THE EFFECTIVENESS OF PROJECT-BASED LEARNING ON PUPILS WITH LEARNING DIFFICULTIES REGARDING ACADEMIC PERFORMANCE, GROUP WORK AND MOTIVATION

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This study focuses upon the effectiveness of project-based learning on primary school pupils with learning difficulties regarding their academic performance and attitudes towards self efficacy, task value, group work and teaching methods applied. The present study is a part of a larger one that included six Greek fourth-grade primary school mainstream classrooms with ninety-four pupils of mixed learning abilities. An eight-week project was implemented within the curriculum area of environmental studies with a topic of 'sea animals'. The methodology applied in this study was a combination of a pre-experimental design (the one group pre- post-test design) and the case study research design. In the present study data were used only for pupils with learning difficulties in those classes. The findings of the present study support that pupils with learning difficulties can gain benefits through project-based learning in academic performance, motivation (self-efficacy and task value in terms of environmental studies) and group work (acceptance in the group and engagement in the learning process). The students also preferred experiential learning to traditional teaching. The implications of our findings for the design of project-based learning programmes in the environmental studies with pupils with learning difficulties are also discussed.

Within the context of student-centered learning, project-based teaching method has become increasingly prominent as a response of schooling to the challenges of the 21st Century. The *project method* teaching approach (PMT) or the project-based learning (P-BL) involves study/research of a topic in depth where students' ideas, questions, predictions and interests form the experiences lived and the works/activities undertaken. The key-characteristic of the PMT is researching questions which have been raised by the students or/and in collaboration with the class teacher and could be further refined during the course of the study.

Further characteristics of the project-based learning are described in the literature as follows (Frey, 1994; Harris, 2002; McGrath, 2002; Solomon, 2003): students can choose the activities and works undertaken during the course of the study, they can become communicative, creative and develop practical thinking as they are engaged in active inquiry/discovery, exploration and decision making; knowledge is based on experience and experimentation in real/authentic life; the project-based learning links manual and intellectual work. In addition, Westwood (2006) points out that projects promote meaningful learning, connecting new learning to student's past experience and prior knowledge, they increase self-direction and motivation, since students are responsible for their own learning, they utilise various modes of communication and presentation (multi-sensory approach) which may be quite helpful for pupils with learning difficulties. Project-based learning is also an inclusive approach, in that all learners can participate to the best of their ability.

In the last decade there are an increasing number of pupils attending the mainstream school who face various learning difficulties. These pupils face various cognitive and psycho-emotional problems. The majority of them have language-based difficulties, concerning either the oral or the written form or both, working memory limitations, attention and concentration difficulties, problems in applying learning to new context, in using cognitive and metacognitive strategies for problem resolution or

organization of their knowledge and problems in self-regulation learning (Elliott, 2000; Lerner, 2003). A number of non-intellective factors, such as repeated failure, may also influence motivation and task persistence for these pupils. When a child experiences repeated failure might well has limited expectations for future success with attendant anxiety, withdrawal, avoidance, passivity and low self-esteem (Bouffard & Couture, 2003; Sideridis & Scanlon, 2006). In terms of self-efficacy, the literature has been compelling with regard to the fact that students with learning disabilities exhibit lower academic self-efficacy than their non-learning disabled peers, even when they were matched by school grades (Frederickson & Jacobs, 2001; Hampton & Mason, 2003; Lackaye, Margalit, Ziv, & Ziman, 2006). Hampton and Mason (2003) posited that learning disabilities students' low self-efficacy was due to less access to sources of efficacy information, including fewer successful experiences, less access to successful peer models with learning disabilities and less support from teachers. Several project-based learning practitioners have stated *P-BL, because of its various features, is a more effective means of adapting to students various learning styles or* multiple intelligences *than is the traditional instructional model* (Thomas, 2000, p.20).

Westwood (2006) indicates that project-based learning may not be an effective teaching method for pupils with learning difficulties who lack adequate baseline skills in reading and writing. There is also a frequently voiced claim that project-based learning increases team working and cooperative learning skills *prompting heretofore reluctant and disengaged students (e.g., low-achieving students) to become motivated and engaged learners* (Thomas, 2000, p. 22).

More specifically, Cornell and Clarke (1999) as well as Wurdinger, Haar, Hugg, & Bezon, (2007) found that project-based learning increased higher and lower performing pupils' engagement in learning activities. The first writers also reported that project-based learning not only gave all of the students an opportunity to work with each other while doing hands-on activities and discover unique skills necessary to complete projects, but also allowed the lower performing pupils to progress at their own pace. In addition, other researchers (Barron et al., 1998; Liu & Hsiao, 2002) discovered that academic performance; cognitive strategy use and motivation towards learning are improved when using project-based learning with low, average and high ability middle school students.

Research on cooperative learning has shown that working in groups positively affects the social acceptance of children with disabilities by their non-disabled peers. Moreover, pupils with learning problems who work in cooperative groups in mainstream classes tend to attain higher learning outcomes than their peers who work in the typical class environment (Gillies & Ashman, 2000). Researchers suggest that pupils who need help can benefit from interactions in a working team, because their peers can provide them with explanations in terms that can be easily understood and focus on the relevant features of the problem, since they are often more aware than their teachers of what some students do not understand. As a consequence, pupils with learning difficulties seem to internalise specific strategies for solving problems and apply them to novel situations. Furthermore, low-ability pupils seem to be more active learners when working in trained mixed ability groups, providing more helpful explanations to other group members than their peers in the untrained group. Through their interactions with others, these children receive feedback and support that help them clarify issues and build understanding (Gillies & Ashman, 2000; Webb & Farivar, 1994). However, for the help to be effective Webb (1985) argues, it must be relevant to the student's needs provided in a way that enhances understanding and at a time when the student will use the explanation to solve the problem.

On the other hand, Mc Arthur, Ferretti and Okolo's (2002) study in which sixth grade students with and without mild disabilities participated in an eight-week project-based investigations about immigration to the U.S. in the early 20th century, showed that although pupils with learning disabilities had better understanding of historian content and more favourable attitudes about their self-efficacy in social studies after the implementation of the project-based learning program, they had no significant changes in attitude towards cooperative learning and academic intrinsic motivation.

Finally, in a research conducted by Guven and Duman (2007) investigating the effectiveness of a project-based learning program delivered to seven children with mild mental disabilities it was found that after the completion of the project special needs pupils increased their knowledge about the topic and maintained interest in the topic of the project during its implementation. Research on project-based learning regarding primary school pupils with learning difficulties is scarce. The authors of this article contribute to the research on this field by expanding the research on project-based learning. In turn the authors use a larger number of pupils with learning difficulties compared to previous studies and

examine two elements to determine the effectiveness of project-based learning on pupils with learning difficulties: academic achievement and attitudes towards learning. More specifically, the aim of the present study is to investigate the effectiveness of project-based learning on primary school pupils with learning difficulties regarding academic performance and attitudes towards self-efficacy and task value in terms of environmental studies, group work (acceptance in the group and pupils' engagement in the learning process) and teaching methods (traditional teaching versus experiential learning).

Method
The present study is a part of a larger one that included six fourth-grade primary school mainstream classrooms with ninety-four pupils of mixed learning abilities. The methodology applied in this study was a combination of a pre-experimental design (the one group pre-test-post-test design) and the case study research design (Bassey, 1999; Cohen & Manion, 1991). The combinations of these two designs were used because our aim was twofold. First, to account for differences between pre-test and post-test scores of typical pupils and pupils with learning difficulties after the implementation of the P-BL. Dependent variables included: (a) academic performance, (b) self-efficacy in terms of environmental studies, (c) task value (i.e. importance of good performance in environmental studies, personal interest in this specific subject area, utility of the task in terms of future academic goals), (d) group work (i.e. acceptance in the group and pupils' engagement in the learning process) and (e) teaching methods (i.e. traditional teaching versus experiential learning). Secondly, the researchers studied both the process and the products of learning during the implementation of the project regarding both the typical pupils and pupils with learning difficulties. The case study design allowed us to study each classroom and participant with learning difficulties as an individual case and then develop themes across all the cases. In the present article quantitative and qualitative results concerning pupils with learning difficulties are presented.

Participants
Twenty-four Grade four learning difficulties pupils (nineteen boys and five girls) from six mainstream mixed ability classes from the cities of Volos, Lamia and Athens (Greece) participated in the study. Ages ranged from nine years and two months to eleven years and one month ($M = 9.6$ months, $SD = 0.7$). The selection of the classes was based on three criteria: (a) class teachers who volunteered to implement a project-based learning educational programme, (b) classes, which had pupils with learning difficulties and (c) teachers with similar amount of experience on project-based learning implementation in the classroom. The 24 pupils were identified as having learning difficulties based on two measures: (a) a standardized teacher questionnaire for identification of pupils with learning difficulties (A.M.D.E.) (Padeliadu & Sideridis, 2008) and (b) a standardized screening software for learning skills and weaknesses (L.A.M.D.A.) (Protopappas & Scalumbakas, 2008). Three of the twenty-four pupils had a diagnosis of special educational needs from the National Diagnostic and Therapeutic Centres of Prefecture of Magnesia and Attica. Two of them were identified as having general mild learning difficulties with an IQ score (WISC-III) between 75 and 80 and one pupil was identified as having specific learning difficulties (dyslexia) with an IQ score (WISC-III) above 85. The other 21 pupils had not undertaken an official diagnostic assessment. The three special educational needs pupils were attending a resource class two-three times per week.

According to A.M.D.E. questionnaire, all the 24 pupils were rated by their teachers as having a high possibility (0-84%) of exhibiting learning difficulties on receptive oral language, expressive oral language, reading and writing. Ninety-two (92%) percent of the pupils were rated as having a high possibility of exhibiting learning difficulties on mathematics and reasoning as well. The other 8% were rated as having a moderate possibility (84-97,5%) of exhibiting learning difficulties on the above two scales. The results from L.A.M.D.A. test are presented in table one.

According to table 1 (next page), the majority of pupils with learning difficulties (from 58% to 85%) exhibited low performance (<25th percentile) on all but two subtests of L.A.M.D.A. test (picture recognition and rhythm reproduction) in terms of accuracy. In terms of speed, only on morphosyntactic awareness 58% of the pupils exhibited a slow response pace.

Instruments
A variety of data collection methods were used to inform the results of this study. The use of multiple methods helped to triangulate the data and to confirm the findings and interpretations. The instruments chosen for the research included standardized learning difficulties screening tests, knowledge test, attitude scale, interviews (from typical, learning difficulties pupils and teachers) and classroom

observations (field notes and observation scales). In the present article results from the knowledge test, the attitude scale and learning difficulties pupils' interviews are presented.

Table 1
Percentage of pupils with learning disabilities scoring below the 25th percentile on L.A.M.D.A. subtests.

Subtests	Accuracy ($< 25^{th}$ percentile)	Speed ($< 25^{th}$ percentile)
Picture Recognition	17%	25%
Word recognition	75%	41%
Spelling	85%	50%
Listening Comprehension	76%	42%
Reading Comprehension	83%	25%
Morphosyntactic awareness	71%	58%
Vocabulary	58%	33%
Working memory (no. of letters recall)	67%	42%
Non-verbal reasoning	65%	8%
Rhythm reproduction	50%	N/A

Standardised Screening Learning Difficulties Tests
1. *Standardized Teacher Questionnaire for Identification of Pupils with Learning Difficulties (A.M.D.E.)* (Pandeliadu & Sideridis, 2008). It consists of six scales: (a) oral language (expressive and receptive), written language (reading and writing), (c) mathematics and (d) reasoning. Each scale comprises 15-20 statements regarding difficulties pupils may exhibit in the above learning domains. The teacher is rating the observed behavior in a scale ranging from one to nine, which is from "never" to "always". It is used for pupils from 9 to 15 years old. The test-retest reliability coefficients range from .95 to .98 for the six scales. Cronbach *alpha* coefficient ranged from .95 to .97 for the six scales.
2. *Standardized Screening Software for Learning Skills and Weaknesses (L.A.M.D.A.)* (Protopappas & Scaloumbakas, 2008). The software assesses: picture and word recognition, spelling, oral and reading comprehension, morpho-syntactic awareness and vocabulary, working memory (no of words recall), nonverbal reasoning and rhythm sensitivity. The above skills are evaluated in terms of both accuracy and speed. This screening test is used for pupils from 7-15 years old. The test-retest reliability coefficients range from .60 to .77 for the ten scales for Year-four. Cronbach *alpha* coefficient ranged from .60 to .80 for the ten scales for Grade four.

Knowledge Test
We assessed student's content knowledge about sea animals with 15 open-ended and multiple-choice questions, developed based on the eight thematic unit of the project, including information presented in whole-class and small group activities. This test was administered both to typical and learning difficulties pupils in each class prior to and at the conclusion of the project. It was read to the whole class to compensate for any reading problems. Pupils with writing difficulties could answer the questions orally. Spelling and morphosyntactic errors were not taken into consideration during the evaluation of the answers. The evaluation of the answers was done using a three-point scale: zero indicated either no answer or a wrong answer, one indicated either limited number of correct answers and/or one-two wrong answers and two indicated correct and adequate number of answers. A total score on knowledge test was given for each pupil. One researcher scored all pupils' protocols initially. A second researcher independently scored a random sample of 30 percent of the protocols. Interrater reliability for the total score was 0.95 (Pearson r).

Attitude Scale
Students' attitudes were examined with an instrument including 40 statements, which consisted of five factors. The first factor assessed pupils' attitudes towards task value concerning environmental studies (r = .83, α = .80), the second factor-assessed pupils' academic self-efficacy in learning environmental studies (r = .85, α = .88). The statements regarding the above two factors were part of the relevant statements included in Pintrich and DeGroot's (1990) *Motivated Strategies for Learning Questionnaire (MSLQ)* adapted for the present study. The third factor assessed pupils' attitudes towards group work and collaborating with the peers (r = .91, α = .89). The statements used to assess this factor were part of the Collaborative Inquiry-based Project Questionnaire (CIPQ) (Chow & Law, 2005) and the Pupils Perceptions of Cooperative Learning (PPCL) (Veenman, Kenter & Post, 2000) adapted for the present study. The forth factor assessed pupils' attitudes towards traditional teaching (r = .87, α = .85), and the

fifth factor assessed pupils' attitudes towards experiential learning (r = .89, α = .84). The authors constructed the statements for the evaluation of the last two factors. The statements were evaluated using a four-point scale (from one equals not true to four equals always true).

Individual interviews
A semi-structured interview protocol was designed with 13 open-ended questions. The interview was conducted with each pupil with learning difficulties and a sample of 25 pupils (almost the 1/3) without learning difficulties within two weeks after the conclusion to the implementation of the Project. The questions referred to issues regarding group work, engagement in the learning process and evaluation of the project procedure, the activities and the experiential learning. Each of the interviews lasted for approximately 30 minutes. One researcher scored all interviews. A second researcher independently scored a random sample of 30 percent of the protocols. Interrater reliability for the total score was 0.97 (Pearson r).

Educational programme
The educational programme lasted for eight weeks and planned activities were implemented between two-three teaching hours per week. The fundamental axis of the educational programme lies on the pedagogical concept of project-based learning as developed earlier.

The topic studied during project-based learning was *sea animals* which arose from discussions in the class about pupils' interests. Pupils expressed a personal interest in studying the sea animals further. This was also linked to the nature of the topic, which could provide pupils with opportunities to experiential and field based learning. Children who live in towns and cities nearby the sea (like the city of Volos) have cognitive stimuli and experiences about the sea animals from their daily life therefore they bring valuable experiences, which can be reinforced and expanded. Moreover, Greece's sea parks with animals threatened by extinction (i.e. the seal *monachus-monachus* and sea turtle *caretta-caretta*) can offer rich material to be studied and develop pupils' environmental sensitivity.

The main thematic units of the topic *sea animals* included sea animals' classification, anatomy, reproduction, and food. Furthermore, the thematic units included sea animals and human nutrition as well as local sea animals, sea animals threatened by extinction in the country and construction of an aquarium (simulation).

For each thematic unit one to three teaching hours were spent on average. Activities included studying and searching for information in primary sources (i.e. field-based visits, hands-on experiences, experts' visits to the class) and in secondary sources (i.e. books, leaflets, pictures, DVD) as well as learning based on games. The topic was cross-curricular linking concepts and principles from different subjects of the national curriculum such as environmental studies, language, local and national geography. On table two we present the thematic units of the topic, the type of activity and the class organisation for each unit.

Table 2
A summary of the Project-Based Learning about sea animals

Thematic units	Types of activities	Class organisation
1. Classifying sea animals.	From secondary sources (pictures & texts)	Whole class teaching and group work
2. Anatomy of sea animals.	Hands-on (real sea animals in the class)	Whole class teaching and group work
3. Sea animals' reproduction.	DVD	Whole class teaching and individual work
4. Sea animals' food.	From secondary sources and a game on food chain	Whole class teaching
5. Sea animals and human nutrition.	An expert's visit (nutritionist)	Whole class teaching
6. Sea animals of the local area.	Visit to a local fish market	Whole class teaching and pair and individual work
7. Sea animals threatened by extinction in the country.	Books, leaflets, pictures, information from an environmental society	Whole class teaching and group work
8. Making a dummy aquarium	Crafty	Whole class teaching and group work

Results
Quantitative outcomes on Knowledge Test and Attitude Scale
Prior to statistical analysis, total knowledge score, attitudes toward academic self-efficacy, task value, group work, traditional teaching and experiential learning were examined for missing values and fit assumptions of multivariate analysis. The two missing values on total knowledge score were deleted.

In order to account for differences before and after the implementation of the project-based learning programme in terms of pupils with learning difficulties the pre- and post-test rating scores regarding knowledge of the project topic, academic self-efficacy on environmental studies, task value, group work, traditional teaching and experiential learning were analysed using paired t tests. Statistically significant differences before and after the implementation of the project were found for all the dependent variables, that is total knowledge score [t (21) = - 8.87, $p < .001$] with an effect size of 1.89], academic self-efficacy on environmental studies [t (23) = - 2.59, $p =.02$), with an effect size of 0.53], task value concerning learning environmental studies [$t(23) = -2.67, p = .01$), with an effect size of 0.54], group work [$t(23) = - 3.01, p = .006$ with an effect size of 0.61], traditional teaching [$t(23) = 3.65, p = .001$) with an effect size of 0.74] and experiential learning [$t(23) = - 2.36, p = .027$) with an effect size of 0.48].

Mean scores and standard deviations of pre- and post testing conditions are presented on table three. Paired t test results and table three data show that pupils with learning difficulties scored significantly higher on the knowledge test administered after the completion of the project, indicating that they enriched their knowledge on all seven thematic units (classification of sea animals, anatomy of sea animals, reproduction, sea animals' food, sea animals and human nutrition, sea animals of the local area, sea animals threatened by extinction) after the implementation of the project.

Table 3
Means and Standard deviations of six dependent variables before and after the implementation of the P-BL about sea animals

	Dependent variables	Mean	N	Std. Deviation
Pair 1	Total Knowledge Score 1	7.86	22	5.48
	Total Knowledge Score 2	16.82	22	4.94
Pair 2	Task value1	2.97	24	0.69
	Task value2	3.36	24	0.31
Pair 3	Self-efficacy1	2.72	24	0.60
	Self-efficacy 2	3.14	24	0.57
Pair 4	Group Work 1	2.77	24	0.37
	Group Work 2	3.28	24	0.31
Pair 5	Traditional Teaching 1	3.41	24	0.70
	Traditional Teaching 2	2.62	24	1.01
Pair 6	Experiential Learning 1	2.43	24	1.11
	Experiential Learning 2	3.58	24	0.56

Note: 1 = Before the implementation of the P-BL
2 = After the implementation of the P-BL

A qualitative analysis of the data revealed that there were prominent differences regarding broad classification categories of sea animals (e.g. mammals, mollusca, reptiles, vertabrates and invertabrates). Pupils with learning difficulties acquired new knowledge regarding both the terminology and the correct classification of sea animals into these categories. Important knowledge differences after the project were also noted in terms of sea animals' reproduction, sea animals and human nutrition, sea animals' food chain, sea animals of the local area and sea animals threatened by extinction. All these topics were explored through hands-on activities and experiential learning. Little but significant improvement was shown regarding specific classification categories [e.g. arthropods, echinoids (i.e. sea urchin), cnidarians (i.e. jellyfish, sea anemones, and corals), sea animals' food categories). In the pre-testing condition the majority of the pupils with learning difficulties did not know the above categories and only after the project they managed to discriminate them, providing one

to two correct examples of each category. An improvement after the project was also noted for well-established prior knowledge (e.g. fish).

A significant attitude change was also revealed for pupils with learning difficulties after the project regarding self-efficacy; task value, group work, traditional teaching and experiential learning (see Table three). On average, after the implementation of the project on environmental studies, pupils with learning difficulties believed they could perform better in the environmental studies than they did before, they scored higher this subject area, they liked working in teams more than doing work on their own and they also found group work more effective in terms of their engagement in the learning process. Furthermore, as it was expected, they stated that they found experiential learning more beneficial than traditional teaching.

Qualitative outcomes from the interviews
In the present study, results from the interviews carried out with the pupils with learning difficulties are presented. The interviews provided complementary information on pupils' with learning difficulties views about evaluation of the project procedure, the activities and the experiential learning, group work and acceptance in the group, and engagement in the learning process.

A qualitative analysis of the data revealed that in terms of the evaluation of the procedure and the activities, all pupils stated that project-based learning helped them learn better and retain much information about sea animals. They found this procedure amusing and more motivational in comparison to traditional teaching methods (direct instruction, teacher talk, studying from their own textbooks). The majority of the pupils (22 out of 24) supported that what they found more effective and pleasant in this procedure was both experiential learning and working in groups:

> -*I liked this procedure very much, because we saw real sea animals in the class, we examined them, we saw a DVD, we made an aquarium. The book doesn't say so much and our teacher does not often show us DVDs and pictures. It is boring when the teacher only is talking* (Vicky).
> -*It helped me that we were working in groups and I was learning from others* (George).

The other two children said that what helped them more to obtain new knowledge was the assignment they had to do. One fourth (6 out of the 24) of the pupils with learning difficulties found difficult and without particular interest the activities related to secondary sources (e.g. magazines, books).

Although all pupils enjoyed working in groups some of them believed that this procedure did not increased their involvement in the learning process. Five of the pupils (5 out of 24) stated that they liked being with others in the group, they learned better through this procedure because peers explained them their queries but they mainly had a passive role in the group. They either were listening or following instructions. They did not express their ideas. Tom, a child with moderate learning difficulties said: *I liked being with others, but most of the time I was listening what others said*, while John, a pupil with mild learning difficulties in writing stated: *I was showing up pictures or I was reading aloud the text from the magazine* On the contrary, the rest of the pupils with learning difficulties (9 out of 24) stated that they got used to a more active role in the learning process when they worked in groups during the project, than they had before. They often expressed their ideas and discussed them with their peers. They were interactive and cooperated with others in order to come to a decision or to produce a final learning outcome: *we used to discuss altogether what we had to do and either we worked altogether or in pairs and then we got everything together and we presented it* (Julia). A few of the pupils with learning difficulties (6 out of 24) said that they asked their teachers to work in pairs or groups in the classroom even after the completion of the project. A closer look of the data showed that, as it was expected, pupils who were used to work in pairs or groups in their classrooms before the project got further advantage of this procedure during the project implementation.

Discussion
The purpose of this study was to investigate the type of differences pupils with learning difficulties exhibited after the implementation of a project on environmental studies about *sea animals* in terms of academic performance and attitudes towards academic self-efficacy in learning environmental studies, task value for environmental studies, group work, traditional teaching and experiential learning. Quantitative and qualitative measures demonstrated learning gains concerning the topic studied for the pupils with learning difficulties. A closer examination of the results showed that these pupils enriched and expanded their knowledge on units studied mainly through hands-on, field based activities and experiential learning because this approach applies better to their educational needs for a multi-sensory teaching method. Little improvement was noted concerning retaining knowledge of specific

terminology and sea animals' categories because the majority of these pupils face working memory problems. Besides, the type of some open-ended questions included in the knowledge test did not seem to help these pupils to reveal the exact knowledge they had acquired through the project, since it came up against their difficulty. Studying secondary sources such as books and magazines were also quite difficult for them, because of their reading problems.

The above findings come along with previous research on project-based learning (Barron et al., 1998; Guvan & Duman, 2007; Liu & Hsiao, 2002; Mc Arthur, Ferretti and O'kolo, 2002), which reveals improvement of academic performance for pupils with learning difficulties after the implementation of a project. This study also indicated that there was improvement for pupils with learning difficulties regarding their attitudes towards group work, their acceptance in the group and their involvement in learning process. These pupils' views about the benefits of group work on learning outcomes, peer interactions and acceptance in the group has significantly changed after their learning experiences with the project. When pupils with learning difficulties requested for help inside the group, they initiated interactions that often led to clarifications and exchange of ideas with other group members, and it is these interactions that probably contributed to an increase in their direct involvement in the learning process and in the acceptance from their peers, as they stated in the interviews. According to pupils' interviews some of them contributed more than others in the groups, but most of the time all the group members had to be involved in the process either by contributing to discussions, reading information, writing up assignments, or presenting the learning product to the class. The majority of pupils with learning difficulties in the present study appeared to be much more engaged with this process as opposed to other passive methods of learning such as direct instruction, especially in curriculum areas like environmental studies where topics can be researched and studied in child-centered approaches. Most of the research done on cooperative learning, project-based learning and pupils with learning difficulties pinpoint the positive effects these approaches have on social acceptance of children with difficulties, academic performance, peer interactions and active engagement in the learning process (Cornell & Clarke, 1999; Gillies & Ashman, 2000; Webb & Farivar, 1994; Wurdinger, Haar, J., Hugg, R., & Bezon, J., 2007). However, Mc Arthur, Ferretti and Okolo's, 2002 study showed that sixth grade students with mild learning disabilities did not change significantly their attitudes towards cooperative learning after their participation in a project on social studies. This different result may be due to the fact that pupils in the above study had finally to produce a debate, which allowed for competition between groups rather than collaborative action in carrying out the activities, assigned. Nevertheless the present study is based on a larger number of pupils with learning difficulties (24) compared to previous studies and more specifically the one of Mc Arthur, Ferretti and Okolo (2002) (nine pupils with learning difficulties), thus the analysis of the findings becomes rigorous in obtaining robust outcomes.

The project-based learning also altered pupils' attitudes towards self-efficacy and task value concerning environmental studies but in a moderate degree according to the effect size. As it was presented in the results section, the majority of pupils with learning difficulties stated in their interviews that P-BL method enhanced their engagement in the learning process. A closer look of the data derived from the field notes and pupils' interviews show that most of the pupils with learning difficulties in the present study seem to have been mainly engaged behaviourally and motivationally in the learning process although sometimes in a superficial way (i.e. they sought help in order to complete the task without necessarily understanding it). Psychosocial factors such as group acceptance and positive affect during learning experience seem to contribute substantially to defining motivational states during engagement in the learning process. However, these pupils did not seem to be cognitively engaged (i.e. using more surface processing strategies like rehearsal, writing down information instructed by peers etc.) during the project experience. As Linnenbrink and Pintrich (2003) support, pupils should not only be behaviourally engaged (put effort, persistence and seek help) and motivationally engaged (show interest, give value and positive affect) in a learning activity but also be cognitively engaged (use cognitive and metacognitive strategies) in order to actually learn and highly improve their self-efficacy. *The more a student is engaged, and especially the more he/she learns and the better he/she performs, the higher his/her self-efficacy* (Linnenbrink & Pintrich, 2003, p. 123). Children with learning difficulties face problems with the use of cognitive and metacognitive strategies and an in-depth examination of a topic. For these pupils it is necessary to teach them individually how to use cognitive strategies and at the same time to include more direct instruction during a project. It may also be needed to adapt the project to their needs by designing a shorter one or by setting fewer and more specific aims.

An interesting finding in this study is also that pupils with learning difficulties had positive self-efficacy beliefs in terms of their academic performance in the environmental studies even before the implementation of the project (see table three). A possible explanation could be that, as several studies found, pupils with learning disabilities tend to overestimate their efficacy (Klassen, 2002a). Another possible explanation could be that, as Linnenbrink & Pintrich, (2003) support, *self-efficacy judgments may vary as a function of intra-individual or environmental differences* (p.122). According to Hampton and Mason (2003) a pupil may has positive self-efficacy beliefs if he/she is exposed to sources, which help to develop these beliefs. That is, if he/she has positive emotional experiences from environmental studies because it provides knowledge, which is related to daily life more accessible to him/her as well as if the pupil receives support from the teacher and peers, then he/she may express positive self-efficacy beliefs about his/her performance on this curriculum subject. The fact that knowledge from environmental studies is applicable to real world may explain why pupils with learning difficulties had positive task value believes even before the implementation of the project.

In conclusion, the findings of the present study support that pupils with learning difficulties can gain benefits through P-BL in academic performance, motivation, cooperative learning, social acceptance, and engagement in the learning process. Children with learning difficulties can engage in learning experiences through P-BL at their own level to meet their social and academic goals. However, for this approach to be effective, activities based on secondary sources (materials from books and magazines) should be adapted and relevant to pupils' need at a level of elaboration that will assist their understanding. P-BL is not an instructional teaching method, which can develop certain learning skills (e.g. reading, writing, strategy use) to pupils with special educational needs. It can, though, support these children's learning through alternative routes (e.g. multi-sensory approach, hands-on experience, co-operative learning). Individualized instruction should be applied for these pupils to develop basic skills for coping in open-ended learning environments. Furthermore, pupils engaged in P-BL need to have been instructed to work co-operatively because they can then develop an understanding of the purpose of the group and of the need to help and support each other's learning (Sharan & Shaulov, 1990). However, as Webb (1985) argues for the help to be effective it must be provided at a time when the pupil with learning difficulties has an opportunity to use the explanation to solve the problem on-task.

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