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Distance education: the role of self-efficacy and locus of control in lifelong learning

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Abstract

Nowadays the use of information and communications technology in distance education is an increasing and widespread phenomenon, crossing physical and temporal boundaries. Distance learning provides the flexibility needed for adults to continue their education or training while working or fulfilling family responsibilities (Bates, 2005). The rapid growth of knowledge in the area of health requires operators to continue to study and learn, just to keep up with the knowledge base of the job and to develop their careers. This study aimed to explore, in the context of distance education, the role of some of the main psychological features involved in learning achievement, such as self-efficacy (Zimmerman, 2002) and locus of control (Fazey & Fazey, 2001). The survey analysed the relations among training goals achievement (based on distance education), self-efficacy (Bandura, 1997; Schwarzer, 1993), and locus of control (Rotter, 1954; Perussia & Viano, 2008) in a group of 115 health professionals. The results show a significant relation between internal locus of control and learning achievement in distance training. Furthermore, a significant relation between self-efficacy and locus of control was found.

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1. Introduction

This survey originates from an important regional health care project, named SETT (Italian acronym: Servizi di Telemedicina e Teleformazione. This project includes the improvement of DL Services, Telemedicine and DL courses related to medical topics), that aimed, on an experimental basis, to improve distance learning (DL) services through web-based training (WBT). DL courses, which were opened to 3,000 health professionals picked from the Regional Health System, concerned medical topics and were based on self-regulated learning (SRL).

To avail of DL courses, health professionals used personalized passwords and IDs; at the end of each course they had to correctly answer at least 75% of the items in multiple-choice questionnaires to obtain Continuing Medical Education (CME) credits. The purpose of CME is different from that of primary medical education, because CME allows adults, having family or work responsibilities, to continue their education or to enrol in training sessions (Bates, 2005). Whereas primary medical education provides the basic foundation necessary for the initial license to practice medicine, CME ensures exposure of the licensed physician to current medical information. This new

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information should be incorporated into the physician's practice and, therefore, should improve the quality of medical practice and the physician's career development.

Distance education, considered in its various features, is the result of an evolution that has capitalized on the results, presenting countless solutions compared with the number of ways of implementation. It is often stressed that learning is essentially a social process (Brown & Duguid, 2000) and how, by contrast, DL is seen as a resolution to learning with the following characteristics:

1. exclusive and inimitable communication modalities; and
2. strong social dynamism in relationships.

Distance learning has evolved as follows:

- DL - first generation: consisting mainly of education by mail, addressed to adults, managed by private agencies and not directly geared to the labour market;
- DL - second generation (20th century): utilization of audio-visuals (VHS-video home system) and media (telephone, fax, television, video conferencing) as training and educational tools, mainly oriented to schools and professionals, mainly for young people rather than adults, and provided by governmental organizations. The second generation transitions the impersonal communication to a widespread modality that sees the change from "one to many" to "few to many";
- DL - third-generation: off-line (floppy disk, videodisc, CD-ROM, DVD-ROM) and online (Web) information technology.

Nowadays WBT is DL, focused on the experience of the students rather than on didactic teaching. DL promotes independent and customized learning (Boccia Artieri, 2002), but it is still discontinuous in space and time (extended network access), thus making true the "separation of contexts" (Thompson, 1995). New interactions become available: it proposes itself as the place itself occurs (Rivoltella, 1999) and as a seat of new ways of social presence.

Known also as e-learning, DL indicates a new method of acquiring knowledge. It is based on peer exchange, and it provides a dynamic and polycentric relationship among different network subjects (Boca, Pace, & Severino, 2009). The e-learning is related to the era of the knowledge society and information; it is an expression of post-modernity, characterized by *disembedding* and, therefore, by the decline of face-to-face interactions. In the opinion of Giddens (1994), *social relations are removed from local contexts and are characterized by an indefinite space-time dimension*.

The main principles of DL are:

- *interactivity* with the learning objects (LO) and the other learners involved;
- *learning by doing*, to encourage the development of personalized training;
- *dynamism*, which refers to the need to acquire new *just-in-time* skills;
- *modularity*, which is related to the possibility of organizing DL contents according to the educational goals and user requirements;
- *flexibility*, intended as the implementation, timing, and utilization of contents (LO);
- *multimedia*, which is related to the integration of multiple forms of media (texts, graphics, audio, video, etc);
- *re-use of LO*, which are developed to be implemented on any platform;
- *traceability*, with the learning management system (or platform) allowing to follow the student's interaction; and
- *human interaction*, through the support of more professionals (tutors, teachers, and so on), which creates a stimulus learning environment, even online (Severino, 2008).

Most of the training process carried out in the network takes place with the interaction of the participants in a real learning community; this allows overcoming the exclusion of the single and mainly allows the development of the relations with the group (Severino, 2008; Calvani, 2006).

Group learning dynamics in the virtual context imply the acquisition of new abilities to make the education

process easier (Severino & Messina, 2010). Virtual learning groups generate collective intelligences (Levy, 1995) that communicate in real time. This context creates new forms of interactions (Calvani & Rotta 2000): the classical one-to-many communication is replaced by the many-to-many communication.

Information and communications technology represents an opportunity for adult training because it allows the preserving, developing, and sharing of knowledge, an increase in efficiency, and the saving of time and money. This is very important in the training of health professionals. The most operative DL is the *blended* approach, composed of a mix of different learning environments (face-to-face instruction and WBT).

Andragogy is a unified theory of adult learning and education. While pedagogy has a *hierarchical* and *vertical* structure, since the teacher has full responsibility for decisions about the content, methods, and evaluation, *andragogy* theory (Knowles, Holton E.F., & Swanson R.A., 2008) is based on the following key assumptions:

- **The need to know** - Adults feel the need to know why they should learn something. Tough (1979) found that when adults begin to learn something by themselves, they invest considerable energy to examine the benefits they draw from learning. The first task of the facilitator is to help learners in the awakening of consciousness (Freire, 1973).
- **The self-concept of the learner** - With the development of the person (from youth to adult), the self-concept moves from a sense of total dependence to a growing sense of independence and autonomy. The adult must feel that his own self-concept is respected by the educator and therefore must be placed in a situation of autonomy (versus dependency).
- **The role of experience** - The adult experience guarantees a greater cultural heritage and repertoire (background, motivations, needs, interests, goals) as well as improved autopoiesis and self-reference (possibility of using internal resources, relying solely on their own capacity). Therefore, with a group of adults in training, being characterized differently from a group of young people, there is a need to focus on the individualization of teaching strategies and techniques and on experiential learning, rather than on transferring learning, plus the mutual help activities among peers. Obviously, a person's having more experience can also result in negative traits, as may be seen in greater rigidity and resistance to new ideas and different ways of learning.
- **The willingness to learn** - What is taught to adults should enhance their skills and abilities; they should be able to effectively apply such knowledge to their everyday work life.
- **Orientation towards learning** - Adults learn new abilities if these abilities are presented as being immediately useful in their working environment.
- **Motivation** - In the case of adults, endogenous motivations are generally stronger than exogenous pressures. Tough (1979) found that all adults are encouraged to grow further in their profession (ascending vertical social mobility), but such growth is often hampered by a negative concept of the self as a student, or by the inaccessibility of training due to various factors (resources, lack of time, difficulty).

Knowledge and ability as social phenomenon are mixed in with the skills, beliefs, and forms of organized life (Wenger, McDermott, & Snyder, 2002). Therefore, it becomes more interesting if it is reported as part of the health professionals' education, in which each individual participates to a different degree and with his own contribution of experience. In fact, the health sector needs to build abilities that support and assist an adjustment and an increase requiring high specialization.

Reinforcing knowledge through collaborative methods (Calvani, 2006; Wenger, 1998) allows the development of technical abilities as well as the cognitive dimension, which contributes to complete the individual's education. The virtual classroom method gives pliability and proximity to individual training paths (Trentin, 2001, 2005).

Motivation plays a central role in adult learning, since it influences the choice to attend a training course and to apply proper learning strategies (Hough, 1984). There are many constructs of importance in understanding motivational processes: outcome expectancies (Feather, 1982; Vroom, 1964), attributions (Miller, Brickman, & Bolen, 1975), goal directedness (Covington, 2000), intrinsic versus extrinsic motivation (Deci, 1975), locus of control (Rotter, 1954, 1966), self-efficacy (Bandura, 1977), volition (Kuhl & Fuhrmann, 1998), self-regulation (Zimmerman, 2002), and self-control (Rosenbaum, 1989). A common thread that runs through many of these constructs is the identification of internal and external sources of motivation. More specifically, locus of control (LOC) is defined as a generalized expectancy of internal as opposed to external control of reinforcements (Lefcourt, 1976). This feature plays an important role in learning goals achievement. Along with LOC, self-efficacy is another effective predictor of students' motivation and learning (Zimmerman, 2000).

2. Purpose of study

The aim of this survey was to analyse the structure of the possible relations among training goals achievement (based on DL) on one hand, and the subjects' features together with self-efficacy (Bandura, 1997; Zimmerman, 2002) and LOC (Rotter, 1954; Fazole & Fazole, 2001; Perussia & Viano, 2006) on the other.

The analyses were conducted on a group of 115 health professionals coming from the 587 health professionals belonging to the Regional Health System. In this paper the possible relationship between the variables involved in the study was assessed by the most popular techniques of analysis of relations.

Harter (1990) and Bandura (1997) have recorded achievement behaviours such as persistence, challenge, interest, curiosity, resilience to failure, and commitment to progress as being associated with high self-perceived competence, with high motivation at the intrinsic end of the motivational continuum (Deci et al., 1991; Ryan & Powelson, 1992) and with high behaviour-outcome contingency expectations or internal LOC. The use of one construct to infer autonomous characteristics was not, in itself, felt to be sufficient. The combinations of high or low self-perceptions of motivation and competence and internal or external control at the beginning of university study were chosen as the focus for the identification of the potential for autonomous learning (Fazole & Fazole, 2001).

Self-efficacy has been the topic of numerous studies involving adult learners, most recently involving computer self-efficacy and online education. This survey aimed to explore the relationship between self-efficacy and adult learning in the health context. According to Bandura (1994), self-efficacy represents the people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. He further explains that people with a strong sense of self-efficacy view challenging problems as tasks to be mastered, develop a deeper interest in the activities in which they participate, form a stronger sense of commitment to their interests and activities, and recover quickly from setbacks and disappointments. Nevertheless, Bandura (1977) states that, expectation alone will not produce desired performance if the component capabilities are lacking. Although self-efficacy beliefs are a powerful influence on behaviour, a number of contextual factors, including social, situational, and temporal circumstances under which events occur, can affect results.

The literature demonstrates that LOC influences learning achievement: people who recognize that the outcome of the activity is contingent upon behaviour (Rotter, 1966; Zimmerman & Schunk, 2003) are described as having an internal LOC. At the other end of the continuum is an external LOC, in which individuals perceive themselves as having little or no control over their achievement. In the locus of control measures, a high score on 'internal' control, with a low score on 'external' and 'unknown' control factors, would indicate autonomy-related LOC. The emphasis here is that autonomous learners perceive themselves to be in control of their success and failure in a learning context (Fazole & Fazole, 2001). With regard to Knowles' thought (1980), adults are available to learn only if new knowledge is to help them *cope effectively with life or job situations* and if they feel themselves to be *responsible for their own decisions*.

3. Data description

The DL courses were originally intended for 587 health professionals belonging to the Regional Health System, all of whom were registered in a Learning Management System (Moodle, open source) customized for the project. The analysis included 115 health professionals who voluntarily participated in the study, following an email introducing them to the purpose of the study and their being sent an attached questionnaire composed of different instruments as shown in the "Instrument and methods" section. The subjects, in particular, were physicians and hospital nurses, distributed among three typologies of DL courses, differentiated by assigned CME (6, 8, or 12). In relation to assigned CME credits, participants had to respond to 30 multiple-choice questions in the "I" type of DL course, to 40 multiple-choice items in the "II" type of DL course, and to 60 multiple-choice questions in the "III" type of DL course.

At the end of each course, the SRL gained through the DL course was assessed through a specific online questionnaire filled out by every subject. Different scores (x_i) coming from different scales were standardized (z_i), through a ratio of two differences: the first one between each original score and the minimum score, the second being the range (maximum minus minimum score) of the original scale:

$$z_i = \frac{x_i - \min(x_i)}{\max(x_i) - \min(x_i)}$$

This procedure yielded a new set of scores $z_i \in (0, 1)$, hereafter named *self-regulated learning (SRL)*. Table 1 shows the means and standard deviations of variables by DL course typology.

Table 1. Distribution of subjects by some principal characteristics and typology of course.

		DL Course			Tot.
		I	II	III	
Gender (%)	Female	40.9	30.8	36.2	37.4
	Male	59.1	69.2	63.8	62.6
Age	mean	51.3	51.3	48.4	49.9
	std.dev.	5.4	4.4	6.1	5.8
Profession (%)	Physician	18.2	30.8	19.0	20.0
	Nurse	45.4	30.8	34.5	38.3
	Other	36.4	38.4	46.5	41.7
Self-efficacy	mean	34.2	33.7	33.9	34.0
	std.dev.	3.6	4.7	3.6	3.7
Internal LOC	mean	17.9	17.6	18.3	18.1
	std.dev.	3.0	4.4	2.8	3.1
SRL	mean	0.540	0.569	0.285	0.415
	std.dev.	0.283	0.227	0.223	0.281
Total		38.3	11.3	50.4	100.0

4. Instrument and Methods

In this survey some instruments were administrated to the subjects involved. Respondents filled out their responses to the questionnaire, briefly illustrated as follows:

- **Online multiple-choice questionnaire:** At the end of each course, a self-regulated learning degree was assessed through an online multiple-choice questionnaire filled out by every subject. To finish their studies and to receive the related CME credits, participants had to get 75% of the multiple-choice items right. The online multiple-choice questionnaire was strictly related to the DL course's contents and duration. Minimum and maximum self-learning questionnaire scores were different according to the assigned CME value. To compare the scores belonging to the different scales, a transformation procedure was applied to obtain a unique distribution of values.
- **Perceived self-efficacy** was investigated through the Italian version of the Perceived Self-efficacy Test (Schwarzer, 1993), a self-report instrument composed of 10 items rated on a four-point Likert scale, covering the degree of belief that one is capable of performing in a certain manner to achieve certain goals. The scale presents good reliability (Cronbach's alpha ranges from 0.75 to 0.94).
- **Internal locus of control** was assessed through the Italian version of the Mini Locus of control scale (Perussia & Viano, 2008), a self-report instrument composed of six items rated on a four-point Likert scale. The scale presents a quite clear and defined factorial structure based on three factors: *Chance*, *Powerful others*, and *Internality*. The scale was developed to measure the internal and external control beliefs of adults. Specifically, *Chance* measures external locus of control, *Powerful others* represents the influences applied from the social context, and finally *Internality* is related to the will, the personal capabilities. Psychometric indices of validity and reliability are available at www.itapi.org, the website directly managed by Perussia and Viano. *Internality*, factor 3, plays a fundamental role in explaining the internal LOC, as suggested by the analysis.

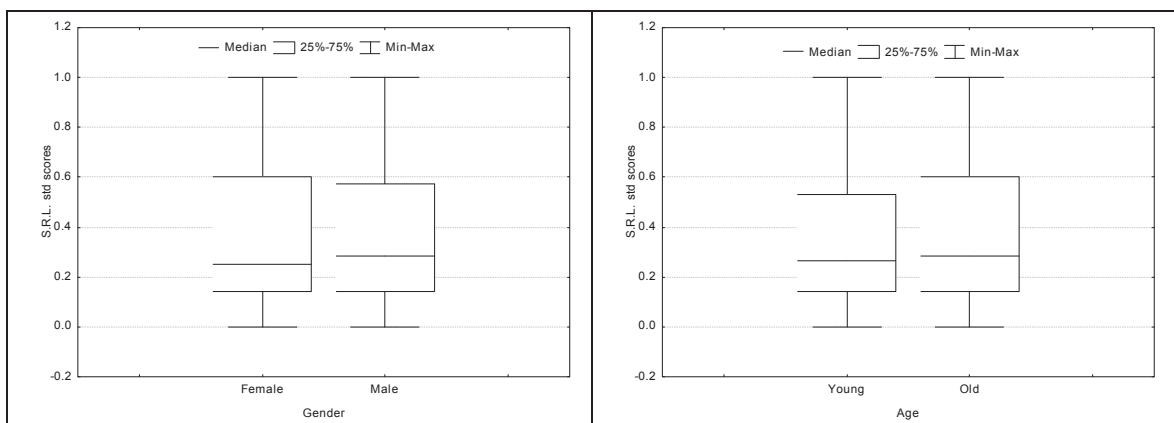
A two-step analysis was conducted before studying the possible effects of self-efficacy and internal LOC on *SRL* score. An explorative analysis was first conducted, based on both graphical investigation and nonparametric tests, to know if the subjects' responses varied according to their features, such as gender, age, and typology of course (see Table 1). At this stage, box plots and the Mann-Whitney U test were carried out. Then the structure of the relationship among the instrumental variables was studied, to see if and how self-efficacy, internality, internal LOC, and *SRL* change simultaneously. The analysis was conducted applying the Kendall *tau* coefficient of cograduation and using once again the box plot and the U test. The aim here was to know which variables could be useful to decompose the observed variability of the *SRL* score.

The last phase of the analysis was devoted to decompose the variability of the *SRL* score, conditioning on the variables selected by the previous analysis of relationship. As will be seen later, the hypothesis was that there could be a conjoint effect of two or more variables on a third one. In other words, this meant investigating statistical interactions, in which the response (the standardized score on the *SRL* scale) to one factor depends on the level of the other factor. Here, the reference model was the *factorial experiment*. To carry out the analysis, the subjects' scores on the internality scales were categorized based on their quartile.

5. Findings and Results

The results of the analysis on the points listed above are the following:

- i. The explorative analysis suggests that only two instrumental variables are significantly related to two subjects' features: *internality* with *age* and *SRL* with the typology of *course*. Table 2 shows the results of the nonparametric tests (the Mann-Whitney U test and the Kruskal-Wallis ANOVA test) for each couple of variables. Figure 1 shows four box plots; the first two illustrate the lack of association whereas the latter two, in contrast, show the above-mentioned relationship between the couples of variables. For the first two, there seems to be no difference between the score distributions conditioning on *gender* or *age*. In Figure 1 are represented the box-plots for the *SRL* (standardized) score in function of *gender*, *age*, and typology of *course*, and the box plot of *internality* based on *age*. The two latter box plots show how the distribution of *internality* and of *SRL* score depend on *age* and typology of *course*, respectively.



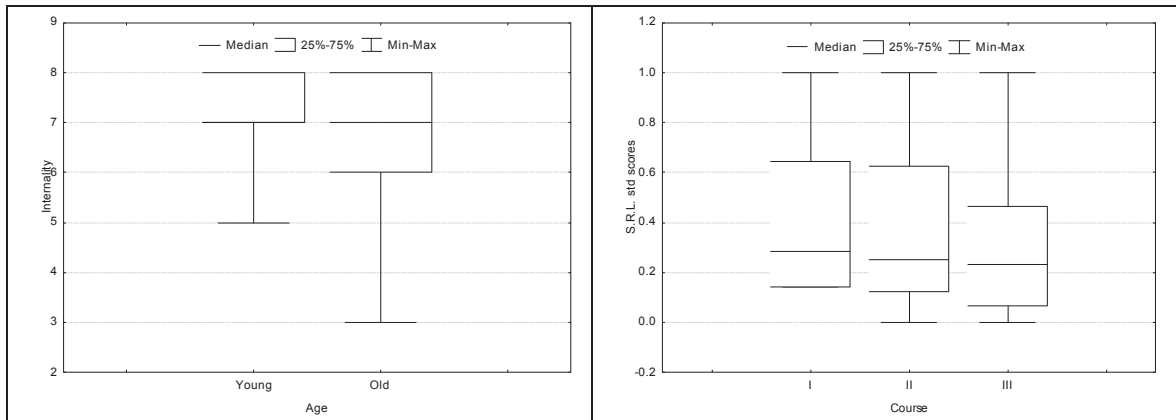


Figure 1. Box plots of SRL score and Internality, conditioning on gender, age, and course.

It can easily be seen that the *SRL* score does not change in function of gender and age, but it seems to vary slightly according to the typology of *SRL* course. On the other hand, it can easily be seen that internality varies (both in median and in distribution) as age varies. Younger subjects have higher and less spread-out levels of internality.

These findings are supported by the results of nonparametric tests on the medians. We compared the scores of subjects on each instrumental variable, conditioning on *gender*, *age*, and *course*. Table 2 reports the results (values and significance levels) of the Mann-Whitney U test (first two columns, *gender* and *age*) and the Kruskal-Wallis ANOVA test (third column, *course*). As mentioned earlier, there are only two worthy results: the first for the relation between *internality* and *age* ($p = 0.02$) and the second for *SRL* and typology of *course* ($p = 0.09$). On the basis of these results, we can conclude that the typology of the *course* should be the first factor to include in the factorial experiment for the final analysis.

Table 2. Results of nonparametric test (values and significance) on variables for independent groups.

	<i>Gender</i>		<i>Age</i>		<i>Course</i>	
	U	<i>p</i> -value	U	<i>p</i> -value	<i>K-W Anova</i>	<i>p</i> -value
<i>Self-efficacy</i>	1444.0	0.551	1460.0	0.743	0.134	0.935
<i>Internality</i>	1545.0	0.989	1118.5	0.019	2.344	0.310
<i>Internal LOC</i>	1525.0	0.897	1387.5	0.451	0.204	0.903
<i>SRL score</i>	1446.5	0.559	1429.0	0.611	4.750	0.093

Bold results are significant at $p < 0.1$.

ii. Rank correlations among the rough scores of the instrumental variables were carried out. Table 3 shows the results. There are many significant coefficients of correlation among ranks. The results show that the relations observed on our data set agree with the literature relatively on the association between *self-efficacy* and *internal LOC*. One more interesting relation emerges for *self-efficacy* and *internality*, which has a higher coefficient, indicating a stronger association. With respect to the *SRL* score, it can be seen that it is significantly and negatively associated with both *internality* and *internal LOC*. The relations have the same direction but a little different strength, with the second one higher than the first. On the contrary, no relation was observed between *SRL* and *self-efficacy*.

Table 3. Kendall τ rank correlations.

	Self-efficacy	Internality	Internal LOC	<i>SRL</i> score
Self-efficacy	1.000	0.361	0.137	-0.059
Internality	-	1.000	0.224	-0.140
Internal LOC	-	-	1.000	-0.194
<i>SRL</i>	-	-	-	1.000

Bold correlations are significant at $p < 0.05$.

To confirm the previous results, a further analysis was carried out. The rough scores of the first three instrumental variables were categorized into four classes based on the quartiles (Schwarzer, 1993; Perussia & Viano, 2008) of each distribution. The goal here was to check if in categorizing the three instrumental variables, their relation with the *SRL* score varies or not. This is why further factors (one or more) must be drawn from this analysis for the factorial experiment. To do this, analyses of box plots (Figure 2) and the Kruskal-Wallis ANOVA test (Table 4) were carried out. The results suggest an overall effect of *internality* and *internal LOC* on *SRL* score. Moreover, when these two relations are compared, the conclusion could be drawn that *internality* acts better than *internal LOC* on the *SRL* score, that is, the first one better explains the observed variability of the *SRL* score. Also on this occasion, no relation was observed between *SRL* and *self-efficacy*.

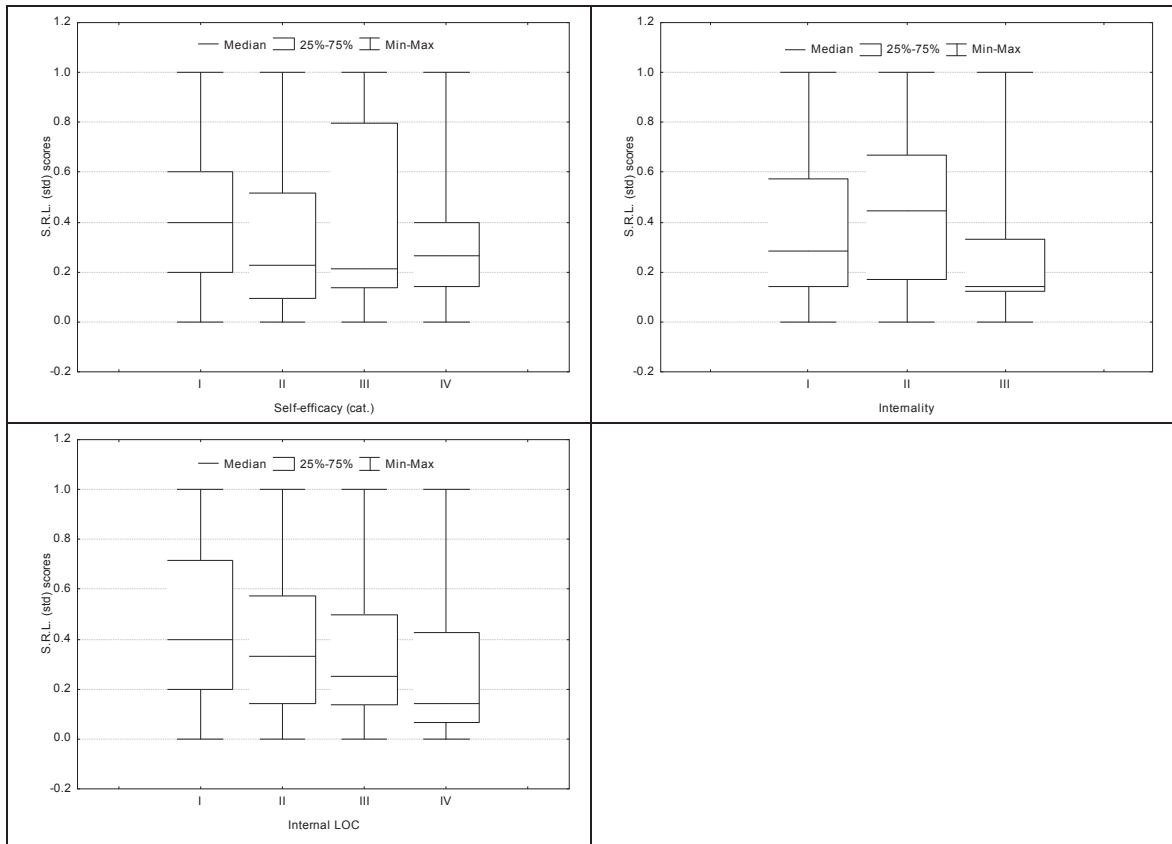


Figure 2. Box plots and Kruskal-Wallis ANOVA test applied to *SRL* score, conditioning on the remaining instrumental variables.

Graphical analysis shows that conditioning *SRL* score on *self-efficacy* does not produce any systematic difference among the medians. Instead, conditioning on the *internality* and *internal LOC* causes differences among medians to come out. In Table 4 it is appreciable that *internality* produces a more significant effect on medians than does *internal LOC*, despite their uneven pattern.

As a consequence of this evidence it seems more suitable to use as a factor the *internality* rather than the *internal LOC*, because of the former’s higher capability to explain the variability of the *SRL* score.

Table 4. Results of Kruskal-Wallis ANOVA by Rank for *SRL* score.

Grouping variable	K-W Test	p-value
Self-efficacy	3.018	0.389
Internality	9.442	0.009

Internal LOC	7.492	0.058
Bold values are significant at $p < 0.05$.		

iii. Finally, a factorial experiment was applied using two factors drawn from the previous analyses: the *typology of course* from the first analysis, and the (levels of) *internality* from the second. That is, the model was a 3×3 two-factor experiment, because no subject got a score higher than the third quartile ($Q_3 = 8$) on *internality* and, as above mentioned, there are three types of *course*. The assessment of the principal and interaction effects on the *SRL* score was conducted in an ANOVA two-way context. Table 5 reports the results, in which the investigated effects are all significant (or at least almost significant).

Table 5. ANOVA decomposition of the *SRL* score: test over all effects.

	Degree of freedom	S.S. (Sum of Square)	M.S. (Mean Square)	F-test	p-value
Intercept	1	9.125	9.125	127.464	0.000
Course	2	0.354	0.177	2.472	0.089
Internality	2	1.039	0.520	7.258	0.001
Course*Internality	4	0.712	0.178	2.485	0.048
Error	106	7.588	0.072		
Total	114	9.378			

Bold values are significant at $p < 0.05$.

This means that the *SRL* standardized score varies according to the level of *internality* (higher for the second level, lower elsewhere, last row of Table 6) and the type of *course* attended (decreasing from the first to the third type, last column of Table 6). More interesting, however, is the interaction effect *internality*×*course*, because the effect of the two factors is not additive: *internality* acts on *SRL* score with different magnitude and direction, depending on the type of *course* with which it is associated. In other words, the *SRL* means vary in a different way based on the different combination of levels of *internality* with the type of *course*. In fact, as can easily be seen from Table 6, considering the first type of *course*, the *SRL* means are decreasing, starting from the first to the third level of *internality* (difference in magnitude); on the other hand, considering the second and the third type of *course*, the means before are increasing and then decreasing, starting from the first to the third level of *internality* (difference in direction and in magnitude).

Table 6. Observed *SRL* means for the interaction effect *internality*×*course*.

Type of course	Level of <i>internality</i>			
	I	II	III	
I	0.518	0.500	0.255	0.424
II	0.188	0.750	0.250	0.396
III	0.305	0.341	0.276	0.307
	0.337	0.530	0.260	0.363

The graphical analysis (Figure 3) of the interaction effects shows that:

1. Given the lowest level of *internality*, subjects gained a higher (mean) score on the *SRL* scale when they attended the first *course*, rather than the other two. On the other hand, it seems that subjects gained the worst score when they attended the second type of *course*;
2. Given the second level of *internality*, subjects gained the highest *SRL* score when they attended the second *course*;
3. Given the highest level of *internality*, subjects gained the same (low) score on the *SRL* scale, apart from the type of *course* they attended.

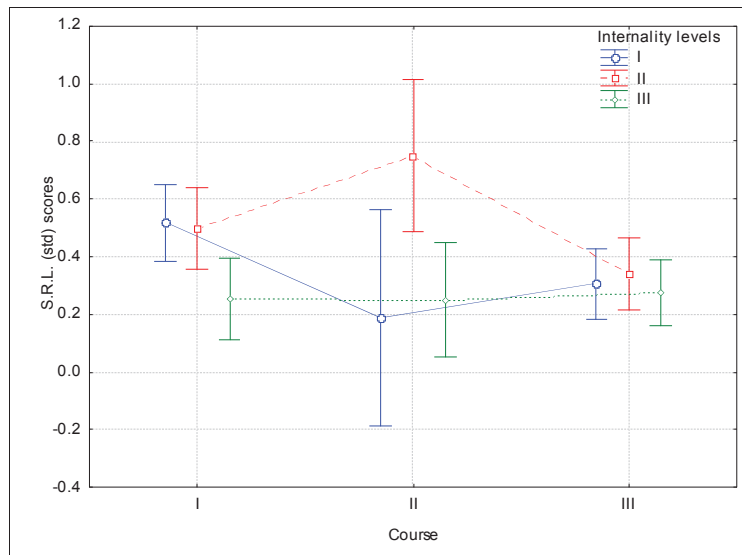


Figure 3. Graphical analysis of the interaction affects *internality*×*course* on SRL score.

To confirm the graphical suggestions, contrast analyses were carried out. The first row of Table 7 shows the contrast test, based on the second course, between the subjects’ group with the second level of internality (Figure 3 “red line”) and the subjects’ group with the first level (Figure 3 “blue line”). The *t* test confirms that the mean of the group with the second level of internality is significantly higher than that of the group with the first level. On the other hand, the third row shows the contrast test, given the lowest internality (Figure 3 “blue line”), between the group of subjects who attended the first course and the group that attended the second course. This contrast is not significant, despite the graphical hint, and it could be due to the extremely low number of subjects included in the second group. The remaining two contrasts are significant, demonstrating that the graphical differences displayed are almost everywhere relevant.

Table 7. Analysis of the contrast for between-group factors on the means (*course x internality*) of the SRL score.

Contrast	Estimate	Std. Err.	t	p-value	CI _(95%) Lower	CI _(95%) Upper
$\bar{D}_{22} - \bar{D}_{21}$	0.563	0.232	2.428	0.017	0.103	1.022
$\bar{D}_{22} - \bar{D}_{23}$	0.500	0.168	2.982	0.004	0.168	0.832
$\bar{D}_{11} - \bar{D}_{21}$	0.330	0.201	1.646	0.103	-0.067	0.728
$\bar{D}_{22} - \bar{D}_{32}$	0.409	0.148	2.767	0.007	0.116	0.702

Bold values are significant at $p < 0.05$.

6. Conclusions and recommendations

The rapid growth of knowledge in the health area involves professionals continuing with their studies to improve their own knowledge and/or career. Knowles' "andragogy" – supposedly the adult equivalent of "pedagogy" (1973) – is a leading *brand* in adult education theory. Knowles supported the following assumptions:

- Adult learners need to know *why* they need to learn something, before undertaking to learn it;
- Adults *need to be responsible for their own decisions* and to be treated as capable of self-direction;
- Adult learners have a personnel background that represents the richest resource for learning;
- Adults are available to learn those things they need to know *to cope effectively with life* situations;
- Adults are *motivated to learn* to the extent that they perceive it will help them perform tasks they confront in their life situations.

The findings of this research suggest that, as Knowles (1980) maintained, extrinsic motivation (such as a raise or career development) yields a more incisive effect on adult learning than does an intrinsic one. Furthermore, analysis of data suggests that factors such as *internality* and difficulty of the *course* affect the DL of the adult.

For these reasons the findings of this survey can be better argued, calling back attention to the following issues:

- *Registration in DL courses.* Health professionals did not adhere voluntarily to DL courses – the SETT project was realized on experimental bases. Therefore, participants were recommended by the Central System to attend the course.
- *Research context.* The opportunity to acquire CME credits is the most important motivational factor to attend DL courses, since it allows health professionals to develop their career. CME represents an assumption of responsibility for health professionals; the explosion in medical knowledge over the last 25 years has increased the demand for several forms of continuing education and, in response, multitudes of postgraduate courses, taped lectures, and DL training. *Research context created in students an external motivation mainly oriented to acquire CME credits.*
- *Difficulty level of the course.* The difficulty of the course can be distinguished based on the contents, duration, and number of CME credits, as illustrated in the “Data Description” section. The most difficult courses are included in the third typology. The first typology of courses allows health professionals to acquire a number of CME credits slightly lower than the second one, but it is harder than the latter.

The survey results suggest that self-regulated learning performance is influenced by some of the factors mentioned above. Even though this survey wonders if self-efficacy and LOC are the main variables on DL processes, *the output demonstrates the importance of the relation between LOC and external motivation (acquiring CME credits)*. Our research was conducted in a context in which subjects developed external motivation that interacts, in our opinion, with the levels of *internality* and the typology of the *course*.

As the literature has amply demonstrated, individuals with internal LOC engage in learning processes more than do individuals with external LOC because the former believe that the achievement of training goals depends on their will. In this case they develop positive expectations and they are more motivated to learn. Nevertheless, as Trevisani (2000) points out, adults generally do not present a solely internal or external LOC; rather, they move on a continuum, searching for an optimal fit in their belief system.

The interaction between *internality* and typology of *course* on the *SRL* score, as shown in Table 5, is one of the main findings that came out from the analysis. According to the analysis of the interaction effects, *internality* × *course* (Figure 1), it is easily appreciable that individuals with the highest level of *internality* gained a low score on the *SRL* scale. In our opinion this result could be associated with the subjects’ propensity to consider their goal achieved when CME credits are obtained. On this basis, we argue that these subjects only aim to pass the test. In fact, the analysis of the contrast for *between-group factors* shows that the performance of this group (posed on the III level of *internality*) is not affected by the difficulty of the *course* (Figure 3). Thus, in each DL course subjects with the highest *internality* probably identified the acquisition of CME credits as the main purpose of DL and they did not worry about their test performance.

Another worthy hint is that subjects with the lowest level of *internality* (Figure 3) have the worst *SRL* score; this performance is posed on the easiest (II) typology of *course*, as indicated in section 3, “Data Description”. In this case the effect of low *internality* on *SRL* performance is clear. Then the highest and the lowest levels of *internality* act on the *SRL* score in the same way. Finally, analysis of the contrasts (Table 7) suggests that subjects who got a medium-low level of *internality* obtained significantly different *SRL* scores; in this group (posed on the II level of *internality*) the highest *SRL* score was observed in correspondence with the second typology of courses (the easiest).

In sum, the combined effect of difficulty of the *course*, *internality*, and extrinsic motivation (acquiring CME credits and developing career) had a crucial role in *SRL* performance. As Fazey and Fazey (2001) maintain, autonomous people perceive themselves to be in control of their decision making, take responsibility for the outcomes of their actions, and have confidence in themselves (see, for instance, Deci & Ryan, 1985; Bandura, 1988; Zimmerman & Schunk, 2003). Many authors link these characteristics to the sense of self, which enables autonomous people to act within a personal belief system, providing them with the framework for their decision making and personal planning (Bandura, Hamilton, Bower, 1988; Zimmerman & Schunk, 1976).

In conclusion, this exploratory survey seems to suggest that in learning processes, and more exactly in DL, adults refer to an articulate and complex system of psychological features (not solely reducible to the variables here investigated) that interact with specifically contextual factors. Thus, considering the relevance of the analysed themes, we suggest further developments following some recommendations, specifically, comparing the results with

surveys conducted in the paying DL context and where communication tools contribute to the development of virtual communities. The next survey should have an adequate sample.

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