
Why Do Learners Cooperate? Hints from Network Sciences on Motivation for Collaborative Learning

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Abstract

The present paper starts from the consideration that, being collaborative learning the cornerstone for learners to take an active role along their lifelong learning process, educational research and practice should aim at improving the understanding of what lies behind learner's cooperative attitudes. To do this, educational research and practice should take into account some findings coming from networks science, and we propose two conceptualisations. First, starting from the work of Novak, we describe some mechanisms that foster the adoption of cooperative behaviours within networks: direct reciprocity, indirect reciprocity, kin influence, spatial influence, multilevel influence; understanding these dynamics is key to sustainably foster cooperation within learning communities. Second, we propose some conditions that should be taken into account when planning collaborative learning support strategies; issues like confidence, commitment, divergence and decentralisation are briefly commented from an educational point of view. Finally, we briefly explore the concept of collaboration leadership within networks. The success of any collaboration learning venture depends on the capacity of the parties to work towards a common objective, sharing concerns and working out common solutions: the paper hints to some findings on collaboration motivations and conditions that can foster meaningful network-thinking within education.

Keywords: collaborative learning, network sciences, collaboration leadership, motivation, networking.

Instilling more “network thinking” within education

The concept of network is gaining ground as a keyword – and buzzword – of our times. Concepts such as information society and knowledge society are increasingly used by sociology, economics and other disciplines as a way to describe and understand our world and its dynamics built on connections, nodes, and communication fluxes. In particular, the term *network society* describes a social endeavour where the internet is becoming a critical technical and social infrastructure of everyday life, crucially enabling individuals to communicate in new ways that reconfigure and enhance their interaction capacity (Castells, 1996). Of course, collaboration among individuals and institutions has always existed, “what is different is the density, extension and complexity of contemporary global networks and their propensity to channel increasingly diverse flows” (Bebbington & Kothari, 2006, p.863).

The centrality of the concept of network is facilitating the emergence of a diffused *network thinking*, both in science and in society at large, through which we are starting to understand the characteristics of our world by focussing on the relations among the elements of the systems and not only on their characteristics: “network thinking is poised to invade all domains of human activity and most field of human inquiry” (Barabási, 2002, p.222). Even if it is probably early to say if we are witnessing the beginning of a knowledge revolution that will urge us to radically change our social paradigms, it is clear that, to properly understand an increasingly network-based societies, we need to get equipped with tools and approaches able to professionally look into the networks we are increasingly immersed in¹. In other words, we need to get equipped with the capacity to *network-think*, that is to grasp the increasingly networked nature of virtually any human and social phenomena, if we want to take advantage of the benefits that networks can bring to many areas of society, including education.

The level of *network thinking* within education varies considerably depending on the sector we look at. As noted by the Learnovation Report (Dondi et al., 2009), learners and professionals from corporate education and informal learners are used to work and learn in collaborative fashions, by adopting peer learning practices and by constantly adapting their teaching and learning methods to the growing availability of

¹ Literature on networks is multidisciplinary, with contributions from physics, management, political and social sciences, computer sciences, innovation studies, telecommunication studies, and communication sciences. See for example Newman et al., 2006.

(social) networking tools. On the other hand, embracing networking and collaborative tools and methods in learning setting such as school, university or vocational training is made more difficult, even in the few cases when the need is expressed by learners and accepted by teachers and trainers, by the slow adaptation dynamics of these systems to innovation processes.

In addition, when networking practices are adopted to facilitate teaching and learning, for example by using social media such as Facebook or Twitter or by applying peer learning and peer assessment practices, this is done starting from the incontestable belief that working in collaboration, typically with the support of ICT, will have a positive impact on the motivation of students and will increase their attainments. Nevertheless, most of the time this reasoning is not grounded on a sound understanding of the dynamics that govern cooperation among the components of a given network – the pupils of a class or the members of a learning team – and it only rarely takes into account the available research findings on networks behaviour coming from network sciences. In other words, in most cases educators and educational researchers are looking at learning networks without the appropriate “networking lenses”. On the other hand, we believe that increasing the level of *network thinking* within education practices is fundamental if we want to understand the motivation factors which lay behind the different cooperation attitudes of learners, and ultimately if we want to take the maximum benefit from any collaborative learning experience.

Why do learners collaborate, at the end of the story?

We believe that a necessary condition to be met, if we want learners to “sit in the driving seat” of the learning process, is to foster their motivation to be active learners. For this to happen, apart from the important changes that need to take place at the system level which are being tackled by a number of studies and research projects and apart from the necessary support in terms of digital literacy², it is fundamental to take action to improve the capacity of learners to work in a collaborative fashion, at all education levels. In other words, we need to work on the motivation of learners to meaningfully collaborate through their lifelong learning path. This, we consider, is an area where educational sciences can learn a lot from network sciences, by adapting

² See for example the work of IPTS at <http://ipts.jrc.ec.europa.eu/activities/information-society/e-applications.cfm> or the VISIR project at <http://www.visir-network.eu>.

important findings on how networks work, evolve and flourish to the specific case of education.

An interesting conceptualisation of the motivational reasons behind cooperation dynamics is provided by evolutionary biologist Martin Novak, who claims (2011) that collaboration has been an important mechanism for life evolution – along with natural selection and mutation – and that the extent to which the members of a network are able to collaborate can tell us how the network will be able to prosper and to reach its aims. If applied to learning, this means that – for example – the *cooperation capacity* of a classroom is a fundamental component to reach the aim of the classroom itself, which is not only to educate its pupils in the best possible way by using the limited available resources but also to sustainably develop transversal and lifelong learning skills.

Novak starts from the assumption that adopting a cooperative approach has a cost, which can be for example the time needed for discussion in a learning community or the effort needed to help a fellow learner. This cost is sometimes forgotten by educational researchers, who tend to consider collaboration as a “natural” attitude of individuals. We believe on the other hand that every collaboration process is based on a specific decision by the individual, and that this decision is based on whether the motivation to cooperate is able to overtake the cost of collaboration. By using the “prisoner dilemma”³, Novak demonstrates that the natural tendency of humans, when faced with a repetitive number of cooperation decisions, is to adopt a “win stay, lose shift” approach, meaning that, as long as a cooperative behaviour of an actor is rewarded by corresponding cooperative behaviours of others, the actor keeps on being cooperative, but when the counterparts are not behaving in a cooperative way, he or she tends to adopt a non-cooperative behaviour. In theory, this attitude should result in a dynamic where non-co-operators would tend to outnumber co-operators and where the network would lose its cooperation chances. On the other hand, some “motivational” mechanisms exist that push people to collaborate within networks to achieve their goals: we believe that understanding these mechanisms is important to grasp what lies behind collaborative learning decisions, and ultimately to increase the level of *network thinking* within education.

³ The prisoner dilemma is a classic example utilised by game theory to show different results in case of cooperative and non-cooperative behaviours of individuals. See Novak, 2011.

A first mechanism is *direct reciprocity*, and is based on the repetition of a cooperative behaviour along the logic “I scratch your back and you scratch mine”: an actor will adopt a cooperative behaviour towards another actor in all cases when he has received a cooperative behaviour from the counterpart. Within learning settings, this is the case for example of a student who decides to help a fellow because this fellow has been supporting him in a previous occasion. This simple dynamic, which is possibly the first step towards cooperation that humans have taken in their history, does raise an important concern, since, as we have seen, adopting a cooperative behaviour has a cost, and therefore “cooperation always comes with the threat of exploitation” (Novak, 2011, p.26). That is why, for direct reciprocity to work in complex systems such as schools or universities, two conditions must be in place. First, a flexible attitude towards non-cooperative behaviours must be adopted, where the reward mechanisms towards cooperative attitudes are mirrored by tailored recovery (and not punishment) mechanisms for non-cooperative attitudes; second, it is necessary that the actors are repeatedly in contact and that they are provided with subsequent and comparable occasions to cooperate.

The mechanism of *indirect reciprocity*, which goes along the logic “I scratch your back and someone will scratch mine”, is based on the reputation that an actor is able to build within a network, and is easily observable within online communities such as eBay or Couch Surfing. In these communities, cooperative or non-cooperative behaviours are made public to the community; on the base of this, actors are rewarded or punished by the community members, who decide to adopt a more or less cooperative behaviour towards them depending on their reputation. “If, thanks to endless chat and intrigue, the world knows that you are a good, charitable guy, then you boost your chance of being helped by someone else at future dates” (Novak, 2011, p.54). Reputation is a key driver for cooperation in learning settings, and it influences both cognitive and affective learning (Russo & Koesten, 2007) as well as group cohesion (Refaffy & Chanier, 2003). Nevertheless, for reputation to guide cooperative attitudes within a learning community, mechanisms must be in place to allow “enough transfer of information about who did what to whom” (Novak, 2011, p.60) within the network. If this is easy in web-based communities where collaborative behaviours are recorded over time, within offline learning settings this is not always the case: to take advantage of reputation dynamics, a communication effort must be made to make sure that information on best cooperation behaviours flows within the network reaching all the involved actors.

Spatial influence and *kin influence* are mechanisms that affect the cooperative behaviour of an actor depending on the proximity of the actors they could collaborate with. Typically, the choice is made to collaborate with actors that are close to us within the network, for example with actors with a similar background or a closer geographic origin with respect to ours. These mechanisms, which are at the basis of the creation of *clusters* and *hubs* within networks, are based on very simple assumptions but are not easy to be measured and fostered. Spatial and kin influences are important motivational drivers in learning settings, especially in the case of cooperation within small collaborative groups which are part of larger communities: a recent research on the eTwinning schools network⁴ has shown that pupils tend to cooperate more easily with others which are close to them, for example in the same school or in the same country, or with students with similar social and scholastic background, but that cooperation beyond these circles is more sporadic and less continuous (Breuer et al., 2009).

A last mechanism is *multilevel influence*, and has to do with how much a network is able to build a common cooperation strategy that goes beyond the behaviour of the single group components. This mechanism typically deals with issues such as self-regulation and self-discipline of networks, and is very important in learning contexts. We must take into account that networks are composed of humans and are therefore imperfect, since for different reasons – a mistake or a bad day for example – an actor can decide not to respond to a cooperative behaviour with a positive attitude. Novak (2011) defines this problem as “the noise of cooperation” and notes that even a minor behavioural change by an actor within a community can have a devastating impact on the network general attitude. This is the case for example of a student which does not adopt a cooperative behaviour where he would be expected to, and initiates a cascade effect of non-cooperative actions by his peers, decreasing the cooperation wealth of the whole learning community.

Supporting meaningful collaborative learning

These motivational mechanisms are very important to understand the way a network works and therefore to increase the capacity of the network managers to support the

⁴ eTwinning is a European initiative aiming at allowing staff (teachers, head teachers, librarians, etc.), working in a school in one of the European countries involved to communicate, collaborate, develop projects, share with counterparts in other countries. More at <http://www.etwinning.net>.

activities of its members. Most of the times, collaborative learning strategies give these dynamics for granted and do not start from the inner reasons for cooperation in building support activities, with the well-known results of achieving poor cooperation results due to a low motivation of the participating learners: on the other hand, we should start from these basic dynamics and build on them from the very planning of any strategies for supporting collaborative.

Understanding the mechanisms behind cooperation is not enough, since supporting collaborative learning – as supporting collaboration in many other fields – is a difficult and demanding exercise, and must be based on some clear conditions and criteria. Starting from the work by Surowiecki (2005) and Van Zee and Engel (2004), we propose a few conditions that should be taken into account when planning collaborative learning support strategies.

A first condition is that network participants need to have *confidence* in their work and must *dare to share* it with others. An open atmosphere where mistakes are allowed and where the group can learn from these mistakes is the ultimate condition to build trust within the learners' own capacities. A second condition is that learners must be *committed* to the collaboration activities and must consider them as priorities within their learning activities, and not as ancillary, and they must recognise a clear added value in their collaborative work. Third, *divergence* must be allowed within the learning community. Any divergent opinion should moreover be used as a starting point for discussion, where each learner must have the right to defend his opinion and the facilitator must make sure that, even when the objective is to reach a consensus around a specific issue, learners' opinions aren't determined only by the opinions of those around them. A good collaboration facilitator should be able to move along the line from full consensus – typical in communities with strong kin influence for example – to full disagreement, but should always make sure that the collaborative learning experience is not merely an adaptation process where the ideas and beliefs of the groups adapt along a mainstream solution. Finally, *decentralization* is important, since the strength of a learning community with respect to its learners taken individually stands in its capacity to valorise the content produced locally by the learners, as demonstrated by the eTwinning analysis (Breuer et al., 2009).

All these criteria are strictly connected to the motivational mechanisms previously presented, and with the basic fact that within any collaborative learning community different attitudes will appear, with learners who tend to build a higher number of collaboration relations than others. Some “collaboration dynamisers” will typically

emerge, who “engage in networking tasks and employ methods of coordination and task integration across organizational and personal boundaries” (Alter & Jerald, 1993, p.46). The characteristics of these collaboration leaders are, coherently with what stated by social network scientists, “a learning mind-set, the ability to be flexible, adaptive, and to simultaneously consider other people’s points of view” (Lynn & MacAvoy, 1995, p.130) complemented by “skilful social entrepreneurship, flexibility and imagination, and the ability to learn on the fly” (Reinicke et al., 2000, p.xi). Identifying these collaboration dynamisers is very important if we want to support a learning community development. Starting from the fact that every member of the community has a given capacity and interest in actively participating in the proposed collaborative activities and that some actions can be taken to foster the participation of specific actors within the network, in general two ways exist to foster fruitful collaboration within the community. The choice is to either focus our support on the actors which show a strong starting collaboration capacity, facilitating the emergence of community leaders with a strong collaboration reputation and with the capacity of “amplifying collaboration” (Novak, 2011), or on the other hand to target the actors that appear more hesitant to engage in collaboration activities, aiming at reaching a more balanced growth of the community. It is not only a matter of finding the best way to activate existing collaboration capacities, but a choice which normally gives an imprinting to the community evolution. Focusing on the collaboration leaders has the benefit of working with a few hubs relying on their capacity to engage the other nodes, but at the same time is a risky solution since, in case a collaboration hub would stop behaving collaboratively, the whole community connectedness is put in danger, with the effect of disengaging the learners which were relying on that particular leader. Focusing on the collaboration followers has the advantage of being able to directly reach all the actors of the community and can facilitate the discovery of hidden collaboration energies, but it is more effort-consuming and risks uncovering existing resistances to collaboration, with a negative effect on the community development.

Conclusions

The success of any networking venture depends on the capacity of the involved parties to successfully negotiate the aspects of the cooperation from their point of view, and on how much the parties are able to work towards a common objective, openly sharing concerns and problems and working out solutions in a collaborative way. This is a fundamental condition to be met, we believe, if we want learners to comfortably “sit in the driving seat” of their lifelong learning process, and if we want them to take

advantage of the collaboration and possibilities offered by ICT. At the same time, the fact that all networking activities depend on negotiation and consensus building among human beings increases the creativity potential of the network but also its unpredictability, and therefore a sound understanding of the mechanisms and of the conditions which lay behind a successful collaboration experience must guide any collaboration support activity.

The scientific community is paying increasing attention to the study of networks (Newman et al., 2006). “Very few people realize, however, that the rapidly unfolding science of networks is uncovering phenomena that are far more exciting and revealing than the casual use of the word network could ever convey” (Barabási, 2002, p.7). Network-based approaches, and especially Social Network Analysis (SNA), can be used to understand networks from a different point of view, since they “inquiry into the patterning of relations among social actors, as well as the patterning of relationships among actors at different levels of analysis, such as persons and groups” (Breiger, 2004, p.1). In the education field, network science can help uncovering the patterning of learners’ interactions. The application of SNA to education, especially in the case of distance learning, can allow understanding the patterns of interactions between learners systematically (De Laat et al., 2007). For example, in their study on collaborative interactions in an online classroom, Russo and Koesten conclude that SNA offers an opportunity to understand how communication among members in an online learning environment influences specific learning outcomes (Russo & Koesten, 2005). In addition, SNA and network sciences can offer to education studies new approaches to understand learners’ collaboration, as demonstrated by the work of Reffay and Chanier (2003) who adopted from SNA a measurable definition of group cohesion that did not exist in education science.

We believe that the findings coming from network sciences that we have briefly presented in this paper can be extremely useful for educational researchers and practitioners when it comes to supporting meaningful collaborative learning. These issues would deserve further exploration and adaptation to real life cases within education. Specifically, it would be important to substantially apply Social Network Analysis techniques to learning networks, as suggested by Breuer et al. (2009), hence looking at collaborative learning with the appropriate level of *network thinking*.

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