Routine Dynamics and Fluid Technologies at Work

Karina Kiær

University College of Southern Denmark (UCSYD), University of Southern Denmark (SDU)

Corresponding author
Karina Kiær
Department of Teacher Education, University College of Southern Denmark (UCSYD) and University of Southern Denmark (SDU)
Lembckesvej, 7, 6100 Haderslev, Denmark
✉ kaki@ucsyd.dk

Abstract
This paper combines insights drawn from the fields of Routine Dynamics and Science and Technology Studies (STS) to analyse the enactment of objects in an emerging organisational routine. I zoom in on a specific case that was part of a three-year ethnographic study shadowing a literacy coach, who facilitates professional development of teachers in regard to literacy in primary and lower secondary school context-based grammar teaching more specifically. Using the concept of "fluid technologies", developed by STS scholars Marianne de Laet and Annemarie Mol (2000), enables me to analyse objects, such as a folder, PowerPoints, and models, to see how a routine develops and varies over time and place while remaining recognisable (Feldman et al. 2021a). The emerging routine renders visible various practices and patterns, although similarities come in varying shades, gradients, and mixtures. The literacy coach's facilitating role is of great importance, enacting objects and guiding the flows and processes of objects in the emerging literacy coaching routine. The article adds to the existing research literature on Routine Dynamics, highlighting the relevance of theories of fluid technologies when studying objects in emerging organisational routines. Furthermore, conceptualising momentarily stabilisation as routines is significant to the STS field to understand more on work and organisation.

Keywords
Routine Dynamics; fluid technologies; objects; STS; literacy coaching.

1. Introduction

This article illuminates how concepts from studies of Routine Dynamics and Science and Technology Studies (STS) can be intertwined and foster new insights devoting certain attention to objects in organisational routines from an empirical setting in literacy coaching in Denmark from which this article derives. Already, researchers have explored how organisational routines develop and emerge (Becker 2008; Feldman et al. 2021a; Howard-Grenville et al. 2016; Parmigiani and Howard-Grenville 2011). Most of these studies apply a process theory perspective, some of them challenging the stability of seemingly established terms as "becomings" to focus on developmental processes (Dionysiou and Tsoukas 2013; Howard-Grenville et al. 2016; Howard-Grenville and Rerup 2017; Langley et al. 2013;

Pentland et al. 2020; Svabo 2009; Tsoukas and Chia 2002). In prolongation with this, the article investigates objects in emerging literacy coaching routines taking inspiration from an STS perspective. This approach fosters new insights into the role of objects in routine dynamics and the article explores how objects on the one hand materially change routines and on the other hand are changed by them. Within STS researchers have been interested in investigating objects and how they are enacted in various practices and finding answers to how they momentarily stabilise in networks (Bowker et al. 2015; Latour and Woolgar 1986; Orlikowski 2007). Proposing concepts like "fluid technologies" has the potential to enrich our understandings of objects within routine dynamics (de Laet and Mol 2000; Gherardi 2023; Lindberg and Walter 2013; Mol and Law 1994). Moreover, Routine Dynamics can advance our comprehension on how associated actors momentarily and continuously stabilise – an aspect that has been sparsely explored by certain STS researchers (Mol and Law 1994). The intersection of Routine Dynamics and STS holds the potential to yield new insights into the realms of work and organisation.

The empirical context in this article is literacy coaching work in Denmark. Literacy coaches are teachers who have received further training within the fields of writing and reading focusing especially on how to support students' development of written language and how to improve teacher colleagues' instructional techniques and strategies when teaching literacy. In the case presented in this article, such changes concerned the development towards more contextual approaches to grammar instruction – i.e., working with grammar in written texts, greater collaboration across three school subjects English, Danish and German, and reflecting on language – instead of rule-based and decontextualised grammar assignments. While research has shown the benefits of contextual approaches (Kabel et al. 2022), such changes were difficult to implement as the learning materials normally used by the teachers were based on decontextualised grammar teaching. As a result, the literacy coach negotiates an emerging routine that enables teachers to devise and develop new objects or adapt existing learning materials in accordance with new research-based knowledge as to what constitutes good grammar teaching. This role as a change agent is common within literacy coaching (Sisson and Sisson 2024) and it is a role literacy coaches are expected to play in Danish schools (Kiær 2020; Kiær 2023; Kiær and Albrechtsen 2023; 2024). Using objects such as data and research knowledge to support instructional development is explicitly mentioned in the curriculum for the Diploma of Education programme in literacy coaching (Pedagogical Diploma Programme 2020, 38-40)[1], which also makes the diploma programme an ostensive aspect of the literacy coaching routine as it is "the ideal or schematic form of a routine. It is the abstract, generalised idea of the routine, or the routine in principle" (Feldman and Pentland 2003, 101).

In this article, I expand the existing body of knowledge on objects and organisational routines by relying on the concept of fluid technologies (de Laet and Mol, 2000). Furthermore, this article advances our understanding of how professionals within organisations employ objects in learning processes facilitated by the emergence of new routines. An organisational routine is defined as "a repetitive, recognisable pattern of interdependent actions, involving multiple actants (instead of simply actors)[2]" (D'Adderio and Pollock 2020, 1). This underlines the importance of actions and the inclusion of the non-human, and it emphasises

the dynamic nature of routines (Feldman et al. 2021b). The dynamics of these routines are characterised by both similarity and difference, dynamism and stability (Deken et al. 2016; Feldman 2000; Feldman et al. 2016; Feldman and Pentland 2003; Goh and Pentland 2019; Pentland et al. 2011; Pentland et al. 2020). Previous studies of the emergence of routines have developed concepts such as paths and patterns that help to understand the processes involved in organisational routines (Goh and Pentland 2019; Pentland et al. 2020; Sydow et al. 2009). D'Adderio, in particular, argues for research focusing on multiple enactments of routines, which with great effort may be assembled temporarily into a routine (D'Adderio 2021).

Despite these important theoretical contributions and broad acknowledgement of the significant role that context and objects play in the internal dynamics and performance of routines, the application of de Laet and Mol's concept of "fluid technologies" (2000) constitutes a novel approach that offers new ways of conceptualising emerging routine dynamics with particular focus on objects and multiplicity.

2. Theory

Marianne de Laet and Annemarie Mol's concept of "fluid technologies" enables to capture the emergence of a routine by drawing attention to the role of objects and how objects come to co-exist as different versions as enacted in organisational practices. De Laet and Mol's (2000)[3] empirical analysis shows how an object – a bush pump – performs after being installed in numerous villages in Zimbabwe to establish and promote better healthcare routines among the population by providing water that is safe to drink and lowering levels of *E. coli* bacteria. De Laet and Mol's introduce new understandings of objects that differ from prior research on boundary objects (Bowker et al. 2015). According to Bowker et al. (2015) objects can be perceived differently by the users and imply a multiplicity of perspectives. This means that a boundary object is formulated iteratively between different communities until it stabilises (Star 2010). However, de Laet and Mol state that:

> Our notion of fluidity serves to flag the way in which object and world are intertwined; it points to the flexibility of the pump's definition and the variability of its perimeter.
> (de Laet and Mol 2000, 257)

The bush pump is a fluid technology, in contrast to ideas concerning the stability of objects as "immutable mobiles" – or actors – that stabilise in networks, as argued by actor-network theory (ANT) (Law 2002). The bush pump constantly changes shape; it is a mutable mobile in an ongoing process of becoming, creating paths that it might not have been possible to define in advance. It is entangled in a variety of worlds, which means it does not need to have a clear boundary to remain solid – it can remain fluid and cross boundaries between these worlds without losing its agency (de Laet and Mol 2000; Mol and Law 1994). Despite this fluidity, the pattern of relations surrounding a mutable mobile can provide stability as it does not necessarily break down if the object is changed or replaced with another object – only if it is no longer able to absorb and adapt to its surroundings. Stability and durability are created through ongoing transformation

and continuity. Fluids continue to flow from one place to another, absorbing new elements that enable them to vary in form, and are capable of transforming themselves (Sørensen 2005).

The relation between humans and water pumps reconfigures the travel of the latter. De Laet and Mol (2000) have shown that the bush pump is a "fluid" actor; it can vary over time and place, and nevertheless remain recognisable. This fluid technology follows paths, travelling to unpredictable places (de Laet and Mol 2000, 226) that the developer of the bush pump never considered, which results in various mixtures, shades, and gradients, and similarity and difference come in varying shades and colours (Mol and Law 1994). De Laet and Mol (2000) argue that the pump is a strong object that travels to unpredictable places, changing shape and adapting over time and can be "tailored to local circumstances" (de Laet and Mol 2000, 226-236). Even though different versions of the pump thereby come to exist, the water pump retains the agency to act as a water pump through its relations with various actors. Nevertheless, the boundaries and constitutions of the water pump vary, shaped by the users of the pump, their methods, and insights though it still has agency to act as a water pump.

The notion of fluidity serves to flag how object and world are intertwined. It points to the flexibility of the definition of, for example, a pump and the variability of its perimeter, but also to its capacity to shape different worlds. However, it is important to note that the fluidity of the pump's working order is not simply a matter of interpretation; according to de Laet and Mol, it is built into the technology itself. By travelling to unpredictable places, an object whose boundaries are not too rigorous, that does not impose itself but tries to serve, that is adaptable, flexible, and responsive – in short, a fluid object – may well prove to be stronger than a solid or stable object (de Laet and Mol 2000, 226).

Borrowing the concept of fluid technology, I will use it to analyse the objects enacted in an emerging literacy coaching routine. Mol (2002) states that every practice produces objects as different versions of reality. The differences between these versions of reality can be big or small, and different versions of the reality can therefore overlap, but such differences exist and have consequences. I argue that routines produce objects as different versions of reality.

I will consider the case of education in a Danish primary and lower secondary school. In this context, objects such as the red folder, PowerPoints, and literacy models are a central aspect of the new literacy coaching routine. What defines it as a routine is that it becomes a repetitive and recognisable pattern in the school. The routine exists of meetings distributed over the fall and spring semester over a period of two years where the English, German and Danish subject teachers meet with the literacy coach. This is not a part of the established literacy coaching routine.

The model which I will use in my analysis is inspired by the work of Pentland and Feldman (2008) investigating how the design of artefacts produces variable patterns in routines (see Figure 1). This approach primarily focuses on the dynamic relation between the *performative aspect* – that is, the way that routines are enacted – and the *ostensive aspect* – which describes the idea with the routine. According to their research, artefacts can take many different forms and are often used to ensure the reproduction of desired patterns of action. Furthermore, they underline that artefacts influence and represent both the ostensive and performative aspects of a routine (Pentland and Feldman 2008). My introduction of fluid technologies expands prior understandings of how the role of artefacts in routine dynamics can vary. This theoretical point of
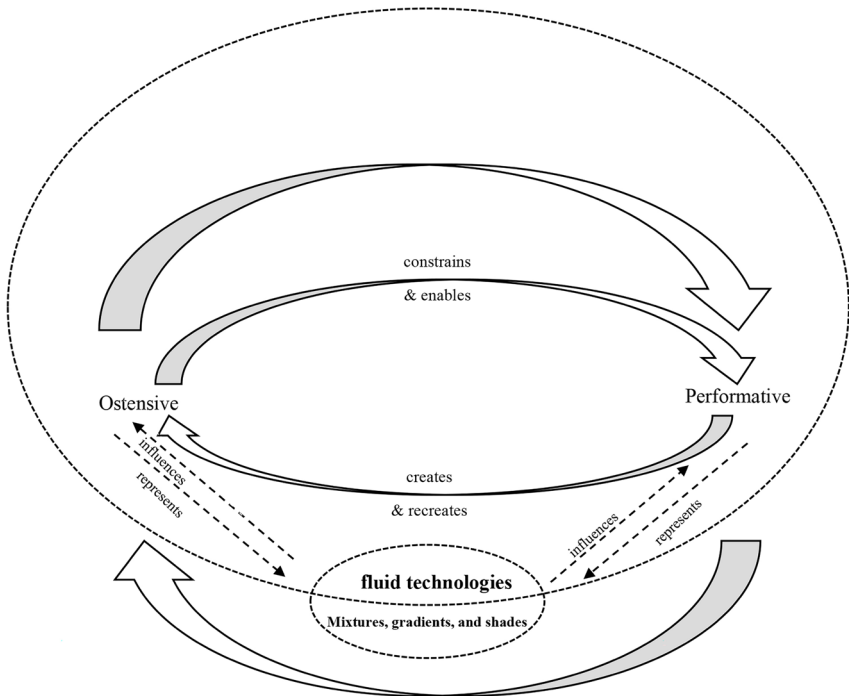
Organizational routines

Figure 1.
Fluid technologies in routine dynamics (with inspiration from
Pentland and Feldman 2008, 241).

departure allows me to contribute knowledge on how artefacts are fluid technologies – objects that come to exist in different shades, gradients, and mixtures enabled by the emerging routine.

In the following, I explore existing literature in the field of Routine Dynamics with a specific focus on the role of objects (artefacts) in organisational routines.

3. Existing research on objects in organisational routines

A strand of research has focused on the role of artefacts in organisational routines and their entanglement with practices (D'Adderio 2011), whereof some include studies of how artefacts enable and constrain routine actions (Pentland and Feldman 2008). The term artefact encompasses various materialities, including technologies (D'Adderio 2011). D'Adderio uses the term objects, stating that artefacts, technology, and materiality are different but overlap-

ping concepts, while emphasising that objects always become something different depending on the agency of different actors (D'Adderio 2011; 2021). I likewise employ the concept of objects to underline the importance of agency.

Feldman (2000) studied three organisational routines: budgeting, recruitment, and training. The objects in these routines were scores, applications, newsletters, and plans. Each of these objects were important for conducting the aforementioned routines, as they lead to a specific outcome. Proponents of Routine Dynamics argue (Feldman et al. 2016) that it is important to study both practice and microprocesses when conducting research on actions and processes within organisations that take place at a specific time and place (Feldman et al. 2021a). According to these researchers, the artefact of the routine influences and represents both the performative and ostensive aspects (D'Adderio 2011; Feldman et al. 2016; Feldman and Pentland 2003). Distinguishing between actions and actants, Pentland and Feldman (2007) introduced the concept of "narrative networks" to characterise routines and questioned that a design of artefacts shapes the ostensive aspect of a routine or constrains the performances in a desirable way or as intended (Pentland and Feldman 2007). Howard-Grenville (2005) found that each enactment of a routine produces artefacts and concluded that artefacts enable and constrain organisational routines, and that artefacts are recreated with different expectations influencing subsequent enactments. Additionally, the author observed that artefacts overlap during routine enactment, which differs from STS.

This article presents an alternative understanding of objects and their multiplicity. While sharing similarities with Howard-Grenville's approach, this article differs by emphasising multiplicity over a process perspective.

The topic of multiplicity has been only addressed by the research on objects in organisational routine over the last years. Recently D'Adderio and Pollock (2020) drew on the idea of ontological multiplicity developed by Mol (2002) for arguing that routines are only established through great effort and are always temporary. In addition, the authors propose using the concept of "fluid patterns" as a way to further unpack routine dynamics. Geiger, Schröder and Kremser (2021) introduced the concept of "temporal boundaries", defining boundaries as "a previously unrecognised form of coordination within and among routines" (Geiger et al. 2021, 220). Temporal boundaries are also an important part of this article's theoretical framework; however, I employ an understanding of boundaries as fluid and as an accomplishment of enactment of objects in literacy coaching routines. Geiger has highlighted the need for further study of the role of boundaries in routine dynamics (Geiger 2022).

Meanwhile, Pentland and colleagues (2020) have called for the development and refinement of concepts and methodologies for exploring multiplicity within the tradition of Routine Dynamics. A review conducted by Wolthuis and colleagues (2021) highlights the need for educational research that investigates the role of artefacts:

> Our review showed a notable lack of attention to the role of artefacts in connection with routines. Neither those that studied routines as entities nor those examining their internal structure sufficiently detailed how artefacts functioned in relation to routines. That is, many studies examined tools, but only four defined and linked artefacts to routines. (Wolthuis et al. 2021, 30)

As shown above, the role of artefacts in routine dynamics has already been investigated by analysing microprocesses in established organisational routines; however, there is a lack of research investigating objects from a multiplicity point of departure. In prolongation of D'Adderio and Pollock (2020) and Geiger et al. (2021) this paper investigates multiplicity and routines and contributes a new perspective on zooming in on objects' (artefact's) multiplicity. This paper investigates objects as fluid technologies in practices and how they influence organisational outcomes in the form of dynamic routines.

4. Methodology

I use empirical data from my PhD project (2019 to 2021), comprising field notes, sound recordings, screen recordings, pictures, e-mails, PowerPoints, and documents. I shadowed (Czarniawska 2007) five literacy coaches (for a total of 150 hours) in three schools recruited via personal e-mail contact. This shadowing spanned a period of almost three years, which enabled me to study emerging routines and how the literacy coaches interacted with different objects to support the instructional development of the teachers. Due to ethical considerations, I only participated with literacy coaches' acceptance. The resulting material was coded and an abductive process took place, alternating between theory and empirical data (Åsvoll 2014). The coding was inspired by grounded theory (Charmaz 2014; Järvinen and Mik-Meyer 2020), going through the material line by line and incident by incident as this enabled me to identify the emerging routine and its objects, which I zoom in on in this article as a key case providing thick and detailed descriptions (Flyvbjerg 2006; Thomas 2015; Quinlan 2008). I applied the following codes to the empirical material: meetings, agendas, PowerPoints, objects, visibility, facilitation, similarity, dialogues/reflections, existing practices/new practices, and boundaries.

In the following I analyse how objects enable and constrain new practices in grammar teaching, using the concept of fluid technologies. More specifically, I analyse how the literacy coach enacts a research project called "Gramma 3" on context-based grammar teaching (Kabel et al. 2022) using a red folder, which I conceptualise as a fluid technology. First, I present the case of the fluid technology. Second, I analyse how the new literacy coaching routine emerges and enables mutual shaping of objects. Third, I analyse how interactions between objects, the teachers and the literacy coach form boundaries constraining how to work with context-based grammar teaching.

5. Analysis: The literacy coach and the red folder – a fluid technology

To develop new grammar teaching oriented towards becoming context-based the literacy coach enacts a red folder which is an assemblage of different kinds of objects, i.e., literacy models like the Teaching Learning Cycle (hereafter TLC), examples on syntactic work as well as ideas on how to work with morphemes and spelling development. The red folder contains approximately 30 pages. Enacting the red folder in the emerging routine enables and constrains the work with new grammar teaching. I characterise the red folder as a fluid technology as it has the ability to function as technology providing context-based grammar teaching.
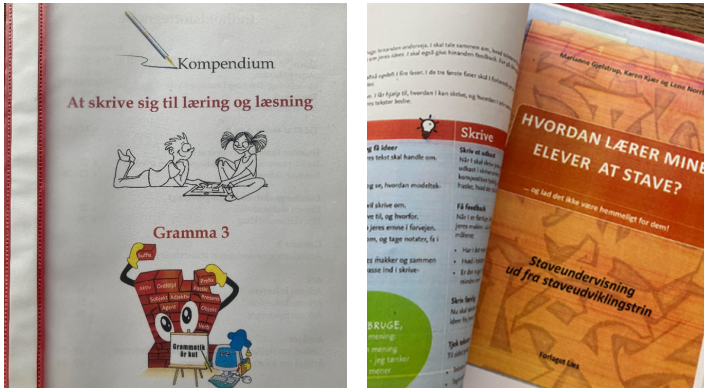
Figure 2.
The red folder, an assemblage of content with materials on writing, language,
and spelling development approximately 30 pages.

The research project "Gramma 3" which the literacy coach enacts does not specify how to practise the new approach to grammar teaching specifically, and therefore the literacy coach improvises. All teachers get the red folder (see Figure 2) at the first meeting and in-between the meetings, the teachers are committed to working with different parts of the folder to, for example, plan new grammar teaching and try it out with students, and send examples from the new practices to the literacy coach. Additionally, the literacy coach produces different PowerPoints preparing for the meetings. These PowerPoints serve a dual purpose. Firstly, they function as points of orientation for the teachers, presenting various models such as the TLC model (see Figure 3) and theories from the field of literacy research on writing and language. Secondly, they assemble teachers' teaching examples with new grammar teaching as the process evolves.
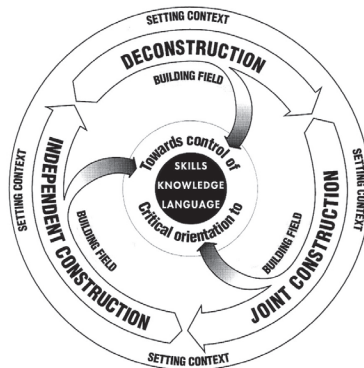
Figure 3.
Teaching-Learning Cycle an example of writing from the red folder
(Rothery and Stenglin 1994, 8).

The TLC model focuses on the processes of writing, providing an example of objects that can easily be combined with existing objects and practices. However, the object also serves as a boundary, defining what falls within the scope of context-based grammar teaching.

Both the objects and interactions during meetings between the literacy coach and teachers establish boundaries. The literacy coach emphasises that existing research lacks clearly defined methods and didactics for teaching context-based grammar:

> they [the learning materials they have used until now] have another agenda.
> (Field Notes FN 30th of June 2020, [37:00])

She also highlights that the learning materials used previously carry their own set of assumptions and agendas. As a result, no specific learning materials have been developed, which allows participating teachers to collaboratively shape this new teaching approach, enabling the emergence of various versions of context-based grammar teaching. The literacy coach introduces objects that promote multiplicity, enabling teachers to apply models and theories to existing components.

6. The emerging literacy coaching routine and the red folder

The emerging routine sought to develop the teachers' grammar instruction through the introduction and continuous mutual shaping of objects introduced by the literacy coach. This process unfolds across six meetings. The drawing in Figure 4 illustrates and reconstructs the becoming of the routine.

Literacy coaching routines exist alongside and are intertwined with school leader routines and teachers' teaching routines (Rosa et al. 2021). One of the literacy coaches initiated the development of a new way of teaching grammar. This required establishing a new routine, as the existing literacy coaching routine lacked the capacity for it. The initial stage of the new routine was introduced with the school leader's approval. The school leader allocated financial resources and scheduled time for 15 teachers in the subjects Danish, English, and German from 4th to 7th grade to participate[4]. The routine stabilised as it became a visible part of the teachers' and literacy coach's schedules and was aligned with other tasks in the school.

The timeline in Figure 5 portrays the gradual emergence of this novel routine, capturing its transformation into a recognisable, repetitive pattern of interdependent actions involving multiple actants in the school.

At the first meeting in August 2020, the literacy coach distributes the red folder and introduces teacher colleagues to a research report on context-based grammar and engages with them in discussions about grammar teaching. The literacy coach introduces research-based knowledge on the PowerPoint:

> This is a new report that we will take a look at and which should end up with us collaborating [to implement] these things across the different subjects [referring to the report on grammar teaching]... [...] ... there is not a single correct approach; we must work together to develop something. (Sound Recordings 00:01:50)
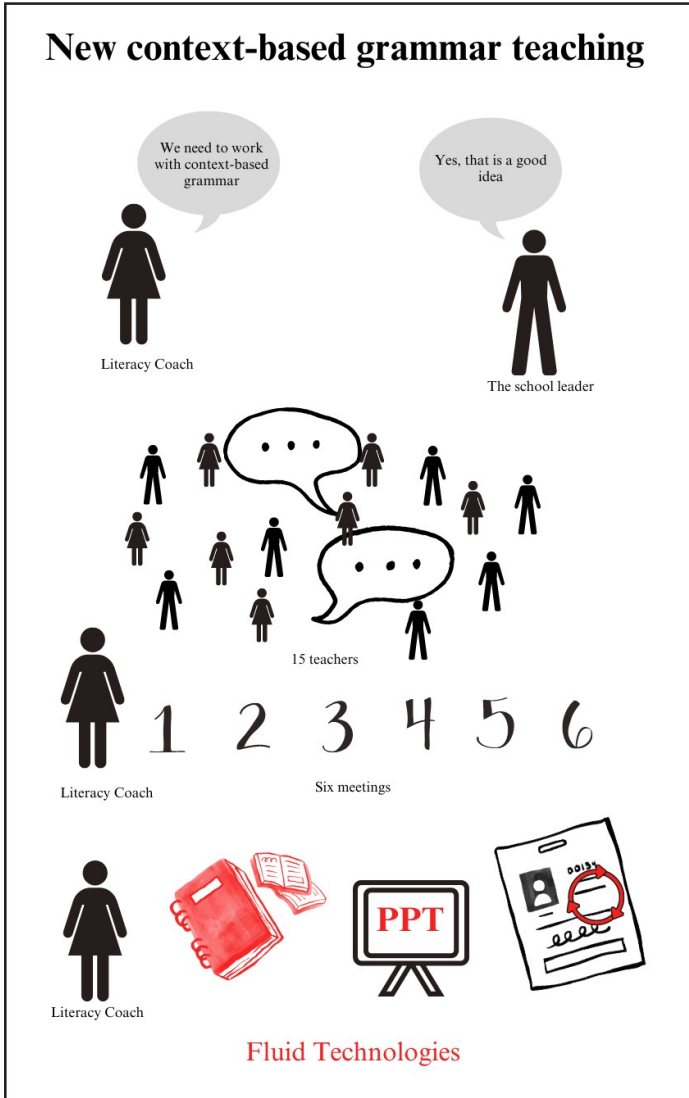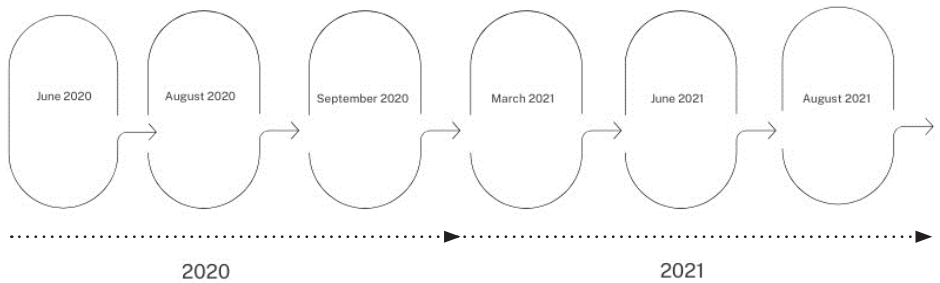
Figure 4.

The emerging routine with fluid technologies (by author inspired by Akrich and Latour 1992). The drawing illustrates how a literacy coach negotiates a routine with the school leader, which enables 15 teachers to meet 6 times.

At these meetings the literacy coach distributes a red folder and enacts PowerPoints and literacy models. The meetings enable the literacy coach to rearticulate teachers' new grammar teaching objects and practices. The routine enables teachers to get inspiration and reflect on context-based grammar.

Figure 5.
Timeline for the events of the emerging literacy coaching routine.

This report referred to in the PowerPoint, enables innovative approaches to teaching grammar but also places constraints by emphasising the importance of teaching grammar across subjects to enhance student understanding and develop a metalanguage for both teachers and students.

During the first school year, the plan was to discuss theory and practice, leading to evaluation in June 2021 (field notes from the 30th of June 2020). A plan presents the *ostensive* aspect of the emerging routine; that is, a script or an idea of when and how the teachers and literacy coach should *enact* the new routine and it describes *what* the meetings concern (see Figure 1). The plan is an object that makes it possible for teachers and the literacy coach to meet during the school year and outlining certain content. The existing literacy coaching routine does not enable meetings gathering teachers across subjects developing grammar teaching. The meetings create a space for the literacy coach to enact the red folder, and to collect teachers' objects from teaching practices. Furthermore, the meetings constitute the new routine and depend on the leader's decisions, a decision which creates a boundary determining who can take part in the meetings and when the process of enacting the routine begins and ends. It is tailored to local circumstances and is dependent on the involvement of users, in this case, the teachers, and on their methods and insights (Mol 2002, 251).

7. Boundaries and fluid technologies

Preparing for each meeting, the literacy coach produces PowerPoints that outline the findings from the research report, attempting to make it clear what the teachers need to pay attention to when planning new grammar teaching. The meetings enable the literacy coach to enact the red folder as well as teachers' different versions of objects as they produce and try out the objects with students.

The PowerPoint outlines different points of orientations for teachers to focus on the new components, i.e., the overall idea with the new way of teaching. However, the literacy coach's enactment of the PowerPoint also creates boundaries. First, teachers must give examples, work with authentic texts, combine grammar and writing exercises, engage in dialogues with students on grammar topics, and support work across subjects. Second, they must encourage

How?
- Teaching grammar must combine and connect the grammar students are learning with teaching in writing
- Grammar must be explained through examples
- Class discussions about language and grammar must be of high quality
- Use examples from authentic texts

(p. 27)

Students must be:
- *collaborative*, i.e., assignments can only be solved in collaboration between two or more students
- *dialogue-based*, i.e., that the collaboration must involve the students having a dialogue about the grammar
- *exploratory*, i.e., that they show each other how they can use their creativity and creative urge to understand grammar.

(p. 105)

Figure 6.
PowerPoint outlining different points of orientation according to research on context-based grammar. The references in brackets ("p. 27" and "p. 105") refer to the Gramma 3 research report (Translations made by Author).

and facilitate students' collaboration and exploratory work. Objects enable flexibility in terms of use, allowing the object to travel almost anywhere and deploy alternative and existing components from the teachers' teaching practices.

However, the PowerPoint above (Figure 6) and how the literacy coach enacts research knowledge constrain ways of working with grammar. Creating such a boundary demonstrates the importance of the routine which enables: a) the literacy coach to enact research knowledge, b) being given the time to read, interpret, make sense of, and to communicate such knowledge to colleagues, and c) to reassemble, rearticulate, discuss, and reflect together with teachers on their objects from teaching practices. This is made possible by the emerging routine. The literacy coach is an important actor guiding the flows and processes; however, the empirical data also reveal how objects in new grammar teaching come to exist as different gradients, mixtures, and shades.

The working order of the routine is closely related to research knowledge outlining understandings of new grammar teaching. It is built into the chosen objects such as the PowerPoints presented and argued for by the literacy coach, and it comes to exist in the interactions. It is not a matter of interpretation but is accomplished through the work done by the literacy coach. However, the meetings also enable the literacy coach to guide teachers in maintaining the correct focus on context-based grammar teaching.

The literacy coach articulates examples from a lesson via the PowerPoint. In this example, a teacher enacts the object TLC, and Figure 7 shows how the teacher adapts it to local circumstances. The teacher uses a text from the Edison Project (the blue printed page in Figure 7), in which the class participates. The Edison Project is an annual competition where students create novel solutions to real-life problems. The teacher follows the process of deconstructing

Figure 7.
Teacher examples of context-based grammar teaching. An example of how a
science teacher has worked with TLC in the Edison Project – writing with the
students, 28th of September 2021. [Sound recordings 30:00]

the text together with the students. First, by asking them about their understandings. This is done on a whiteboard, highlighting the introduction, the explanations, and the ending of the text. To do this, the teacher uses different colours, deconstructing the text by numbering the different parts of the text like a dresser drawer. Opening the first drawer provides knowledge on the weather in general. Opening the second drawer provides information on climate and temperature, the third drawer stipulates explanations on climate changes and so forth. The teacher uses different colours to illustrate that each drawer represents different parts of the text. This collaborative deconstruction of a text enables students to construct a similar text afterward jointly and finally an independent construction of texts. The object TLC enables to work with new grammar teaching on writing in science but constrains the work solely focusing on grammar, i.e., vocabular and spelling in science. As an object, the TLC model on the one hand enables new practices with context-based grammar and on the other hand, it constrains teachers' instructional decisions and their enactment of new grammar teaching. The interactions at the meetings between literacy coach and teachers enable the objects to have agency, but at the same time means they create a boundary.

The routine not only enables the literacy coach to enact research knowledge on Power-Points. The interplay between the emerging routine and the literacy coach enables the literacy coach to rearticulate teachers' new practices at the meetings with teachers. The literacy coach visualises multiple uses of objects from the red folder in PowerPoint at these meetings.

8. Conclusions

In response to this article's research question: "How are fluid technologies enacted in emerging organisational routines?", the analysis of the empirical material illustrates how objects such as the red folder in an emerging literacy coaching routine can be characterised as a "fluid technology". Fluid technologies are objects that come to exist as different versions but remain recognisable.

The emerging literacy coaching routine enables and constrains the mutual shaping of objects that can be used to enhance context-based grammar teaching. Furthermore, the routine has paved the way for the literacy coach to introduce various objects which were previously inaccessible. The objects have undergone transformations, with different versions emerging, e.g., the TLC model, grammar in students' texts, expanding existing learning materials with dialogue and collaboration. This is similar to various versions of a water pump as described by de Laet and Mol (2000). Despite the transformations, these objects have retained the agency to facilitate new grammar teaching through their interactions with various actants. The literacy coach has rearticulated teacher produced objects using PowerPoint, which has encouraged discussions and reflections on novel knowledge and context-based grammar teaching practices among the participating teachers. One could argue that the literacy coach's facilitative role could be likened to that of an emulsifier, enabling the absorption of various forms of fluidity.

While the routine provides the flexibility for objects to adapt to local circumstances, it also imposes certain limitations. The analysis has revealed how the introduced objects became integral to the emerging routine, finding their way into classrooms and instructional settings with students. Some of these objects possessed the capacity to serve as context-based grammar. This phenomenon can be partially explained by the adaptability of the objects within the red folder chosen, introduced, and enacted by the literacy coach, which allowed the objects to be customised to fit specific local contexts. Despite the objects coming in various shades, gradients, and mixtures, they retained the ability to function as context-based grammar, much like a water pump can continue to serve its purpose even when some of its components are replaced.

On one side, the routine facilitates the mutual shaping of objects, enabling them to adjust to local circumstances, which encompass teachers' instructional practices. The routine provides teachers with the opportunity to reflect on new grammar teaching practices. On the other side, the routine places constraints on certain approaches to grammar teaching. However, the routine does not afford the literacy coach the opportunity to observe how teachers implement these new objects in classrooms with students. In conclusion, the literacy coach plays a crucial facilitating role, akin to that of an emulsifier, by introducing various models and creating boundaries. This role transcends the application of mere fluid technologies, as organisational routines encompass more than that. It permits these objects to be integrated into other components and guides the flows and processes of the emerging routine. The simplicity and fluidity of these objects are inherent characteristics, enabling adaptive actions (de Laet and Mol 2000, 225). Additionally, these objects exhibit durability and encourage "community participation", contributing to the development of the school's new grammar teaching. However, it's crucial to note that, similar to the Zimbabwe bush pump, grammar teaching requires maintenance; neglecting this aspect can lead to its failure.

The empirical case sheds light on how the proposition of novel concepts, such as "fluid technologies", can enrich our understanding of objects within routine dynamics. It contributes with knowledge on how these routines can advance our comprehension of how associated actors momentarily and continuously stabilise. In conclusion, I posit that the intersection of Routine Dynamics and STS holds the potential to yield important insights into the realms of work and organisation.

Acknowledgements

Notes

[1] See: *Studieordning for den Pædagogiske Diplomuddannelse* ("Pedagogical Diploma Programme 2020", trad.). Available at: https://www.ucsyd.dk/sites/default/files/inline-files/Studieordning_pædagogiske_diplomuddannelse_1-8-2023.pdf (retrieved May 22, 2024).

[2] This highlights the importance of the relational aspect, indicating that activity is granted by the relation to another human or non-human actor. It also emphasises the role of non-human actors. Furthermore, it follows the distinction between actant and actor, as discussed in ANT (see, for example, Latour 1986).

[3] De Laet and Mol's article builds on previous work by Annemarie Mol and John Law (1994).

[4] I did not participate in these negotiations.

References

Akrich, Madeleine and Latour, Bruno (1992) *A Summary of a Convenient Vocabulary for the Semiotics of Human and Nonhuman Assemblies*, in Wiebe E. Bijker and John Law (eds.), *Shaping Technology/ Building Society: Studies in Sociotechnical Change*, Cambridge (MA), MIT Press, pp. 259-264.

Becker, Markus C. (ed.) (2008) *Handbook of Organizational Routines*, Cheltenham, Edward Elgar.

Bowker, Geoffrey C., Timmermans, Stefan, Clarke, Adele E. and Balka, Ellen (2016) *Boundary Objects and Beyond: Working with Leigh Star*, Cambridge (MA) and London, MIT Press.

Charmaz, Kathy (2014) *Constructing Grounded Theory* (2nd ed.), London, SAGE.

Czarniawska, Barbara (2007) *Shadowing: And Other Techniques for Doing Fieldwork in Modern Societies*, Copenhagen, Copenhagen Business School Press.

Deken, Fleur, Carlile, Paul R., Berends, Hans and Lauche, Kristina (2016) *Generating Novelty Through Interdependent Routines: A Process Model of Routine Work*, in "Organization Science", 27(3), pp. 659-677.

de Laet, Marianne and Mol, Annemarie (2000) *The Zimbabwe Bush Pump: Mechanics of a Fluid Technology*, in "Social Studies of Science", 30(2), pp. 225-263.

Dionysiou, Dionysios D. and Tsoukas, Haridimos (2013) *Understanding the (re)creation of routines from within: A symbolic interactionist perspective*, in "The Academy of Management Review", 38(2), pp.181-205.

D'Adderio, Luciana (2011) *Artifacts at the centre of routines: Performing the material turn in routines theory*, in "Journal of Institutional Economics", 7(2), pp. 197-230.

D'Adderio, Luciana (2021) *Materiality and Routine Dynamics*, in Martha S. Feldman, Brian T. Pentland, Luciana D'Adderio, Katharina Dittrich and David Seidl (eds.), *Cambridge Handbook of Routine Dynamics*, Cambridge (UK), Cambridge University Press, pp. 85-99.

D'Adderio, Luciana and Pollock, Neil (2020) *Making routines the same: Crafting similarity and singularity in routines transfer*, in "Research Policy", 49(8), 104029.

Feldman, Martha S. (2000) *Organizational Routines as a Source of Continuous Change*, in "Organization Science", 11(6), pp. 611-629.

Feldman, Martha S., Pentland, Brian T., D'Adderio, Luciana, Dittrich, Katharina, Rerup, Claus and Seidl, David (eds.) (2021a) *Cambridge Handbook of Routine Dynamics*, Cambridge (UK), Cambridge University Press.

Feldman, Martha S., Pentland, Brian T., D'Adderio, Luciana, Dittrich, Katharina, Rerup, Claus and Seidl, David (eds.) (2021b) *What Is Routine Dynamics?*, in Martha S. Feldman, Brian T. Pentland, Luciana D'Adderio, Katharina Dittrich and David Seidl (eds.), *Cambridge Handbook of Routine Dynamics*, Cambridge (UK), Cambridge University Press, pp. 1-18.

Feldman, Martha S., Pentland, Brian T., D'Adderio, Luciana and Lazaric, Nathalie (2016) *Beyond Routines as Things: Introduction to the Special Issue on Routine Dynamics*, in "Organization Science", 27(3), pp. 505-513.

Feldman, Martha S. and Pentland, Brian T. (2003) *Reconceptualizing Organizational Routines as a Source of Flexibility and Change*, in "Administrative Science Quarterly", 48(1), pp. 94-118.

Flyvbjerg, Bent (2006) *Five Misunderstandings About Case-Study Research*, in "Qualitative Inquiry", 12(2), pp. 219-245.

Geiger, Daniel (2022) *Routine dynamics and paradox: A revised research agenda*, in "Scandinavian Journal of Management", 38(4), 101244.

Geiger, Daniel, Danner-Schröder, Anja and Kremser, Waldemar (2021) *Getting Ahead of Time—Performing Temporal Boundaries to Coordinate Routines under Temporal Uncertainty*, in "Administrative Science Quarterly", 66(1), pp. 220-264.

Gherardi, Silvia (2023) *The fluid affective space of organizational practices*, in "Qualitative Research in Organizations and Management: An International Journal", 18(5), pp. 1-19.

Goh, Kenneth T. and Pentland, Brian T. (2019) *From Actions to Paths to Patterning: Toward a Dynamic Theory of Patterning in Routines*, in "Academy of Management Journal", 62(6), pp.1901-1929.

Howard-Grenville, Jennifer A. (2005) *The Persistence of Flexible Organizational Routines: The Role of Agency and Organizational Context*, in "Organization Science", 16(6), pp. 618-636.

Howard-Grenville, Jennifer A., Rerup, Claus, Langley, Ann and Tsoukas, Haridimos (eds.) (2016) *Organizational routines: How they are created, maintained, and changed*, Oxford (UK), Oxford University Press.

Howard-Grenville, Jennifer and Rerup, Claus (2017) *A Process Perspective on Organizational Routines*, in Ann Langley and Haridimos Tsoukas (eds.), *The SAGE Handbook of Organization Process Studies*, London, SAGE, pp. 323-337.

Järvinen, Margaretha and Mik-Meyer, Nanna (2020) *Qualitative Analysis: Eight Approaches for the Social Sciences*, London, SAGE.

Kabel, Kristine, Christensen, Mette V. and Brok, Lene S. (2022) *A focused ethnographic study on grammar teaching practices across language subjects in schools*, in "Language, Culture and Curriculum", 35(1), pp. 51-66.

Kiær, Karina (2020) *Spændinger mellem testdata og valg af læremidler. Et virksomhedsteoretisk perspektiv på læsevejledning i skolen*, in "Learning Tech", 8, pp. 94-121.

Kiær, Karina (2023) *Læsevejledning og databrug som organisatoriske rutiner i folkeskolen* (Bd. 2023), Aarhus Universitet, DPU [PhD Dissertation].

Kiær, Karina and Albrechtsen, Thomas R. S. (2020) *Forandringer i organisatoriske rutiner: Læsevejledning og testning i skolen som eksempel*, in "Forskning og Forandring", 3(1), pp. 28-46.

Kiær, Karina and Albrechtsen, Thomas R. S. (2023) *Sandfærdig, retfærdig, omsorgsfuld: Databrug og professionsetos i læsevejledningen*, in "Learning Tech", 8(13), pp. 55-77.

Kiær, Karina and Albrechtsen, Thomas R. S. (2024) *Enacting Professional Responsibility in Literacy Coaching: A Sociomaterial Perspective*, in Lars E. D. Knudsen, Merete Wiberg, Karen B. Petersen and Lisbeth Haastrup (eds.), *Teacher Ethics and Teaching Quality in Scandinavian Schools: New Reflection, Future Challenges, and Global Impacts*, London, Routledge, pp. 202-216.

Langley, Ann, Smallman, Clive, Tsoukas, Haridimos and Van de Ven, Andrew H. (2013) *Process Studies of Change in Organization and Management: Unveiling Temporality, Activity, and Flow*, in "Academy of Management Journal", 56(1), pp. 1-13.

Latour, Bruno (1986) *The powers of association*, in John Law (ed.), *Power, action belief: A new sociology of knowledge?*, London, Routledge and Kegan Paul, pp. 264-280.

Latour, Bruno and Woolgar, Steve (1986) *Laboratory Life: The Construction of Scientific Facts*, Princeton, Princeton University Press.

Law, John (2002) *Objects and Spaces*, in "Culture & Society", 19(5-6), pp. 91-105.

Lindberg, Kajsa and Walter, Lars (2013) *Objects-in-Use and Organizing in Action Nets: A Case of an Infusion Pump*, in "Journal of Management Inquiry", 22(2), pp. 212-227.

Mol, Annemarie (2002) *The Body Multiple: Ontology in Medical Practice*, Durham, Duke University Press.

Mol, Annemarie and Law, John (1994) *Regions, Networks and Fluids: Anaemia and Social Topology*, in "Social Studies of Science", 24(4), pp. 641-671.

Orlikowski, Wanda J. (2007) *Sociomaterial Practices: Exploring Technology at Work*, in "Organization Studies", 28(9), pp. 1435-1448.

Parmigiani, Anne and Howard-Grenville, Jennifer (2011) *Routines Revisited: Exploring the Capabilities and Practice Perspectives*, in "The Academy of Management Annals", 5(1), pp. 413-453.

Pentland, Brian T., Hærem, Thorvald and Hillison, Derek (2011) *The (N)Ever-Changing World: Stability and Change in Organizational Routines*, in "Organization Science", 22(6), pp. 1369-1383.

Pentland, Brian T., Mahringer, Christian A., Dittrich, Katharina, Feldman, Martha S. and Wolf, Julia R. (2020) *Process Multiplicity and Process Dynamics: Weaving the Space of Possible Paths*, in "Organization Theory", 1(3), pp. 1-21.

Pentland, Brian T. and Feldman, Martha S. (2007) *Narrative Networks: Patterns of Technology and Organization*, in "Organization Science", 18(5), pp. 781-795.

Pentland, Brian T. and Feldman, Martha S. (2008) *Designing routines: On the folly of designing artifacts, while hoping for patterns of action*, in "Information and Organization", 18(4), pp. 235-250.

Quinlan, Elizabeth (2008) *Conspicuous Invisibility: Shadowing as a Data Collection Strategy*, in "Qualitative Inquiry", 14(8), pp. 1480-1499.

Rosa, Rodrigo A., Kremser, Waldemar and Bulgacov, Sergio (2021) *Routine Interdependence: Intersections, Clusters, Ecologies and Bundles*, in Martha S. Feldman, Brian T. Pentland, Luciana D'Adderio, Katharina Dittrich and David Seidl (eds.), *Cambridge Handbook of Routine Dynamics*, Cambridge (UK), Cambridge University Press, pp. 244-255.

Rothery, Joan and Stenglin, Maree (1994) *Exploring Literacy in School English – Write it Right: Resources for Literacy and Learning*, Sydney, Metropolitan East Disadvantaged Schools Program.

Sisson, Diane and Sisson, Betsy (2024) *The Literacy Coaching Handbook: Working With Teachers to Increase Student Achievement* (2nd ed.), New York, Routledge.

Star, Leigh S. (2010) *This is Not a Boundary Object: Reflections on the Origin of a Concept*, in "Science, Technology, & Human Values", 35(5), pp. 601-617.

Svabo, Connie (2009) *Materiality in a practice-based approach*, in "The Learning Organization", 16(5), pp. 360-370.

Sydow, Jörg, Schreyögg, Georg and Koch, Jochen (2009) *Organizational Path Dependence: Opening the Black Box*, in "Academy of Management Review", 34(4), pp. 689-709.

Sørensen, Estrid (2005) *STS goes to school*, in "Critical Social Studies", 9(2), pp. 15-28.

Thomas, Gary (2015) *How to Do Your Case Study* (2nd ed.), London, SAGE.

Tsoukas, Haridimos and Chia, Robert (2002) *On Organizational Becoming: Rethinking Organizational Change*, in "Organization Science", 13(5), pp. 567-582.

Wolthuis, Fenna, Hubers, Mireille D., van Veen, Klaus and de Vries, Siebrich (2021) *The Concept of Organizational Routines and Its Potential for Investigating Educational Initiatives in Practice: A Systematic Review of the Literature*, in "Review of Educational Research", 92(2), pp. 249-287.

Åsvoll, H. (2014) *Abduction, deduction and induction: Can these concepts be used for an understanding of methodological processes in interpretative case studies?*, in "International Journal of Qualitative Studies in Education", 27(3), pp. 289-307.