Extending the SIPS-Model: A Research Framework for Online Collaborative Learning

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Abstract. The SIPS-model, introduced to emphasize social aspects of online collaborative learning (OCL) expresses the degree to which online environments for collaborative learning support social aspects through social affordances by the sociability attribute. However, OCL-environments are primarily meant to support collaborative learning. Hence, SIPS was extended by adding an educability attribute to express the degree to which these environments have educational affordances for collaborative learning (CL). In this paper, we propose a second extension, adding hedonicity to express the extent to which OCL-environments give pleasure and enjoyment during the interacting with them. By adding hedonicity, we stress that learning should not only be effective and efficient but also enjoyable. That aspect, though missing in SIPS, is an important element in learning. To reduce complexity of the SIPS-model caused by the two extensions, SIPS is split into three distinct sub-models: the PIP-, SIP-, and HES-model. By characterizing OCL-environments by the attributes hedonicity, educability, and sociability, we can more accurately evaluate the impact of OCL-environments on social presence, participation, social interaction, and social space which are needed for socio-cognitive (where group learning/knowledge construction takes place) and socio-emotional processes (where group forming/dynamics takes place) in groups. The TEL-community should take up the non-trivial task of designing OLC-environments that possess hedonicity, educability, and sociability through their respective affordances.

Keywords: Online collaborative learning · Hedonicity · Educability · Sociability
Social presence · Social space · Affordances · Extended SIPS-model · CSCL

1 Introduction

Collaborative learning is "the instructional use of small groups so that students work together to maximize their own and each other's learning" [20; p. 87]. A variety of pedagogical techniques was developed to implement collaborative learning (CL) such as structured academic controversy [19], and jigsaw [3]. In contrast to these so called direct approaches, Johnson and Johnson [18] suggested a conceptual approach, which entails that every successful collaborative pedagogical technique should fulfill five conditions: (1) positive interdependence, (2) group and individual accountability, (3) promotive interaction, (4) group processing, and (5) social skills. CL was first applied

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in face-to-face classrooms but as technology developed and internet became the dominant way to connect computers, computer supported classroom collaborative learning (CCL) and online collaborative learning (OCL)—collectively known as computer supported collaborative learning (CSCL)— became possible. Computer-supported CCL is basically synchronous collaboration whereas OCL supports a-synchronous CL. While a-synchronous collaboration has certain benefits such as relaxation of time and place constraints enabling collaboration between distance education students, it has also drawbacks [30]. First, social interaction for socio-cognitive processes risks not occurring unless specific pedagogical techniques are developed that takes the asynchronous mode of OCL into account. Second, while group dynamics processes naturally take place in face-to-face settings, they are hampered in online settings unless explicit attention is paid to them by recognizing that social interaction is not only necessary for socio-cognitive processes but also for the socio-emotional processes underlying group forming and group dynamics. It is hampered because the social interaction has to take place via communication media which are mostly text-based, which cannot easily communicate the expressiveness and richness—in terms of verbal and non-verbal cues—of face-to-face social interaction. These cues are needed for impression formation which is at the basis for developing the interpersonal relationships so important in group dynamics [54].

Group forming and group dynamics and all the variables that may affect these processes are all social aspects of OCL. Kreijns, Kirschner, and Vermeulen [29] proposed the SIPS-model (SIPS: *S*ociability, social *I*nteraction, social *P*resence, social *S*pace; see also [57]) to emphasize the social aspects of OCL. In the SIPS model, the degree to which online environments for CL support social aspects through social affordances is expressed by their sociability attribute. But as the purpose of OCL-environments is to support CL, Kirschner, Kreijns, Phielix, and Fransen [25] extended the SIPS model, adding an educability attribute expressing the degree to which these environments have educational affordances to support collaborative learning. In this paper, we propose a second extension, namely the hedonicity attribute which expresses the extent to which OCL-environments give pleasure and enjoyment during the interaction with them. By adding hedonicity, we stress that learning should not only be effective and efficient but also enjoyable. That last aspect was missing in SIPS but considered an important element in learning [23]. Not considering hedonicity in OCL would mean an incomplete picture of all the variables that may affect social interaction and, thus, CL, group forming and group dynamics.

To reduce complexity of the SIPS-model caused by the two extensions, the model is split into three distinct sub-models: the PIP-model (PIP: *P*articipation, social *I*nteraction, *P*erformance), the SIP-model (SIP: *S*ocial *I*nformation *P*rocessing) based on Walther's SIP-theory [54, 55] and the HES-model (HES: *H*edonicity, *E*ducability, *S*ociability). In the next sections each of the sub-models (PIP, SIP, and HES) will be described.

2 The Extended SIPS-Model

2.1 The PIP Model: *P*articipation, Social *I*nteraction, *P*erformance

The PIP-model (*P*articipation, social *I*nteraction, *P*erformance), introduced by Kreijns, Kirschner, and Jochems [30, 31], is meant to show the dual function of social interaction, namely for the meta-cognitive and socio-cognitive processes and for the social and social-emotional processes, and how these processes affect learning and social performances. Meta-cognitive and socio-cognitive processes are those processes in which the group learning and knowledge co-construction takes place and are seen as being important for regulating CL in groups.

Figure 1 displays the PIP-model along with a number of variables that affect participation and social interaction, and some outcome variables. The next sub-sections will discuss pedagogical techniques, academic and social skills, the dispositions OCL-group members may have, and finally social space and social presence.

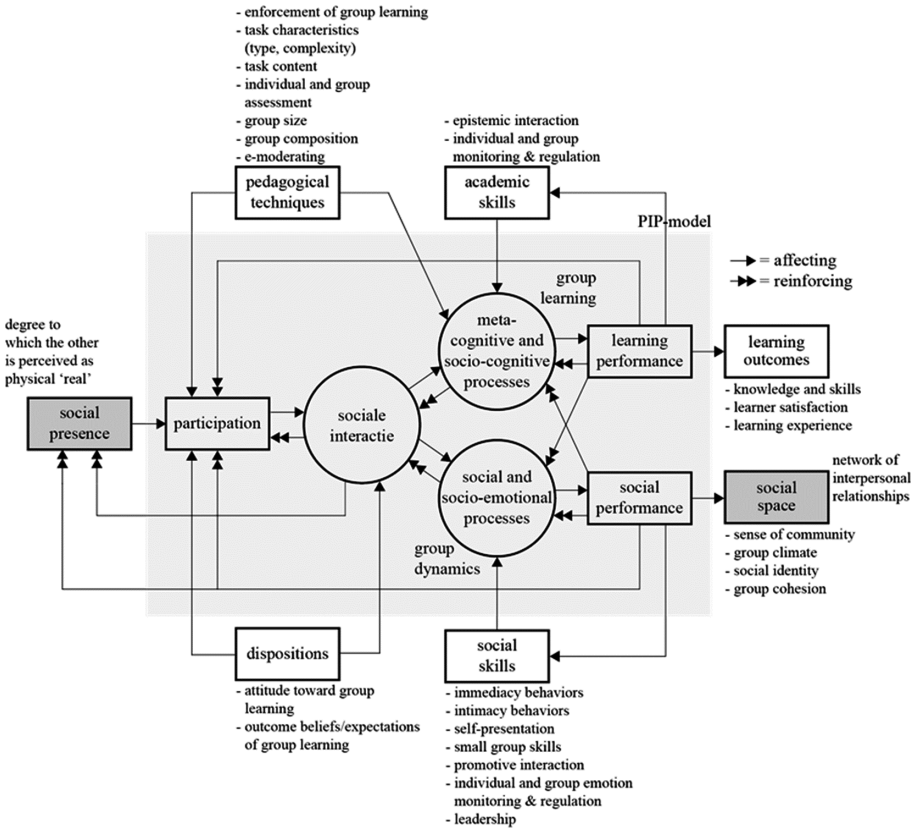

Fig. 1. The PIP-model applied to collaborative/group learning.

Pedagogical Techniques. Researchers have developed pedagogies specifically suited to CSCL. One stream exploited the graphical possibilities of computer displays by introducing shared graphical workspaces. Knowledge Forum® is a knowledge building environment in which shared discourse is supported by the textual and graphical representations of ideas that can be reorganized or reconstructed [46]. A second stream investigated the effectivity of scripting on the degree to which productive social and cognitive interactions emerged between members of a CL-group by showing prompts/cues on the computer screens to which they have to respond [10, 58]. Through scripting, CL-members are more engaged in problem solving, fostering mutual understanding, and giving elaborated explanations than when there is no script guidance. With scripting the probability of learners sharing knowledge construction is increased; without scripting learners risk diverging from the topic [58]. Recently a third stream of CSCL-researchers are augmenting cognitive load theory [52] so that it can be applied in groups as well. They stated that when group task complexity exceeds the complexity level that an individual can process alone, the task should be divided among more individuals working together but under the condition that transactional costs—because of communication and coordination—is kept acceptable [24]. However, these pedagogical techniques are primarily for synchronous computer-supported CCL and may not all be well suited for a-synchronous OCL.

Academic Skills. Academic skills refer to the "ability to identify and use different ways of knowing, to understand their different forms of expression and evaluation and to take the perspectives of others who are operating within a different epistemic framework" [39; p. 109). Ohlsson [42] proposed seven epistemic activities associated with academic skills: (1) describing, (2) explaining, (3) predicting, (4) arguing, (5) critiquing/evaluating, (6) explicating, and (7) defining. Some researchers point to the ability to perform these epistemic activities as argumentation competence that can be supported by argument scaffolds, a specific kind of scripting [59]. By performing epistemic activities, CL-group members acquire domain-specific knowledge.

Social Skills. In addition to academic skills, social skills are also necessary and complement academic skills. Johnson and Johnson [18; p. 369] included small group skills in their five conditions because "participants must (a) get to know and trust each other, (b) communicate accurately and unambiguously, (c) accept and support each other, and (d) resolve conflicts constructively […]. Interpersonal and small-group skills form the basic nexus among individuals, and if individuals are to work together productively and cope with the stresses and strains of doing so, they must have a modicum of these skills." Except for these skills, social skills also encompass many other skills including leadership and self-presentation in an online environment.

Dispositions. Dispositions like attitude and beliefs towards CL must be taken into account because they affect participation and social interaction in both the educational and social dimensions. The OECD Programme for International Student Assessment (PISA) 2015 [41] found females to be more positive than males about CCL when assessed on its relational potential (i.e., working with peers) whereas the opposite was true when CCL was assessed on its potential for efficient teamwork (e.g., make better decisions). A study by Kreijns [27; Chapter 10] showed that the majority of distance education students

involved in OCL had negative attitudes towards CL. Distance education students are often adults with families and full-time work and therefore, the freedom to study whenever they wish, in their own pace, and from any location made them decide to enroll in distance courses. CL jeopardizes freedom of pace and forces them to coordinate their activities with each other. Indeed, Rourke and Anderson [44; p. 270] pointed out that there is a "group of students [that] may select distance education because it has traditionally allowed students to work towards their goals independently without having to interact with others."

Social Space. Effective CL can only take place when a group is productive and well-functioning with a positive group climate, mutual trust, a sense of belonging and of community making the group a psychologically safe place to engage in critical discourse and share knowledge [18, 49, 53]. These features are manifestations of a sound social space; the network of social relationships amongst group members [29]. As Jacques [17; p. 72] stated "lack of attention to the socio-emotional dimension means that many of the task aims cannot be achieved. Without a climate of trust and cooperation, students will not feel taking the risk of making mistakes and learning from them." Kreijns, Kirschner, and Jochems developed a social space measure [34].

Social Presence. Whether social interaction is used for socio-cognitive or for socio-emotional processes, it is affected by the communication media's limited capacity to communicate verbal and non-verbal cues. To build a theory around these media effects and how they affect participation and social interaction, OCL-researchers (e.g., [13, 14, 61]) adopted the concept of social presence from communication researchers, defined by Short, Williams, and Christie [48; p. 65] as the "degree of salience of the other person in the interaction [first part] and the consequent salience of the interpersonal relationship [second part]." Kreijns, Weidlich, and Rajagopal [28] redefined the first part as the "degree to which the other person is perceived as physically 'real' in the communication" and identified this as 'social presence', for which they developed a social presence measure to assess this realness. However, not all social presence researchers agree with this definition as illustrated by Lowenthal and Snelson [36]. The second part of the definition was identified as 'social space,' which is mentioned above. Social presence research claims that social presence influences participation, social interaction, leaner satisfaction, and learner outcomes [13, 14, 61].

2.2 The SIP Model: *S*ocial *I*nformation *P*rocessing

Impression Formation. Walther's [54] *S*ocial *I*nformation *P*rocessing (SIP) theory states that despite the fact that online communication lacks the full richness of face-to-face communication in terms of the extent to which communication media can transfer the physical signals conveying verbal and non-verbal cues, communicating partners still can develop interpersonal relationships. SIP-theory was a response to existing theories (e.g., media richness theory [7], cues-filtered-out theory [50], and social presence theory [48]) denying that interpersonal relationships can develop in lean media. According to these theories, if verbal and non-verbal cues cannot be transferred, behaviors that rely on these cues and which play an important role in developing interpersonal relationships

[48] such as intimacy [2] and immediacy [60] will be hampered. SIP-theory states that communicating partners develop interpersonal relationships over time even in lean media with possibly the same relational dimensions and qualities as face-to-face relationships. Given enough time, messages accumulate and through this accumulation and the compensation of non-transferable physical signals to express intimacy and immediacy behaviors (e.g., emoticons or particular spatial arrangement of words in the messages), communication partners form individuating impressions of each other resulting in corresponding mental models.

Impression Management. Impression formation and mental models are the bases on which the interpersonal relationships develop [54] and communication (i.e., social interaction) transforms them from impersonal into interpersonal and, in some cases, even into hyperpersonal [55]. To elaborate the latter, Walther's SIP-theory also includes a process of impression management; that is, the process in which communication partners determine how they will present themselves online and how to sustain this. Usually, communication partners create more favorable impressions of themselves to others by deciding what to share about themselves and what not. They are informed by the same accumulated messages—which now function as a feedback channel—whether they succeeded in this endeavor or if they have to make some adjustments. On the other hand, communicating partners also tend to evaluate and judge the accumulated messages more positively than they are, thereby idealizing the other communication partners, which is reflected in the mental models formed. The selective self-presentation and the idealized mental models cause the hyperpersonal effect. Walther [56] also showed that this hyperpersonal effect diminishes once communicating partners meet each other in a face-to-face setting.

The SIP-theory of impression formation and impression management, that explain how mental models of the communicating partners are formed and how communicating partners create online identities will ultimately have an effect on social presence as realness. The SIP-model in Fig. 2 graphically depicts the SIP-theory.

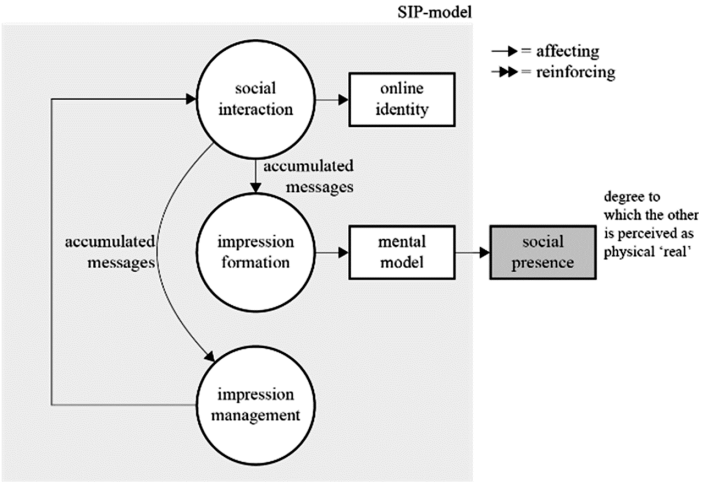

Fig. 2. Walther's [54] SIP-model. Accumulated messages for impression management are filtered on feedback information about one's own online identity; accumulated messages for impression formation are filtered on information about the other.

2.3 The HES Model: *H*edonicity, *E*ducability, and *S*ociability

The last model is the HES-model (*H*edonicity, *E*ducability, and *S*ociability), which represents an affordance perspective on online environments used for CL. The attributes hedonicity, educability, and sociability characterize OCL-environments. As such, these attributes contribute to the usefulness of the OCL-environment.

Hedonicity. Hedonicity expresses the extent to which OCL-environments give pleasure and enjoyment during the interacting with them. To do so, these OCL-environments should possess hedonic affordances. Gamification widgets are obvious choices for bringing hedonic affordances to the OCL-environment. Gamification is the application of game-design elements and game principles in non-game contexts [15]. But other, not gamification-based features in the OCL-environment, may also possess hedonic affordances and should be considered as well. In that respect, human-computer interaction (HCI) research on *funology* studies how we should understand and design for fun as a user experience [4]. Findings from HCI-research may inform the design of OCL-environments that exhibit hedonic affordances. Our search for literature on hedonic affordances in CSCL, however, made clear that the CSCL-research community is not yet exploring hedonic affordances that are built in OCL-environments and how they affect participation and learning and social performances with the exception of Suh and Wagner [51]. In that respect, the CSCL-research community lags behind the e-commerce community that has collected empirical evidence on the role of hedonicity and purchase intention of users visiting web-stores (see, for instance: [6]).

While the OCL-environment by itself may possess hedonic affordances, collaborative tasks may also have these affordances. For example, a difficult problem-solving task

may cause enjoyment among group members when it is finally solved after hard work. Interestingly, in some cases negative hedonic value (e.g., frustration) in the short term combined with positive hedonic value in the long term may ultimately result in higher learning gains than when there was solely positive hedonic value throughout the task performance [21]. This suggests that striving for positive hedonic value all the time may not always be the best strategy. Hedonic value through gamification can also be designed into the collaborating tasks. Research has found gamification-based hedonic affordances in (collaborative) tasks to be important in increasing students' motivation to persevere [35]. The relationship between hedonic affordances and motivation for learning originates from the observed enjoyment and persistence when young people play computer games to reach next levels until the game is over. However, gamification may not always result in positive learning gains [8, 15]. When meaningful gamification is brought in the collaborative tasks, and the OCL-environment supports this type of gamification, it actually adds to the educability of the OCL-environment and, as a kind of spin-off, also its hedonicity.

Educability. Educability expresses the degree to which an online environment has educational affordances to support CL. If the online environment is oriented towards CL, these affordances are requisite.

Sociability. Sociability is the degree to which the OCL-environment supports social aspects; that is, the emergence of a sound social space with its associated qualities (e.g., positive group climate, sense of community, mutual trust) [32, 33]). Social affordances—elements in the OCL-environment that have potential for evoking specific actions—affect sociability of the OCL-environment; here, social interaction that serves social and socio-emotional processes. One kind of social affordance is aimed at reducing transactional distance. According to Moore [38], the distance in distance education is more than just geographical. It implies a psychological and a communication distance both between fellow students and with instructors. He designated this kind of distance as transactional distance which can be reduced through virtual proximity (or teleproximity) [32]. Research on the effects of physical proximity has shown that proximity facilitates impromptu encounters and informal or casual conversations. Festinger, Schachter, and Back [9] found that proximity leads to social relationships and even close friendships between people. One way to create virtual proximity in an OCL-group is to provide real-time group awareness information about all the other group members through group awareness widgets embedded in the virtual environments whether these are for learning, collaboration, information exchange, and so on. Group awareness is the condition in which one is informed about a number of issues including the availability of other persons, their whereabouts, their activities, and with whom a conversation can be started [31].

Learning Analytics. As can be seen from Fig. 3, the HES-model explicitly incorporates learning analytics to feed awareness information into the different types of widgets. Learning analytics are "the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" [47]. These widgets visually display the awareness information in the OCL-environment.

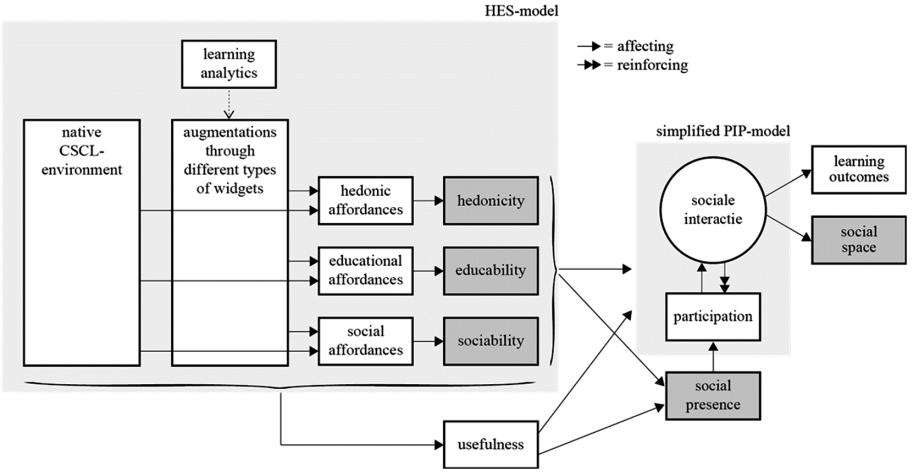

Fig. 3. The HES-model applied for collaborative/group learning. In so far, the native CSCL-environment is lacking functionalities, augmentations are added through different types of widgets. These widgets—in the context of this paper—provide group awareness.

Usefulness. Figure 3 also shows another variable, namely usefulness which refers to both the utility and usability [40]. Utility refers to the functionalities available in a system, here the OCL-environment. The attributes hedonicity, educability, and sociability represent underlying functionalities that are required in the OCL-environments as advocated in this paper but in varying degrees present in current available environments for OCL. Usability is the ease-of-use of a system so that users can interact and perform their tasks in an intuitive way [40]. According to Preece [45; p. 27], a system with good usability "supports rapid learning, high skill retention, low error rates and high productivity [and] is consistent, controllable, and predictable, making it pleasant and effective to use." It is also clear that usability also influences the degree of social presence and the social interaction; in a clumsily designed OCL-environment with bad usability, members are busier fighting the system than with learning.

Support for the HES-Model. The HES-model and its affordance perspective on OCL-environments seems to fit the uses and gratification theory (UGT; Katz, Bumler and Gurevitch [22; see also 37]). UGT purports that the extent to which media are selected and used depends on the degree to which four general motivational needs are gratified, namely: (1) integration and social interaction: the need to socialize by meeting new people and sustaining existing contacts via a sense of belonging and connectedness; (2) information: the need to self-educate, acquire new knowledge and understanding; (3) entertainment: the need for relaxation and enjoyment; and (4) personal identity: the need to reaffirm one's individual identity by getting involved in activities of others who have similar interests or other things in common.

Brandtzæg and Heim [5], studying why people use social networking sites, confirmed these four motivational needs. If at least one of the four motivational needs is not fulfilled, the medium is at risk of non-use. In other words—and from the

perspective of HCI—if media misses functionalities for achieving some purposes (i.e., gratification of one or more of the motivational needs), its utility is neglectable and, as a result, it is designated as being useless; the medium will not be used [40]. Once again, hedonicity, educability, and sociability, if present, will avoid such a risk as they simultaneously address the four motivation needs: hedonicity addresses the entertainment need, educability the information need, and sociability the need for integration and social interaction (i.e., socialization). The three attributes together address the need for establishing personal identity. A recent study [1] using UGT on the linkage between social media and job performance saw three categories of media use, namely, the hedonic, cognitive, and social use to be responsible for job performance via social capital, thereby supporting the validity of the HES-model as these categories of uses correspond very well with the three attributes of it.

3 Putting it all Together

The extended SIPS-model integrates the three sub-models (i.e., PIP, SIP, and HES);. see Fig. 4 with simplified versions of the sub-models. Furthermore, the extended SIPS-model is drawn to resemble earlier versions of it (see, Kreijns, Kirschner, and Jochems [30]; Kreijns, Kirschner, and Vermeulen [29]; and Kirschner, Kreijns, Phielix, and Fransen [25]).

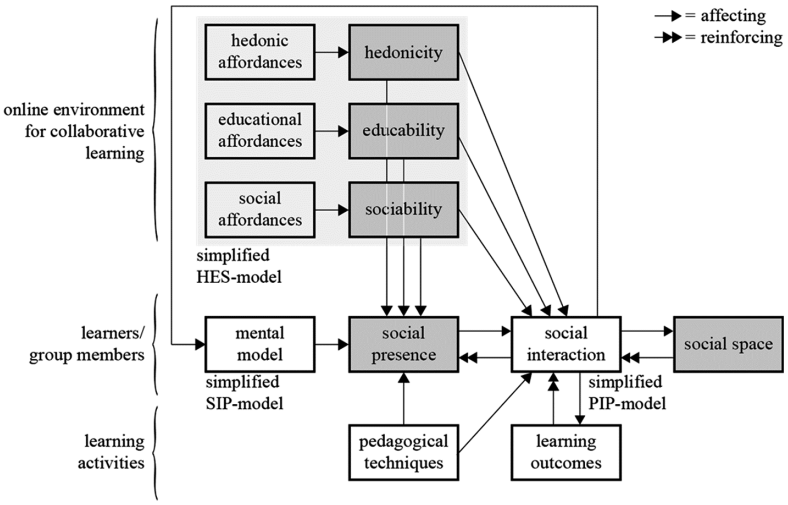

Fig. 4. The extended SIPS-model

3.1 Discussion and Conclusion

This conceptual paper [12] extends the SIPS-model by introducing hedonicity in addition to educability and sociability. Three distinct sub-models were introduced, namely the PIP-, SIP-, and HES-models. The PIP-model— centering around social interaction

for socio-cognitive (where group learning/knowledge construction takes place) and socio-emotional processes (where group forming/dynamics takes place)—is of particular interest to the CSCL-community. It shows (not surprisingly) that pedagogical techniques directly affect participation and social interaction. Most research, therefore, concentrate on finding effective and efficient pedagogies such as those based on scripting. This research is mostly done in the context of computer supported CCL but rarely in the context of OCL. The PIP-model also shows group dynamics to be essential for OCL. Unfortunately, research on the effects of mediated communication in OCL on group dynamics is seldom an item on the CSCL research agenda. The PIP-model further shows that apart from academic skills, social skills are also important.

Impression formation and impression management as shown in the SIP-model may not be of interest in the context of computer-supported CCL, but is essential in the context of OCL as it affects the degree of social presence, either perceived (through impression formation; [13]) or projected (through impression management; [11]). OCL-group members, therefore, have to acquire the social skills for appropriate impression management. Especially, when social networking sites are used, impression management is becoming even more an important issue [26].

The HES-model is concerned with the OCL-environment. It is, therefore, of particular interest to the TEL-community. If OCL-environments are not well-designed (e.g., they lack functionalities such as a shared text-editor) or have badly implemented user interfaces, it will directly affect the OCL-members dispositions in that they will dislike the OCL-environment and not use it. Furthermore, the TEL-community should answer questions about how to design OCL-environments that possess hedonicity, educability, and sociability through their respective affordances. This is not a trivial matter. One way to realize these affordances is by means of group awareness widgets [31, 32] and gamification widgets.

We hope that the extended SIPS-model and its sub-models (PIP, SIP, HES) are helpful as a research framework for OCL—and potentially also for computer-supported CCL—because they capture all the important issues of CSCL-research and show important relationships between the many variables involved. But as was already made clear in Kreijns, Kirschner, and Vermeulen [29], many of the relationships are still hypothetical and future research should investigate them.

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