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Emergent school leader subjectivities in digitized practices: the case of VSware

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ABSTRACT

This article provides insight into digitized school leadership practices in Irish schools, and the making of the school leader in mediations with the sociomaterial relations emerging from these practices. Drawing on actor-network theory, the study illustrates how school leaders' subjectivities emerge through relations and attachments to VSware, a software package for monitoring student attendance, behavior, and performance. VSware elements and interviews with school leaders at three secondary schools are analyzed using material-semiotic methodology. Findings indicate the school leaders constantly emerge in their leadership positions in schools through relations that are intrinsic and external to the VSware software, whereas VSware elements work as highly specific 'subjectifiers'. Likewise, findings show that school leaders can shape and steer elements in VSware. This suggests the relations and subjectivities that emerge in digitized leadership practices in schools have fluid characteristics, albeit with different and sometimes asymmetrical ways of 'acting on each other'.

Introduction

This article provides insight into digitized school leadership practices in Irish schools, and the making of the school leader in mediations with the sociomaterial relations emerging from these practices. Since the introduction of SchoolsIT in 2000, Irish schools have undergone various digitalization phases. The most recent initiative, Digital Strategy for Schools 2015–2020, highlights digital school leadership as vital for effective integration of other school policies and initiatives, such as School Self-Evaluation (SSE; Department of Education and Skills, 2015a). With the dual commitment to integrating data use for school accountability with digitalization, Irish school principals produce and have access to a vast amount of digital data, albeit with varying assimilation in practice (O'Brien et al., 2019). Data-driven leadership is made possible and enhanced by digital technologies of education (Williamson, 2017), and implies a strong emphasis on governing knowledge through performance monitoring and surveillance, putting at the forefront school leadership that can document, operate, and exploit school data (Selwyn, 2016). Although studies have revealed the narratives

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and identity stories of school leaders in the neo-liberal climate by referring to policy, accountability, and use of data (Gunnulfson, 2021; Heffernan, 2018; Rezai-Rashti & Segeren, 2020; Sugrue, 2015), the making of the school leader by ‘zooming-in’ (Nicolini, 2012) on digitized practices remains underdeveloped (although, see Landri, 2021).

In social sciences, the terms *subject* and *subjectivity* often refer to various processes of micro- and macro-sociological approaches that emphasize human intention, action, and response in various ways. One can find subjectivity viewed as a force of mind and rationality (Boudon, 1986), the embodied subject with representations of bodily responses, such as affect (Braidotti, 2013; Brøgger, 2018), and the political subject in various systemic, historical, and cultural contexts (Cremonesi et al., 2016; Niesche, 2013; Niesche & Heffernan, 2020).

In this study, I decenter intrinsic human properties as something retained from the mind, the body, the history, or the context. I draw on actor-network theory (ANT) to conceptualize subjectivation as emerging human actors that form attachments and relations to their social world. In this view, the school leader internalizes certain properties only as they attach to other entities that allow them to *become*. This is not to say that context, history, and culture are disconnected from the subject in the ANT perspective; on the contrary, the subject is expressed through constantly fluctuating configurations that *make* the social world and the actor at various points in time and space. For ‘outside’ expressions to be internalized, one has to understand practice through configurations that may stretch indefinitely through various relations among humans, things, and discourses. An eminent characteristic of these relations is their ability to work as ‘subjectifiers’ (Latour, 2005). Therefore, the practice and its constituent relations are the focus in this article, as opposed to the subject as an ontological figure (Rebughini, 2014).

Digital practices make an interesting case, as our digital lives enable us to activate a whole range of activities. Websites, software, and platforms are enfolding and enfolded by the social, and when studied in practice, the digital actively enacts particular user subjectivities. Although some literature has focused on the digital subject as subjects existing in (and only in) data, models, biometrics, and so on (Goriunova, 2019), the interest in this paper is how the subjectivities of school leaders are mediated in their interactions with digital software. In education, scholars have found that students’ subjectivities may be found in data, numerical or visualized (see for instance, Nemorin, 2017). However, digital software that targets the learner can enact various subjectivities extending from the students’ point of view because educational technology is designed to serve many different actors. For school leaders, data-driven practices imply an interaction with student data as they are collated and analyzed to address challenging issues of curriculum, quality, and development. This suggests that leadership subjectivities may also emerge from the enactment of a software program that assesses students’ learning and motivation, although the subjectivities are usually connected to leadership responsibilities of monitoring teachers’ work, evaluating in-house practices, reporting, and surveilling. Therefore, in this paper, I have chosen to investigate and disentangle VSware in school leadership practices, a software package offered to Irish secondary schools to monitor student attendance, behavior, and performance. The elusive nature of how digital–human assemblages create certain school leadership subjectivities and

simultaneously construct and reconstruct each other is highlighted by referring to ANT (analytical framework) and material-semiotics (methodology) in this article. I ask the following research questions:

RQ1: What are the relations that emerge within and between VSware, school leaders, and other actors?

RQ2: How do school leadership subjectivities emerge in the relations between VSware, school leaders, and other actors?

The paper is organized as follows: First, I present the theoretical underpinnings of ANT and subjectivation. Building on these premises, I present the methodological considerations as twofold within a material-semiotic approach; the methodological steps done to examine relations within the VSware software and the analysis of school leaders' practice with VSware at three secondary schools in Ireland. Then I present my findings and discuss them as 'scenes' of practice, before pointing to contributions and considerations for future research.

Analytical framework

In this section, I highlight three main sensitivities of ANT that are deployed to discuss subjectivity as an emerging effect (Latour, 2005; Moser, 2003). I take a broad view of what constitutes school leadership, and I refer to school leaders as all of those holding leadership positions in various forms within schools (principals, assistant principals, year heads, etc.). Moreover, following the ANT perspective, actors include any given entity that participates in an activity, gives meaning to an activity, or is affected by an activity in relation to other actors (Latour, 2005).

ANT in human–digital assemblages¹

This study displays three connected features of ANT: heterogeneity, semiotic relationality, and materiality, or materialization of practice (Law, 2009). I use *heterogeneity* in this analysis as an analytical starting point. In ANT, human and non-human actors may form a configuration of practice and are of equal importance to the analysis (Law, 2009). This implies the analysis is sensitive to the performative effects of human–digital assemblages. In the first part of the analysis, heterogeneous entities (such as data in various forms, organizations, educational frameworks, and so forth) were identified. Although this first step demonstrates a 'mapping' of entities (Crossley, 2015; Youdell & McGimpsey, 2015), ANT remains a relational approach. *Semiotic relationality* refers to a view of practice as configurations of entities that define and shape one another through the relations they form (Fenwick & Edwards, 2012; Law, 2009). Such a relational notion negates the 'individual' in how actors act, and that a practice cannot be reduced to individual actors' capacities (Crossley, 2015). Instead, ANT builds on interdependency in that an actor cannot do or influence a practice in and by itself, but does so as the actor *becomes* through interactions and relations to other actors (as they, too, 'become'). The study of such emergent actors implies that school leaders, or a digital element from VSware, obtain

their properties and characteristics as a result of materialization processes that make up such entanglements. Consequently, the analysis of the relations is reflected as a stepping stone for identifying the actors.

In the process of the materialization of monitoring software like VSware, actors may emerge with certain characteristics. A school leader may emerge as successful or not based on visualized school data, and a student may emerge as 'low performing' or 'high performing': Both are from the same digital element of software like VSware but display the different sorts of relations (and effects) attached to it. This *materiality* (Law, 2009), or *materialization of practice*, attributes fluid characteristics to relational configurations. Although the performative properties of actors are established relationally, these same actors are not detached from previous, present, or future assemblages. In practice, this implies that the materialization of school leaders' use of VSware may maintain traces of other materializations, for example, processes of national school completion programs. This notion suggests various internal and external relations enfolded in digitized leadership practice. It also displays how leadership subjectivities may be shaped by, and mutually shape, the configuration of practice through its constituent actors.

Subjectivities as emerging effects of human–digital assemblages

The relational premise in this paper has two main focuses: disentangling relations and tracing the emerging effects of these relations (Crossley, 2015; Decuyper, 2019a; Fenwick & Edwards, 2012). I draw from Latour's (2005) work to analyze subjectivity as an emerging effect that is relationally produced and made possible in practice. Thus, by drawing on *semiotic relationality*, I analyze and discuss the subjectivities that emerge from material-semiotic relations in human–digital assemblages as 'neither inherent intellectual capacities nor a socially constructed core of identities in individualized, natural bodies, but positions made possible in material practices and relations' (Moser, 2003, p. 86). The exact force of the semiotic relations is described by Latour (2005) as a fluid essence of 'subjectifiers' or 'plug-ins'. Plug-ins, a term used to mirror our digital lives, relate to bits and pieces of practice that when attached to the human actor *activate* and internalize what was not necessarily always visible. Thus, school leaders are composed of layers and layers of the self as a provisional achievement of the assemblage (Decuyper, 2019b; Latour, 2005). The central point is that an actor's characteristics are *attached*, meaning it is not a human property but a constant state of becoming, and thus, a constant circulation of emerging subjectivities. In the analysis, I look for relations and actors as 'plug-ins' that directly or indirectly contribute to building the school leader within interactions with VSware. Therefore, entities that I did not deem as contributing to the establishment of school leaders as actors are not included in the analysis.

In Latour's (2005) proposed process of emerging subjectivities, the subject is shaped through relations, but they are mutually able to shape whatever or whoever they are shaped by. I frame this simultaneity as the ability to 'act on each other'. The flux of digital elements (numbers, colors, or other data visualizations) is often static in the sense that these elements have already been 'produced'. The notion of subjectivities is far more fluid, and is always being constructed and reconstructed by its relational agentic forces (Højgaard & Søndergaard, 2011). However, a subject (a school leader) can alter the aims of the data produced or gather a new series of data that may have different characteristics

and ambitions to provide alternative information about the same cause. In turn, the school leader may adapt to the piece of data by changing school policy, and it may cause a reshaping of the school leaders' subjectivity as they are assembled and mobilized. This exemplifies the simultaneous, mutual, and agentic shaping of actors in semiotic relations, albeit with varying actions taking place in terms of altering (the data) and being set in motion (the school leader). It also implies that all actors are able to govern, and be governed, as a continuous process in practice (Fenwick, 2010; Højgaard & Søndergaard, 2011).

Last, as the process of concurrent, past, and future *materializations* reminds us, actors may hold traces of other relations that extend beyond the analyzed configuration. In this article, this is shown in terms of digital actors in VSware that hold certain characteristics in relation to external actors, such as texts, frameworks, and outside organizations.

Methodology: tracing actors, relations, and emerging subjectivities

In this section, I introduce a short description of VSware, the types of data collected from the software, and the mode of analysis and description for the analysis of the software. Then I focus on the second data set (interviews) and the analytical tools.

VSware: potential actors, actions, and subjectivities

VSware is a software package offered to Irish schools by the Ireland-based company with the same name. The software package includes features for attendance tracking, assessment and assessment analysis, behavior records, and scheduling. VSware is available on mobile applications, iPad applications as well as online, and has an Office 365 integration. Access must be granted and is monitored by the schools, and students and parents may be provided access. VSware was purposefully selected for this study because it draws on data-driven school leadership practices that update in real time and is one of the most frequently used software packages in Irish secondary schools. In the first part of the study, I positioned myself as a potential user of the VSware software. Because of issues concerning data protection, screenshots provided by the informants were used as data from VSware.² Two VSware features (attendance and behavior) were chosen to display the relational composition within and between VSware, school leaders, and other actors.³

ANT offers sensibility toward understanding practices as always material, and always semiotic because the relations that form between elements give meaning to an activity (Akrich & Latour, 1992). I combined the ANT sensitivities with material-semiotics in the analysis of the VSware screenshots, an approach that is commonly used in digital systems research, and that can easily be applied to the unpacking of digital software (Cabitza & Mattozzi, 2017; Landri, 2019; Mattozzi, 2010).

First, I analyzed the VSware data (screenshots) to disclose the digital elements. I paid particular attention to digital elements such as colors, icons, text, figures, and numbers. From these data, I analyzed the semiotic relationality (Law, 2009) between the various digital elements and examined how colors are used, how colors are used to distinguish one from the other, links that are established between different colors, and the relations between colors and other elements, such as a specific icon in the software. When I spotted links between elements, I analyzed what types of actions the elements encourage (scripts),

how users are addressed, and the type of interactions users may construct with the software. This analysis yielded insight into the way in which user subjectivities may emerge (Decuyper et al., 2014), and how school leaders may ‘act on’ the software. As the last step, I analyzed relations that may extend beyond the inherent VSware elements when materialized in practice (Law, 2009). They include relations to human actors in various positions, but also to materials, such as curriculum frameworks. While structuring this part of the analysis as potential actors, relations, and materializations of practice, I view the material-semiotic analysis of VSware as a tentative result of the subjectivities that may emerge as school leaders interact with the software.

External relations: interviews

As ANT reminds us, it is only within a practice that relations and their effects may fully emerge (Crossley, 2015; Fenwick & Edwards, 2012; Law, 2009). The relations inherent to VSware can take different spatial relations beyond their own stable interactions. The second data set of this study is the interviews conducted with school principals and middle management (see Table 1). Schools were chosen based on their everyday practice with VSware at the secondary level (Junior and Senior Cycle). The school leadership roles of the informants varied, but all middle managers were members of the schools’ management teams.

To map actors and relations in practice, it was important to allow for a particular mode of design and analysis for the interviews. Although observing or ‘shadowing’ school leaders would have shed light on some in-house leadership practices, it is my belief that this type of approach would have been more fruitful had the main aim of this study been digitized leadership practices in general, and not targeted toward a specific software. Additionally, to avoid issues of access and data protection, another type of design was sought as a way of gaining rich and thick descriptions. The individual interviews were conducted with the principals, and group interviews were conducted with informants who were middle managers. All interviews were semi-structured, where the primary focus was on bringing the narratives of the VSware activities to the forefront. Informants were asked to describe their personal use of the VSware features. The screenshots were brought to the interviews and displayed through a projector. The interviews were recorded by using the software Captura, which records sound and onscreen activity simultaneously. The informants were asked to reflect upon and describe situations using the software, and were able to demonstrate and exemplify by interacting with representations of VSware during the interviews. The main aim of the interviews was to examine the relations that take place in the informants’ interaction with the software. When deemed necessary, I probed by asking questions about exactly what

Table 1. List of interviewed informants.

Informants	School A (Sa)	School B (Sb)	School C (Sc)	Total
Principals	1	1	1	3
Deputy principals	0	1	0	1
Assistant principals	0	1	0	1
Year heads/heads of departments	3	2	2	7
SNE coordinators	0	0	1	1
TOTAL	4	5	4	13

elements, who or what engaged in the activities the informants portrayed. The interviews were later transcribed, with accompanying screenshots according to the discussions taking place in the interviews. The interview design used the three ANT sensitivities as parameters: I followed the actors and relations by engaging with the informants' descriptions of their actions (Latour, 2005).

The interviews were analyzed according to 'scenes' of practice. Each scene is introduced by a segment from the interview data, with a brief description of the activity. The segments (or quotations) are presented in the scenes to account for the informants' reflections, and as a presentation of the subjectivation process stemming from the digitized practice. Then, the heterogeneity and semiotic relationality (Law, 2009) of the scene are analyzed. The actor characteristics materialized from the relations are then used as a stepping stone to analyze school leaders' subjectivities as they emerge, reemerge, and dis-emerge in interactions with plug-ins (Ferreira, 2020; Latour, 2005) during the various scenes. Rather than classifying the school leaders as actors in a given leadership orientation, I looked for clues in the uses of VSware that pointed to specific techniques of the self (Ferreira, 2020). For instance, in the description of using VSware data to report to outside agencies, a school principal (School A) noted:

If I'm on the phone with an outside agency, I can print all that information, attendance, all that, or I can look up the school reports, and at a glance, I can say yes, she's doing well in history, she's doing well in geography, she's not so good at maths. So I have it [VSware attendance data] in front of me.

In this quote, the actors identified are an outside agency, VSware attendance information, school reports, and the principal. The relation of interest, in particular, is between VSware data and the principal, as the former works as a 'plug-in' for the school leader to emerge as confident in his effort to respond to an external inquiry by having the VSware data 'in front' of him at that particular moment.

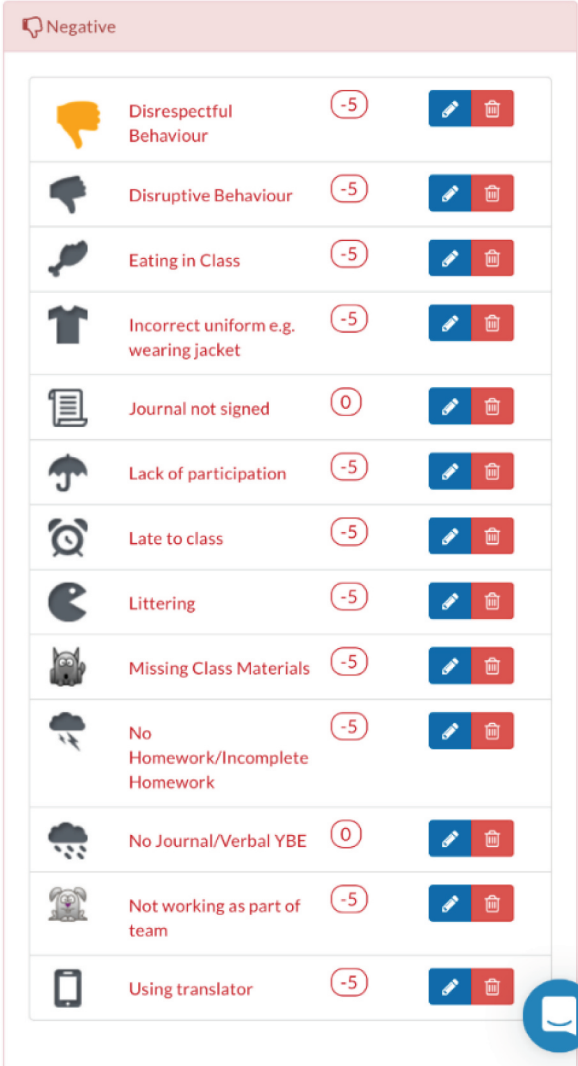
Last, I focus on the premises of the relation to discuss how the actors 'act on each other' as they mutually shape one another (Fenwick & Edwards, 2012; Højgaard & Søndergaard, 2011). The discussion builds on the previous analysis of actors and relations to determine 'who does what' and in that way, shed light on the sometimes asymmetrical ways of how actors contribute to an activity.

Unpacking relations and subjectivities within and beyond VSware

I focus on two points in the presentation of the analysis: the inherent elements and relations of VSware and external relations of VSware and leadership subjectivities as emerging effects.

The VSware software

In this section, I draw from the material-semiotic analysis to unpack VSware's digital elements. The analysis shows how VSware emerges as software with multiple material, digital, and discursive elements. Simultaneously, the analysis addresses how VSware enables certain actions, by looking at how the relations between digital elements address and invite school leaders to contribute to a specific activity.










































Icon	Behavior Category	Score	Actions
	Disrespectful Behaviour	-5	 
	Disruptive Behaviour	-5	 
	Eating in Class	-5	 
	Incorrect uniform e.g. wearing jacket	-5	 
	Journal not signed	0	 
	Lack of participation	-5	 
	Late to class	-5	 
	Littering	-5	 
	Missing Class Materials	-5	 
	No Homework/Incomplete Homework	-5	 
	No Journal/Verbal YBE	0	 
	Not working as part of team	-5	 
	Using translator	-5	 

Figure 1. Negative VSware behavior categories.

The behavior page on VSware encompasses behavior categories (Figure 1 and Figure 2), and behavior entries (Figure 3). Figure 1 and Figure 2 show behavior categories. Icons, text, and numbers are framed in the behavior categories. The text in each category is written in red or green, depending on whether the category awards negative or positive behavior. The accompanying numbers indicate scores, and the icons to the right provide visuals for each behavior category. The framed behavior categories are user-friendly and intuitive for potential users: school leaders, teachers, students, and parents.

VSware includes many behavior categories, some of which represent key skills from the Key Skills Framework in the New Junior Cycle (the current school curriculum for the lower secondary level in Ireland), such as ‘being creative’, ‘managing information and thinking’, ‘staying well’, and ‘managing myself’ (Department of Education and Skills, ,

Positive		Showing Leadership Skills	
 Being Creative	5	 Sin i Gaeilge!	2
 Class Participation	5	 Sixth Year Class Test	0
 Exemplary Homework	5	 Speaking in the Target Language	5
 Fifth Year Class Test	0	 Staying Well	5
 First Year Class Test	0	 Third Year Class Test	0
 Great Communicating	5	 Word of the Week	2
 Growth Mindset	5	 Working with Others	5
 Listening to the Other Side	5	 You spotted Maths!	2
 Managing Information & Thinking	5		
 Managing Myself	5		
 Perfect Term Attendance	20		
 Perfect Weekly Attendance	5		
 Presentation of Work	5		
 Second Year Class Test	0		

Figure 2. Positive VSware behavior categories.

2015b). However, as the two elements to the far right in the behavior sections indicate (Figure 1 and Figure 2), the user may change or delete the categories: The blue pencil symbolizes an editing function, and the red trashcan icon signifies that the user may delete the category. On one hand, the behavior categories work as a point system, where teachers and school leaders are encouraged to award students points for certain behavior. On the other hand, the point system ‘does’ more than simply encourage and provide school leaders with a ready-to-use classification for desired student behavior: The system provides the possibility to invite users to interact with the point system by adding customized categories. In this sense, school leaders are encouraged to evaluate the quality of the point system and to make changes according to their school circumstances. As users make changes to the point system, they can also change what is framed, or included, as valued and disvalued behavior. In relation to the other icons, text, and numbers, the edit and delete icons gesture the specific action of altering and adapting a behavior-awarding system.

As students are given points based on their behavior, it is registered as a behavior entry in VSware (Figure 3). The background color of the entry corresponds to positive and negative behavior. Included in each behavior entry are icons, the number of points, and



Figure 3. Behavior entries in VSware.

five rows of text. The textual elements represent data: the date and time of the incident, the subject, the type of behavior awarded, who gave or registered the VSware points, and a notes section for a qualitative description of the incident. At the top-left corner, there is a blue pencil icon, meaning the behavior entry can be edited. For school leaders, the behavior entries work mainly as an inscription activity, but the behavior entry also invites continuous monitoring (of students' and teachers' work) and may be used for reporting purposes. In addition, the person with editing access (usually the year heads and the principal) can edit the behavior entry, in the event that something needs editing.

The color theme continues and is expanded in the VSware attendance feature. [Figure 4](#) shows a student's attendance record for the 2019–2020 academic year. There are three different color-coded pie charts, including a line underneath that has four different color headings. The pie chart to the far left titled Absent Days has three contrasting colors: red, amber, and green. The text underneath explains the meanings of the colors: Red is absent, amber is partially absent, green is present, and blue is unexplained absence. As can be seen at the top of the Absent Days pie

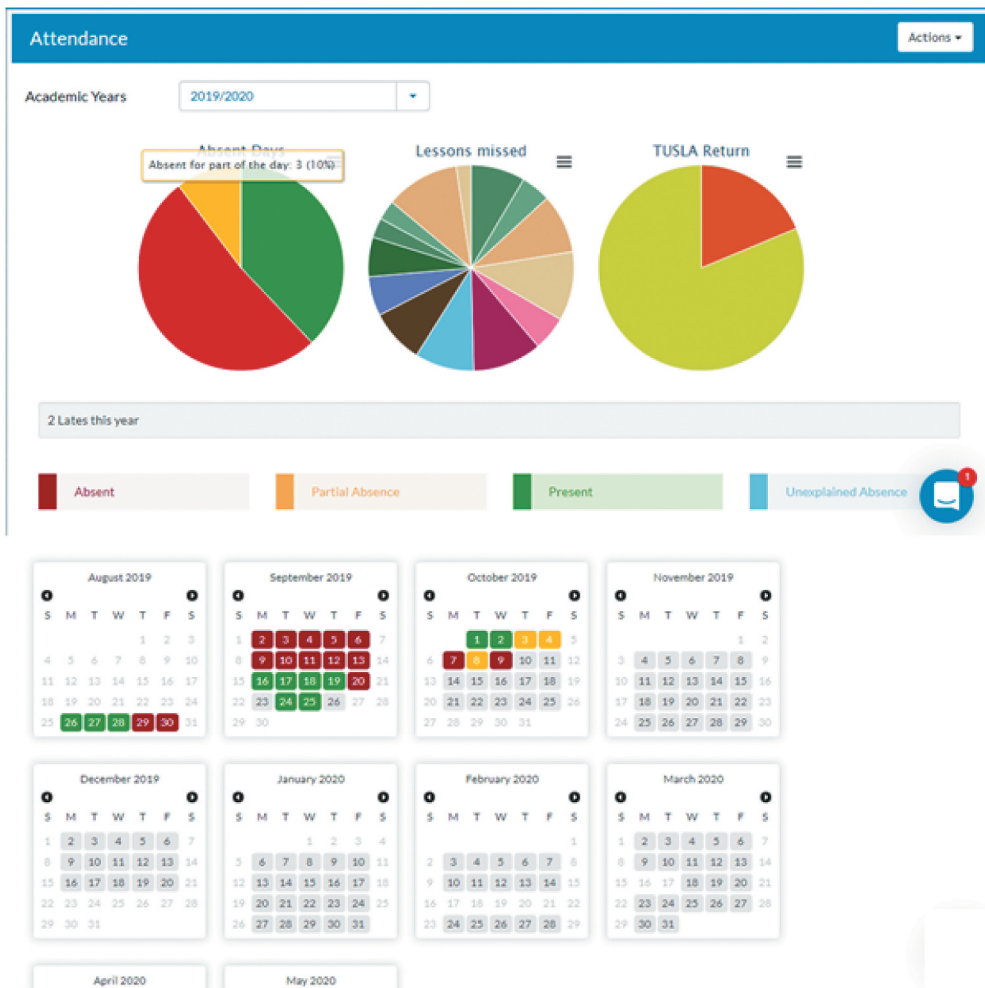


Figure 4. Student attendance record shown in pie charts and calendars on VSware.

chart, VSware shows the number of days and the percentage of (type of) absences by clicking on the specific colors in the pie chart. The pie chart in the middle, Lessons Missed, has nine different colors; all represent specific school subjects. By clicking on a color, the user gains information on which subjects the student has been absent. The pie chart to the far right, TUSLA Return, is lime green and orange and represents an established practice of attendance reporting to the Irish Child and Family Agency. Orange signifies the number of days absent above a certain level (20 days), while lime green represents the days present in school.

Below the pie charts, there is a calendar of the academic year. Grey dates are standard school days, white dates are national holidays, and red, amber, and green dates represent the attendance information shown in the pie chart to the far left. The three color-coded pie charts and the color calendar mainly encourage inscription and reporting activity, as well as being a source of information on student attendance. The pie charts that visualize

attendance in school and within school subjects encourage attendance tracking for internal use, but the TUSLA Return pie chart works as a direct link between the school, the student, home, and the Child and Family Agency.

The analysis of VSware indicated various relations between colors, icons, text, numbers, and figures, all representations of links between (digital) elements. In terms of descriptions of activities and potential subjectivities, two points should be emphasized. First, the setup of the behavior feature on VSware allows for certain flexibility and autonomy. Users (in this case, school leaders) are invited to employ a predefined list of behavior categories as well as modify the categories. The categories can be modified according to the schools' needs. Similarly, the behavior entries can be modified if the user changes their mind, or if the year head or principal notices something is missing or needs editing. This flexibility within the behavior monitoring scripts gives a sense of autonomy, and although the predefined categories may steer school leaders and teachers toward awarding certain behaviors, they are simultaneously encouraged to challenge these categories. These are clear indications of mutual and agentic shaping of actors, respectively, defining the characteristics of the relation that emerges between the behavior categories and the user (Fenwick & Edwards, 2012; Højgaard & Søndergaard, 2011). Both actors may emerge as 'the governed' and 'the one who governs' as the material-semiotic relation encourages both actors to 'act on each other'. Put differently, school leaders may emerge as an autonomous subject.

Second, although the inherent relations between the digital elements of VSware may encourage monitoring, inscription, reporting, and editing practices, the software also encourages certain external relationships for these activities to take place. These relations include relations with outside agencies, as well as material actors such as curriculum frameworks. On one hand, the predefined categories in the VSware behavior feature link to the Key Skills Framework, and in so doing show traces of previous materializations of the assessment of these key skills. On the other hand, the other categories in relation to the edit and delete functions imply that there may be additional materialization processes tied to the same behavior feature in the past and the future, for instance, in terms of specific school targets at the class, subject, or school level. This is also the case for the TUSLA Return pie chart as it suggests external relations with the Child and Family Agency, whereas attendance records materialize as a reporting practice to external actors. In this case, the user, school leaders, may emerge as accountable to outside agencies.

VSware in use: emerging leadership subjectivities

In this section, I provide a short description of the three schools and the leadership teams' predominant practices with VSware. Then, I present my findings as 'scenes' of practice.

School A is a medium-sized Catholic voluntary secondary school in an urban area. The school is enrolled in the Delivering Equality of Opportunity in Schools (DEIS) program, a support program for schools with high percentages of students from socio-economically disadvantaged areas. The informants from School A reported that their predominant use of VSware included internal monitoring of attendance and behavior, as well as reporting to a vast number of external agencies and partnerships. School B is a large Educate Together secondary school⁴ in a suburban area. The school has made substantial efforts to digitalize their teaching and learning, including one-to-one devices

for all students and staff. The informants reported numerous activities tied to VSware, which include daily and weekly monitoring of attendance, behavior, assessment, rewarding students, home-school communication (parents have been given VSware access), and (some) reporting to outside agencies. School C is a large Catholic voluntary secondary school in a rural area. The school staff stated a wish to digitalize a greater extent of internal data use and reported that their main use of VSware included internal monitoring and information exchange. All three schools reported that they used VSware elements (numerical and qualitative data, pie charts, etc.) in leadership meetings, such as care team meetings, as well as in informed conversations with students and parents. In addition, the three schools indicated that data recorded on VSware would be presented in the event of external inspections.

Scene 1: targeting students in whole-school strategies and care team meetings

During the course of whole-school strategies, leadership meetings are set up to follow the schools' development; however, the informants reported that the same issues were often raised in care team meetings (pastoral meetings that address students' well-being). Depending on the issue, the staff present at these meetings usually have a specialist and/or leadership role: guidance counselors, principals, deputy principals, year heads, and special needs education (SNE) coordinators. In the description of an ongoing whole-school strategy targeting attendance, VSware elements are presented as central actors:

So I guess I would be looking at total attendance numbers, and then that broken down, comparing it to our school target, then narrow it down to the top offenders. It's really, mainly, data coming from VSware, for something like attendance that is, you are either in or you are out, but we would maybe be supplementing that with some feedback from tutors and year heads, regarding maybe special circumstances and reasons why you are not in school. And I guess we would be looking at what interventions we would need to put in place, looking at all our leadership roles to support the student. What would the tutor do, what would year head do, what would the deputy principal do? And then, coming up with an action plan and a date for when we will run this data and see if we've made any improvement. (ML1, School B)

Attendance numbers (as numerical data in VSware), tutors, year heads, the deputy principal, and the strategy as a whole present as actors, as they contribute to the activity of targeting specific students or student groups to reach the desired attendance objectives. This assemblage of relations indicates two central points. First, aggregated data from VSware (attendance) activate the leadership team to gather qualitative information (which may, in turn, materialize as actors during the course of the strategy) about specific students. This suggests that although the VSware data take an active part in this specific scene, the data's actor-like characteristics also extend in time to future presentations of the whole-school strategy. Second, within the segment above, we find the description 'interventions we would need to put in place' followed by 'looking at our leadership roles to support the student'. The action of putting in place interventions suggests the second action of distributing tasks and responsibilities. Thus, the VSware data not only *activate* the school leaders but also initiate certain actions of *internalizations* of leadership roles. This suggests the relation performs an action that allows for school leaders' characteristics to emerge as they attach to VSware attendance data, and their leadership role internalizes in accordance with the action (Ferreira, 2020). These relational

characteristics suggest the relation is a plug-in (Latour, 2005), a subjectifier that allows the school leaders to *become* in terms of their leadership duties. This is also highlighted in the descriptions of care team meetings:

The information that we bring would be, depending on who is bringing information, you know, a year head might bring attendance records from VSware, behavior points that have been issued by various teachers, Guidance might bring evidence of a phone call which they've had with various agencies or parents, the deputy would always bring a record of serial offenders. Students would hit our radar, and we would appoint members of the care team to follow up. (ML3, School C)

In this quote, one can detect that the school leaders emerge in their leadership position at the schools, as the year heads, deputy principal, etc. The school leader also emerges as data informed at different levels in agreement with their established role in the assemblage. The type of data (and thus, the actor) interacting with the different school leaders varies. In this view, the school leaders as data-informed emerge with more particularities according to the characteristics of the data; the school leaders emerge as data-informed by quantitative measures (year head, deputy principal) or qualitative measures (guidance counselor). These findings indicate that in this specific scene, the school leaders materialize their leadership positions within the schools through their relations with VSware and other actors (i.e. phone call records) and in that way, make the invisible characteristics of the school leader in leadership meetings visible, tangible, and traceable. This scene also highlights the fluidity of subjectivation in human–digital assemblages (Decuyper, 2019b; Højgaard & Søndergaard, 2011). The role of the school leader (as a quantitative-informed year head or a qualitative-informed guidance counselor) shifts according to the data that attach to the leader. Thus, school leaders as actors may experience a change in characteristics according to the relations the leaders form with the digital actors.

Scene 2: adjustment of behavior categories and registered data

The previous analysis of actors inherent to VSware indicated certain flexibility for users. The informants called attention to two things in this regard: their opportunity to make desired changes to behavior categories and to make necessary changes to secure correct information. First, the schools had made substantial changes to the VSware behavior categories by adding new ones. This was done predominantly to reflect new whole-school strategies and projects:

That [Growth Mindset category on VSware] was actually only recently added, stemming from a leadership meeting on the end of this year. (...) We have always been a growth mindset school; we kind of wanted to recognize that effort on VSware as well. (ML2, School B)

In this short quote, the actors are an added growth mind-set category in VSware (see Figure 2), the leadership team, and the school as a whole. In addition to these actor relations, I draw attention to the actor that makes the materialization of added categories a reality: the blue pencil button in Figure 1 and Figure 2. Within the scene of adjusting the behavior categories, the blue pencil button works as a highly specific plug-in (Latour, 2005). The action of adding a new category (here, growth mind-set) renders self-reflection possible and sets school leaders in motion to make it their 'own' which allows them to act on the digital

actors in a greater extent than in scene 1. This segment highlights how the school leader emerges as an autonomous subject, not only by inherent scripts of the software (Akrich & Latour, 1992; Cabitza & Mattozzi, 2017) but also by the presentations of interactions in practice. New behavior categories, and thus, a new series of data, are constructed to visualize other aspects of the school, such as their work with growth mind-set. Other self-customized categories include ‘you spotted maths!’ and ‘sin i Gaeilge’ (Figure 2). These categories do not pertain to certain student behaviors; instead, the categories mirror school efforts to optimize numeracy and use of the Irish language. In this case, the school leader’s characteristics are not only defined by VSware; the leaders are also able to change the characteristics of the digital actor to move beyond its intentions of monitoring student behavior, and by so doing, forge relations with external actors, such as national or local whole-school strategies.

Second, the school leaders at all three schools reflected clear responsibilities tied to their autonomous role in practice. This became especially evident in a scenario portrayed by one principal, where the relation between the school leaders, teachers, and behavior data implies VSware serves as an important actor in monitoring, controlling, and intervening in teachers’ work:

Sometimes, teachers go in and vent, the steam coming out the computer because they are so angry at what has just happened. Sometimes you get the ‘I’m so, so angry, and I am fuming,’ and I’m saying well that’s not really relevant, because if I bring a parent in, and I have to read this back to the parent . . . Some teachers were using VSware entries as a punishment (. . .), so we’re saying, as a teacher you must record what happened, and record what you did to deal with the situation. (. . .) I’m there to monitor that every day because it’s great to have the statistics. (Principal, School A)

In this segment, the principal is describing the qualitative comments in behavior entries (Figure 3) and his efforts to monitor what teachers record. He described how he, in some cases, engages directly with the behavior entry by using the editing function of the blue pencil button. Moreover, he later appointed other members of the leadership team to carry out collective comment training for school staff. The blue pencil may be identified as a plug-in that allows for activation of the school leader as a monitor of teachers’ work, aiming attention at a new series of activities, including staff training. Although scene 1 established a school leader’s fluid notion of subjectivities, scene 2 attributes flexible and adjustable characteristics to the traditionally stable (digital) actor as well. As a result, the dual function of the digital actor (the blue pencil button) illustrates how they present themselves with various leadership subjectivities, according to the attachments formed with the leaders. This finding indicates the ability of ‘acting on each other’ as intrinsic to human–digital assemblages (Fenwick & Edwards, 2012; Højgaard & Søndergaard, 2011).

Scene 3: reporting to outside agencies

The informants described using VSware to report to various outside agencies. The following quotation illustrates informal reporting to external social workers:

The number of outside agencies that I worked with who care for the kids; social workers who are different, external services, and they ring up and you know, I would talk to them (. . .), I can open up the thing [VSware] and they’re talking and saying, you know, ‘Is attendance an issue?’ and I can say, ‘Well no, she hasn’t missed one day this week, or she hasn’t missed any days the last month,’ and it’s all there in front of me. (Principal, School A)

Another segment exemplifies reporting to the Garda (police) and securing that they have the necessary information to know their school:

They [Garda] could come along; there could be a trial about absenteeism. Maybe they are bringing a parent to court because of lack of attendance. I need to have accurate records, and another court case was missing school, and having inappropriate relationships, they were trying to track the date a student was out, to try to convict somebody, and again, it was important that I had accurate information. (Principal, School A)

The specific VSware element that emerged as an actor in both segments above is attendance data (Figure 4), in relation to other actors, such as the principal, social workers, and the Garda. In this case, attendance data work as a specific plug-in that ensures the school principal is able to emerge as a confident and responsible school leader who has accurate records for his students. This highlights how data-informed activities allow the school leaders to function confidently in their roles within the school. In a broader picture, the attendance data play an important role in surveillance performed by schools (Williamson, 2017), where the school leaders can position themselves in systemic tasks as they forge relations with external actors.

Moreover, Latour (2005) reminded us that plug-ins are specific *activators*. The actions motivated by attendance data in this case are setting school leaders in motion to secure correct information in VSware as the data are ‘only as good as the people who record it’ (Principal, School C). The characteristics of attendance data as a plug-in continue to materialize in school leaders’ exact protocols for fact-checking attendance data before external inquiries are made:

Where you see an amber there [Figure 4], that is whether they are in-and-out in one day. Red is they’re absent, and green means they’re present. But also, amber could mean a missed register. So I would have to open up a lot of those ambers and be going, ‘Oh, present, present, present, blank, present, present. I’m guessing that student was there.’ And I’d basically mark them in. But, ‘cause all those gaps, because if I’m running an attendance report or if there are those gaps, it won’t, I won’t obviously get a true picture. So I spend a lot of time looking at those amber little dots there. Wishing they were red or green. (ML1, School B)

The characteristics of attendance data in relation to the school leader and outside agencies remain stable in the sense that it sets the human actors in motion to collect and report factual data. However, the data materialize as more fine-grained as they are defined by colors; red, green, and amber. From this notion, I find that the plug-in in question is not attendance data in general, but broken down in color and visualized attendance data; all of which may represent three disparate plug-ins that may activate different sorts of actions. Red may activate a support apparatus for the student; amber may activate fact-checking among the leadership team.

While the school leader emerges as confident or responsible, by identifying issues with the data, they actively become a leader who engages directly with the data in terms of recording. This is made possible by internalizing their leadership responsibilities (Ferreira, 2020) and is materialized in terms of accurate data records.

Discussion and concluding remarks

The material-semiotic analysis of VSware in school leadership practice identified several actors that participated in activities of leadership meetings, reporting processes, and in-house data work. These actors include outside agencies and partnerships, national and local school improvement projects, individuals in varying positions linked to the schools, texts and other materials, as well as VSware digital elements that emerged as actors in the interactions with the actors above. Thus, the heterogeneity is clear from the analysis. However, as is intrinsic to ANT, actors have the ability to 'act on each other' as a result of the materialization process (Fenwick & Edwards, 2012; Højgaard & Søndergaard, 2011; Law, 2009).

On one hand, the analysis illustrated how digitally stable VSware elements materialize as actors; the blue pencil button emerges as an important contributor in building the schools' commitments to whole-school strategies, and the color dates in Figure 4 emerge as vital for the activity of reporting to not only TUSLA but also other outside agencies, such as the Garda. On the other hand, the flexibility of VSware allowed for the digital elements to become over-and-over again, each time with different inherent characteristics. The blue pencil button exemplifies this notion; it allowed school leaders to change behavior entries and behavior categories, which consequently, changed the scripts of the elements. Thus, the software's characteristics emerged according to the interactions it participated in to fit the schools' priorities and contextual concerns.

This is also true for the school leaders in the digitized assemblage: A range of school leader subjectivities emerged through interactions with VSware elements, such as color pie charts, color dates, and icons that signaled editing functions. The analysis showed how the school leaders built their own sense of leadership tasks and duties according to what was happening 'outside' in the digitized practices. For instance, as scene 1 illustrates, the school leaders emerged in their leadership positions in the schools after the data on VSware had informed on a specific concern about students' attendance. When attached to the color attendance data, school leaders were *activated* to perform a series of future actions that internalized in terms of reflections of their roles and egos. In scene 3, as the quotations showed, the school leaders subscribed to VSware data to become more confident and provisionally competent in their job. As subjectifiers, or plug-ins, the VSware data put into motion a set of reflections that declared the school leaders were responsible mediators between teachers' work and external inquiries. This finding indicates two things. First, it illustrates how school leaders' subjectivities are not 'owned' by them, but become in fluctuating relationships. Thus, the school leader as a subject is plural; a result of the digitized practice that is more than the school leader and less than everything within the practice. Instead, the school leader is fluid and contingent on time and space, and everything and everyone that 'happen' or become in direct relation to them. This conforms to the view of the human as an actor network where nothing pertains to the subject, but it is made to be 'by a swarm of other agencies' (Latour, 2005).

Second, the fluid nature of the emerging school leaders (and the VSware actors) suggests their governing role also changes. In scene 1, VSware emerges as static and more inclined to govern its users. It creates priorities for school leaders that may otherwise not have been corporal and visible. In contrast, in scenes 2 and 3, VSware materializes as more flexible. As the material-semiotic analysis showed, the blue pencil button provides school leaders somewhat of a governing role. In scene 2, this is evident as school leaders change behavior categories and thus, change the categories' intentionality; they also directly alter or modify registered data. In relation to the blue pencil button, the data, thus, emerge as less static than one would think, and the school leader is able to act upon the other actors (behavior entries and data). This illustrates how all actors were able to 'act on each other' as a result of the materialization of the assemblage, but that these processes are dependent on the specific activity, and may change as fast as a new series of actions takes place (Moser, 2003).

Existing literatures in education leadership have explored data-driven practices by highlighting accountability measures, standardization, and school improvement (i.e. Heffernan, 2018; Niesche, 2013; Sugrue, 2015). Although these in-house practices are undoubtedly linked to external-internal, and individual-systemic processes, such literature has often dealt with the phenomenon by referring to anthropocentric reflections of how the leader identity is constructed. This article contributes to this considerable research by decentering the human experience and putting the enactment center stage through ANT. The design of the study has allowed to account for the performative characteristics of digital elements, such as data, as they attach and de-attach from school leaders in practice.

Adopting a sensitivity toward sociomaterial framings like ANT can highlight not only the material (and digital) side of leadership enactment, but also how the school leaders function and participate in leadership duties that include various actors, partnerships, and interests. These ideas of the networked subject can help in understanding mundane tensions where school leaders negotiate their own and others' governing roles. These are issues that are likely to stretch to overarching representations of school governance that are presented in ready-to-use digital solutions, in the form of software, apps, or persuasive guidelines. We need to better understand the various material processes that stretch between time and space through which numerous people, discourses, and practices are presented in software like VSware. Digital tools are not neutral devices, but enablers of certain concerns, facts, and problematizations. Consequently, software like VSware will encourage and show traces of subjectivities connected to humans in various positions linked to schools.

Future studies might examine how software like VSware presents several subjectivities within the same piece of data, be it leadership subjectivities, student subjectivities, or institutional subjectivities. Such studies may also address the various practices that connect the different subjectivities, rather than analyzing one practice at a time. The assemblages of relationships constituting such notions can potentially (and preferably) shed light on negotiations between the various actors. In this regard, ANT as an analytical approach presents as empirically capable of examining school leadership and practice as assemblages of things and people in continuous governing processes in education.

Notes

1. Although ‘assemblage’ may refer to several sociomaterial conceptualizations, I do not use it as a concept in this article.
2. The informants were asked to take screenshots of features in the software they often used in their daily practice and anonymize them.
3. VSware has data-based features for attendance tracking, behavior reporting, and assessment. The former two were chosen for the analysis because the informants used these features the most, and because the assessment feature was relatively new in VSware at the time.
4. Educate Together Schools are non-fee-paying schools that are not under the patronage of the Catholic Church (and are not affiliated with any specific religion). They are state-funded and teach the National Curriculum.

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