Metacognitive Components of Student's Difficulties in the First Year of University

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Abstract

Metacognition is a good predictor of University student's achievement and should be more systematically considered since it might also help reduce student drop outs. In particular drop out is a dramatic problem for Italian Universities since it may concern more than 40% of students. The identification of factors that lead to academic failure and of remedial programs seems, therefore, necessary. The present paper examines the role of metacognitive aspects in more than 1,000 freshmen who participated in a project at the University of Calabria, in the South of Italy. Students at the beginning of the academic year completed two Questionnaires, concerning their study skills and other personal characteristics, and then followed a 10-hour metacognitive training course on the study and personal skills necessary for succeeding at university. A few months later, students again completed the Study Skills Questionnaire and, at the end of the year, information was collected on their achievements. Results showed that significant predictors of the students' achievement were perceived self-efficacy, and other self-regulatory and motivational constructs. Furthermore, the training was able to change the students' perceived ability to use study strategies and to process study material in a more in-dept manner.

Keywords: Metacognition, University students, Intervention programs, Drop out

1. Introduction

Students often encounter problems when they enter University, as they must deal with new contexts, study methods, topics, and types of examinations. One result could be that students become discouraged and avoid examinations, finally resulting in drop outs or significant delays in concluding their studies. Research has already extensively examined these issues and produced a series of findings about factors that influence and correlate with academic achievement, in an attempt to predict and prevent drop out, but many questions still remain to be answered.

Two main issues to be analyzed are the factors best predicting University students' failures and educational strategies which could reduce the size of the problem. With regard to the first issue, it is well known that ability and knowledge in the study area are necessary, but not sufficient. In fact students frequently have been seen to fail dramatically, despite good basic cognitive skills. Many factors have been proposed as particularly critical, including personality characteristics (Poropat, 2009), the students' and his/her family's socio-cultural level, intelligence, expectations and/or previous school achievement (Simpkins, Davis-Kean, & Eccles, 2006), a pause before entering university (Martin, 2010), etc. However, there is evidence that metacognitive factors may be crucial. Robbins et al. (2004) meta-analyzed more than 100 studies and found that academic self-efficacy and study skills were among the best predictors of college outcomes, over and above socioeconomic status and high school grade point average.

As far as the possibility of reducing the degree of academic failure in university students is concerned, various suggestions have been given. For example Crocker et al. (Crocker, Canevello, Breines, & Flynn, 2010) showed the importance of increasing interpersonal goals in order to reduce the anxiety and dysphoria of first-semester college students. Azevedo and Cromley (2004), focusing on self-regulated learning, were able to improve students' learning

with hypermedia. The importance of increasing self-regulated learning has also been demonstrated by Robbins et al. (Robbins, Oh, Le, & Button,2009), who showed the positive effects of self-management-based interventions and the mediating role of psycho-social factors. These aspects can be included in the area of metacognition and offer further evidence to a well-established body of data showing the importance of metacognition for success in studying (Borkowski, Milstead, & Hale, 1988).

In a wider perspective, metacognitive variables can be distinguished in two clusters of interconnected (Cornoldi, 1998; 2010) components. The first cluster concerns the student's reflections and states of awareness on his/her own study process. The second cluster involves the control components by which the student regulates this process. These latter components are relatively heterogeneous and include different aspects, such as study organization, strategies devoted to improving learning and depth of encoding, monitoring, and so forth, and share a common reference to the subject's ability to control his own learning process and to use his metacognitive knowledge in order to do so adequately (Cornoldi, 1998).

Evidence showing how metacognition can positively affect learning is robust. For example, it has been shown that an appropriate selection and an adequate monitoring of strategies can improve school achievement (Wolters, 1998; Zimmerman, 2000). In particular, metacognition is critical in the achievement of late adolescents, including college students (Ley & Young, 1998; Stoynoff, 1996; Wolters, 1998).

Within a broad metacognitive perspective (e.g., Borkowski & Muthukrishna, 1994) metacognition involves not only cognitive, but also related emotional-motivational factors. In this perspective, the nature of the student's learning goals, self-attributions, self-perceptions is critical. For example, during learning, a student can be motivated either to increase his competence, or to simply obtain success, even without taking into account the substantial degree of learning goals: these two different categories of goals (learning vs. performance) are inherent to two different implicit metacognitive theories of intelligence (Dweck, 1999; Dweck & Leggett, 1988).

Another emotional-motivational factor related to the student's metacognition is his/her perception of self-efficacy, that is the perception that the finalized actions while studying will realize the desired effects (see also Bandura, 1986). In fact this perception is related to a student's reflection on how his/her own mind works and his own effectiveness. It can be assumed that a high perceived self-efficacy will have a series of effects on control processes, including an increased inclination to use effective strategies more extensively. Moè, Cornoldi and De Beni (2001) illustrated how strategies may be critical in students' success. In particular they distinguished between three different components of the strategic attitude, i.e., strategic knowledge and evaluation, strategy use and strategic coherence and they showed that they are all necessary for the academic achievement in late adolescents.

Despite the importance of metacognition for students success and the evidence concerning late adolescents and University students, in particular, no systematic efforts have been made to use metacognition to promote University students' success, and more specifically to prevent student drop outs. The phenomenon of university student drop outs is particularly evident in Italian Universities, due in part to a series of structural factors, such as large classes and difficulty in finding accommodation close to the University when students live too far to be able to attend classes. The university drop out rate is particularly high.

The national mean for students who do not complete their studies is about 40% and the phenomenon very frequently concerns freshmen. In recent years, about 17% of Italian students who were enrolled in the first year of undergraduate courses decided to interrupt their studies. For example, students matriculated in 2008/2009 were 294,933, whereas students enrolled in their second year in 2009/2010 and also matriculated in 2008/2009 were 245,731, with a drop out rate of 16.68% from the 1st to the 2nd years. In the southern part of Italy the situation of education is even more dramatic, as the students' learning outcomes may be one standard deviation below the learning outcomes of students in northern Italy (source: MIUR, 2010) and the percentage of university students who are not able to complete their studies reach high values. For example, in 2007, for the group of undergraduate students attending the University of Calabria, located in the south of Italy, only 35.1% concluded their studies within the expected period of three years, compared to a percentage of 56.8% for the students in Padova, located in the north of Italy (Alma Laurea, 2011).

In order to try to improve this situation, the University of Calabria decided to start a study project involving a large number of freshmen in an assessment (mainly based on students' self-reporting of their study skills) and in a short training course on self-regulated study skills, in the academic year 2008-2009. This paper presents the main results obtained from this study and in particular the variables, assessed at the beginning of the academic year, which best predicted students' achievement and the effects of the short training on self-perceived study skills. Because research has shown that students' drop out is mainly related to the fact that students were not able to tackle or pass

examinations, in this study we used the number of examinations the student had passed at the end of academic year as a measure of achievement (De Beni, Moè, & Cornoldi, 2003; Newble & Entwistle, 1988). Study skills were assessed with a standardized Study Questionnaire – AMOS - (De Beni et al., 2003) which requires the student to describe his/her skills regarding study organization, depth of encoding, self-evaluation, use of strategies and metacognitive awareness. In this way we could see whether the training which focused on study strategies was able to change this area and to extend its effects to other areas. Students also completed a questionnaire where they described other aspects of themselves, which had been shown to be related with academic success, including motivation, prior school achievement and parents' level of education.

2. Method

2.1 Participants

1,185 students (482 males and 703 females) enrolling in the first year of undergraduate studies at the University of Calabria. Students' age ranged from 18 to 28 (M_{age} = 19.4 years, SD = .91 years). Students were enrolled in courses in the faculties of Economics (34.8%), Pharmacy (10.1%), Engineering (31.2%) and Humanities (23.9%).

2.2 Instruments

At the beginning of the university courses (September, 2008) and during the first year of study (March, 2009), students were administered, in large groups, the Study Approach Questionnaire (Questionario di Approccio allo Studio; QAS) included in the AMOS Battery (De Beni et al., 2003). The questionnaire asks the student to rate himself/herself using a five-point Likert scale on 50 items, 10 for each of five dimensions: study organization, depth of encoding, self-evaluation, use of strategies and metacognitive awareness. Examples of items are the following: 'Before an examination I have the material well organized in order to review selected materials' (Organization), 'While studying I repeat ideas in my own words to be sure to have understood' (Depth of processing), 'After an examination I am able to predict the evaluation I will receive' (Self-evaluation), 'I alternate study and self-testing' (Study strategies), 'I like to think about how my mind works' (Metacognition). The psychometric properties of the Questionnaire are relatively good (Cronbach alpha for the five areas ranges between .48 and .79 and test-retest reliability ranges between .52 and .77). A characteristic of the Questionnaire is that the variability is relatively small (SDs in the normative sample vary between 5.4 and 4.5), but the mean scores remain stable at retesting and the Questionnaire is able to discriminate students with learning problems well (De Beni et al., 2003).

Students had also previously completed an online Descriptive Questionnaire where they had answered a series of questions concerning personal characteristics and some attitudes towards studying. We report the main questions and the percentages of responses obtained for the extreme values for each question (in parentheses): degree of difficulties associated with study (great difficulty: 0.3%; little difficulty: 34.5%), perceived self-efficacy (little: 9.0%; lots: 28.3), will to study more in depth (8.2%), uncertainty about continuing with studies (somewhat: 8.5%; not at all: 42.3%). The Questionnaire also included information about the parents' level of education, ranging from upper middle school/ high school (33.5% for the mothers and 33.8% for the fathers) and an elementary school diploma (fathers: 11.1%; mothers: 12.6%) and about the student's diploma grade (i.e. the final grade obtained by the student at the end of the secondary school, which in Italy may range from 60 and 100: average diploma grade: 89.6).

At the end of the academic year a measure was collected on school achievement, by considering the number of European University Credits (ECFs) obtained, determined by the sum of the 'Credits' associated with each passed examination.

2.3 Training

Students were enrolled in a short three-session training course (in groups with a maximum of 40 participants) which took place in the months of September and October for a total of 10 hours. In the first session topics presented (and discussed within the group) concerned self-knowledge, study habits, attributions and study motivation. In the second and third session, the topics included strategies for study and test-preparation, study organization, anxiety management. Sessions were guided by teachers, educational counselors or psychologists.

3. Results

Our first analyses studied which variables measured at the beginning of the first year were most able to predict the outcomes at the end of the year. To this purpose we carried out two linear regression analyses (considering only the 1,019 students who had data on all the variables) using the stepwise method having as dependent variable the student's achievement (number of ECFs). The first regression analysis had as predictors the following variables: Perceived difficulty, Self-efficacy, Will to study more in depth, Conviction about continuing with studies, Mother's

level of education, Father's level of education, the Diploma grade and the dimensions of the QAS. The resulting model explained 18% of variance. The results indicated that the best predictors of the number of credits achieved were the following: Diploma grade ($R^2 = .16$, $p < .001$), Organization ($R^2 = .02$, $p < .001$), Will to study more in depth ($R^2 = .01$, $p < .01$). Because the final result at secondary school (Diploma grade) proved to be a very powerful predictor and had the effect of overshadowing the role of other variables, a second regression analysis was carried out including the same predictors, with the exception of Diploma grade. In this case the following variables entered the model (total proportion of explained variance = .12%): Self-efficacy, ($R^2 = .08$, $p < .001$), Organization ($R^2 = .03$, $p < .01$), Will to study more in depth ($R^2 = .01$, $p < .01$) and Conviction about continuing with studies ($R^2 = .01$, $p < .01$).

Table 1. Mean scores (M) and standard deviations (SD) obtained by the students in the five areas of the Study Questionnaire QAS before (1) and after training (2)

	M	SD
Organization 1	38.62	5.23
Depth of encoding 1	34.77	4.65
Self-efficacy 1	38.96	4.43
Use of strategies 1	36.88	5.22
Metacognitive awareness 1	34.02	4.98
Organization 2	38.41	5.18
Depth of encoding 2	35.79	4.69
Self-efficacy 2	39.13	4.34
Use of strategies 2	38.00	4.87
Metacognitive awareness 2	33.54	4.97

The effects of the short training course were analyzed by comparing the responses given by the students in the five areas of the Study Questionnaire in September and in March. A preliminary statistical analysis (on the raw scores) also took into consideration the role of Gender (males vs. females) and of the Type of Courses followed by the students (Economics vs. Pharmacy, vs. Engineering vs. Humanities). We ran a $2 \times 5 \times 2 \times 4$ MANOVA including as factors the moment of the assessment (pre-training vs. post-training), the five areas of the Questionnaire, Gender and Type of Courses. The effect of training was significant, $F(1, 1177) = 9.08$, $p < .01$. The interaction between training and area was also significant ($p < .01$) $= 11.76$, $p < .01$. The interaction was due to the fact that the significant improvements only concerned the areas of Depth of Processing and Strategies. The interactions between training and Gender and between training and Type of Courses were not significant, suggesting that the changes after training were similar for all students. On the contrary other significant effects concerned Areas ($p < .01$), Gender ($p < .01$) and the interaction between Areas and Gender ($p < .01$). As can be seen in table 1, students had an impression of higher competence in the areas of Organization and Self-evaluation and of lower competence in the areas of depth of Processing and Metacognitive Awareness. This pattern corresponds exactly to the pattern reported by De Beni et al. (2003). The gender effect was due to the fact that girls had higher scores ($M_{rating} = 37.59$) than boys ($M_{rating} = 35.96$), an effect which was specified by the interaction with areas. In fact, the girls' ratings were higher for all the five areas, but the difference was more evident for Organization (39.8 vs. 37.19) and Strategies (38.38 vs. 36.4).

Further support for the positive effects of the training comes from the comparison of the mean grade obtained at the examinations by the University students at the end of the academic year and that obtained by the students who attended the course, for whom it was possible to collect this type of information. The whole group of students attending courses at the University of Calabria had obtained an average grade of 23.72 (the range was between 18 and 31, corresponding to '30 with laude') whereas the mean grade for the students who attended the metacognitive course was higher, since only a minority of students had received a low mean grade (see in Table 2 the frequencies for the classes of mean grades).

Table 2. Mean vote obtained at the end of the academic year by the students who had participated to the Course: number of cases within each vote range

Grades Average per class	N	%
18-22	198	16.7
22.1-26	438	37.0
26.1-31	307	25.9
NA	242	20.4

Note. NA=not available.

4. Discussion

The importance of metacognition in student success has long been demonstrated (Borkowski et al., 1988). A large body of studies has examined the role of specific metacognitive factors, such as knowledge about how the mind works, the appropriate selection and use of strategies or adequate monitoring (Wolters, 1998; Zimmerman, 2000). In particular, it has been shown that metacognition is critical for the achievement of late adolescents, including college students (Ley & Young, 1998; Moè et al., 2001; Stoynoff, 1996; Wolters, 1998). Despite this, recent research and intervention programs seem to have underestimated the role of metacognitive variables in students success. The present study offered further evidence of the importance of considering metacognitive variables, in association with other motivational and demographic characteristics, in the identifications of factors affecting students success, but especially of aspects that could be used in intervention programs. These intervention programs seem particularly crucial in the case of Italian Universities where students, although potentially competent, frequently encounter severe problems.

In fact, the difficulties met by University students, and particularly by students in universities in southern Italy, are very severe with a resulting dramatic drop out rate. This situation does not appear tolerable to Italian authorities, who have dedicated parts of the recent University legislation to the problem and a joint effort by experts and politicians is necessary to bring about a radical change of the situation. The experience carried out at the University of Calabria during the academic year 2008-2009, assessing and training more than 1,000 freshmen represents an important effort in this direction. The positive reactions of authorities and students confirm the validity of the project, which was reconfirmed and refinanced the following year as part of the activities of the Pre-studies Project - 2009/2010.

The project also provided an opportunity to examine two important issues concerning the predictors of the academic achievement of students and the effects of a training course on study methods.

Research (e.g., Robbins et al., 2004) has already shown that many factors contribute to college students' achievement. Therefore, it was impossible to expect that the limited number of measures we had collected could explain a large portion of the variance of achievement. Actually, the variance explained by our predictors was modest, ranging between 18% and 12%. However, the results provided interesting information about the specific Italian situation, showing, for example, that, unlikely in other contexts (Robbins et al., 2004), the final grade (Diploma Grade) in secondary school is a good predictor of university outcomes. In Italy there is a large debate on the use of this measure in the University admission tests as it is argued that each school may use different parameters when assessing students, but this result suggests that the measure can offer predictive information. This observation was further supported by the participation rate in lessons and the University success among the students with higher High School Leaving Diploma grades. A public document indicated a mean value of 83 lesson hours for students belonging to the group with a low grade compared to 117 hours for the group of students who got the highest grade (the correlation rate between lesson hours and High school Diploma grade was 0.41) and a 20% difference in the examinations (Evaluation of the Pre-studies competence deficit study paths – Regional Plan for human Resources – Action Plan 2008. June 2009).

When the Diploma Grade was excluded from the regression analysis, a new powerful predictor emerged, i.e. the rated academic self-efficacy, supporting previous literature on the importance of this aspect (Robbins et al., 2004), but also confirming the partial overlap of the measures of academic Self-efficacy and Actual Achievement. Despite the fact that they explained a small portion of variance, it is important to observe that Self-regulatory (Organization) and Motivational Aspects - will to study more in depth and Conviction about continuing with studies - gave a specific contribution as predictors, confirming the importance of Metacognitive and Motivational aspects. Surprisingly, the level of parents' education, which in other Italian studies has been strictly related to younger children's academic achievement (and a good index of the family socioeconomic status) (Coscarelli, Balboni, &

Cubelli, 2007), did not explain any further portion of variance. The result is in agreement with observations collected in other contexts (Robbins et al., 2004) and suggests that the effect of student's socio-cultural context loses its influence at University level.

According to the academic authorities and the students themselves, the training was satisfactory and provided a useful opportunity for students to rethink their approach to their studies. The nature of the project itself did not offer the possibility of collecting sufficient measures in order to assess the efficacy of the training. In fact, we could only administer a single self-rating questionnaire and only to the students participating in the training. Therefore, the measures are weak and also biased by the fact that the students in some way rated not only themselves but also the program and were affected by the new attitude toward themselves as students which had been created by the training. This danger was partly eliminated by the fact that the completion of the second questionnaire took place a long time after the end of the training (six months), but was nevertheless present. However, students felt responsible when they completed the questionnaire and differentiated their responses, according to the areas, suggesting they did not have either compliance or other biases. The observed changes concerned depth of processing and study Strategies. The latter change was highly predictable as the training focused on them, but it is interesting to observe that, due to improved strategy use, the depth of elaboration benefited as well.

In conclusion, the opportunity provided by such an important University, as the University of Calabria, to develop a large-scale metacognitive study made it possible to analyse the role of a series of metacognitive factors both in predicting students' successes and failures in their first year of study and in helping to prevent failures and –hopefully- drop outs. The fact that a simple, relatively low-cost and easily replicable metacognitive training course, carried out in three-sessions and in large groups, influenced students' metacognition and learning should encourage University authorities to further develop these types of programs. Future research should study the effects of these programs more extensively and identify characteristics that could improve their efficacy.

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