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Motivation and engagement in computer-based learning tasks: investigating key contributing factors

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Abstract

This paper, drawing on a research project concerning the educational use of digital mind games with primary school students, aims at giving a contribution to the understanding of which are the main factors influencing student motivation during computer-based learning activities. It puts forward some ideas and experience based reflections, starting by considering digital games that are widely recognized as the most promising ICT tools to enhance student motivation. The project results suggest that student genuine engagement in learning activities is mainly related to the actual possession of the skills and of the cognitive capacities needed to perform the task. In this perspective, cognitive overload should be regarded as one of the main reasons contributing to hinder student motivation and, consequently, should be avoided. Other elements such as game attractiveness and experimental setting constraints resulted to have a lower effect on student motivation.

Keywords: motivation; attention; games-based learning; digital games; primary school.

1. INTRODUCTION

This paper aims at giving an insight into some of the main factors influencing student motivation while carrying out computer-based learning activities. It starts from the conviction that the students

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of the digital era who can, reasonably, be considered "digital native" (Prensky, 2001) appear not to be inclined to use any digital product "just because it's digital".

Today's students, the "new millennium learners" (Pedró, 2006), make large use of Information and Communication Technologies (ICT) in their everyday life for both leisure and communication/social interaction purposes. This definitely affects their expectations and needs as well as their attitudes and choices: indeed, they also show well defined tastes and clear preferences as to the software tools to be used (both for leisure and educational purposes).

This evidence has major potential implications for teachers and educators who face the challenge of selecting the e-tools* to be used during classroom/educational activities. They, in fact, besides considering the ease of use and the potential effectiveness of the e-tools (of course, together with their adherence to the educational objectives) necessarily must take into account and evaluate also their actual ability to authentically stimulate and keep students involved in the learning tasks.

Enhancing student active and genuine engagement (which actually can be regarded as mix up of motivation, interest and attention) in learning activities is widely recognized as an important goal to be reached (Robertson & Howells, 2008) also because it appears to have positive influence on the learning outcomes (Cordova & Lepper, 1996; Ryan & Deci, 2000). In this direction, it is important that teachers and educators make use of those educational means that, in principle, can be more stimulating and motivating for the students, namely those means that are able to keep students "…enthusiastic, focused, and engaged", that are able to sustain and maintain their interest, "to make them enjoy what they are doing so that they try hard, and persist over time, thanks to an inner self-determined drive, determined by their own volition rather than external forces" (Garris, 2002).

The picture of "motivated students" sketched by Garris (2002) is quite fascinating and a number of field experiences tell us that is not so infrequent to "find" them in real classrooms, nevertheless, the question of whether and how such a behavior can be encouraged or even induced has not yet been fully answered (Boekaerts, 2001).

Starting from the conviction that both personal attitudes/social conditions and learning tools employed play a major role to foster motivation in learning activities, this paper, investigates the matter from the viewpoint of the tools, thus also following the idea that different educational means have a different impact on student engagement (Robertson & Howells, 2008).

In doing so, it starts from those that are widely regarded as the most suitable e-tools to enhance student attention and motivation, namely digital games. Indeed, digital games are considered highly effective to foster learning (Papastergiou, 2009), mainly because of their expected positive effect on student involvement, attention and motivation (de Freitas, 2006, Rosas et al., 2003) and it is recognized that this happens starting from the very first school years (Tüzün et al., 2009).

In the following the research question of which are the main features of educational digital tools that potentially foster and improve student motivation is addressed and some tentative answers are

* Henceforth this term is used to refer both to software tools and services.

given by referring to a long term research project dealing with the use of digital games for educational purposes at elementary school level.

2. METHODS

2.1. Context

The research project mentioned above consisted in a longitudinal study carried out over three years in a primary school. It was mainly aimed at helping students develop strategic and reasoning abilities through the use of digital mind games. It had, therefore, the main objectives of shedding light on the cognitive abilities involved in such games (Authors, 2006; Authors, 2007) and of identifying which design and interface features make digital games more or less fruitful for these purposes (Authors, 2009).

In the framework of the project the necessity of investigating in detail if and to what extent student performance/results were linked to their actual motivation and active involvement in learning tasks emerged. In this direction, specific research actions were taken, that are fully illustrated in the following.

2.2. Participants

The experimental research project was conducted by a research team comprising educational technologists, psychologists from the Local Health Authority and primary school teachers from the school.

It involved a group of 40 children (almost the same, apart from a few new arrivals and withdraws per year), from 3rd grade (age 8/9) up to 5th grade (age 10/11), 26 were girls and the other boys. Two whole 3rd grade classes were chosen out of the four parallel classes (same grade) in the school. The two experimental classes were selected by the school teachers on the basis of purely logistical criteria.

For experimental purposes, the students of each class were divided by the teachers in four groups on the basis of their school achievement (intermediate and final school reports were used at this end): the first one comprised low achievers, the second one included high achievers while the remaining two groups were formed by those medium achievers that represented the very majority of the students (their number was, in fact, almost double than the other two). Students with severe learning disabilities participated in the computer sessions together with their classmates but data on their performance were not considered.

2.3. Experimental setting

The students used digital games during normal school hours: they were divided into groups of 5 or 6, according their level of school achievement, with each group taking it in turns to attend a

computer session of approximately one hour per week over six months of each school year. Each student had at his/her disposal a computer so that they could play individually; as a general rule, each game was used by the same student for two gaming sessions, at different levels of difficulty: the students were thus engaged in repetitive play over time, thus tackling each game according to a multi-trial and multi-level approach (Garris et al., 2002).

2.4. Tools

The experimental project was based on the use of mind games (that are also called "brainteasers" or "puzzlers"), namely those games that require the user to exercise reasoning skills and strategies in order to solve specific problems (Muller & Pearlmutter, 1985). More than one hundred of these games (among which Master Mind, Minefield, Battleship, Domino, Labyrinths etc…) were analyzed and about forty of them were actually used during the experimental work in the course of the three years (Fig.1).

Fig.1 Screenshots of some of the games used

The games were chosen on the basis of an accurate evaluation of their consistence with the project objectives and of their appropriateness for students of the target age; ten teachers who had been involved in a built on purpose "focus group", contributed to the selection of the games to be used by testing them in their classrooms with students of the same age of the target experimental population. Only games that were rated as having a high level of "ease of use" were chosen, given the main objective of the experiment and the age of the target population.

During this in-field testing, games were also divided (by the teachers together with some members of the research team) into three categories according to their level of "attractiveness": the former category included games very attractive, the second category comprised games having a moderately attractive interface, while the third one category consisted of those games that had been judged as basically unattractive.

All the adopted games can be ascribed to the category that Prensky (2005) calls "mini-games", that is "games that take less than an hour to complete (often far less)" in order fit within the time span of a typical single-class unit (Becker, 2007).

2.5. Procedures, methods and materials adopted to assess student motivation

Before starting the experiment, a "focus group" made up of all the involved researchers plus ten teachers from different schools was established, with the aim of choosing the games (as explained above) and of highlighting the most relevant aspects to be considered in the framework of such an undertaking. During the focus group's meetings, it was suggested:

- To take into account and note down separately both students' subjective feelings/impressions about the exercise and teachers'/observers' specific comments on the perceived level of students' involvement in computer-based activities
- To distinguish among the initial, in itinere and final level of engagement and motivation, (this in order to avoid objective data being too much influenced by initial enthusiasm or final tiredness).
- To focus on the students' intrinsic motivation (Martens et al., 2004) as clearly distinguished from extrinsic motivation (i.e. consequential to specific interactions with the research team and the teachers).

Before starting each gaming session, each student's attitude was monitored through specific, although non- structured, interviews; the observers reported on both their spontaneous declarations and their answers to the questions.

During the computer sessions, each student was followed individually by a member of the research team, whose main task was that of monitoring the students' activities and of recording objective data as well as personal opinions about both their performance and behavior; this was done through two specific "monitoring sheets":

- A "performance sheet" reporting quantitative data on performance (score obtained, errors committed, etc…)
- An "attitude sheet" containing specific notes about students' attitude, feelings and behavior (working approach adopted, attention, perceived motivation etc …).

Both the sheets were filled in by one member of the research team (henceforth named "observer") after each working session: this means that, if the game was used in more than one session, we had more than one "sheet" for each game and for each student. Authors (2007) report on the quantitative analysis of the results obtained (drawing on the "performance sheet") while the reflections at the core of this paper mainly draw on the analysis of the "attitude sheets" collected during the three years work.

Such an "attitude sheet" distinguished among the initial, in itinere and final mood/attitude of each student. The evaluation of the initial and final feelings/behavior of each student was mainly based on the written recording of both students' spontaneous declarations and actual responses to

specific question; the core part of the "attitude sheet", contained the teachers' findings and personal opinions resulting from the direct "in itinere" observation in the form of free-style notes.

In particular, the observers were required to note down data on: level of engagement (low, moderate, high); level of autonomy (not autonomous, need for substantial help, need for some hints, fully autonomous); awareness of personal performance (unaware, basically underestimating errors/difficulties, good level of awareness, totally aware). Some basic information about the context specificities during the gaming session (e.g.: noise, presence of disturbing elements, spontaneous/unexpected interactions among students, external factors preventing full concentration etc…) was also noted down.

After each computer session, the level of satisfaction of each student was assessed by means of specific direct interviews.

2.6. Research Methodology

The research techniques adopted in this study basically followed the paradigms of "mixed research methodology" (Burke & Onwuegbuzie, 2004; Burke et Al. 2007); a combined use, in fact was made of both quantitative and qualitative approaches.

Basically, qualitative research methods were employed: in particular the overall experience was conducted by adopting the "direct observation" research method (Herbert, 1970); hence the name itself of "observers" given to the members of the research team in charge of monitoring the students' activities. As it will be explained more in detail in the following sections, key qualitative data were obtained by means of individual interviews and free-style opinions written by the observers in the "monitoring sheets". In accordance with the "grounded theory approach" (Glaser and Strauss, 1967) the analysis of such data began together with their collection and mainly consisted in an open coding process of texts written down in the form of "free notes" and "summaries" of the interviews, this was done by means of the open coding framework offered by the Atlas.ti software (Muhr, 2004).

A number of categories emerged from the above mentioned qualitative analysis, which were, then, used to build up the quantitative part of the "monitoring sheet" (e.g. the four categories related to autonomy: not autonomous, need for substantial help, need for some hints, fully autonomous). Data collected for these categories, were then studied by applying basic methods and tools for standard statistic analysis, as it will be explained in detail in the following "Results" section.

3. RESULTS

The research project allowed both to shed light on the level of the students' motivation and to make some tentative more general hypotheses on which are the main factors influencing student engagement in learning activities.

3.2. Level of the students' motivation

The motivation of the students involved in the experiment was assessed by taking into account three key categories:

- Keenness towards carrying out the activity
- Satisfaction about the performed activity
- Engagement shown during the activities

Such basic categories emerged from the qualitative analysis carried out by means of the Atlas.ti software (Muhr, 2004); main sources were the direct interviews with the children and the observers' notes reported in the "attitude sheet". The elaboration of such material and the related analysis started from the very beginning of the experiment, in accordance with the "grounded theory approach" (Glaser and Strauss, 1967) thus informing the following research actions.

3.2.1. Keenness towards carrying out the activity

The attitude of the students before starting each gaming session, as explained above, was assessed by means of direct, non-structured interviews. These interviews were carried out by the psychologists of the Local Health Authority who had expressly requested to be allowed to make free content/non structured interviews mainly because of the age of the target population.

In this framework, the level of keenness toward the proposed activity was rated on a three level scale basis (high- medium- low); the three levels of student keenness were established following the open coding process of the interviews: high keenness was instantiated by "expressions" of high interest (*verbs*: like, want, enjoy… *adjectives*: willing, interested… *adverbs*: much, very much, really…), low keenness was instead identified by expression of scarce interest to carry out the activities (*verbs*: end, stop, change, choose,/prefer another game, … *adjectives*: too much demanding, boring, useless, tiring… *adverbs*: if necessary, not so much, really…). All the other expressions which didn't fit with the "coded" terms were classified as showing "medium keenness".

Data resulting from the analysis showed (Table1) that most students were, in principle, genuinely interested in the gaming tasks and willing of taking part in the proposed activities.

Table 1 Initial attitude of students: keenness towards carrying out the activity

	High keenness	**Medium keenness**	**Low keenness**
First session	*86%*	*13%*	*1%*
Second session	*70%*	*23%*	*7%*
Global	*78%*	*18%*	*4%*

Data presented in Table 1 refer to all the game sessions carried out in the three years period and refer to all the game session (global), but they also distinguish between the two game sessions

carried out with the same game (first session- second session). We see that while a very high percentage of the students (78%) declared to be very interested in the proposed activities in the second working session a significant number of students showed reduced enthusiasm (70%-high keenness and 7% low keenness) with respect to the first session (86% high keenness and 1% low keenness). Since data also told that students showing lower keenness towards the proposed activities were mainly those classified by teachers as low achievers, and, in particular, those low achievers who had shown more problems during the first session, this was mainly interpreted as a consequence of previous failures.

3.2.1. Satisfaction about the performed activity

After the conclusion of each working session the satisfaction of each student was assessed, by directly asking the children about their actual feelings (Table 2).

The procedure adopted to define high medium and low satisfaction was exactly the same as the one adopted to assess the keenness towards carrying out the activity, with the only difference that the terms used to identify the different levels, referred to already concluded activities (from a terminological viewpoint, instead of showing "willingness" the terms used were "happiness, pleasure and reward…" as they had been experienced while carrying out the activities).

Table 2 Final attitude of students: satisfaction about the performed activity

	High satisfaction	***Medium satisfaction***	***Low satisfaction***
First session	70%	18%	12%
Second session	60%	26%	14%
Global	65%	22%	13%

A good level of satisfaction was shown by almost all the students (65%), although it was lower than the initial enthusiasm (78%). The second session, again, appeared to be the less satisfactory for the children, in particular for those who had not been able to complete the required task and of those who had come to the solution too easily (low achievers on the one hand and high achievers on the other).

3.2.1. Engagement shown during the activities

A slightly different picture emerges if we look at the level of engagement as it was judged by the "observers" (both teachers and researchers, members of the research team) as it emerged from the observers' free notes, taken while monitoring student activities.

In this case the open coding procedure was again used to distinguish among student high, moderate and low engagement; the coding process was, here, much easier since the range of terms used by the observers was narrower (mainly because both the limited number of observers and because they had previously agreed on the standard terminology to be used- which also included exactly the term "engagement" and the three levels "high, medium and low"-); a number of terms

such as attention, concentration motivation (both in a positive and negative sense) resulted as significant from the coding procedure and contributed to define students' attitudes.

As a matter of fact, while according to the findings reported above, the students themselves generally perceived the activities as stimulating and satisfactory, the view changes if we consider data coming from observers (Table 3).

Table 3 Student engagement during the activities

	High engagement	***Moderate engagement***	***Low engagement***
First session	44%	31%	25%
Second session	26%	53%	21%
Global	35%	42%	23%

From the observers' viewpoint (Table 3), in fact, most students, showed a moderate engagement in learning tasks (42%) and only the 35% appeared to be genuinely motivated; surprisingly, with respect to students' declarations, a quite high number of students (23%) was judged as having scarce enthusiasm and attention in carrying out the activities. The trend accounting for higher motivation/engagement in the first session with respect to the second one, appeared, instead, to be respected.

3.2. Main factors influencing student motivation (keenness, satisfaction, engagement)

Before starting the experiment, a survey involving around seventy primary school teachers had been carried out, with the objective of investigating which are in teachers' opinions, the key elements responsible for students' involvement in computer- based learning activities. Four main teachers' "believes" emerged, accounting for a direct relationship between student motivation and:

- The quality/appeal of software interface (93%)
- The concern for teacher's evaluation/judgment (64%)
- Transient, contextual conditions: a number of different elements related to the momentary personal situation and /or to the specific working/learning context (62%)
- The ability to perform the required activities (48%)

In order to understand which are the main factors influencing student engagement, the correlations among student keenness, satisfaction and level of engagement, and the parameters corresponding to the teachers' believes, mentioned above were studied. The concern for teacher's evaluation/judgment was not considered since, in order to obtain the families' permission for the experiment, the students had previously been informed that their performance was not supposed to affect their academic evaluation. As both keenness and satisfaction only correlations with the ability to perform the task and software attractiveness were studied, while as to the level of engagement

also the correlations with transient, contextual conditions were calculated: it was in fact judged that children shouldn't have the exact perception of the relevance of contextual constraints on their attitude and behavior.

3.2.1. Keenness and satisfaction

The correlations among the level of performance reached by each student (data acquired through the "performance sheet") and his/her own declarations about both keenness and satisfaction was studied and are reported in Table 4.

Data on student performance have been fully reported in Authors (2007), and have been classified on a three level basis scale (high, medium and low). By comparing data on performance with the level of keenness and satisfaction a strong correlation emerged with the ability in solving the game (high ability subjects showed a tendency to high keenness/satisfaction and low ability subject to low keenness/satisfaction).

The study was conducted by referring to the Spearman's rank correlation coefficient (r_s) by considering: $r_s < .20$ = Modest correlation;$.20 < r_s < .50$ = Moderate correlation; $r_s > .50$ = High correlation.

Table 4 Correlations student performance/ keenness and satisfaction

	Performance
Keenness	High (r_s= .84)
Satisfaction	High (r_s= .88)

This was also confirmed by referring to students declarations before starting the second session (i.e with games they had already previously used); as a matter of fact, students who at the first attempt with a specific game, had performed well, were more keen on carrying out a further working session with the same game, while others frequently asked for a "change".

The relationship between the level of students' keenness/satisfaction and the level of attractiveness of the games (assessed and ranked at the beginning of the project by teachers-volunteers, as mentioned above) was studied, following the previously mentioned methodology (Table 5). The "ease of use" of the games was not considered in that the games had been selected on the basis of their appropriateness and usability for students of the target age.

Table 5 Correlations keenness and satisfaction/attractiveness of the games

	Keenness	***Satisfaction***
Game attractiveness	Modest (r_s=.15)	Moderate (r_s=.29)

A modest and moderate level of correlation was found between game attractiveness and keenness and satisfaction. As a matter of fact, it happened that high keenness and satisfaction was

also shown for games with low level of attractiveness while, correspondingly, a low degree of both keenness and satisfaction was found for games classified as having a high level of attractiveness.

3.2.1. Engagement

This part of the study was based on the examination of the quantitative data on student engagement reported by the observers in the "monitoring sheets". The research was conducted by calculating the Spearman's rank correlation coefficient (r_s) by considering: r_s < .20 = Modest correlation;.20 < r_s < .50 = Moderate correlation; r_s > .50 = High correlation.

Resulting data are reported in Table 6-7 and 8.

Ability to perform the required activities

The ability to perform the task was studied by taking into account performance results (that is the capacity to reach the solution).

Table 6 Correlations student engagement/performance–autonomy-awareness

	Performance
Engagement	High (r_s=.79)

Table 6 shows that the students' intrinsic engagement and motivation resulted to be highly related to performance.

Transient, contextual conditions
Among these were considered:

- The experimental setting (excessive dark/ light, cold /hot, noise, presence of external disturbing elements…)
- Interactions with other people (observers and classmates), in particular those resulting from unexpected actions (such as friends calling him/her, speaking aloud about their findings/results, extra people entering the room)
- Personal contingent situation (mood, pain, need for resting, feeling asleep..):

Table 7 Correlations high student engagement/transient contextual conditions

	Setting	***Interaction***	***Personal Constraints***
Engagement	Modest (r_s=.16)	Moderate (r_s=.28)	High (r_s=.69)

In particular, it emerged (Table 7) that the students' engagement was modestly related to some specific situations related to the experimental setting and that it was moderately related to the interactions with other people; the highest correlation was, instead, found with some aspects of the personal, contingent situation (pain, need for rest, sleep..).

Quality/appeal of software interface

Table 8 shows the correlations between student engagement and software attractiveness (as it was assessed by teachers-volunteers before starting the experiment).

Table 8 Correlations high student engagement/game attractiveness

	Attractive	***Medium attractiveness***	***Unattractive***
Engagement	Modest (r_s=.17)	Modest (r_s=.19)	Modest (r_s=.14)

Data show that a low correlation was found between student engagement and software attractiveness, thus also confirming results coming from the students' declarations.

Student awareness and autonomy

In addition to the previous categories the monitoring sheet also had apart related to the assessment of student autonomy (that is the capacity to reach the solution without significant help) and awareness (consciousness of own performance). The correlations among these two parameters and student engagement was also investigated and is reported in Table 9.

Table 9 Correlations student engagement/autonomy-awareness

	Autonomy	*Awareness*
Engagement	Moderate(r_s=.44)	Modest (r_s=.18)

As shown in the above table data on engagement appeared to be more directly related to autonomy than to awareness.

3. DISCUSSION

The project results contributed to shed light on the actual level of young students' motivation while carrying out game-based learning activities and also allowed to put forward some hypothesis about the main factors influencing student motivation engagement.

3.2. Level of student motivation in computer-based learning activities

Students declared a good level both of keenness towards carrying out the activities and of satisfaction following performance (Table 1 and Table 2); a significantly higher percentage of them, nevertheless, showed more initial "*a priori*" eagerness /keenness (78% showed enthusiasm towards carrying out a new gaming session) than "*a posteriori*" satisfaction (65% showed happiness for the concluded gaming activity); this was interpreted as a consequence of their perception of the cognitive effort required to carry out the activities.

Correspondingly, as a result of the observers' ratings it emerged (Table 3) that during the second gaming session carried out with the same game only the 26% of the students (with respect to the 44%of the first session) had shown high engagement in the learning activities. In addition the qualitative analysis of the observers' freestyle notes (analyzed following the above mentioned procedure) indicated that the diminished engagement/motivation during the activities were mostly related to the number/ weight of the encountered problems and of the actual "defeats". Most observers explicitly referred to "cognitive overload" as to the main factor responsible for the students' lack of motivation and engagement (the term emerged from the enacted coding process).

As to the actual level of motivation, a significant discrepancy was found between the level of eagerness and satisfaction declared by the students before and after the gaming sessions and the level of engagement observed by the research team during the same sessions, being the formers much higher. The global percentage of student showing a high level of engagement corresponded to the 35% (Table 3) while high satisfaction was demonstrated by the 65% (Table 2) of the target population and high keenness was found in the 78% (Table 1).

3.2. Main factors influencing student motivation and engagement

The major significance of the results of the work, nevertheless, lays in the fact that it allowed to shed light on which factors are to be considered the most important in order to enhance student engagement in learning tasks. In this perspective, the relevance attributed to different factors by the teachers who had participated to the preliminary interviews seemed not to correspond to reality.

Those teachers, in fact, considered the quality/appeal of software interface as the most important aspects to be taken into account and to a lesser extent, also transient, contextual conditions; the project's results, conversely, showed that the actual ability/capacity to perform the task was the main factor influencing student motivation and engagement in the learning activities.

Indeed, in the framework of the study, it basically emerged that student engagement was:

- On average, *tool independent*, that is moderately related to some specific software's features (Table 5 and Table 8).
- To some extent, *context sensitive*: it appeared, in fact, to be moderately related to some specific aspects of the educational setting and, in particular, to environmental, personal contingent situation (Table 7)
- Strongly *performance dependent*, that is directly linked to the ability to carry out the required activities (Table 4 and Table 6).

As to this last point, as mentioned above, the in-depth qualitative analysis of the observers' free notes suggested that the most students were able to carry out the activities without perceiving a "cognitive overload", the most they appeared to be genuinely engaged in the task; this leads to thinking that engagement is connected to the actual students' abilities and to the "cognitive effort" required to perform the task.

Student engagement also appeared to be a very "inner" attitude in that it didn't result (Table 9) as strongly related to how correctly they interpreted their level of performance (awareness); the fact that a higher correlation emerged between engagement and performance (Table 6) with respect to the correlation between engagement and awareness (Table 9), leads to thinking that genuine engagement is more linked to inner factors than to metacognitive reflections. On the contrary, a higher correlation between engagement and autonomy emerged (Table 9), which accounts for the fact, also noted down by the observers, that those students that were able in performing tasks were also very autonomous.

3. CONCLUSIONS AND RECOMMENDATIONS

The issue of student motivation and engagement in learning activities has been explored by referring to an experimental context dealing with games-based learning and children at the primary school level. In this specific situation, a significant level of student eagerness/engagement/satisfaction has emerged, both from students' interviews and spontaneous declarations and from teachers' observations.

The fact that significant differences emerged between the level of motivation declared by the students and the level of engagement observed by the research team, allows us to give an insight into the wider research issue of which should be considered the most suitable means to assess students' motivation: direct interviews/declarations, indirect questionnaires, external monitoring….

Further investigations appear also to be needed as to the actual level of self- awareness of the children of the target age and of the role of metacognitive abilities in determining their motivation and engagement during learning activities.

The main results of the experiment, nevertheless, concern what factors actually influence student motivation; in this perspective, it came out that the main factor contributing to enhance student motivation was their actual capacity/ability to perform the task at hand.

Further research is needed in this direction, in order to explore if the results of the experience with games can be extended also to other contexts / different computer-based learning environments. If these findings are confirmed, there are grounds to think that particular attention should be given to choose and preferably employ those e-tools that allow a graduation of the cognitive effort required to perform the task and to build up educational plans characterized by a high level of individualization/personalization.

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