A Cognitive Model of Online Collaborative Writing

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ABSTRACT

This paper presents a new cognitive model of online collaborative writing. This model describes collaborative writing as a cyclic socio-cognitive process that is developed in sequential way. The model combines the idea of collaborative writing with the idea of collaborative review, and collaborative revising. This model will show how different form of scaffolds influence the group decision-making process. This paper will show that a collaborative writing project will not only result in final paper but also knowledge transfer and changes in personal behavior and group skills that will impact the structure of personal collective memory in the future.

Key words: Online collaborative writing, cognitive process, scaffolds, results.

1. Introduction

Writing is a cognitive and creative activity. The complexity of duty and the new form of work in the organizing has led the classroom and business development to amend the point of view from individual to team (group) structures to complete the task. The rise of Web 2.0 generation such as wikis and blogs has led the individual writing style into online collaboratively writing style. The term *collaborative writing* (CW) means that the composition written in collaborative form rather than individual form. Lowry, Aaron, and Rene (2004) defined CW as an iterative and social process that involves a group focused on a common goal that negotiates, coordinates, and communicates during the creation of a common document. The potential range of CW covers the possibility of pre-task and post-task activities, group formation, and planning. Furthermore, CW may include the possibility of many different writing strategies, activities, document management approaches, team roles, and work modes. Amongst the positive impacts of collaborative writing are learning, socialization, new ideas and more understandable if not more effective document (Philips, Lawrence, & Hardy, 2004). However, Lowry, Nunamaker, Curtis, and Lowry (2005) mentioned that collaborative writing is highly complex process because it is frequently unstructured and includes multiple roles, sub tasks and activities-which can be performed interactively (Lowry et al., 2005). Lay and Karis (1991) provides several other reasons why CW can be complex, including: (a) CW documents are complex artifacts; (b) processes of preparing documents are more multifaceted under collaboration; (c) writing processes generate strong emotions; (d) groups can revise CW documents infinitely; (e) it is challenging for collaborative writers to converge toward a common goal and understanding of a document or even use a common language; and (f) success in CW is difficult to predict and guarantee.

In order to parse the persistent discrepancy between novice writers and expert writers and complexity of revision, writing researcher has tried to propose various writing model employed in the act of writing. Flower and Hayes (1981) found that the writer use combination of cognitive process, which appear to foreground when and as needed. Moreover, they stated that there is a hierarchical structure in the writing process where changing level of goal becomes the key feature of the process. Furthermore, Flower and Hayes indicated that the changing imagination, art and goals of the writer will feed and sustain the act of creation. To better represent the recursive nature of revision, Carl Bereiter and Marlene Scardamalia expanded the evaluation and revising process suggested by Flower and Hayes in 1981 by developing a compare, diagnose and operate (CDO) planning stage in their 1983 model, which they later refined in 1985 (Hsiao, 2006). Flower and Hayes in 1986 tried to fix their previous cognitive writing model. In this new model they tried to

represent more specific cognitive paths followed during the evaluation and revision processes. For the first time, the writer's knowledge and intentions are both included in the model (Hsiao, 2006).

Despite all of the refinement made in entire cognitive writing models above, all of the models above have communal weaknesses. Firstly, they all just address the cognitive model at the individual level; none of them talk about collaborative writing. Secondly, all of the models above pay more attention on the writing product itself rather than the writing process. Finally, the previous writing models do not the account of the power of scaffolding and feedback into collaborative writing process.

This paper will introduce a cognitive model of online collaborative writing involve to a more detailed study of thinking process in collaborative writing. The new cognitive process theory will perceived a collaborative writing process as a cycle of that consists of: collaborative authoring, collaborative reviewing and collaborative revising. In addition, this paper will describe how various forms of scaffolds, such as electronic feedbacks, teacher's feedbacks and peer reviews can be incorporated into collaborative writing.

2. Collective Memory

Collective memory is a plausible analog or extrapolation of human memory. It includes long-term and working memory. It contains both tangible knowledge (stored in a computer system) and intangible knowledge (carried in the heads of the group members' knowledge). Operation on the knowledge-based belongs to the processes in the memory. CW group's concrete strategies uses higher level strategies composed from these components. The concrete strategies will depend on: the collaborative authors and their objectives, the topic to be presented and the intended readers. The CW group determines: the group's awareness, the group's ways of communication, the group's distribution of responsibility, and comprehension of the topics.

2.1. Tangible Memory

A computer readable tangible memory contains a program of instructions for managing a distributed storage system. It includes a plurality of storage units which are connected to a host through a network. It also a place where the distributed-storage-system can be accessed by using a multicast message without identifying the storage unit. A computer readable tangible memory may include messages sent by the CW group members. A computer readable tangible memory can be used to send requests or reminders to the CW group members, and to allocate and to comprise a copy of a file in the storage units. In collaborative writing, tangible memory will preserve all of the preliminary texts as the product of iterative collaborative writing.

2.2. Intangible Memory

Intangible memory consists of two big parts, i.e.: (a) the audiences, (b) knowledge and beliefs. An individual in a team can be an expert coming from a certain area. His or her intangible memory can be motivated by the importance of the audiences, but also by his or her knowledge or beliefs. Combination of these aspects will serve as a base for individual knowledge and individual behavior toward the collaborative writing.

Intangible memory involves planning or forethought, where individuals define the task, set goals, elaborates strategies, and self-motivate. Next, individuals enact their plans and strategies. During this phase individuals will self-regulate by engaging in metacognitive monitoring. This will

lead to an attempt to control the learning process through changes of the focus of self-regulation. For example, an individual may notice that a particular learning strategy (e.g., outlining) does not seem to be leading to retention of the material, and switch to another strategy (e.g., self-questioning). Finally, each of the models includes a self-reflective phase where performance (measured in terms of intrinsic or extrinsic benchmarks) is evaluated. This process often leads to adaptations to individuals' self-beliefs, beliefs about learning tactics and strategies, and learning contexts. These adaptations may then influence future learning activities. It is also possible that individuals may recycle back through previous stages over the course of learning, particularly when monitoring reveals that the strategies being used are not resulting in understanding or retention.

2.3. Audiences

The main objective of writing usually is presentation of a certain view of problem domain where the level of knowledge of potential audience is taken into account. Such domain is usually complex and ill-structured, which leads to the danger of misinterpretation of over simplification when being transformed into linear form. Thus on the writer's ability to spontaneously restructure his or her own knowledge is adaptive response to changes in situational demands is important. This ability is called *cognitive flexibility* by Spiro and Jehng (1990) and will play a key role in my model. It involves: choosing the scope of the domain, point of view, a level of abstraction, a set of concepts, and realizing or discovering relationships. They help to activate relevant knowledge in the writer's long-term memory and this knowledge become the content of his or her working memory.

2.4. Cognitive Self-regulation and Motivational Self-regulation

In the beginning, researcher defined metacognitive knowledge in tem of the knowledge possessed by a student about the condition of effective and ineffective strategy use within content domain (Brown, 1978). Later, Flavell (1987) distinguished between three types of metacognitive knowledge including: knowledge about self, knowledge about various cognitive tasks, and strategy knowledge. Some authors regard motivational beliefs, such as goal orientation, interest, attitudes, and self-concept of ability as part of metacognitive knowledge.

All knowledge about cognition and motivation emanating from direct or indirect experiences related to a specific domain. Yet a distinction is made between metacognitive specific domains. It is assume that a domain-specific subset of the students' experiential knowledge base is activated when they are confronted with a concrete learning task. This subset includes strategy belief, self-referenced cognition related to the value of the task and subject matter areas, capacity beliefs, and goal orientation.

Metacognitive knowledge allows students to better comprehend, monitor or assess conceptual and procedural knowledge related to a domain, whereas motivational beliefs help them to sustain information. Chi, Siler, Jeong, Yamauchi, and Hausmann (2001) said that student who are meta-cognitively aware of what they are doing, differ from those who lack of this knowledge in metacognitive skills. These include orientation, planning, execution, monitoring, reflection and self-testing. Students who have access to these skills can deliberately represent a learning goal and to design and execute a plan of action. Students who lack of cognitive regulatory strategies will experience difficulties defining and attaining their own learning goals. In order to achieve mastery; these students have to rely on external regulation (Pea, 2004; Philips et al., 2004; Quintana et al., 2004).

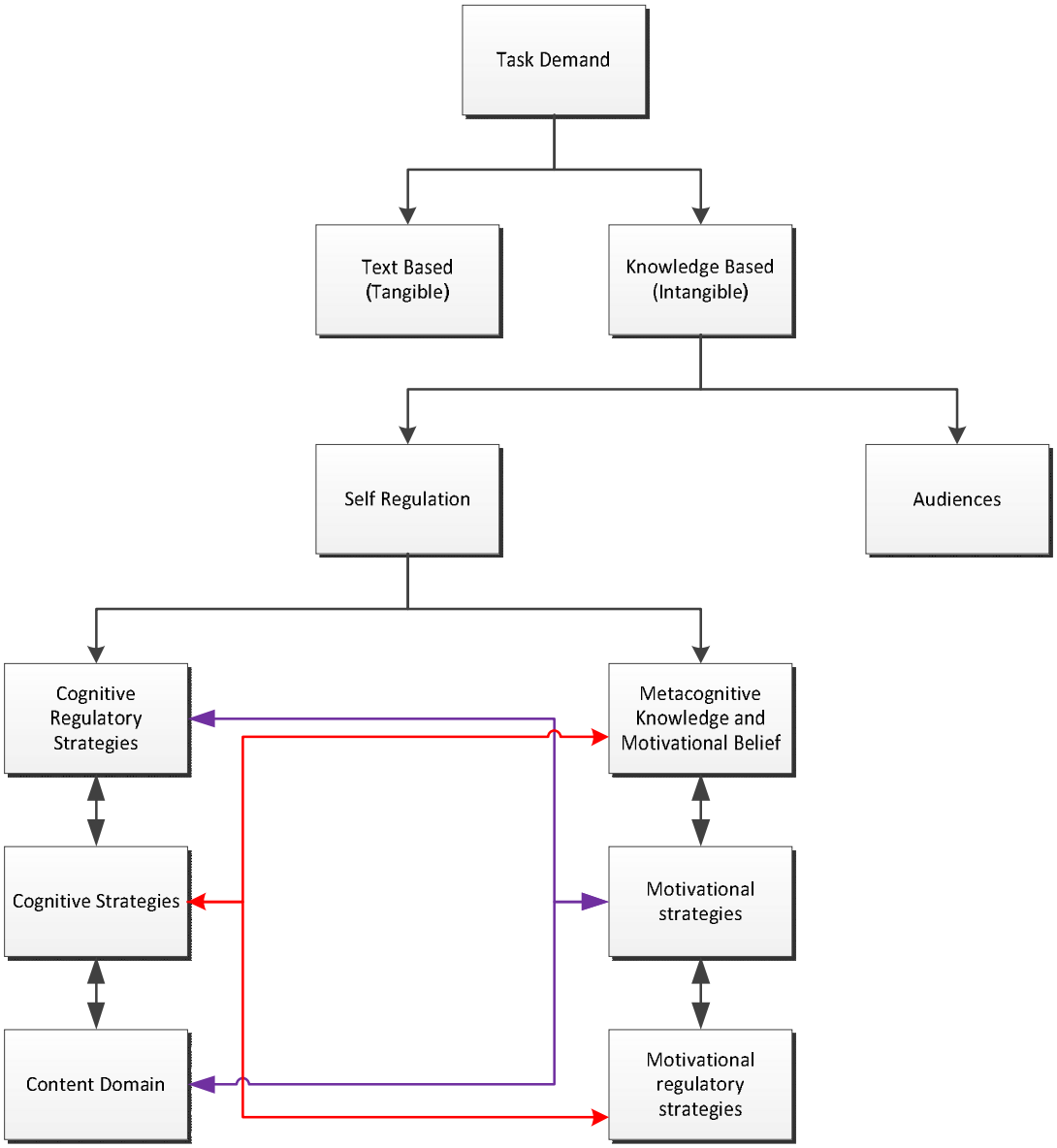

Figure 1. Collective memory.

3. Collective Processor

A collective processor performs small-grains operation in the group's memory. This process consists of developing norm(s) and developing team bonding as a based to regulate and monitor the group process. This process also includes assessing the tools available for creating the writing product and monitoring the writing process. The group must also maintain the information among the group members.

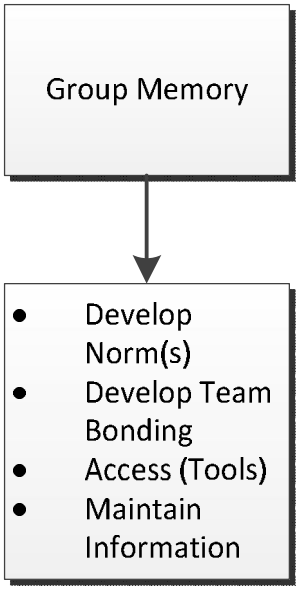

Figure 2. Collective processor.

4. Collaborative Strategy

Collaborative writing strategies focus on the text creation process (Rosenshine & Meiser, 1992; Rummel & Spada, 2005; Sherin, Reiser, & Edelson, 2004). The collaborative writing strategy consists of three phases: initiation, iteration, and finalization. For initialization, usually the groups review the task and expectation, set the collaborative writing, brainstorming the ideas for the paper. The group may also develop norms that regulate the writing task among the group, or use the script to regulate their learning. The script may define the roles and responsibilities for each group member. In order to create an effective atmosphere among the group member, it is important that the roles and the job description should match the group member competencies.

The group must also establish a work plan at the beginning of the work. A good work plan should state clearly how the group will manage the tasks, which includes: communication management, coordination management, writing strategies, and document control tools/systems). To make sure that the task in completed a specified time frame; the group must also set the milestones as well as the target and the date for each milestone (Goos, Galbraith, & Renshaw, 2002; A. O'Donnel & Danserau, 1992; A. M. O'Donnel, 1999).

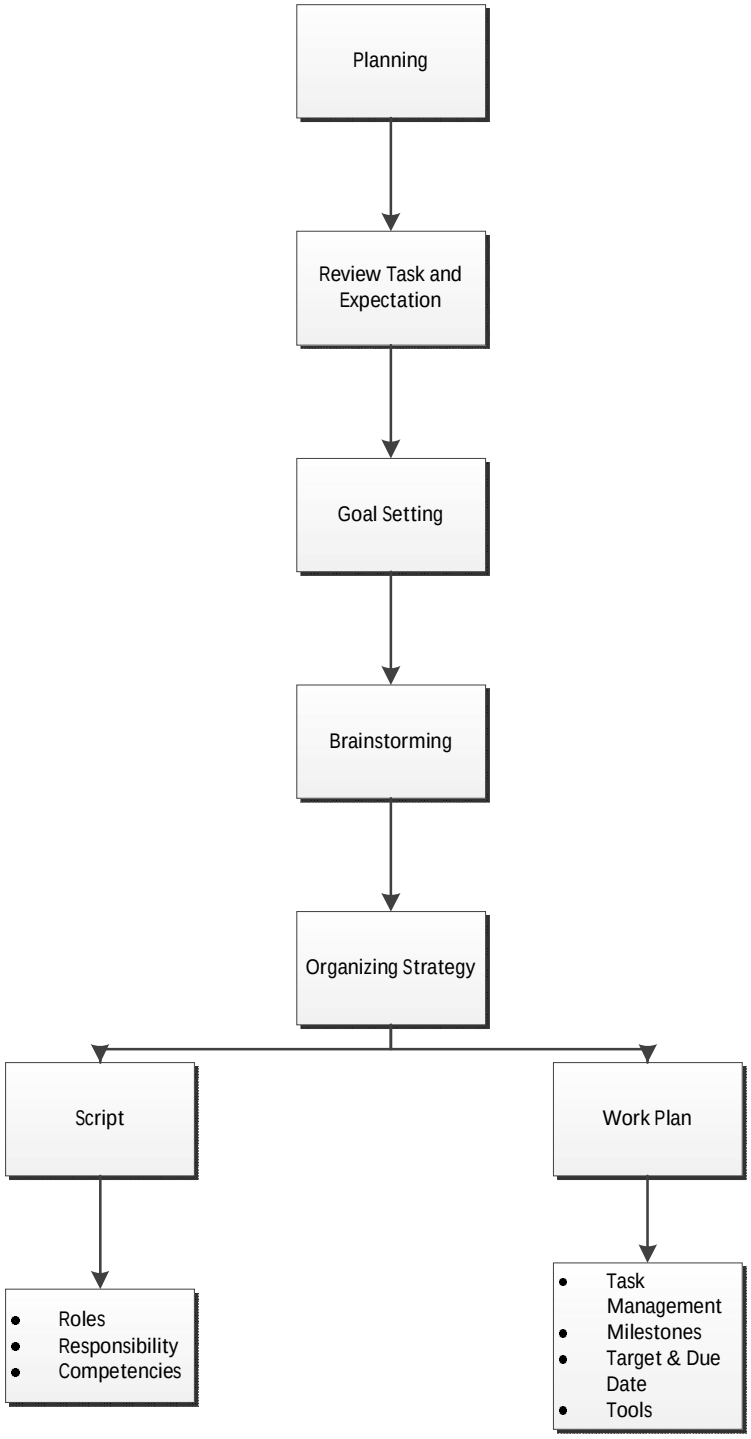

Figure 3. Collaborative strategies.

5. Collective Awareness

The writing process goes through multiple versions of text or its parts. Revisions are the key aspect of iteration between tuning of local structures and development of the global text. The concept of relevancy is renovated and revisited during the process of writing. Previous phases of writing are activated, and some are deactivated. As a result, text in the previous phase is being read again and again.

Research has shown that sometimes learners may have difficulties to operate and to perform the group tasks on their own; for example: unequal participation (Cohen & Lotan, 1995), low-level argumentation (Bell, 2004), incomparable level of knowledge acquisition (Tabak, 2004) coordinating collaborative process (Graesser & Pearson, 1994). Learners often feel that the degree of difficulties to operate and to perform the tasks on their own in computer supported collaborative learning environment is higher compared to the ordinary collaborative learning. Learners may also feel the peculiar nature of communication, because they may not know each other and they may not quite know how to behave in the learning environment (Jermann & Dillenbourg, 2003).

These indicate that learners may need some kinds of conduct. Scaffolding is an instructional support that guarantees a higher level of both collaborative processes and individual learning outcomes (Pea, 2004; Quintana et al., 2004; Reiser, 2004; Sherin et al., 2004; Tabak, 2004). Scaffolds can be used to improve the collaborative writing process by shaping the design and interactive process. Research has shown that scaffolds can support student to stimulate a schemata, i.e. a mental structure that represents some aspects of the world (Ge & Land, 2004; Palinscar & Brown, 1984), organize and help retrieve knowledge (Gillies, 2006), monitor and evaluate and reflect on their learning ((Lin, Hmelo, Kinzer, & Secules, 1999; Rosenshine & Meiser, 1992). (Ge & Land, 2004) argued that scaffolds can be used to promote cognitive and metacognitive processes.

5.1. Collaborative Script

A collaborative script is one form of scaffolds that commonly used in collaborative learning environment. Collaborative script is a series of instructions prescribing how students should form groups, how they should interact and collaborate and how they should solve the problem (Jermann & Dillenbourg, 2003).

Many studies have revealed the potential and beneficial effect of scripted computer collaboration (A. O'Donnel & Danserau, 1992; A. M. O'Donnel, 1999). Many classical scripts to facilitate collaborative learning, assume that through long practice with the script; the students would little by little internalize relevant elements of the scripts so that the external scaffolding provided by the script could be faded out over the time (Palinscar & Brown, 1984). However, (Dillenbourg, 2002) stated that there may be a chance to over scripted collaborative environment. He states that scripting computer collaboration might prevent the independent, exploratory thinking required for generative learning or problem solving. Dillenbourg (2002) argues that this is especially true for highly coercive scripts which govern the interaction in a highly detailed and uncompromising system. The scripts that concentrated exclusively on providing online help during certain ongoing collaborations may found motivational problems and reactance towards the scripts itself (Rummel & Spada, 2005).

5.2. Peer Feedback

Peers work in a common context; therefore, they may have insight into learner needs, leaners' focus and the best way to explain (Lay & Karis, 1991). Recipient benefits from peer review because they get the opportunity to experience new approaches to thinking. On the other hand, helpers benefits because when they explain their ideas to others because they have to verbalize their understanding, making elicit the differences in what in his or her mind and his or her utterance, and by doing so contain a clearer perspectives to the topic (Gillies, 2006; Teasley, 1995).

Effective collaboration show increased participation of the peers in the group discussion who then demonstrates a more sophisticated level of discourse, engage in fewer interruptions when other speak, and provide more intellectually valuable contributions to those discussions (Sherin et al., 2004). Peer review contributes to productive meta-cognitive decisions, by making think publicly, and exposes their ideas to critical scrutiny (Goos et al., 2002).

5.3. Teacher's Feedback

Graham (1990) stated clearly that praise and blame from teachers can send counter-intuitive ability messages to students. Specifically she explained that praise on easy tasks and showing sympathy for students when they fail at a task, conveys a low ability message. Whereas blame or anger and disappointment for failure conveys a high ability message. (Barab & Duffy, 2000) found a developmental shift in children's perceptions of these types of feedback. Teacher's feedbacks also provide final judgement of the correctness of the idea and final consideration for content development of the writing product.

5.4. Electronic Feedback

Computers may offer support during the reviewing process. Support for collecting and aggregating the date might be provided by mirroring tools, which assist learners and teachers in the collection of data by providing them with graphical feedback about their interaction. Support for the comparing and contrasting the current and desired state might be provided by cognitive tool in the computer program, which assist learners' or tutors' diagnosis of the interaction through visualizations that represent the standards of productive interaction. Support for the final steps might be provided by guiding systems, which propose remedial actions based on a computational assessment of the situation. The collection of data and the diagnosis of the current state of interaction remain hidden to the learners in guiding systems.

In parallel with changes in the text, changes of ideas and group norms also occur. The changes of the idea and group norms may occur as a result from feedback from peer review, tutor review and electronic feedback as well as the collaborative script. In this case, collaborative script and feedback work as scaffolds for the collaborative writing. Collaborative script and feedback help learners to elaborate thoughts, explain results, evaluate solutions as well as explore and clarify inconsistencies and knowledge gaps. It also links verbal information to new strategies and tangible action and so benefits from the cognitive restructuring that underpins cognitive change (Teasley, 1995). The small size of the group will foster each group member to verbalize his or her ideas in order to convince himself or herself and his or her group mates of the correctness of his or her view. This allows learners to explore variations between their own and their partner's knowledge (Gillies, 2006).

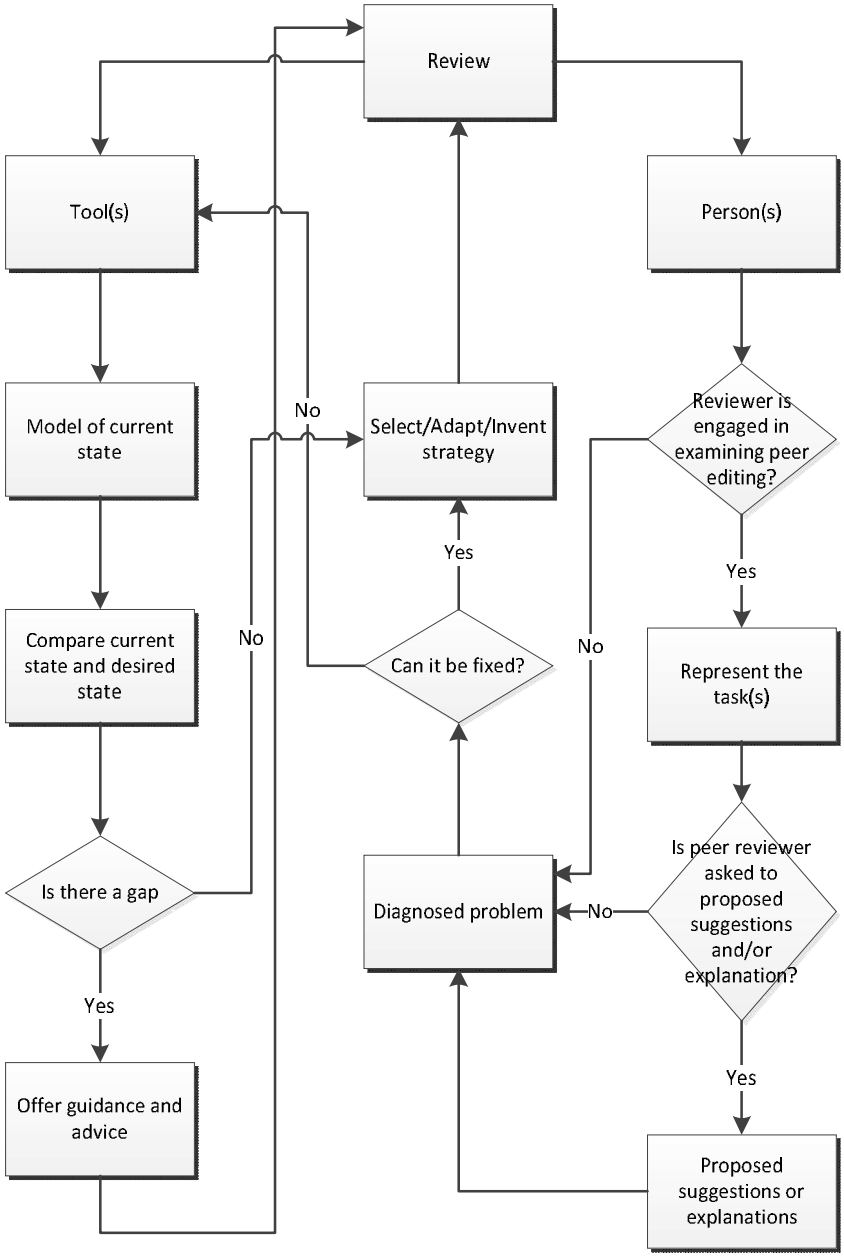

Figure 4. Collective awareness.

6. Final Product and Outcome

Collaborative writing produces final paper as its final product. In addition to the final paper, collaborative writing may also affect the individual behaviour, individual skills and also individual knowledge transfer. Becoming a member of a group and the part of an individual appears to influence the group members' behaviours in many ways.

6.1. Risk Taking Phenomenon

Risky shift phenomenon is the tendency of an individual to takes greater risk when he or she has to work collaboratively. Risky shift phenomenon happens due to the spread of responsibility among the CW group members. People may feel less blame for possible failure in collaborative setting. This results in parts from persuasive communication. If most member of the group agree that risk is correct value for the problems under consideration, then most of the reasons and justification brought out in the discussion with favour risk.

6.2. Social Facilitation

Social facilitation effect is the tendency to be aroused on the single task when under the eye of the others, rather than while they are left alone. Collaborative writing environment, make people give more concern about the opinion of the others. Especially when the individual is being watched or evaluated by someone whom he or she does not know well.

6.3. Collaborative Skills

An iterative process of collaborative strategies and collective awareness which accumulate in collective knowledge building and collective cognition will help student to sharpen and deepen their collaborative skills. These skills are some of the skills that people need to succeed. A good collaborative writing experience will help the learners to acquire collaborative skills including: the abilities to contribute to group activities and discussion, considering the ideas and perspectives of other, including others in the collaborative process, staying focused on the task, and providing and receiving feedback constructively.

6.4. Knowledge Transfer

Knowledge transfer consists of moving knowledge to where it can generate value. It can be used to support the executions of the next group collaborative writing tasks. Computer supported collaborative writing can support knowledge transfer; and at the same time, it improves creation process of new knowledge (Hsiao, 2006).

Individual transfer of knowledge is facilitated by confronting students with problems and causing them to reflect upon problem cases with a given theory in computer supported collaborative writing environment (Barab & Duffy, 2000).

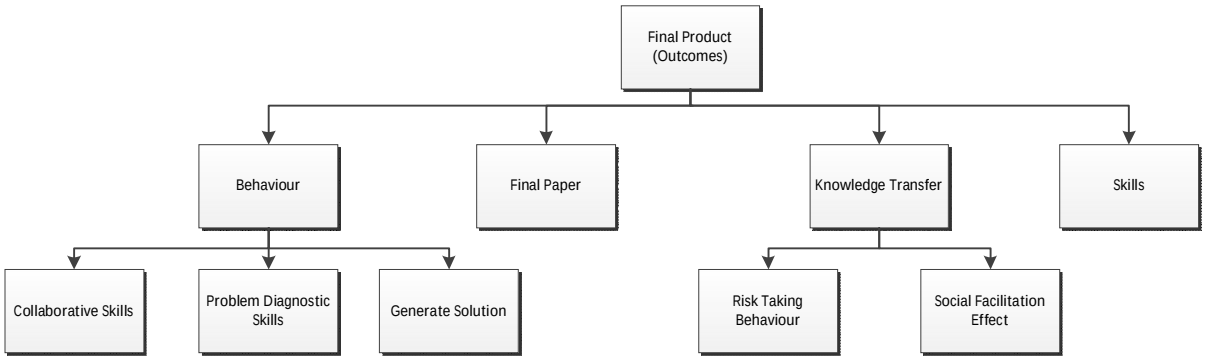

Figure 5. Final product and outcomes of collaborative writing.

The final product and outcomes of the collaborative writing will be saved in tangible memory form. The knowledge transfer, collaborative skills and behaviour will influence the writers' beliefs and knowledge. These beliefs and knowledge with will serve as tangible (knowledge based) component in the collective memory. Thus all of the collaborative writing phases (collective memory, collective processor, collaborative process, collective awareness, and final product and outcomes) will form a cycle in our cognitive model for online collaborative writing system.

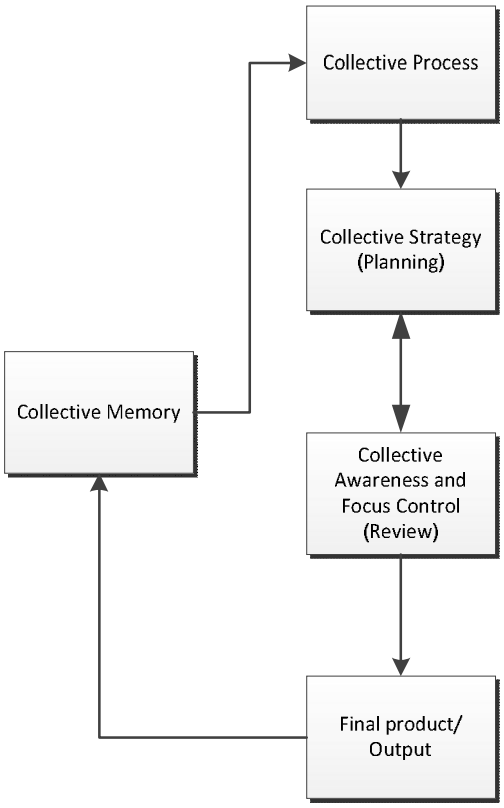

Figure 6. A cognitive model of online collaborative writing.

7. Conclusions

The proposed cognitive model of online collaborative writing picture a cycle of collective memory, collective process, collaborative strategies, collective awareness and final product and outcomes of collaborative writing.

There are different types of prior knowledge that the learners may have. Although some of the cognitive strategies present in the experts' cognitive repertoire may be applicable to master the writing task, attention should be given to decontextualize these strategies and to make them as an instrumental for the emerging domain-specific components. However, it is possible that the metacognitive knowledge and motivational beliefs concerning time and effort management are invalid. This may imply that the motivational strategies maybe ill- adapted thus need elaboration. Specific scaffolds may be necessary to extent and adapt the learners' prior memory. Therefore, teachers should be aware of different kinds of prior knowledge. They should invite their students to activate their prior knowledge and make it instrumental to the new domain.

Since learner often having difficulties in collaborative writing process, intervention to the pre structured the contents appears to be very useful. Scaffolding might be particularly effective when learners are asked to apply theories to authentic problem based-case and vice versa. Collaborative script can give the learner meta-communication components by providing the learners with roles and introduce them to perform particular interaction at specific time. Computer supported collaborative writing tolls allow the adaption of the writing material to the current group needs in an easier way than face-to-face collaboration.

The collaborative writing process is related to the acquisition and the content renewals of the competencies (knowledge and skills), in which the collaboration among group play a fundamental role. The challenge is to develop a system which will able to adapt to the context, structure and presentation of the information to the current context, as well as user needs and level of knowledge. To achieve this, an integration of several information technologies, information retrieval, knowledge based system, and groupware are needed.

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