SUCCESSFUL IT INTEGRATION: THE HUMAN FACTOR BEHIND IT

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Abstract

Even if research has shown the positive impact of IT integration on student learning, most people would agree that simply having IT in the classroom doesn't guarantee its effective use. Surveying more than 20 years of research in the area, ARC – Association pour la recherche au collégial – has been attempting to answer the question of IT impacts on student learning at the collegial level, a network of pre-university and technical post-secondary schools. The first parts of this study resulted in a heuristic model that integrated factors which had positive impacts on student achievement. Our personal contribution to the model shed light on the human factor as an important one for successful IT integration in the classroom. Based on the results of two previous studies we performed, the following paper aims at presenting our conceptualisation of how student and teacher characteristics interact as determiners of successful IT integration.

Keywords - Innovation, technology, research projects, collegial, student, teacher, motivation, learning

1 CONTEXT

Aiming at increasing the quality of education and student academic success, the 1993 pedagogical reform that took place in Québec's collegial level schools[1] directly called for changes in teaching practice. Three years after the reform, the government invested an important amount of money for the integration of information technologies (IT) in its different schools and in the collegial network. The massive integration of IT in teaching reinforced the need for changes in teaching practices. Considering the importance of the reform goals and the financial resources invested in IT implementation, the question of IT pedagogical impacts remains an actual one.

The potential of IT in the education field has been recognized by many [1][2][3] Even though the positive impacts of IT activities on student learning and motivation have been referenced, no direct relation has yet emerged between the type of technology used and the type of impact produced.[4][5] Actually, most people would agree that simply having IT in the classroom doesn't guarantee its effective use. In fact, IT can lead to student frustration, demotivation, disengagement, and decrease in participation.[3][6] Surveying more than 20 years of research in the area, ARC – Association pour la recherche au collégial – has been attempting to answer the crucial question of IT impacts on student learning and academic success at the collegial level.

To answer this question, ARC undertook the meta-analysis of results from various experiments (32 in all) in the field of IT application at the collegial level. The end-product of this study was a heuristic model that integrated different factors which have empirically been found to have positive impacts on student achievement at the collegial level.[7] The objective of this paper is to 1) present the two studies at the origin of our model, and 2) describe our conceptualisation of the human factor underlying successful IT integration.

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1 The collegial level is a network of pre-university and technical post-secondary schools. There are two types of collegial level schools in the network: the *public* colleges, also called cégeps (collège d'enseignement général et professionnel) and the *private* colleges. The expression « collegial network » covers both realities.

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2 SPECIFIC CONTEXT – OR USING IT TO TEACH ENGLISH AS A SECOND LANGUAGE AT THE COLLEGIAL LEVEL

Our contribution to the wider heuristic model emerged from two studies we conducted on IT use in the ESL classroom at the collegial level. The first study took place in the context of IT implementation [6] while the second one studied the impact of IT on students' and teachers' perceptions and roles.[8] The two following sections briefly describe the studies performed as well as the results obtained. We then present our conceptualisation of successful IT integration.

2.1 Study 1: Impact of IT on student motivation

The first study we performed aimed at evaluating the impacts of a change in the teaching-learning context (the implementation of an IT laboratory) on second language learner motivation.[6] Overall, 373 students were surveyed (pre-test and post-test) with regards to 3 determiners (interest, self-efficacy, epistemological beliefs) and 2 indicators (effort, satisfaction) of motivation.

As conducted, this study showed the multimedia language laboratory implementation had no impacts on student epistemological beliefs, interest, and effort. Slight non-significant increases in self-efficacy and satisfaction were found for the experimental groups. Overall, this study showed that the taxonomic level of the learning task and the pedagogical strategy opted for emerge as major elements to consider for positive IT impacts on student motivation and, consequently, on student academic success. Actually, when not integrated in an adequate pedagogical approach, IT use would increase the risk of a decrease in student interest, self-efficacy, satisfaction and global motivation, all of which are important variables for student academic success in the school context.[9] From another point of view, results also allow us to add that IT material does not trigger student interest and effort as teachers can. It is, as Bandura [10] would put it, the social structure of the learning situation and other people's expectations that will substantially influence the learner's behaviour. Actually, as interactive as IT tools can be, they do not and can not create this expectation component. It is the teacher who will, so to say, convince the learner to put more effort into his/her learning in order for the later to experience success.

2.2 Study 2: Impact of ITs on perception of ESL learning and on student and teacher roles

This second study evaluated the impacts of an IT innovation with regards to students' and teachers' perception of their roles and learning done in the experimental course.[8] Two ESL teachers and 59 students participated in the study.

Comparing their actual ESL course using IT to their previous one which did not, students report an equal perception of learning i.e. students did not feel that they neither learned more nor less in one course as compared to the other. However, student comments reveal the need for a learning environment that supports and meets collegial level student diversity and needs. As for the teachers, they say that using IT modified the classroom dynamics in terms of classroom management and student-teacher relations. In support to the latter, teachers actually mention not only adapting their ways of teaching from a "lecturing" approach to a more "individualized" one, but also and being able to answer more questions one-on-one. Both students and teachers reported that students developed more autonomous work methods and that the IT tool created for this course facilitated students' active engagement in their learning. Briefly put, this shows that there has been a change in how students and teachers perceived their respective roles. Finally, with regards to the IT integration process, results confirm the need to consider teachers' characteristics, level of skills with IT and teaching beliefs when implementing IT pedagogical innovations.

3 THE HUMAN FACTOR BEHIND SUCCESSFUL IT INTEGRATION: A CONCEPTUALISATION

Following these two studies, we were invited to participate in the ARC's study and to elaborate, based on our research findings and teaching experience with IT, on our conceptualisation of successful IT integration. The data that emerged from the two hour long interview was translated into a conceptual map (see fig. 1, next page). This contribution added to the ARC's heuristic model by shedding light on the human factor as an important one for successful IT use in the classroom. Recognizing all the

potential ITs have in education, we now advance that it is because of and through the human factor behind the tool that ITs can have an impact on student learning and, consequently, on student academic success.

The c-map depicted next page represents our conceptualisation of successful IT implementation. It comprises a total of 42 concepts and 75 utterances describing the relations between two concepts. Major concepts (n=19, see table 1 below) and utterances (n=42, see appendix 1) were classified according to the number of links that they shared with other concepts in the c-map. A concept showing 4 links or more with one or more concepts was identified as a major one; this also applied for the identification of the major utterances.

Concepts	Nb. of links
Teachers	11
Beliefs, representations	8
Choices	7
Implementation context, variables	7
Management of pedagogy, of professional tasks	7
Student-teacher relation	7
Exercises	6
ICTs	6
Pedagogical objectives	5
Tools	5
Student motivation	5
Academic success	5
Differentiation individualisation	5
Variety of possibilities	5
Differences	4
Balanced use	4
Teacher motivation	4
Students	4
Interest and self-efficacy	4

Table 1: Major concepts identified in the c-map

Drawing from the c-map itself and the main concepts and utterances identified, we will now describe our conceptualisation of the human factor underlying successful IT integration. Even if many of the relations conceptualised in our model need to be supported with more empirical findings, many of them can also be found in the literature on the subject. In order to better support our model thereafter described, references will be used when possible. For clarity purposes, we will choose the "organization" as our discussion starting point.

The milieu where one teaches appears to be the first element that could facilitate or hinder one's decisions to integrate IT in his/her teaching or not. That is to say, for example, that depending on the principal's philosophy, on financial support allotted, or human resources availability, one may be more or less encouraged to innovate and use IT. In fact, it is the organizational milieu that establishes the conditions that will make IT integration possible.

Learning objectives as identified in the official curriculum also influence teachers' choices: they guide and orientate teachers' pedagogical choices when it comes to tools, tasks, techniques, etc. In terms of quality of learning, learning objectives and learning tasks taxonomic levels need to show some kind of adequacy i.e. to work towards students' learning, students must be presented with tasks and contents that will engage them cognitively speaking. Actually, students have to interact and to play, if we may say, with complex enough materials that, at the same time, allow them to come up with their own conclusions, as compared to being a passive decipherer of knowledge.[11] If content or exercises provided don't meet adequate taxonomic levels, chances are that integrating IT will not make a difference in the classroom.

Even though the curriculum and the milieu definitely influence teachers' pedagogical choices, it is actually the teacher's interest in and perception of self-efficacy with IT that will predominate and bring him or her to use IT in effective ways. Teachers' motivation to use IT in their classroom also appears to depend on one's learning and teaching representations about. These beliefs and representations

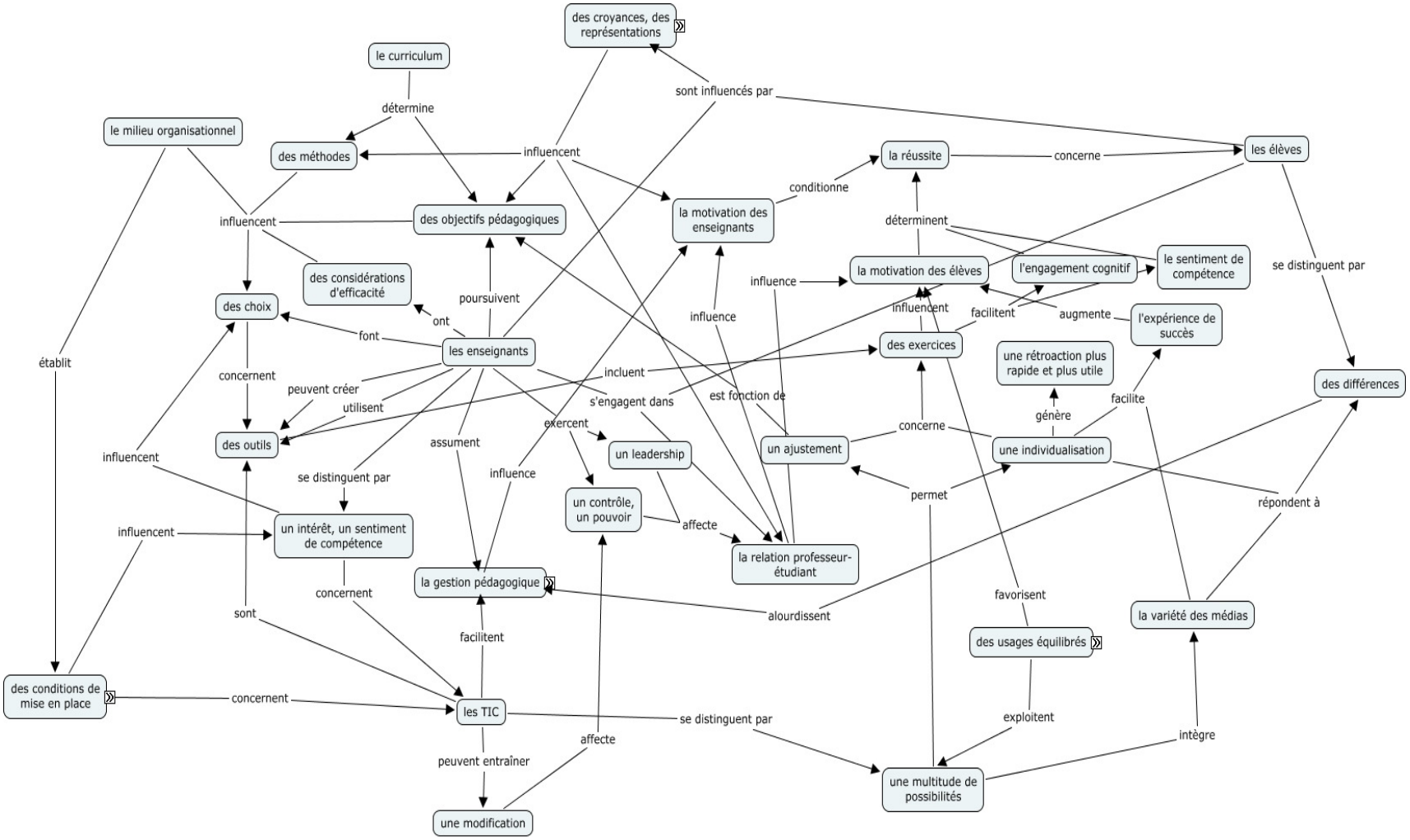

Fig. 1: C-map of the human factor behind successful IT integration

make up a reading grid with which teachers interpret curricular objectives and choose the teaching methods which would meet these objectives best. One of the main reasons for teachers to use IT appears to be the time benefits they can make with regards to their professional tasks. For example, the choice of whether to use or not IT in one's teaching-learning activities would depend on how much time teachers estimate they can save in student follow-up, administrative duties and/or class management tasks. Teachers must be able to expect to save time on work-related tasks if they are to be interested in trying and, later on, in integrating IT in their teaching.

According to our model, the student-teacher relation would play an important role with regards to interest (triggering and maintaining), motivation, and teaching or learning in an IT context. This corresponds to what numerous studies have already shown i.e. that even the most enthusiastic groups of learners usually do not last that long in the absence of an animator.[12] It is actually the absence of a real leader that would explain the termination or non-continuation of an IT-based activity. The animator, in our case the teacher, therefore appears to be one of the most if not the most important actor for successful IT integration in the classroom. Yet, teachers and students usually engage in an unequal relation: teachers represent the figure of authority in the classroom and exert a certain type of power. Because students develop more autonomous work habits, IT integration redefines the student-teacher relation in the classroom calling for teacher leadership as opposed to teacher authority.[8] Built on teacher leadership, this new dynamic would positively influence student and teacher motivation, a facilitating combination for IT integration and learning in the school context. As for the students, they are definitely influenced by, not to say submitted to their teachers' pedagogical choices, which implies that they are also more or less directly influenced by their teachers' beliefs and representations of teaching and learning. However, when teachers truly believe in what they are doing and in the tools and methods they are using, it usually leads to student learning. Moreover, as Heining-Boynton said it, "Teacher attitude has a great effect on students, and student success." [13] Again, teachers have to be motivated, ready to at least partly adapt their ways of doing things in the classroom and believe in the efficiency of IT use to make IT integration successful.

One characteristic of IT is the variety it can bring in the classroom. Because of the many possibilities it offers in terms of types of exercises, tools, accessibility to knowledge, etc, IT enables adjustments to student diversity and make differentiation in teaching easier. An integration that will take into consideration this potentiality that IT offers will have more chances to impact positively on student learning because it is through variety that teachers will be able to meet various learners' interests and learning styles. Consequently, teachers will be able to better guide more learners towards the experimenting of academic success and achievement. In fact, IT triggers greater student interest for the learning task and improve academic success through their impact on student motivation.[14] Assuming that appropriate pedagogical and classroom management strategies have been put into place, IT will enable faster and more pertinent individualized feedback to learners. Some warning should however be made here when it comes to the potential IT offers. In reality, successful integration lies more in a balanced usage of IT than on always providing students with a variety of tasks or sources of knowledge. Indeed, if one should avoid always using the same IT tools, exercises or tasks to keep students interested and engaged in their learning, this does not mean varying to the point where students can not get anchored with the knowledge and the tasks to be performed.

Actually, the type of in-class exercises also impacts on student motivation and learning. Because IT can influence, at least for a certain amount of time, student interest, students will give more time and will tend to persevere more when facing a more difficult learning situation or problem.[16][17][18] This is the case of in-class exercises that would impact on student perception of self-efficacy, cognitive engagement and that would lead to experiencing some sort of academic success. Moreover, student motivation, self-efficacy perception and cognitive engagement all influence academic success which, in turn, increases student motivation. However, because of the perceived easiness students can have as skilled technology users, IT tools can also induce a fallacious perception: if the task is easy to perform, the subject matter could also be perceived as easy to learn. Teachers need to be aware of this possibility if they want to be efficient in their implementation of IT because this perception of easiness can lead students to underestimate the effort and cognitive engagement they have to put in to really learn.

Finally, student diversity and differences make the managing of pedagogical and professional tasks heavier for teachers. It is therefore important to reflect on how IT can help make this burden lighter when implementing IT in the classroom. IT can, when appropriate devices are used, facilitate one's

pedagogical and classroom management. If student motivation and learning are increased, one may think that teacher motivation to use IT will also increase, especially if gains in time are to be foreseen.

4 CONCLUSION

Successful IT integration resides in adequate taxonomic learning objectives, an appropriate pedagogical approach and a coherent alignment of the IT tools with these. Yet, successful IT integration would not be possible without human input. This is actually what our conceptual model of IT integration brings into light i.e. how the human factor constitutes an important variable for successful IT integration in the classroom. Our model depicts how student and teacher characteristics interact and work as determiners of successful IT integration i.e. one that leads to student learning. On the first hand, teachers' motivation, self-efficacy beliefs and expectations of economic gains appear to be determining elements in their commitment to initiating IT teaching activities. As Kadel would put it, « One has to have the right attitude » to guarantee the effective use of IT in the classroom.[19] On the other hand, successful IT integration would depend on how ITs are pedagogically exploited by the teachers in or outside the classroom. In fact, it is not the technological aspects but the managing and the organising of the teaching-learning situation that represent the real challenge of successful IT integration.[20] With a view to being successful and leading to student learning, IT integration has to harmonize with a pedagogical approach that will enhance student learning. In order to do so, the approach must trigger student cognitive engagement as well as meet taxonomic levels appropriate to student level and targeted learning objectives.

In terms of professional development, and assuming that teachers possess a basic level of IT skills, our conceptualisation suggests that teaching training programmes address as much (not to say more) the pedagogical applications and integration of IT tools as teaching the tools per se. Integrating IT actually implies revisiting one's teaching approach i.e. working on teachers' professional representations. Our model also suggests that IT innovations or integration attempts greatly take into consideration the important role of the "human behind the machine." This last opening has actually become the trigger for a new research project. This project aims at evaluating the impact of the human factor in a distance IT tutoring context. The project has been set up so as to increase the human component behind the distance IT tutoring sessions future ESL teachers will be giving to collegial level ESL learners.

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Appendix 1

–	IT can induce modifications
–	balanced uses exploit a variety of possibilities
–	differentiation yields faster and more useful feedback
–	teachers exert control, authority
–	teachers make choices
–	teachers can create tools
–	teachers exert leadership
–	teachers are in charge of management of pedagogy, of professional tasks
–	teachers engage in teacher-student relation
–	students engage in teacher-student relation
–	organization, milieu establishes des setting up restrictions/limits/conditions
–	teacher motivation influences success
–	beliefs and representations influence teacher motivation
–	management of pedagogy, of professional tasks influences teacher motivation
–	IT facilitate management of pedagogy, of professional tasks
–	teacher-student relation influences teacher motivation
–	teacher-student relation influences student motivation
–	teacher-student relation influences success
–	self-efficacy influences success
–	cognitive engagement influences success
–	balanced uses encourage student motivation
–	experimenting success increases student motivation
–	exercises enable self-efficacy
–	differences overload management of pedagogy, of professional tasks
–	exercises enable cognitive engagement
–	variety of media enables experimenting success
–	differentiation enables experimenting success
–	curriculum prescribes methods
–	interest, self-efficacy influence choices
–	beliefs and representations influence pedagogical objectives
–	teachers are influenced by beliefs, representations
–	students are influenced by beliefs, representations
–	beliefs, representations influence methods
–	exercises influence student motivation
–	variety of media enables meeting differences
–	methods influence choices
–	beliefs, representations influence student-teacher relation
–	variety of possibilities enables adjustments
–	pedagogical objectives influence choices
–	curriculum prescribes pedagogical objectives
–	organization, milieu influence choices
–	differentiation enables meeting differences
–	adjustments are made according to pedagogical objectives
–	self-efficacy concerns influence choices
–	variety of possibilities enables differentiation
–	implementation context, variables influence beliefs, representations

List of the 46 strongest utterances identified from c-map.