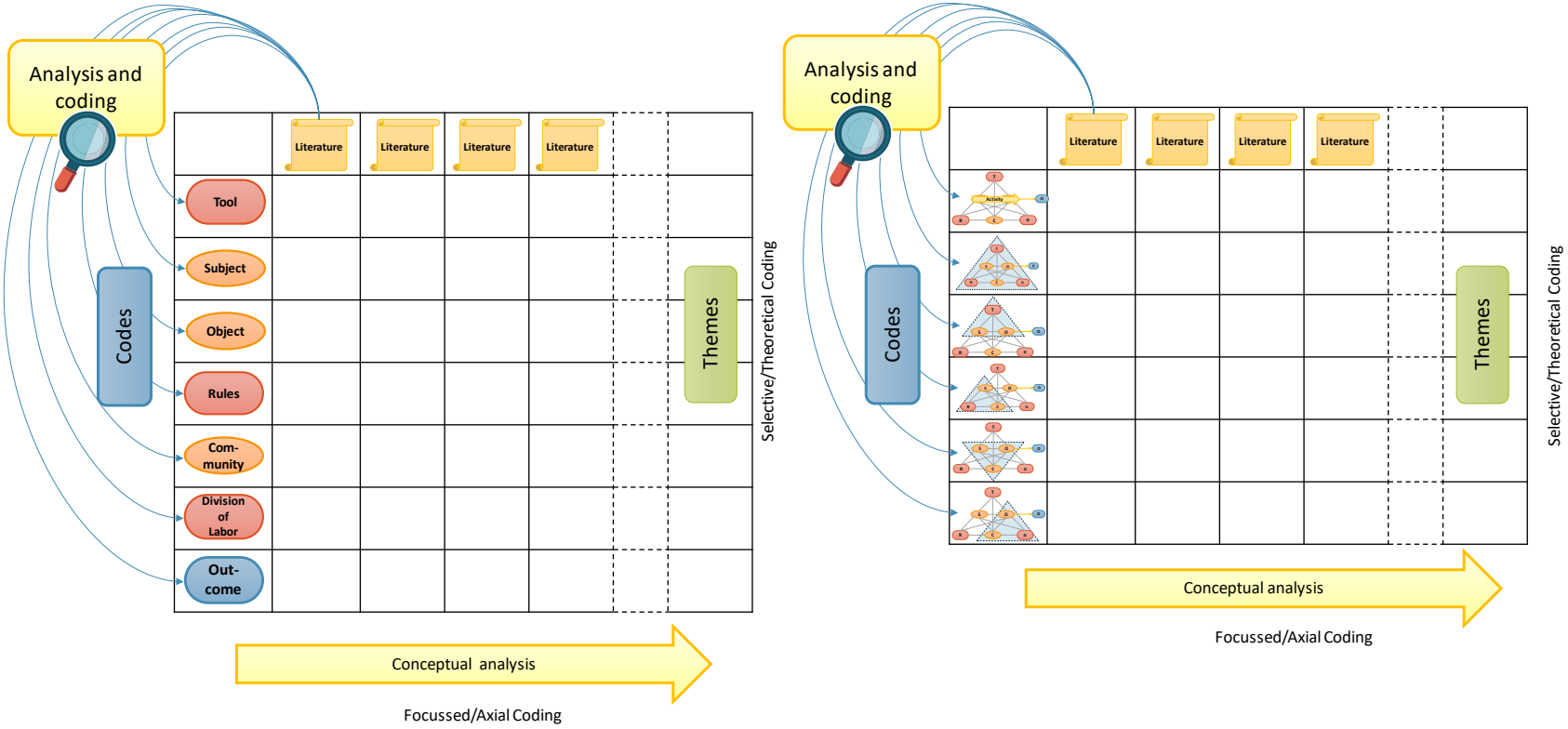


The relationship between the subject, the object and the community



The relationship between the object, community and the division of labor

APPENDIX C: POTENTIAL MEANS OF ANALYSIS USING A GRID



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