Motivational Processes in Online Learning: The Role of Tutorship for Laboratory Activities through the Semistructured Self-Evaluation Tests

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1. Introduction (Main Research Paradigm in Cognitive and Motivational Processes in Online Learning)

In the recent specialist literature, the main theoretical models show the cognitive functions (attention, perception, and memory) which go to influence multimedia learning: managed by metacognitive processes and nurtured by emotional-motivational components Mourlas et al. [1]. In its more developed forms, this kind of learning is characterised by the integrated use of different communication channels (multimediality). A great deal of research, particularly over the last few decades, has pinpointed some important factors characterising multimedia learning in e-learning contexts and, among the main theories devised, there is the one by Mayer [2], which integrates and summarises the general principles stressed in the previous orientations. Mayer took up Paivio's [3] dual-coding theory, according to which sensory memory and working memory proceed through two separate channels when we have visual and auditory type information available, and this reinforces the learning and recall of the contents themselves. He also took up the so-called load theory by Chandler and Sweller [4], according to which we must take into account the limited capacity of working memory when selecting and organising materials to be learnt. Mayer also stressed the concept of active learning and the intervention of cognitive processes underlying the activities of selecting, organising, and integrating the materials to be learnt.

There is by now ample literature on the pedagogical theoretical models of e-learning and in particular on the methodological and didactic aspects (Domenici, [6, 7]; Calvani and Rotta, [5]; Trinchero, [8]; Trentin, [9]; Maragliano, [10]) and also on the metacognitive aspects of learning processes, shown in particular by the studies of Pellerey...
which have highlighted the role of self-regulation as one of the main success factors in e-learning. To explain the specific cognitive and affective processes underlying learning, including online multimedia learning, we believe the contribution made by psychology is important. This is particularly true for the distance tutor’s role, for which, in the various types of activities, from organisational tutoring to the more strictly scientific kind, it is easy to trace the centrality of the care of the psychological aspects of the educational relation, of the motivational and relational aspects, and of the influence of these factors on the learning levels achieved. If we consider that in e-learning—besides there not being spatial proximity between the service provider and the learner—the most widespread communication form is asynchronous, we thus grasp the importance of tutoring functions in the qualification of the educational process.

Many authors recognise the figure of tutor as essential for learning success. The reason why students may abandon the course is often linked to a tutor’s inadequate action in handling the networked communication dynamics or in using the learning materials (Trentin, [9]).

A recent study carried out by Meyer et al. [12] showed how personalised type instructions generate more positive effects in students than standardised instructions: students receiving instructions tailored to their personal needs showed a positive attitude to the computerised activities, with significant positive effects on learning.

The same research group (Meyer et al. [13]) also demonstrated the importance of the kind of feedback (elaborate/simple) on students’ results in a reading comprehension task. Students who received elaborate feedback achieved better performances: simple, not very structured feedback does not help students to improve and/or gain skills and/or competencies. On the other hand, obtaining elaborate feedback from a tutor on mistakes made leads to great gains in terms of cognitive performance. In short, the tutor’s role is also to continually guarantee the finding and management of information and, in particular, to offer the opportunity for continuous interaction with students: these are necessary conditions, even if not sufficient, to make individualised teaching possible. To this end, it is worth structuring a kind of didactics that meets users’ needs by also focusing on specific laboratory activities for promoting and testing learning activities. With regard to affective variables, in the recent specialist literature there has been a reappraisal of the role of motivation geared to facilitating learning through e-learning programmes. Zaharias [14] stressed how, in particular, it is nonmotivated adults who prematurely drop out of e-learning courses and suggested integrating the factors favouring usability, that is, which make e-learning usability possible, with the affective dimension of learning. Motivation to learn is often underestimated and not adequately assessed, while it is instead a dominant factor for the effectiveness of learning itself. The author suggested that this factor should be considered as a new type of usability dimension in programming and evaluating e-learning applications. These studies integrate the view that motivation has a first effect in particular on metacognition (self-efficacy, self-regulation, etc.).

Mammarella et al. [15] highlighted how, from a psychological standpoint, studying these learning systems allows seeing how several cognitive processes (perceptual and attentional ones) interact and how individual differences intervene (such as different learning styles with regard to the information presentation style etc.).

With regard to the emotional and relational aspects of e-learning, Magno Caldognetto and Cavicchio [16] presented certain human-machine interface typologies which make use of natural language in its written, vocal, and multimodal form in order to implement a new kind of more human-oriented interaction with the computer. It is a fact that discussion forums, chat rooms, and the like constitute a virtual space in which users can also take account of emotional contents as integral parts of learning processes.

The results of a comparative study of different interactive contexts showed that there is a preference for multimodal systems which manage to integrate forms of communication that are familiar to the subjects involved in the system. On the other hand, for didactic innovation in e-learning systems, we recall how using multimedia didactic tools, employed at a good aesthetic and informative level, can facilitate learning (Biasi et al. [17]).

Another factor for achieving a facilitating effect in multimedia learning processes was found in specific attitudes, among which, in particular, the so-called “immersion capacity” (corresponding to the impression of finding oneself immersed and included within an environment which provides a continuous flow of stimuli, Bonaiuto et al. [18]). A group of over fifty participants agreed to complete certain personological questionnaires: the Italian version of the Immersive Tendencies Questionnaire, according to Witmer and Singer [19], and the Roman Alexithymia Scale (SAR). A positive correlation was found between the learning level achieved and the overall score in the Immersive Tendencies Questionnaire (ITQ): \( r_{54} = 0.28; P < 0.05 \). The correlation between learning achieved and the score of “Difficulty in reading one’s own and others’ emotions” according to the Roman Alexithymia Scale (SAR) was thus understandably negative: \( r_{54} = -0.27; P < 0.05 \).

These factors go to determine the broad construct of emotional involvement—a determinant factor in communication for didactic purposes. For the reasons outlined above, we believe that emotional and motivational involvement, also enhanced through the aesthetic component and the development of experiences of “immersion” and “presence,” is a facilitating macrofactor in communication for didactic purposes, particularly with regard to e-learning. These components can be appropriately increased through multimedia technologies, which largely end up expanding the teacher’s personal aptitude array and ensuring greater interpersonal contact experience—an aspect which surely, at least from a psychological standpoint, needs to be reinforced and promoted more in online education systems (not by chance still called “distance” education).
2. Hypothesis of the Present Investigation

Within the general aim geared to identifying and enhancing certain factors facilitating e-learning processes through the individualisation of learning and the promotion of an active attitude towards the contents to be learnt, we aimed to test the hypothesis that semistructured self-evaluation tests within laboratory activities facilitate learning processes thereby reinforcing both convergent and divergent cognitive processes. We also aimed to highlight the role of specific psychological components of online learning and, namely, how certain affective variables (which motivations and which attitudes) facilitate this learning process.

3. Materials and Methods

We organized a specific online didactic strategy particularly based on laboratory activity. This kind of didactic methodology gives a central role to tutorship. We studied the role of tutorship for laboratory activities especially conducted by the semistructured self-evaluation tests and the results obtained in learning levels and motivational levels of students.

According to the experimental research methodology approach, we compared, with the objective final examination test, two groups of students: those that completed these online laboratory activities (*n* = 252) versus students who did not enroll in the laboratory activities (*n* = 168) but participated in classical nonlaboratorial lessons.

3.1. Semistructured Self-Evaluation Tests in Online Laboratory Didactics. We shall present the kind of laboratory activity carried out by starting from the definition of semistructured tests formulated by Domenici [20]: “Among the many evaluation tools which can be productively used, particular importance goes to semistructured tests, so called because at the time of administration with respect to objective tests, the only well structured component is the part soliciting the competencies to be assessed. They are, in effect, tests which have a closed-stimulus and open-answer structure, but open such that—in almost all cases—the student is, so to speak, forced by the specificity of the prompt to clearly show whether or not s/he possesses the knowledge being tested and to enable markers to attribute a score in a generally univocal and objective manner (thereby assuring good validity and high reliability of the test)” (p. 24). The specific characteristics of these tests include the capacity: “to grasp some of the knowledge possessed by students and especially their ability to select this knowledge when required; to convey the evaluation procedures used in this regard, and how they are revised and adapted to the context; to bring out the privileged schemas in structuring decisions and the ability to restructure them on the basis of facts and context data…” (p. XIV).

Indeed, the specificity of the items and the prescription of certain restrictions on the way answers are formulated, such as by indicating the maximum length allowed, the quality, quantity, and order of presenting particular information or conceptual elements concerning the issues posed, the degree of generalisation to adopt in dealing with the topics, and so on, enable checking the so-called higher intellectual processes better than by using other tools. Namely, the idea is to check the students’ capacity to apply the knowledge gained to new contexts compared to the ones characterising their relative school education process, their originality in solving particular problems, and their capacity to integrate the various disciplinary competencies possessed in order to solve specific problems posed in simulated contexts. Thanks to the formal limitations placed to the reference context—theoretical or practical as may be—considered by the test, “it becomes possible to assess not just and not so much “convergent”, “analogical”, “repetitive” and “mechanical” knowledge, but especially “divergent”, “original”, “creative” and new knowledge—at least when used in the specific simulated context” (p. 25). With regard to the possibility of grasping how students “reason” and use the knowledge gained, these evaluation tools allow focusing greater attention—both on the part of students and teachers or those responsible for education—on processes besides results, that is, on how and not just what is learnt and/or taught. This is particularly useful for distance education in which the awareness of one’s own cognitive and affective strategies that is developed on the basis of evaluation feedback during the education process is decisive to really favour conditions for implementing lifelong learning (Domenici [7]; Biasi [21]).

These tests were applied in online laboratory orient students not only in their self-evaluation of learning, but also—and particularly, in our view—in the search and development of effective study methods, precisely because their structure stresses the self- and heteroformative value of the testing and evaluation processes.

As an example, here is a test model used.

**Topic: Experimental Method (Definition and Applications)**

**Instructions.** You will prepare your answers by consulting the syllabus tests after you have studied them, and you can then compare your answers with the teachers’ answers that will be published on the platform ten days later.

1. State: (a) the difference between a dependent and independent variable; (b) two hypothetical experimental situations in which the dependent variable of one becomes the independent variable of the other.

   (a) .................

   (b) .................

2. Briefly describe: (a) what "the experimental method" consists of at a formal level; (b) the researcher’s different “role” in scientific studies of an “experimental” type and of a “nonexperimental” type.

   (a) .................

   (b) .................

3. State what features a control group must have compared to the experimental group(s) and what its purpose is.
Features. ................

Purpose. ................

(4) Imagine you are setting up an experimental group to activate conflict by administering the “Stress Drawing” with pre- and posttreatment tests to assess the participants’ emotional state.

Briefly describe at least two of the outcomes you would expect.

Then, construct a grid to record the emotional outcomes of the test and attach the file, giving your reasons for choosing the elements characterising it.

(5) Now imagine you are setting up the relative control group and applying the same grid to assess the emotional state. What outcomes would you expect? List them in decreasing order of importance.

............... (For further details, see chapter 1 of the Manual of General Psychology of the course syllabus.)

As we can see, the kind of test proposed envisages both information gathering by consulting study texts (a prevalently convergent type cognitive operation based on the ability to provide exact answers to problems having only one acceptable answer) and a comparison and restructuring of this knowledge by applying it to various simulated contexts (a mainly divergent type cognitive operation consisting of the ability to provide different answers to similar problems envisaging more than one acceptable answer). This enables both a transfer of learning and a creative restructuring for new elements of the problem considered.

3.2. Structure, Characteristics, and Functioning of the General Psychology Online Laboratory. The form online platform (http://formonline.uniroma3.it/) using an Open Source format for e-learning allowed implementing a laboratory based on semistructured tests envisaging tasks to be completed with reference to specific parts of the study programme and then to be sent to tutors for their relative feedback. The tasks envisage closed-stimulus, open-answer items on specific chapters and sections for students to prepare and have space limitations with regard to the number of lines of text (10, 12, or 15) to write. The task was published online and had to be sent in through the platform after 7 or 10 days (depending on the number of items concerned). The tutors sent a message confirming reception of the test answers and, when necessary, provided guidance on suitable further study or clarification of some answers without revealing the relative solutions but guiding the students on the sections of the syllabus to review, thereby stimulating a critical attitude of research and processing of disciplinary contents. The online laboratory activities were not compulsory but strongly recommended. Table 1 shows the distribution of the groups followed by the three tutors.

Discussions were started up in the Laboratory Forum (one for each task, with the heading: “Discussion addressed to those who have problems in attaching exercise “n””) with the sole aim of sending in the tasks should students have problems in doing so through the relative function on the platform. The analysis of the problems found and of the exchanges recorded in the Laboratory Forum and in the Forum for Clarifications showed that requests of a didactic-organisational type were for the following reasons: to confirm reception of the task; to signal problems in sending laboratory self-check tests; to ask why there was no feedback on the second, third, and fourth task (unlike the first, in which feedback was provided to all students, in order to have some comparison and exchange); to ask how to resend tasks already sent in (when students requested corrections of parts of a task which had been the object of the tutors’ observations); to enquire whether it was possible to also use notes or other information reformulated by the students themselves to answer the questions; to ask when the next task would be published; to signal difficulties in downloading the didactic material; to express doubts and requests for clarification on how to answer particular questions in the tasks and so forth.

4. Results and Discussion

4.1. Effects on Motivational Levels. The affective-relational psychological aspects turned out to be of great importance, as shown below. The tutors’ objective was to adopt a welcoming role able to arouse curiosity, reinforce self-esteem, and promote an active attitude towards the learning contents. The students showed their worries and anxieties and asked for help on various topics. The analysis of the exchanges with the tutors and among peers (chat room and forum activated on the platform within the online laboratory) showed the following specific motivations, with respect to the overall list, with a definition of the respective target objects (Bonaiuto [22]; Biasi [21]):

(a) Motivation to Knowledge (Acquisition of Information and Development of Mental Schemata. Two Main Components Are Found: Varied Knowledge and Ordered Knowledge). Motivation to knowledge concerns the overall need geared to information gathering and concept building or mental schemata building. It includes aspects of ordered knowledge, typically referred to convergent cognitive skills (i.e., the ability to solve problems that have only one correct answer) and varied knowledge, particularly the aspects of exploration and imagination (i.e., the ability to provide many solutions to problems that have several solutions).

Here is an example of this.

Student: "If we find any shortcomings, concepts we have not put in, what must we do? Is it possible to complete our answers or must the test remain as it is? Also, if it is possible to make a correction or to extend our answer, can we attach it to the test we have already sent in??"

This is the tutor’s reply, which illustrates the aim of the laboratory.

“You do not need to send your previous tests in again… the feedback we give you is only to provide indications on the way to organise
your studying. Your own personal evaluations, thanks to the comparisons with the answers that we punctually publish, will also help you to understand the strengths and weaknesses of your answers.

(b) Motivation to Self-Assertiveness (Emergence of the Self, Excellence, Experiences of Success, Possession, Duration, and Personal Worth). Motivation to self-assertiveness is expressed in behaviours geared to asserting oneself, tending towards goals experienced as positive, striving to actually achieve them and thus for a position of excellence of the Self, for example, for achieving desired goals experienced as positive such as problem-solving and overcoming difficult tests, situations which can be experienced when learning new contents. Pursuing a goal, such as good cognitive performance, a good grade, and a good result in the learning evaluation test, enables reaching an ideal of the Self. The satisfaction of this affective component involves feelings of superiority and euphoria versus insecurity, feelings of inferiority, and dependence (for failure). It is expressed through the search for personal situations of social recognition, appreciation, and valorisation. It is the opposite of behaviours of self-aggression, but it may be connected to aggression geared to the overcoming of obstacles (competition and competitive spirit).

Here is an example.

Student: “I cannot understand why I have not received any feedback from you... my problem is understanding where I went wrong and where I can improve and how... seeing that the exam is drawing near... do not leave me like this!!!!”

The tutor replied illustrating the weaknesses of the tests performed and reassuring the student also on the great deal of time still available for self-evaluation and on the necessary checks with the official answers which would be made available. Not achieving a personal situation of recognition, appreciation, and valorisation leads to frustration, with negative feelings of insecurity, inferiority, and dependence (for the dreaded failure).

(c) Motivation to Sociality (Positive Social Relations, Coexistence, and Collaboration). Motivation to sociality includes aspects of attraction relationships with the “other” (familiar figures); moments of mere sociability (group); an evolution from solitary play to parallel play, to collaborative play; experience of imitating models of others’ behaviour for identification. It may be triggered by situations of a lack of conditions of specific fulfilment, social isolation, and lonelines. It may also activate recourse to means of communication (telephone, television, networked computers, e-mail, chat rooms, forums...). It is the opposite of isolation and aggression, as a negative relation.

Here is an example.

Student A: “Hello everyone, I wasn't in class today. Can anyone tell me how to send my answers to the self-evaluation tests? Thanks a lot.”

Student B: “Hi! To send your answers, you must go to the link: first self-evaluation test: experimental method; once you have clicked on this, scroll down with the cursor where you find the word “browse”: insert the file saved with your name and surname and at the end click on “transfer this file”. Kiss, kiss”

Student A: “Thanks again.”

These motivational components found an answer in this learning environment which thus assured a greater experience of interpersonal contact—an aspect which, from a psychological standpoint, we feel needs to be strengthened and promoted in online education systems.

4.2. Effects on Learning Levels. The effects on learning levels turned out to be good, as shown in Table 2. The group that completed the activities (n = 252) obtained an average score of 27.7 in the objective examination test; the students who did not finish the activities or who never even started them, because they did not enrol in the laboratory (n = 168), obtained an average score of 25.7 in the objective examination test. These differences are statistically significant and underline the appropriateness of this specific intervention on study contents and methods, thanks to using semi-structured self-evaluation tests.

According to the findings we can state that the advantages and strengths of the online laboratory activities described here are based primarily on the development of an active attitude towards the contents to be learnt solicited by tutor support focusing on reinforcing motivation to knowledge and motivation to self-assertiveness, consolidated by sharing, as regards motivation to sociality (with an increase in self-esteem and in so-called self-efficacy).

From a psychodynamic standpoint, the identified motivational activation strengthens critical thinking for the learning contents and, in particular, for convergent and divergent cognitive skills: in our case, thanks to the specific semi-structured tests used, which not only have an effect on knowledge acquisition but—and this is an innovative aspect of using...
Table 2: Average results obtained in the objective examination test by students who completed the online laboratory activities versus those who did not.

<table>
<thead>
<tr>
<th>Teaching of &quot;General Psychology&quot; Academic year 2010-2011</th>
<th>n</th>
<th>Average score in the objective examination test</th>
<th>Standard deviation</th>
<th>Statistical significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students who completed the online laboratory activities</td>
<td>252</td>
<td>27.69</td>
<td>3.20</td>
<td>$F_{(1,449)} = 38.05$</td>
</tr>
<tr>
<td>Students who did not do the online laboratory activities (either not finished or not started)</td>
<td>198</td>
<td>25.65</td>
<td>3.80</td>
<td>$P &lt; 0.001$</td>
</tr>
<tr>
<td>Total students</td>
<td>450</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

these tools in laboratory activities—also on finding and consolidating a study method.

On the basis of an integrated theoretical psychodynamic orientation, this cognitive dynamic then goes to affect the motivational setup in a circular manner (with a strengthening of proactive attitudes towards knowledge), making the process of individualisation of learning possible.

In conclusion, the advantages of online learning are highlighted: developing an active attitude towards learning, enabling the individualisation of learning, and strengthening motivation with regard to knowledge, self-assertiveness, and sociality. This motivational activation reinforces critical thinking as well as convergent and divergent cognitive skills, owing to the semistructured tests, which facilitate knowledge and study method acquisition.

We recall that the concept and term "creativity" has seen widespread use in psychological disciplines for about sixty years, mainly following works by Guilford [23, 24], Eysenck [25], Csikszentmihalyi [26], Sternberg [27], Runco [28], and others. These have contributed to the distinction between "convergent" activities, geared to establishing and solving closed problems demanding the choice of a single correct answer, and the typically creative, or "divergent," activities that can put together as many answers as possible to open problems. The characteristics considered attributes of creativity are not only novelty, originality, anticonventionality, but also appropriateness and functionality with respect to value systems, so as to deserve suitable acknowledgements.

The semistructured tests facilitate convergent knowledge because each student must give a correct answer in the test proposed, analyzing the topic presented in a chapter, and the specific material required. At the same time, these semistructured tests reproduce the topic studied with different contexts and require different and new applications of the topic studied: this approach facilitates divergent knowledge. The use of the two kinds of cognitive ability gives more stability to the learning process and reinforces the formation of mental schemata. Returning to the results of affective processes, we see how tutorship contributes to the development of motivation of sociality, which is particularly relevant in online communication, such as forum activity. The tutors were able to stimulate curiosity and self-confidence, reassuring students who expressed anxiety towards the content to be learned.

Motivation to self-assertiveness and motivation to knowledge (the interest in acquisition of information and development of mental schemata) are guided and reinforced by the tutorship activity directly during the learning processes, especially in the laboratory session, presented here, based on the semistructured self-evaluation tests.

For further development, we can enlarge the sample interviewed in order to study the dynamics of the relationships between learning processes and motivational processes and to assess the strengths of new educational technologies which can contribute greatly to characterizing the processes of didactic communication, enhancing, as we have seen, the functions of online educational training.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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