Pedagogical interaction and learning performance as determinants of academic achievement

Cesário Costaa, Ana Paula Cardosob,*, Margarida Pedroso Limac, Manuela Ferreirad, José Luís Abrantes e

aColégio Liceal de Santa Maria das Lamas, CI&DETS, Portugal
bInstituto Politécnico de Viseu, CI&DETS, ESEV, Portugal
cFaculdade de Psicologia e de Ciências da Educação, Universidade de Coimbra, Portugal
dInstituto Politécnico de Viseu, CI&DETS, ESSV, Portugal
eInstituto Politécnico de Viseu, CI&DETS, ESTGV, Portugal

Abstract

This investigation aims to relate teacher competencies, student-student interactions and learning performance, and its direct and indirect effects on academic achievement of high school students. A quantitative research was carried out, involving a representative sample of 1986 students attending Secondary Education Schools located in the central region of Portugal. The results obtained through the structural model show that perceived teacher competencies influence student-student interactions and learning performance positively and significantly; student-student interactions positively and significantly influence the learning performance which, in turn, influences positively and significantly students’ academic achievement. The established model provides insights for a better understanding of the importance of communication, in the context of the classroom, and of the students’ learning involvement in the academic activities, towards the promotion of school success.

Keywords: Academic achievement; learning performance; pedagogical interaction

* Corresponding author. Tel.: +351-232-419-000; fax: +351-232-419-002.
E-mail address: a.p.cardoso@esev.ipv.pt
1. Introduction

Predicting and explaining learning activity and outcomes is a great challenge (Kornilova, Kornilov, & Chumacova, 2009). There are multiple factors related to learning and there is also little consensus on the nature and number of the dimensions that measure precisely and entirely the learning experience (Patrick & Smart, 1998; Shevlin, Banyard, Davies, & Griffiths, 2000).

In this study we’ll consider two learning outcomes: learning performance and academic achievement. Learning performance can be defined as students’ self-evaluation of acquired knowledge, understanding and skills developed, and their desire to learn more (Young, Klemz, & Murphy, 2003). Academic achievement can be described by the grades obtained by the student.

There are several factors that contribute to the explanation of the learning outcomes, among them, pedagogical interaction such as teacher competencies or student-student interaction. These factors are considered fundamental for creating effective learning environments, likely to improve the learning outcomes of students.

Pedagogical interaction has been proposed as one of the key parts of any learning experience (Hay, Hodgkinson, Peltier, & Drago, 2004). Despite the interpersonal relationships in classroom, empathy between students and teachers with students is one of the most relevant factors to establish an efficient interactional environment, promoting the development of meaningful learning and allowing the emergence of attitudes of trust, security and openness (Hargreaves, 1979).

Educators and learning environments are perceived to be most effective when students are proactive and engaged (Peltier, Hay & Drago, 2005). Researchers found that student’s involvement is most due to pedagogical interaction between students with their peers and with the teachers (Hay et al., 2004). In this line, pedagogical factors are essential in creating a productive learning environment, and therefore a greater academic achievement.

Classroom environments that “actively engage students have the potential of stimulating the development of self-regulated learning” (Young, 2005, p. 25). The self-regulated term is used to describe the learning performed by anyone who controls and evaluates their own learning guided by strategic actions (planning, monitoring and personnel evaluation) and by the motivation to learn (Zimmerman, 1990; Butler & Winne, 1995; Winne & Perry, 2000; Boekaerts & Corno, 2005; Perry, Phillips, & Hutchinson, 2006).

A relevant conceptual framework for investigating self-regulated learning and related factors is social cognitive learning (Bandura, 1986). In this theoretical perspective, personal cognitive factors, actual behaviors and social environment interact, so that people are both products and producers of environments. Learning is viewed “as knowledge acquisition through cognitive possessing of information, acquired both from being a part of society and from individual thought process” (Young, 2005, p. 26).

Within this scope, interaction dynamics in the classroom and students’ involvement are considered crucial to understand the quality of student learning. Thus, this study aims to analyze what influences do pedagogical factors, namely teacher competencies and student-student interactions, and learning performance have on the academic achievement of high school students.

This paper begins with an overview of literature and then develops the conceptual framework and the hypotheses. A presentation of research methodology follows. Using data from a representative sample of high students, this study uses confirmatory factor analysis and structural equation modeling to test the conceptual framework. The paper concludes with research implications for teachers and school managers.

2. Literature Revision

2.1. Teacher competencies

The stronger the student satisfaction with school the greater involvement of the teacher in the pedagogical relationship and more significant the opportunities for dialogue and interactivity. Students appreciate teachers who are competent, dedicated, available, interested and attentive to their personal, social and academic problems (Astin, 1993).
The classroom environments that transmit acceptance facilitate the students’ relationships and meet the conditions that are necessary for learning. The most successful students seek to be trustworthy, responsible, doing things promptly, and get good results (Wentzel, 1989; Lemos, 1996).

To reach students’ involvement and get their interest in the learning process often requires interaction skills from their instructor in his relationship with them (Hay et al., 2004; Faranda & Clark, 2004). Empirical research suggests that a positive pedagogical interaction provides an effective learning environment that enhances the learning outcomes (Paswan & Young, 2002; Hay et al., 2004; Cornelius-White, 2007; Peltier, Schibrowsky, & Drago, 2007; Cardoso, Ferreira, Abrantes, Seabra, & Costa, 2011).

The teacher competencies evaluated in this study refer to students’ perception about some of his/her features, such as being enthusiastic, well spoken, dynamic, caring, helpful, knowledgeable, and able to present the subjects and materials in an appropriate manner (Curran & Rosen, 2006; Marks, 2000; Paswan & Young, 2002).

These teacher characteristics are highly valued by the students because they allow them to ask questions, practice the free expression of ideas, develop their own skills, and improve class discussion (Paswan & Young, 2002). Empirical research shows that a high level of teacher competency leads to increased student interest overall and better learning outcomes (Paswan & Young, 2002; Marks, 2000; Curran & Rosen, 2006), since students tend to prefer instructional methods that are more interactive and student-focused (Abrantes, Seabra, & Lages, 2007). Thus we proposed that teacher competencies positively and significantly affect student-student interactions and learning performance. So, we can state the following hypotheses:

H1: A higher degree of teacher competency leads to a higher student-student interaction.
H2: A higher degree of teacher competency leads to a higher learning performance.

2.2. Student-student interaction

The student-student interaction supports and motivates to achieve a higher cognitive level and to find personal meaning for learning (Dempsey, Halton, & Murphy, 2001). These interactions may occur in the classroom and beyond, through traditional or Web methods (Abrantes et al., 2007; Hay et al., 2004; Peltier, Drago, & Schibrowsky, 2003).

A number of authors have suggested that student-student interaction, whether formally structured or spontaneous, can enrich learning outcomes (Johnson & Johnson, 1990; Topping, 1996). Through interaction students “gain better understanding of the knowledge and become more committed to further learning” (Hay et al., 2004, p. 195).

In this regard there is a current line of research who addresses the social cognitive conflict process. These studies retake the Piaget idea about cognitive conflict in child (Inhelder, Sinclair, & Bovet, 1974). Piaget's theory describes the conflict producer of progress as a psychological conflict resulting from confrontations and contradictions between the actions or anticipations of the subject and the results of his/her action. According to Perret-Clermont (1978), the fundamental process that triggers the conflict is social interaction, in terms of a confrontation between the subject and the statements or actions of others.

Student-student interaction can be evaluated by students in terms of the way in which they are given the opportunity to learn from each other, and also if they are encouraged to contribute, making their interaction with the peers an important learning component (Hay et al., 2004).

Previous research reveals that a high level of student-student interaction improves the perceived quality of the learning experience (Peltier et al., 2003) and has a positive influence on the learning outcomes (Hay et al., 2004; Topping, 1996; Cardoso et al., 2011). When teachers and students actively engage and participate in the knowledge construction, learning environments are perceived to be more effective. As a result the level of learning performance is also enhanced. This leads to the next hypothesis.

H3: A higher degree of student-student interaction leads to a higher learning performance.

Students’ active role in the learning process involves a new approach, based on a significant knowledge construction. The students cannot be replaced in their learning and cognitive achievement; they must be helped to develop the necessary skills for their success. Adequate opportunities to learn how to think and to learn should be given to students (Almeida, 2010).
The students’ believes about their capabilities to learn influences their attitude towards the schoolwork, the choice of the tasks to perform and the persistence and effort expended in carrying them out (Bandura, 1993; Shunk, 1994). This affects the student involvement in the learning process and thus increases learning performance. Learning performance is usually correlated with a more positive attitude toward the environment, namely courses and teachers (Dunn, Giannitti, Murray, & Rossi, 1990; Duke, 2002). When students have more positive attitudes toward learning and instruction they are more likely to get a higher academic achievement. This allows us to propose the hypothesis.

H4: A higher level of learning performance leads to a higher degree of academic achievement.

3. Model development

Building on previous research, our conceptual model presents the major determinants of academic achievement (see Fig. 1). Our model incorporates two pedagogical factors (perceived teacher competencies and student-student interaction), and two learning outcomes (learning performance and academic achievement). To sum up the model briefly, teacher competencies have a positive influence upon student-student interactions and learning performance; student-student interactions have a positive influence on learning performance, which in turn affects academic achievement directly and positively.

4. Method

4.1. Data collection and sample

Data was gathered from a representative sample of 1986 high school students from eighteen schools from the centre region of Portugal. The largest school provided 375 completed questionnaires, and the smallest completed 28. The average mean of respondents by school was 110. Of the total number of respondents, 38.5% were male, and 61.5% were female, aged between 14 and 22 (the average age of males was 16.69 years, SD = 1.13, and that of females was 16.62 years, SD = 1.14); and attending different levels of secondary education (10º, 11º and 12º school year); 21.2% of the students had failed at least once, 36% studied less than an hour per day, whereas 45% studied one to two hours, and 8% studied between three to five hours.

Fig. 1. Conceptual framework
4.2. Survey instrument

The study included measures used in prior research to develop an initial version of the instrument. The items were designed to be answered using a 5-point Likert-type scale. People knowledgeable of the nature of the concepts discussed these measures in order to refine it. Afterwards, a pretest was taken by a small sample of high school students to verify reliability of the factors through Cronbach's alpha. The pretest results helped further refine the questionnaire (for a list of constructs, items, reliabilities and their sources, see Appendix A). Teachers of eighteen different schools then delivered final questionnaires to the students to complete in class at the end of the 2010 school year.

5. Results and discussion

A confirmatory factor analysis assessed the validity of the measures, using full-information maximum likelihood estimation procedures in LISREL 8.54 software (Jöreskog & Sörbom, 1996). Although the chi-square for this model is significant ($\chi^2=1962.33$, $df=203$, $p<0.00$), the fit indexes reveal a good model. The other generic adequacy measures are NFI=0.98, PNFI=0.86, CFI=0.98, IFI=0.98, and RMSEA=0.066. The large and significant standardized loadings of each item on its intended construct provide evidence of convergent validity (average loading is 0.79). All possible pairs of constructs passed discriminant validity test (Fornell & Larcker, 1981) (see Appendix A).

The final structural model has a chi-square of 1970.61 ($df=205$, $p<0.00$), and the fit indexes suggest a good fit on the model to the data (NFI=0.98, PNFI=0.87, CFI=0.98, IFI=0.98, and RMSEA=0.066). The estimation results for the structural paths appear in Fig. 2. The results confirm all the hypotheses.

Fig. 2. Summary of significant relationships
Values in upper rows are completely standardized estimates. Values in lower rows are t-values.
*p<0.05, **p<0.01 (two tailed tests)

The findings reveal that academic achievement is directly influenced by learning performance and indirectly affected by teacher competencies and student-student interaction. As proposed earlier, positive and significant relationship exists between learning performance and academic achievement. The students who evaluate their learning performance more positively in terms of the overall knowledge gained, understanding and skills developed, and their desire to learn more, are more likely to get a higher level of academic achievement.

The student-student interaction has a relevant impact on learning performance. This result is consistent with the self-regulating learning theory that emphasizes the importance of the student participation on the construction of
knowledge. Also confirms the previous research that students learn more when they are involved in the classroom and positively interact with their peers (Lowman & Mathie, 1993; Webster & Hackley, 1997). Through interaction, students have opportunity to learn with their peers and gain better understanding of the knowledge (Hay et al., 2004).

Teacher perceived competencies are strongly related with student-student interaction. Students positively evaluate teachers that encourage engagement and discussion in the classroom (Paswan & Young, 2002). They also appreciate interactive and student-focused methods (Abrantes et al., 2007), and usually want and need ask questions and express their doubts about what is being learned, analyzing and comparing one’s response to others (Thorpe, 2001). If students have a strong and open relationship with instructors, they will invest more in the learning process and create a more positive opinion about teachers and their methods.

Teacher competencies also influence learning performance. There is an association between teacher perceived competencies and students’ self evaluation of the learning outcomes. As prior research has proposed (Marks, 2000; Young et al., 2003), students learn more when they are motivated and interested in the course, and in environments in which instructional methods are congruent with their preferences (Young et al., 2003; Abrantes et al., 2007). This highlights the importance of the teachers on supporting and motivating students to achieve a higher cognitive level (Almeida, 2001) and to find a personal meaning for learning (Dempsey et al., 2001).

6. Conclusions

The results of this study emphasize the importance of pedagogical interactions and students involvement in the learning activities on academic achievement, thus providing useful information for teachers and school managers. On the one hand, students should have the opportunity to interact with teachers and with their peers in order to increase their learning opportunities; on the other, teachers should provide a classroom environment in which students are motivated and involved in the learning process.

This study highlights the importance of an open and empathic learning environment where teachers are learning facilitators, and the students are active achievers of their knowledge. First, teachers and school managers should consider students’ evaluation of their learning performance since it is essential to self-regulating learning and has a direct impact on their academic achievement. Second, there are benefits in teachers providing an effective learning environment, revealing enthusiasm, dynamism and communication skills; they should also be knowledgeable, and present the materials in a clear and organized manner. This makes the interactions between students easier and also enhances students' learning performance that has a direct significant impact on academic achievement and indirectly in life realization and wellbeing.

Acknowledgements

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References


### Appendix A. Constructs, scale items and reliabilities

<table>
<thead>
<tr>
<th>Constructs, scale items and reliabilities</th>
<th>Std. coefficients</th>
<th>T-values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Student-student interaction</strong> (Scale 1 = Strongly disagree / 5 = Strongly agree)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC1A1 1. The course provides an opportunity to learn from other students.</td>
<td>0.73</td>
<td>35.13</td>
</tr>
<tr>
<td>VC1A2 2. Student interaction is an important learning component of this course.</td>
<td>0.77</td>
<td>37.68</td>
</tr>
<tr>
<td>VC1A3 3. I have sufficient opportunity to interact with other students on this course.</td>
<td>0.76</td>
<td>37.25</td>
</tr>
<tr>
<td>VC1A4 4. Each student is encouraged to contribute to class learning.</td>
<td>0.70</td>
<td>33.23</td>
</tr>
<tr>
<td>Adapted from Hay et al., 2004.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Teacher competencies</strong> (Scale 1 = Strongly disagree / 5 = Strongly agree)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC1D1 1. The teacher is enthusiastic.</td>
<td>0.72</td>
<td>36.88</td>
</tr>
<tr>
<td>VC1D2 2. The teacher is helpful.</td>
<td>0.84</td>
<td>45.44</td>
</tr>
<tr>
<td>VC1D3 3. The teacher is well spoken.</td>
<td>0.82</td>
<td>44.49</td>
</tr>
<tr>
<td>VC1D4 4. The teacher is knowledgeable.</td>
<td>0.80</td>
<td>42.83</td>
</tr>
<tr>
<td>VC1D5 5. The teacher is lively.</td>
<td>0.81</td>
<td>42.94</td>
</tr>
<tr>
<td>VC1D6 6. The teacher is caring.</td>
<td>0.81</td>
<td>43.47</td>
</tr>
<tr>
<td>VC1D7 7. The course is well organized.</td>
<td>0.78</td>
<td>40.96</td>
</tr>
<tr>
<td>VC1D8 8. The material is presented in an orderly manner.</td>
<td>0.79</td>
<td>41.86</td>
</tr>
<tr>
<td>VC1D9 9. Teacher presents subject in clear and organized manner.</td>
<td>0.83</td>
<td>44.01</td>
</tr>
<tr>
<td>VC1D10 10. Teacher concerns whether student learned material.</td>
<td>0.81</td>
<td>43.39</td>
</tr>
<tr>
<td>Adapted from: Curran &amp; Rosen, 2006; Marks, 2000; Paswan &amp; Young, 2002.</td>
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<td></td>
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<tr>
<td><strong>Learning performance</strong> (Scale 1 = Extremely low / 5 = Extremely high)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC2A1 1. The knowledge you gained.</td>
<td>0.76</td>
<td>38.48</td>
</tr>
<tr>
<td>VC2A2 2. The skills you developed.</td>
<td>0.83</td>
<td>43.99</td>
</tr>
<tr>
<td>VC2A3 3. The effort you expended.</td>
<td>0.62</td>
<td>29.41</td>
</tr>
<tr>
<td>VC2A4 4. Your ability to apply the knowledge you gained.</td>
<td>0.76</td>
<td>38.30</td>
</tr>
<tr>
<td>VC2A5 5. Your desire to learn more about this subject.</td>
<td>0.69</td>
<td>33.50</td>
</tr>
<tr>
<td>VC2A6 6. Your understanding of this subject.</td>
<td>0.76</td>
<td>38.60</td>
</tr>
<tr>
<td>Adapted from Young et al., 2003.</td>
<td></td>
<td></td>
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<tr>
<td><strong>Academic achievement</strong> (Ratio Scale)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC2B1a2 Classification obtained in the 1st period in the discipline.</td>
<td>0.93</td>
<td>41.99</td>
</tr>
<tr>
<td>VC2B1b2 Classification obtained in the 2nd period in the discipline.</td>
<td>0.97</td>
<td>43.50</td>
</tr>
<tr>
<td>Adapted from Young et al., 2003.</td>
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**Notas:**
- $\alpha$ = Internal reliability (Cronbach, 1951)
- $\rho_{vc(n)}$ = (Fornell & Larker, 1981)
- $\rho$ = Composit Reliability (Bagozzi, 1980)