Understanding Nomadic Collaborative Learning Groups

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Abstract

The paper builds on the work of Rossito et al. (2014) on collaborative nomadic work to develop three categories of practice of nomadic collaborative learning groups. Our study is based on interviews, workshops and observations of two undergraduate student's group practices engaged in self-organised, long-term collaborations within the frame of Problem and Project Based Learning. By analysing the patterns of nomadic collaborative learning we identify and discuss how the two groups of students incorporate mobile and digital technologies as well as physical and/or non-digital technologies into their group work. Specifically, we identify the following categories of nomadic collaborative learning practices: 'orchestration of work phases, spaces and activities', 'the orchestration of multiple technologies' and 'orchestration of togetherness'. We found that for both groups of students there was a fluidity, situatedness and improvisational aspect to how they negotiate the orchestration of their work. Their ways of utilising space, places, technologies and activities over time was a complex interweaving of the digital and physical. We conclude by suggesting that the three categories of practice identified are important for deepening our understanding of nomadic collaborative learning groups.

Keywords

Collaborative Learning Groups, Mobile Learning, Nomadicity, Problem and Project Based Learning

Introduction

The ubiquitous access to the internet and the increasing pervasiveness of mobile technologies in Higher Education institutions are changing the everyday experiences of learning and the opportunities for students to study and collaborate (Traxler & Kukulska-Hulme, 2016). Mobile technologies, such as the combinations of smart phones, laptops and internet access are re-framing temporal and spatial aspects of educational landscapes and new patterns of nomadic collaborative learning in groups are emerging (Rossitto, Bogdan, & Severinson-Eklundh, 2014).

Existing literature on collaborative learning groups has tended to focus on either face-to-face group work in physical settings or, increasingly, on collaborative learning and group work within online and web based part-time and/or distance learning programmes (McConnell, 2005; Staggers, Garcia, & Nagelhout, 2008). Less attention has been given to studies of nomadic collaborative learning groups supported by mobile technologies. As Ellis and Goodyear (2016) comment in their review of models of learning space;

> observing what students actually do'—how they move in, inhabit and reconfigure space, how they create congenial learning places, how they assemble tools and other artefacts in their work as students—is the best way of gaining insights into likely mechanisms; so too is talking with students (and teachers and other stakeholders) to gain their sense of what they are doing and why, how they experience different spaces, what they believe to work best for them, in each of the diverse activities making up their studies. Combining observational and experiential data is still relatively rare, yet vital (Ellis & Goodyear 2016, p. 181)

To date research on mobile learning has generally had more of a focus on the 'designed learning experiences', where teachers are responsible for designing content and structure for access, participation and learning for students (Traxler & Kukulska-Hulme, 2016). There are less empirical studies of student's self-organised ways of practising collaborative learning across formal, informal, and non-formal contexts. Traxler and Kukulska-Hulme (2016) suggest that the mobile learning community could benefit from a turn to more sociological ways of researching and designing for mobility and transform "what has been called 'mobile learning' from the mobile component of learning, actually e-learning, to the educational component of mobility and mobile societies" (Traxler & Kukulska-Hulme, 2016, p. 210). To this end we believe that the notion of modern nomadicity and 'nomadic work' can help to extend our understanding of the educational and learning component of mobile learning and, as Ellis and Goodyear propose, give us greater insights into what students actually do. In the paper we will focus primarily on the notion of nomadic collaborative learning groups rather than mobile learning per se. Mobile learning being more about the design of learning mediated by mobile

technologies or as Sharples et al. (2005, p. 8) explain is the *'process of learning through continual exploration of the world and negotiation of meaning, mediated by technology'*. Our concern is: how do student collaborative learning groups adopt and utilise mobile and other technologies to enable them to complete their collaborative work across a range of locations and sites.

In the paper we present the results of a study of two different groups of students engaged in Problem and Project Based Learning at Aalborg University. Each group was involved in self organised long term collaborative projects and consequently provided ideal circumstances to look closer at collaborative learning groups' nomadic work and learning practices and to expand on the concepts of nomadic group work as it has been developed in the literature, in particular, by the work of Rossito et al. (2014). Building on their work we highlight three categories in our analysis: 'orchestration of work phases, spaces and activities', 'the orchestration of multiple technologies' and 'orchestration of togetherness'.

Nomadic work and modern nomadicity

The notion of modern nomadicity is increasingly discussed as an aspect of work practices associated with work that takes place in multiple locations and is mediated and supported by technology. Ciolfi and Carvalho (2014, p. 127) explain that for many authors:

> the advent and spread of mobile and networked technologies such as laptops, PDAs, mobile and smart phones and so forth, is one of the foundations to the proliferation of nomadic practices, because it allows for the mobility of the workplace to new locations where necessary resources to conduct the work can be found. (Ciolfi & Carvalho, 2014, p. 127)

Nomadic work within the Computer Supported Cooperative Work (CSCW) literature has a longer history, and refers to workers (or in our case learners) who accomplish their task across locations, but equally entails collaboration with others and can be distributed in time (Perry, O'Hara, Sellen, Brown, & Harper, 2001). While the concepts of mobility and nomadicity are often used as overlapping terms, Ciolfi and Carvalho (2014) argue they should be understood as two distinct concepts, where 'mobile work' can be understood as jobs or activities where people move across locations to accomplish their work (sailors, drivers or pilots), whereas the notion of nomadicity adds a layer of complexity as: "it involves both the movement of people and things but also the work in preparing for such movement and following the movement in creating conditions to engage with work and life activities." (Ciolfi & Carvalho, 2014, p. 121). Some studies of nomadicity focus on the nomadic worker or 'hot deskers' (Brown & O'Hara, 2003; Nelson, Jarrahi, & Thomson, 2017; Perry et al., 2001), others focus on nomadic work of collaborative groups, meaning groups that have a shared objective, such as students completing a common project (Rossitto et al., 2014). It is the latter we are interested in in this paper.

While the notion of 'nomadic work' has become common within workplace studies (Ciolfi & Carvalho, 2014), it seems less common within educational studies. As discussed in the introduction studies within educational research have predominantly, though not exclusively, been focused on groups working collaboratively within bounded learning environments and with activities designed by lecturers. Studies of students engaged in working across multiple locations in self-organised, long-term collaborative engagements are, as mentioned by Ellis and Goodyear (2016), fewer, and are more often found within e.g. the area of CSCW. Within CSCW studies of how teams or groups use technologies to support cooperation and collaboration are common, but learning is not the focal point of attention. However, we believe that notions of nomadic work as explored in other fields can help strengthen our understanding of mobile learning and, more specifically, nomadic collaborative learning groups.

Background to the study and data collection

Aalborg University students, teachers and supervisors from different study programs make use of various open, flexible and shared spaces to support problem and project based learning. Generally the project work each semester lasts 3-4 months where students go through different phases of enquiry: problem identification, problem formulation, theoretical and methodological inquiry, data collection, analysis and discussion. During this process students often work with self-chosen problems leading to the production of a final project report (app. 60-100 pages). While the students have a supervisor that support their academic work, the organisation of the collaborative work is managed predominantly by the students, including what technologies to use and how.

In this study, we examine how Communication and Digital Media (CDM) and Architecture and Design (A&D) undergraduate (UG) students work in groups and how they support their project work using a range of technologies, e.g. mobile phones, laptops, posters, and blackboards. The University provide the setting and some

basic resources (e.g. tables, chairs, power, wifi, blackboards, etc.). The CDM students have no permanent workplace, whereas the A&D students have a permanent group room in an open and flexible area (the room is separated by moveable screens). The students in the two educational programmes thus have different socio-material conditions, and these different conditions were initially what we wanted to explore in the research project. However, we found that in both cases the students modify their group work and learning spaces to align with their needs and preferences. Consequently in this paper it is the similarities in and between the student group's collaborative practices we focus on.

Data collection

The study followed a qualitative inquiry research approach (Denzin and Lincoln, 2013) involving interview workshops, informal interviews and observations of the CDM (6th semester) and A&D (4th semester) groups of students. These groups were selected as we sought to involve students with at least three semesters of experience in doing group work. We aimed initially at recruiting six students from each programme. As we had no relations (teaching or otherwise) to the students in the 4th semester A&D programme (app. 80 students) we decided to contact these students face-to-face in their work area to introduce ourselves and explain the purpose of the research project (a project group of six students volunteered). For the CDM programme (16 students), two of the authors were known by the students so we posted an invitation to participate via Moodle to avoid students feeling pressured to participate by face-to-face contact (six students from two different project groups volunteered).

The interview workshops took place in spring 2015 and were divided into three stages: basic introduction to the research, questions on the students' experiences from their project work and finally each of the students produced a poster depicting relations between space, technologies and processes in their group work. During the spring and autumn 2015 semesters they were followed-up by impromptu in-situ interviews with the students, video observations of the A&D students as well as observations of CDM students inhabiting public working spaces and environments. The observations of CDM students were not observations of one particular group, but informal observations and conversations with shifting CDM student groups who work in the areas around two of the authors' offices during the entire project period. These observations and conversations served primarily as background information. The video observations of work of the group of A&D students that participated in the interview workshop took place in spring 2015 and were followed up in autumn 2015 with video observations of five other A&D groups. This included daily informal conversations and contact with the groups when recording equipment was setup or taken down.

All the data collected were then analysed and cross analysed by two of the authors to discern and identify recurring themes or practices within the different collaborative learning groups. The interviews, posters and observations have been the main point of departure for analysis, but equally the wider video material served to support or challenge this. It has not been possible to view the entirety of the video material (more than 600 hours), but two of the authors held data sessions together, as well as with fellow research colleagues showing, discussing and analysing parts of the recordings (app. 20 hours) at different points of time in the groups' work processes.

Practices of nomadic learning in collaborative learning groups

Previous categories identified in nomadic group work studies within CSCW informed the analysis of our data, in particular Rossito et al. (2014) identified three categories in nomadic project work: 'Orchestrating constellations in place', 'Orchestrating constellations in time', 'Orchestrating constellations to create a workplace'. In analysing our own data we initially applied these categories but in the course of our analysis we found it necessary to develop three new categories that we argue are central nomadic learning practices in nomadic collaborative learning groups. They are 'orchestration of work phases, spaces and activities', 'orchestration of multiple technologies' and 'the orchestration of togetherness'. These categories whilst similar to those of Rossito et al. (2014) emphasise different aspects. For example, in their own analysis Rossito et al. (2014) state that the spatial, temporal, social and contextual aspects are heavily intertwined, overlap and mutually affect each other. We argue that the categories developed in our analysis reflects better this entangled or inseparable nature of space, time, activities, social aspects, and technologies, and we return to these points in the analysis and the final discussion.

Orchestration of work phases, spaces and activities

We first examine the entangled nature of space, time, activities, social aspects, and technologies in the student's orchestration of their work phases and activities throughout their project work. This is illustrated well in a poster produced by one of the CDM-students (Figure 1). The poster describes the relations between space, process, and

technologies during their collaborative group work. It shows a 'macro-temporal' and generalised overview of the process of problem oriented project work that distinguishes between work phases and physical locations over time, as well as technologies used:

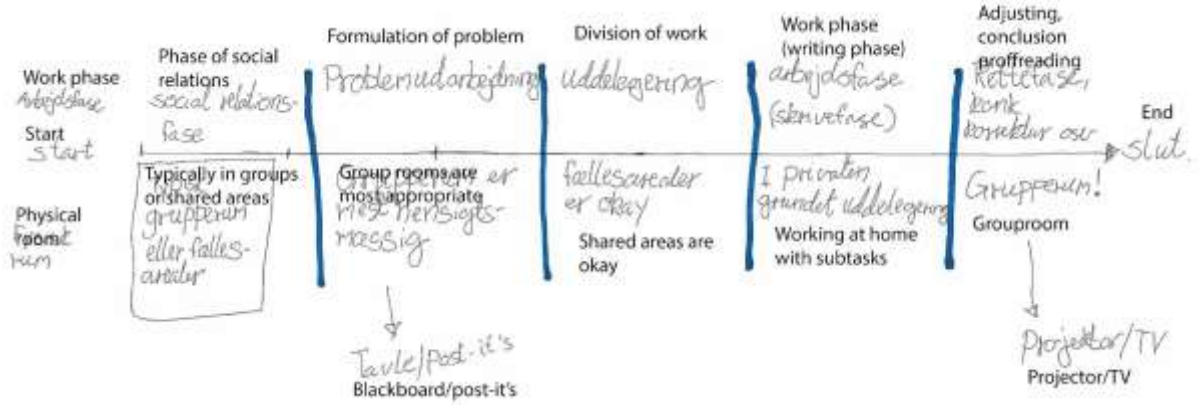

Figure 1: Poster made by Student 1 from the CDM programme

In the initial phases ('social relations' and 'formulation of a problem'), we can see the student highlights the need for group rooms or shared spaces, as well as blackboards and post-its. This is a phase of work that we would highlight as particularly 'collaborative' with a need for deepened discussions and establishment of a common focus on the direction of the project. It is also a phase where there is a need to form social relations amongst group members as they might not have worked together previously. Later in the process, the student illustrates, they distribute the work and shift to, what we term a more 'cooperative' mode of work. This distinction draws on the work of Dillenbourg (1999) and refers to whether there is a mutual, shared and sustained cognitive engagement with a task (collaboration) or whether individuals contribute with smaller parts of the whole i.e. dividing tasks (cooperation). The later phases ('division of work' and 'work phase') are phases in the project work where the student says shared or public spaces 'are okay', as is working from home or other places.

Towards the end phase, this student proposes, there is a greater need again for shared spaces and group rooms, and particularly projectors/tv screens are mentioned for collaboratively going through, editing and discussing the entirety of the project report. This illustration on first impression gives a rather macro-temporal overview and generalisation of the entangled nature of space, time, activity and technologies in the orchestration of the work phases of their projects. However, the distinctions between cooperative and collaborative modes of work seem to blur when we zoom in closer, as in practice they alternate dynamically between cooperative and collaborative patterns of work.

Considerations of where to work during different phases of their project are also present in other students' accounts and suggest more of a daily decision. In Figure 2 another student visualised working in different locations - from having group rooms, using open working spaces and then the cantina area:

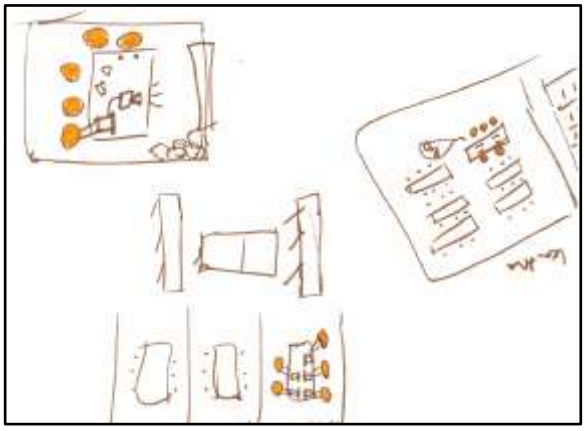

Figure 2. Poster made by Student 2 from the CDM programme

As another student explains, when discussing their use of the large public cantina area:

> Well, we used it a lot right after a lecture or the like … Then we just sat in the cantina area and got on top of tasks for tomorrow. So it was more like the minor task we sorted there, and then you could book a group room for the next day if necessary. (Student 3, CDM, Interview)

These considerations of the appropriateness of spaces in relation to the task at hand was a particularly strong feature in the work of the CDM students. As they did not have their own space they were used to moving around and to temporarily use different spaces. Some mentioned cafés, the library or other public spaces as alternatives to sitting at home or in the university building. The CDM students strategically decided when it is necessary to book a group room, and when to exploit other facilities.

> In the past projects we began work at campus. Like sitting in that café area in the cantina and find out who people in the group are […] then I at least have worked a lot in cafés to read a lot of things […] and then there is the big phase that has been in group rooms or in the library to generate a lot of things (ideas [authors]), what should be analysed and so forth, and then we have made these smaller groups that have maybe been working in pairs. (Student 4, CDM, Interview)

In this sense the students continuously balanced their needs, tasks, spaces, and technologies in relation to each other. Do they need to discuss? Do they need silence, a projector, post-its, to work together or alone? These are concerns and shifting needs they consider in choosing appropriate temporary spaces for their work. The cantina works for minor tasks and distribution of tasks, but as it is a noisy place that lacks electrical outlets, they seep into other areas or group rooms as they deem necessary in relation to the task at hand. This spatial nomadicity was particularly pronounced amongst the CDM students, but it was equally present with the A&D students.

The A&D group we interviewed had a permanent group room in an open space. They referred to this group room as a "home", but it was clear from observations that they also often left their space e.g. to observe in the field to gather inspiration for their designs, and they all worked from other locations, such as their homes. Albeit, the A&D students were more static than the CDM students, they also exhibited patterns of spatial nomadicity. For example, two of them went out to a nearby traffic crossing to study shared space. Here they observed how pedestrians, cyclists and drivers used the public space. The group went to a car park to experience the actual size and texture of concrete pillars; often they also visited the site they were designing for (harbour front). What we could also glean from the interviews and video observations was that they often split into smaller groups of 2-3 students to work on minor tasks (e.g. two would work on a 3D model, others on sketches). The shared areas and the surrounding hallways often served as places for breaking out into smaller and spontaneous teams to solve issues not requiring attention from all the group members. Thus, we see again that the distinction between collaborative and cooperative patterns of work are more fluid, than an initial macro-view of phases would suggest.

As with the CDM students the intimate connections between space, time, activities, and technologies featured heavily in their orchestration of work phases. Their group room spaces were an interesting material manifestation of the interdependencies between time, activity, space, and technologies.

Figure 3. Picture of the A&D students' group room

For example they positioned and repositioned post-its in different colours every day on 'home-made' calendars (yellow=courses, pink=group members away, orange=project work). However, the space had an even more

symbiotic relationship with aspects of time, process, activities, and technologies. As a student showed in his illustration (Figure 4) the group room was tidy and organised in the initial phases of the project (lower part of Figure 4 - group room over time), whereas it became messier over time:

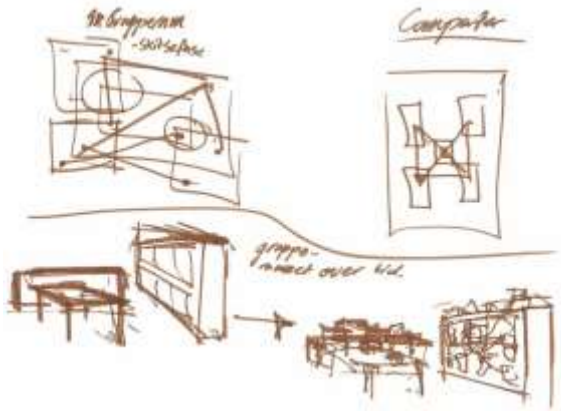

Figure 4. Poster made by Student 1 from the A&D programme

In general the group members differentiated between two recurring phases in their project work: 1. A creative phase where they use different materials and methods to challenge their understandings and beliefs about their design. 2. A concrete phase where they use software to produce more accurate designs based on numbers and measurements. This is explained by one of the students in his poster (Figure 4).

> I have tried to visualise how it is in the group room and the idea phase vs. when we start working with computers, because it is very messy - a lot of brainstorming and idea generation … then when we start working with the computers it is getting more accurate and to scale and it can of course still be 3D. (Student 1, A&D, Interview)

The student described the initial phases as ”very messy” with loads of brainstorming and sketching. Ideas were then transformed into digital representations that were more 'precise' models of the designs, which however could be re-opened and re-negotiated. Thus, we can see how processual and temporal aspects are tightly interwoven with the uses of space and technologies. The orchestration of work phases and activities entails both decisions of where to work, in what social constellations to work (whole group/smaller groups, collaboratively/ cooperatively), what technologies to employ, and how to appropriate the space. Considerations which are all made in relation to the task at hand, and where they are in the overall process of their project. The distinctions of Rossito et al (2014) categories ‘Orchestrating constellations in time’ and ‘Orchestrating constellations in place’ on their own did not seem sufficient for making sense of what we were finding.

In the data we can see there is a fluidity, situatedness and improvisational aspect to how students negotiate the orchestration of their work. Though they have work plans, they also respond to the needs of the situation and dynamically create assemblages that fit with space, time, activities, technologies and social aspects. In doing so, they create ‘constellations of technology’, as described by Rossito et al. (2014), that consist of both digital and non-digital technologies, which we will discuss next.

Orchestration of multiple technologies

Facebook, Google Docs, Dropbox, Hangouts, and Skype are prevalent and omnipresent in students' study practices. This mixture of technologies, or what Rossito et al. (2014) term a *potential constellation*, is negotiated within the groups. For example should they rely mainly on Dropbox or work in Google Docs? Should they communicate in a Facebook group or arrange meetings via texts? Do they want to use an advanced project management tool or is that too difficult and time consuming? The mixture of technologies varies across the groups depending on the preferences and competences of the group members. As some of the students explained, they develop practices in the groups over time. Each group member has certain preferences regarding the use of technologies for communication, collaboration, and coordination which they bring into their new group.

While they do settle on an *aligned constellation* (Rossito et al., 2014), the students continuously negotiate and

refine their use of technologies as part of their work together. From our observations it was clear that their work is supported through a dynamic assemblage of technologies, and as we saw in the previous section their needs and means to support their work changes over time (even on a daily basis) depending on the type of tasks and phase of the work they are involved in.

While, the use of digital technologies is important, what we would emphasise from our study is the composite nature of the constellations of technology they create and orchestrate, as these involve mixes and shifts between digital and non-digital technologies. In some of our video data the A&D students are discussing a design idea and seamlessly switch between a styrofoam model, a 3D model on a PC, paper sketches on the table, sketches on an Ipad and sketches on a blackboard when discussing aspects of the design and making sense of each other's ideas.

While the orchestration of digital, mobile and networked technologies was omnipresent in the students' accounts it was equally clear that they used many other physical and non-digital technologies: pens, post-its, manifold paper, models and blackboards. These are obviously technologies even though we often reserve this label for 'new' digital technologies. Some of these technologies were intransient, stable tools - such as pens, post-its etc. but there were also examples of transpositions of various technologies. For example, the students gave accounts of how non-digital representations are digitised or how digital representations e.g. digital mindmaps are remade, re-enacted and restructured on post-it notes and paper. One of the students said about mindmaps and work-plans.

> Typically you have them on your computer. But both here and on [location] we have used the blackboards that were present to establish an overview and get it up in a bigger format, so there is a good overview for group of what we are working on at the moment. (Student 3, CDM, Interview)

Likewise another student reports:

> We have sometimes used MindMeister [auth: online mindmapping tool] where you can create a mindmap or brainstorm and then put it in there. Because then you can have it on all screens simultaneously, but equally we have been really good at sitting with different pieces of papers that we have pasted together and then sitting with pens. (Student 4, CDM, Interview)

In these quotes we see how the students alternate between digital and non-digital technologies, but equally they reported examples of how an overview of tasks might be in a Google Doc, then renegotiated and reorganised on a temporarily available physical blackboard to be re-inscribed in Google Docs. In this sense, their use of technologies continuously alternates between different media and modalities as their work develops or as their spatial conditions change. The spatial conditions available to the student groups was an important aspect of their nomadic learning practices, particularly for the CDM students these transpositions and orchestrations of technology were necessary, as, for example, they would have to reify a post-it notes overview in a digital format, when they had to move out of a group room.

However, this was equally necessary for the A&D students when they were visiting field sites and captured pictures or video. In the A&D group we observed an interesting practice around their use of Pinterest. Whenever the students came across interesting designs, textures, parks, buildings or other objects of interest that could inform their design they would share it in their Pinterest group. Some of these photos were then printed on paper and hung on wires and notice boards in their room.

> We took the best from the board on Pinterest and then printed it and used it - virtual – and also in the group room as inspiration – also just to like not being on Pinterest all the time to look. (Student 2, A&D, interview)

These transpositions between the digital and physical served as important ways of structuring the group's ways of thinking and acting. With the photos hanging on wires above their workspace they were constantly close to inspirational sources, and as they developed new ideas for their work they rearranged the order of the photos to reflect this.

The use of digital technologies was important in relation to supporting other aspects of the nomadic nature of their work i.e. for coordinating meetings and tasks, for communicating and for managing the sharing of files and collaborative writing of their project. We found interesting their multidextrous way of orchestrating and

dynamically shifting between different technologies, as well as creating transpositions that helped them in managing the work across different spaces. As we touched upon in the previous section there are intimate connections between the task, phase of their work, space and the technologies they employ. We saw how one of the students highlighted the need for pen and post-its in certain phases of their work and in other phases for a projector. We also saw in this section how, there are very organic connections between the design work of the A&D students and the technologies they employ: sketches for the phases where they brainstorm and quickly need to develop multiple different design ideas, that are then transformed into more 'precise' and 'accurate' digital representations in later phases of the project work.

While such orchestrations of multiple technologies are present and discussed in the work of Rossito et al. we find it to be a central aspect for nomadic collaborative learning groups, consequently, we identified it as a category in its own right.

Orchestration of togetherness

In the previous sections we have seen that students orchestrate their work and technology towards different social constellations: individually, in smaller groups or dyads, as a whole group, and also how they swiftly alternate between cooperative and collaborative modes of work. Digital technologies are important in the coordination of the groups' work and with increasingly mobile technologies and pervasive internet access students have – at least in theory – an 'always on' as a potential backdrop for coordinating and making each other aware of their work. They can quickly contact each other through Facebook messenger, as group members are assumed to be always available via that. Or, as we have also observed, they use 'likes' of posts to signal that they have read posts from group members, as a way of showing awareness and presence.

While the groups need to negotiate and orchestrate 'constellation of technologies' to use they similarly need to negotiate and orchestrate their idea of and preferred 'constellations of togetherness'. While, the A&D students we observed have a strong culture of working in their group room every day, the CDM students have to walk around looking for spaces to work. Therefore, as inferred in the previous section, they need to reflect on and decide the 'efficiency of togetherness' i.e. for what activities is it crucial that they work together collaboratively as a group, and when can they divide work and sit elsewhere? From the interviews and observations, groups seem to manage this very differently, and some e.g. employ orchestrations of togetherness where three group members are co-present and a fourth member joins via Skype. Likewise, it is not uncommon to see students sitting together, but focusing on different tasks, or working in smaller dyads in the larger group, as previously mentioned. From an earlier quote from one of the students (Student 1, A&D, Interview), we also glean how such decisions are taken by the students in situ e.g. coming out from a lecture and trying to establish how to work most efficiently for that day and the next; perhaps then deciding to split up and work from home individually if no rooms are available.

While our current level of analysis of the data does not give us a sufficiently detailed insight into how groups create a sense of social cohesion or sociability, previous work would suggest its importance. That this is likely to be the case is supported by early online research such as that of Stacey (1999) and Rourke, Anderson, Garrison, and Archer (1999). Stacey's work revealed the range and complexity of interactions that occur between the participants of online collaborative learning groups and the significance of establishing a level of 'social presence'. Rourke et al. (1999) explain that 'social presence' in distance education contributes to being an effective learning community. Nomadic collaborative learning groups are similarly highly dependent on each other and on maintaining good social relations and presence for the work to progress. The social processes in these complex and composite 'constellations of togetherness' are an equally important part of the processes for learning within nomadic groups. These aspects are also discussed in the work of Rossito et al. (2014), in relation to the category 'orchestrating constellations to create a workplace', but we view the social aspects as particularly important in understanding work practices of nomadic collaborative learning groups, and therefore highlight it as a specific category.

Concluding discussion

As set out in the introduction Traxler and Kukulska-Hulme (2016) and Goodyear and Ellis (2016) both point to the need for closer empirical scrutiny of what students 'actually do' and how they move around in and reconfigure spaces as part of self-organised learning processes. Responding to this, our study provides insight into how contemporary collaborative learning groups adopt and utilise mobile and other technologies. We have argued that the notions of 'nomadicity' and 'nomadic work' are particularly useful lenses to understand students' learning in nomadic collaborative learning groups across a range of locations and sites. These ideas are

adopted from the area of CSCW and are particularly informed by the categorisations initially presented by Rossito et. al (2014) of ‘Orchestrating constellations in place’, ‘Orchestrating constellations in time’, ‘Orchestrating constellations to create a workplace’. These we have further developed into three categories of nomadic learning practices of: ‘orchestration of work phases, spaces and activities’, ‘the orchestration of multiple technologies’ and ‘orchestration of togetherness’. These categories are not at odds with the categories or findings presented by Rossito et al. (2014), but rather they emphasise particular aspects we find relevant in understanding the education and learning component of the mobility processes and work of nomadic collaborative learning groups. What surfaces from our analysis (and the analysis by Rossito et al. (2014)) is the complex, intimate bonds or entanglements of space, time, activities, and technologies that learners need to manage as part of being a nomadic collaborative learning group. We find that this complexity is better captured by referring to ‘orchestration of work phases, spaces and activities’, rather than the distinct categories of ‘time’ and ‘place’. This is because the orchestration of students’ work, concerns both decisions of where to work and consideration on the mode of work (e.g. collaboratively/cooperatively, in smaller groups or together). Decisions that need to be made in relation to the tasks they have at hand, the spaces available, as well as the current phase of their project.

These decisions also impact on their uses of technologies and the ‘orchestrations of multiple technologies’ as a distinct category or practice. What we want to highlight with this category is the fluid boundaries between the 'digital' and 'physical' – a fluidity that (increasingly) seems to render the very distinction superfluous. The digital spaces are always present in the physical spaces, and we see from the data how various technologies are transposed from digital representations, to a blackboard and post-its and then re-digitised – a point also made by Rossito et al. (2014). Thus, the digital and physical are heavily interwoven and difficult to separate. We believe that the focus on ‘digital technologies’ only is problematic and that we should rather attempt to understand in more depth how students use many and varied technologies and appropriate various spaces for learning. An overly strong focus on 'digital technologies' might make us overlook important aspects of the practices in nomadic collaborative learning groups as these take place in hybrid and multimodal spaces that lead to complex entanglements between physical and digital technologies, spaces, activities and time.

Finally, we argue that the category of ‘orchestration of togetherness’ is an important practice of nomadic collaborative learning groups and one dealing more explicitly with the social aspects of collaboration than ‘Orchestrating constellations to create a workplace’ developed by Rossito et al. (2014). This category concerns how students choose to alternate between different modes of collaborative or cooperative work and continuously negotiate and alternate between these configurations. However, it equally includes figuring out how to ‘work together apart’, while maintaining a level of social presence and cohesion, which is an important feature of nomadic collaborative learning, as established in the literature on group work online. This was particularly pronounced among the CDM students, who had no fixed space available and therefore needed to frequently find other means to create a sense of social presence and awareness, such as online meetings or likings of other members’ posts. It was further an aspect which was articulated by the students as important (for example as ‘social relations’ in Figure 1).

As we can see from the data, students' nomadic collaborative learning is a complex dance that involves not only which technologies to use, but also in what spaces particular entanglements of technologies and activities are meaningful - often dependent on the processual aspects (are they in an early explorative phase or in a production phase where work can be distributed). This knowledge seems to be both implicit and tacit amongst the students. We are only beginning to understand the complexity of student practices that are involved in nomadic collaborative learning groups and the extent they involve mixtures of digital and physical spaces, activities, social cohesion and technologies.

Statements on open data, ethics and conflict of interest

The data obtained in the present research is not accessible due to ethical reasons of protecting the identity of the respondents.

The study was conducted under the ethical guidelines in place at Aalborg University. Informed consent forms were signed by each participant in the present research. In the paper participants are coded as “Subject 1, 2, 3, etc” to protect their anonymity and to avoid tracing their identity in the data.

There is no potential conflict of interest in the work being reported here.

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