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To cite this article: Karin Smit, Cornelis J. de Brabander & Rob L. Martens (2014) Student-centred and teacher-centred learning environment in pre-vocational secondary education: Psychological needs, and motivation, Scandinavian Journal of Educational Research, 58:6, 695-712, DOI: [10.1080/00313831.2013.821090](https://doi.org/10.1080/00313831.2013.821090)

To link to this article: <http://dx.doi.org/10.1080/00313831.2013.821090>



Published online: 24 Aug 2013.



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## **Student-centred and teacher-centred learning environment in pre-vocational secondary education: Psychological needs, and motivation**

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In this study the perception of psychological needs and motivation in a student-centred and a teacher-centred learning environment are compared, using Self Determination Theory as a framework. The self-report Intrinsic Motivation Inventory was completed by 230 students (mean age 16.1 years) in pre-vocational secondary education. School records on absenteeism and achievement were also analysed. As predicted, multi-level analyses showed that students in the student-centred learning environment reported higher levels of perceived autonomy, competence, relatedness and motivation, measured by pleasure and effort. Furthermore, boys were less absent. Achievement shows no differences. These results suggest that a student-centred form of learning can be more beneficial for students' motivation if granted autonomy is embedded in a supportive environment.

*Keywords:* motivation, learning environment, psychological needs

### **Introduction**

Motivation directs, energises and regulates behaviour (Ford 1992), but many students seem to lack motivation for learning at school (Martens et al. 2010) or their motivation decreases during adolescence (Eccles 2004; Peetsma et al. 2005). This displays itself in less pleasure, effort and interest, and can lead to absenteeism and drop-out (Peetsma and Van der Veen 2008), especially in vocational education. This tendency can be seen all over Europe (OECD 2011), including in the Nordic countries (Statistics Sweden 2008; Markussen et al. 2011; Statistics Norway 2012).

Motivation for learning is a process that partly takes place within the person and partly arises from the interaction between the individual and the environment (Bandura 1986; Ryan and Deci 2000a). Accordingly, schools shift from teacher-centred learning environments (TLEs) to student-centred learning environments (SLEs) (Cannon and Newble 2000; Savery and Duffy 2001).

Underpinnings of the effect of new learning concepts on motivation, however, are scarce. In this study, Self Determination Theory (SDT) is used to explain the relation between SLEs and motivation. SDT states that the fulfilment of three basic psychological needs – the need for autonomy, competence and relatedness – supports and enhances students' intrinsic and

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autonomously regulated motivation, leading to pleasure and effort in relation to schoolwork (Deci and Ryan 1985; Ryan and Deci 2000a, 2000b). The characteristics of SLEs correspond with the core of SDT, as will be illustrated in this article. It is therefore assumed that SLEs will fulfil students' needs, and consequently enhance students' motivation.

However, there are doubts about the mechanism of need fulfilment in the actual practice of the classroom, especially where it concerns the need for autonomy and competence (Assor et al. 2002; Kirschner et al. 2006). In addition, little research has been done in more complex real-life situations (Lowyck et al. 2004).

This study aims to explore differences in students' motivation between a student-centred and a teacher-centred learning environment in practice, using Self Determination Theory as a framework. First, we describe the theoretical foundations of new forms of learning. Next, the three needs and their effect on motivation will be discussed and, finally, learning environments will be related to need fulfilment and motivation.

### **Student-Centred and Teacher-Centred Learning Environments**

New forms of learning are based on psychological and educational theories, stating that learning is a constructivist, situated and social activity (De Kock et al. 2004). According to these theories, knowledge is situated in real-life contexts. Students construct their personal representations of knowledge, and link new information to prior knowledge and the context (Brown et al. 1989). Furthermore, learning takes place through a dialogue with teachers, peers and one's self, through, for example, the articulation of problems and the encountering of different solutions (Vygotsky 1978; Simons et al. 2000). For a more extended overview of new forms of learning and instruction, we refer to Slavich and Zimbardo (2012).

Student-centred learning is based on those learning theories that consider learning as a constructivist, situated and social activity. It is defined by Cannon and Newble as 'ways of thinking about teaching and learning that emphasize student responsibility and activity in learning rather than content or what the teachers are doing' (2000: 16). We describe the TLE and SLE as they are presented in theory with five tangible characteristics: tasks, student activities, teacher activities, sources of information and assessment (Savery and Duffy 2001), starting with the SLE.

First, tasks in SLEs are problem based and situated in a rich, authentic context. This provides students with a clear purpose and different perspectives from which to approach the learning material. It also enables attachment of new information to familiar situations (Brown et al. 1989; Simons et al. 2000). Furthermore, tasks are presented like a 'smorgasbord' (Arnqvist 2010: 54) from which students can make their choice. Second, the students' role in SLEs is an active one; they perform real-life activities and are challenged to be mentally active through tackling problem-based tasks. Learning is also self-regulated: students set goals and take responsibility for the learning process (Van Hout-Wolters et al. 2000). Furthermore, students learn cooperatively to enable negotiation and social construction of knowledge (Vygotsky, 1978; Simons et al. 2000). Third, teachers take the role of coach, expert, model and facilitator during the learning process. In dialogue with the student, learning goals are set, and the learning process is monitored and evaluated. Teachers gradually hand over responsibilities for the learning process (Boekaerts 2002). Fourth, sources of information in the SLE are extended from teachers and text books to, for example, the Internet. Teachers also provide scaffolds to help students obtain knowledge and skills that are almost within their reach (Vygotsky 1978). Finally, learning is assessed through reflection

on both the product and the process of learning, with a focus on improvement of tasks to come (Black and William 2009).

In traditional learning environments, like TLEs, tasks are mainly theoretical (De Corte 2003). Knowledge in these tasks is de-contextualised. The focus of learning is on content, not on the learning process. Second, students' role is mainly passive; knowledge is transferred from teachers to students, whereupon students practise the assigned exercises individually. The learning activities are identical for all students and performed simultaneously. Third, teachers mainly provide whole-class instruction and control the learning process. Fourth, teachers and text books are the main sources of information. Finally, assessment concerns the content only and winds up a learning period. We have thus described the two learning environments according to the theory and as two extremes on a continuum (O'Neill and McMahon 2005). In practice, learning environments hardly ever are fully teacher-centred or student-centred, but take on hybrid forms (De Kock et al. 2004).

### **The Need for Autonomy, Relatedness and Competence in Relation to Motivation**

School activities are rarely performed solely for pleasure or out of curiosity. An important question raised by Ryan and Deci is 'how to motivate students to value and self-regulate these activities and, without external pressure, to carry them out on their own?' (2000a: 60). SDT identifies the need for autonomy, competence and relatedness, as 'innate psychological needs essential for on-going psychological growth, integrity and well-being' (ibid: 227). Need fulfilment or the thwarting of need fulfilment supports or disturbs innate intrinsic motivation. Moreover, if an activity is not inherently motivating, need fulfilment establishes autonomously regulated motivation, relocating motives for learning and the regulation of learning from external motives to the individual. The extent to which external motives are being internalised determines the quality of motivation, and affects school engagement, effort, pleasure, persistence and achievement (Deci and Ryan 1985; Ryan and Deci 2000a, 2000b).

The need for autonomy, first, refers to the need for self-determination (Deci and Ryan 1985); students need to feel they can contribute to their learning process, and have a choice in subjects and learning activities. Several studies show that teachers who support autonomy enhance motivation, curiosity and engagement (Levesque et al. 2004; Assor et al. 2005; Backman et al. 2011), whereas teachers who display controlling behaviour have a negative effect on motivation (Assor et al. 2005; Stormes et al. 2008). Moreover, autonomy-supportive contexts are of vital importance in terms of students appreciating intrinsic goal-setting (Vansteenkiste et al. 2004), and offer opportunities in the classroom for students to pursue multiple goals, encouraging a high level of student involvement (Hijzen et al. 2006).

Second, the need for competence refers to the need to feel able to perform a task successfully (Deci and Ryan 1985; Backman et al. 2011). Students who feel competent show more persistence when meeting obstacles on their learning path (Bandura 1994). It enhances their motivation and increases the use of deep level learning strategies (Levesque et al. 2004). In this study a distinction is made between perceived personal competence and perceived organisational competence. The basic assumption is that students can feel competent on their own account and as a result of being empowered by the organisation (De Brabander et al. 2009). Since criticism about new learning environments especially concerns too much autonomy and the lack of support and structure provided by teachers, we operationalised perceived organisational competence mainly as perceived support from the teacher.

Finally, the need for relatedness refers to the need for attachment and secure connections to important others. We studied the relatedness to teachers, which implies trust, reliability and feeling at ease with them. Relatedness improves students' well-being; furthermore, students who trust their teachers are inclined to value their teachers' opinion (Ryan and Deci 2000a, 2000b). Students who perceive their teacher as indifferent are less motivated, even when tasks are reported as interesting (Ryan and Grolnick 1986). Relatedness, therefore, predicts motivation for learning (Furrer and Skinner 2003; Backman et al. 2011).

### **The Learning Environment in Relation to Fulfilment of Psychological Needs**

'New' learning concepts, like student-centred learning, have emerged on the assumption that they will lead to more active engagement (Simons et al. 2000) and increase students' motivation. However, many assumptions remain implicit (Martens et al. 2007). In this study we used the SDT framework, arguing that SLEs fulfil the three basic psychological needs more extensively than TLEs and therefore are more motivating for students. We will illustrate this below.

First, Urdan and Turner (2005) studied the effect of learning environments on students' perceived personal competence. They report that tasks embedded in a realistic context are comprehensible for students and therefore increase their feeling of competence. This is confirmed by Dochy et al. (2003). Furthermore, choice in subject and working methods enables students to choose tasks within reach of their capabilities. Finally, feedback, assessment and teacher support, provided at individual level, support students' sense of competence (Urdan and Turner 2005). These features correspond with the characteristics of SLEs, as described earlier in this article.

Second, autonomy is automatically embedded in SLEs; students are expected and stimulated to self-regulate their learning and to choose subjects and working methods. Moreover, realistic tasks in authentic contexts often have no clear-cut solutions and require autonomy to solve problems (Simons et al. 2000).

The perception of relatedness, finally, is fed by cooperative learning and by the interaction with teachers in the roles of coach, guide, expert and provider of feedback (Savery and Duffy 2001). It is assumed that the fulfilment of these three needs will have a positive effect on pleasure and effort.

However, the positive effect of SLEs on perceived need fulfilment is not self-evident. Educational researchers have fiercely debated the balance between granted autonomy and lack of structure in new forms of learning. They have expressed concerns about the minimisation of guidance, leaving students with a decreased feeling of competence (Assor et al. 2002). Kirschner et al. even named an article 'Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry based teaching' (2006: 75). Indeed, students who experienced new forms of learning reported difficulties in finding an appropriate way of tackling authentic tasks (Mayer 2004) and show higher achievements when tasks are well-defined (Lodewyk et al. 2009). The motivational challenge of SLEs can even be detrimental to motivation (Lehtinen et al. 1995).

In conclusion, although experimental research proved that perceived fulfilment of the three psychological needs affects motivation positively, there are doubts about this mechanism in actual practice. This study aims to examine need fulfilment and motivation in a more complex real-life situation.

In addition gender, achievement and absenteeism are taken into account. The effect of motivation on achievement is not straightforward. Ahmed et al. (2010) found a positive relation between motivation and grades, whereas Sánchez et al. (2005) state that grades are poor predictors. However, as grades are one of the main elements on which students are judged in practice, they are taken into account here.

Absenteeism is a significant predictor for drop-out (Hammond et al. 2007). However, little research has been done on this subject. Sánchez et al. (2005) show that learning environments, especially relatedness with teachers, predict absenteeism. This is confirmed by Baker et al. (2001), who mention it as one of many predictors. Lack of relatedness can affect well-being and decrease the influence of teachers on students' perception of the importance of education (Ryan and Deci 2000a, 2000b). Teasley (2004) adds, as a predictor of absenteeism, a feeling of incompetence that often becomes more visible in secondary education; students avoid feeling incompetent by not attending.

Finally, gender differences are studied. Boys show more drop-out from school than girls (CBS 2011; Statistics Norway 2012). Research also reports gender differences in motivation (Martin 2003; Sánchez, et al. 2005); boys pointed out that, for example, a feeling of relatedness and autonomy at school is important to them (Martin 2003), but differences are small (Martin 2004).

### **Aim of the Study**

The aim of this study was to compare a student-centred learning environment with a teacher-centred learning environment to answer the main research-question: 'Is the learning environment related to students' need fulfilment and motivation?'

In this study it is hypothesised that students in the SLE will perceive more autonomy (Simons et al. 2000; Hypothesis 1a), more relatedness with teachers (ibid; Hypothesis 1b) and more personal and organisational competence (Urdu and Turner 2005; Hypotheses 1c and 1d ) than students in the TLE. Furthermore, we assume, based on SDT, that the perception of autonomy, competence and relatedness will lead to motivation, indicated by pleasure and effort (Deci and Ryan 1985; Ryan and Deci 2000a, 2000b; Hypothesis 2). Also, we expect that boys will be more motivated in the SLE than boys in the TLE (Martin 2003; Hypothesis 3). Finally, as relatedness and perceived competence are related to absenteeism (Baker et al. 2001; Teasley 2004; Sánchez et al. 2005), we assume that students in the SLE are less absent (Hypothesis 4). Findings in previous studies on achievement in relation to motivation are not decisive and therefore no hypothesis is formulated.

## **Method**

### **Participants**

For this study, 17 classes in third and fourth years of pre-vocational secondary education filled in a one-time self-report questionnaire at the end of the school year. This was done during school time in the classroom, in 25 to 40 minutes, supervised by the researcher and the teacher. One class filled in the questionnaire after school time in less than ten minutes and therefore probably inattentively; the class was excluded from the analyses.

Pre-vocational secondary education prepares students over a period of four years for vocational training. Assignment to type of secondary education is mainly based on an

entrance test in the final year of primary education; those with the lower test results, about 60 per cent of the pupils, are referred to pre-vocational secondary education.

During the first two years the curriculum consists of general subjects and at the end of the second year students choose a vocational discipline, based on, for example, personal preferences, orientation on vocational disciplines in the second school year and parents' preferences. In the third and fourth years, general subjects cover approximately two-thirds of school time and the vocational subject covers one-third.

The analyses included 123 students in seven classes (61 per cent boys) in a teacher-centred learning environment with a class size ranging from 9 to 21 students ( $M = 16$ ;  $SD = 1.16$ ), and 107 students in nine classes (58 per cent boys) in a student-centred learning environment, with a class size ranging from 7 to 22 students ( $M = 13.7$ ,  $SD = 1.45$ ). Students' age ranged from 15 to 18 years ( $M = 16.1$ ;  $SD = 0.70$ ).

## Design

This study was carried out in one school, gradually changing from teacher-centred to student-centred learning, discipline per discipline, over several years. The aim of the school was to involve students in the learning process, and to increase their motivation. School management decided in which year which discipline was to switch from TLE to SLE. At the time the study was executed the SLE had been in practice for four years in the vocational discipline ICT, for three years in Sport, Services and Security and for one year in Care and Well Being. The vocational disciplines with a TLE were Commerce, Graphics and Media, Administration, and Mechanics.

Obviously, the choice of vocational discipline was made by the students. As a preference for a particular learning environment or discipline could bias the findings, a question was added regarding students' choice (e.g. how this discipline is taught appealed to me; I like this discipline; I like the teachers in this discipline). A chi-square test, to determine the distribution of reasons over the TLE or SLE, showed no specific preferences for disciplines related to a specific learning environment.

## Description of the Learning Environments in Practice

We verified whether the learning environments indicated by the school as SLE and TLE actually met the characteristics as described in theory. For both learning environments we compared curricula, interviewed team managers and observed a lesson in each discipline. Also, documents on school policy were consulted. We used the five characteristics formulated earlier in this article to describe both learning environments in practice: tasks, role of the student, role of the teacher, sources of information and assessment. We start with the learning environment indicated by the school as SLE.

## Tasks

Tasks for the vocational subjects are either real assignments (from, for example, businesses, the city council and non-profit organisations) or simulations. The subject Dutch language is almost fully integrated in the vocational subjects; letters of application, tenders, reports and presentation skills are linked to the assignments. Students choose the task they want to execute in consultation with the teacher or tasks are assigned by the

teacher according to students' level and interest. Tasks also involve the learning and application of meta-cognitive skills; planning, monitoring and evaluating the work is essential in the learning process.

### **Teacher activities**

Every lesson for the vocational subject and the Dutch language starts and ends with a plenary session discussing the progress of the tasks. Subsequently, students work independently, individually or in groups. Teachers lecture the whole class, a group or an individual student, depending on what students ask and need to execute the task. Otherwise, teachers are available for questions, actively monitor students' progress and provide scaffolds where necessary.

### **Student activities**

Students are actively involved in the lessons, choosing tasks and activities. They work individually or in groups. The exact problem, and the skills and knowledge necessary to execute these tasks, need to be determined by the students in dialogue with customers, teachers and peers. Students use their prior knowledge and figure out what aspects of the assignment are unknown to them and if they require help. Students also keep account of their development of competences and meta-cognitive skills in a personal workbook.

### **Assessment**

Every six weeks the teacher discusses the learning process with each student individually to determine the progress made and what needs further improvement. This is recorded in the workbook and will be used for the next assignments.

The utility and quality of the product made in the real-life setting is also assessed. For example, students' welding may be tested to determine whether it is strong enough to withstand a collision. Also, students record their work in a digital portfolio. Finally, the product is graded by the teacher in accordance with government requirements.

### **Sources of information**

Every classroom in the school has two computers, except for the ICT discipline, which has a computer available for every student. Students are allowed to use the computers when necessary. Furthermore, the teacher provides information.

The TLE in this study is almost identical to the description earlier in this article, based on De Corte (2003), except for the Graphs and Media discipline that has been working with real-life tasks for several years. Also, most subjects in the TLE work occasionally with projects that grant certain autonomy and are executed in groups.

In conclusion, the SLE is carried out quite thoroughly, but only within the limited area of the vocational subject and Dutch language; students in the SLE actually experience student-centred learning in these two subjects, covering approximately one-third of the time at school. The other subjects in the SLE and all subjects in the TLE are taught in a teacher-centred style. Graph and Media forms an exception because it shows some SLE characteristics.



**Instruments**

Students’ motivation and their perception of psychological needs were measured with the Intrinsic Motivation Inventory (IMI). The items inquired about schoolwork in general. The validity of the IMI was tested by McAuley et al. (1989). For this study, scales were added to measure perceived organisational competence. The questionnaire was scrutinised by a group of experts and tested by 20 students. One item was deleted because of a poor language fit. The analyses were performed with 230 students. All scales were scored on a five-point Likert scale ranging from 1 (*I don’t agree at all*) to 5 (*I fully agree*).

**Pleasure/interest, effort, perceived autonomy and relatedness**

Pleasure and interest were measured using one scale, in line with the IMI, with six items (e.g. ‘I think schoolwork is fun’). Five items measured effort (e.g. ‘I put a lot of effort into schoolwork’). Cronbach’s alpha was 0.85 for both scales. Five items measured perceived autonomy (e.g. ‘I feel I can determine what I do at school’). Two negatively formulated items were recoded, but not reliable; after deletion, perceived autonomy showed a Cronbach’s alpha of 0.71. Perceived relatedness was measured with six items (e.g. ‘Teachers make me feel at ease’; Cronbach’s  $\alpha = 0.90$ ).

**Perceived personal and organisational competence**

Four different aspects of competence were measured. Perceived personal competence consisted of five items (e.g. ‘I think I am good at doing schoolwork most of the time’). Three aspects of perceived organisational competence were measured: five items on usefulness of help (e.g. ‘Teachers make sure I understand what I have to do’), five items on accessibility of help (e.g. ‘Teachers are present when I need help) and six items on help with looking up information (e.g. ‘Teachers help me find my way on Internet’). The competence scales differed from the original IMI, therefore the data were analysed using confirmatory factor analysis with a maximum likelihood method (Table 1). After two recoded items were removed, the four hypothesised factors fitted the data satisfactorily (model 1). However, the factor on usefulness of help and the factor on accessibility of help were highly correlated ( $r = 0.83$ ). In model 2 we amalgated them in one factor, ‘quality of teacher help’. The lower fit of this model could be addressed by allowing the covariance of some of the error terms to be estimated (model 3). A multi-level analysis with very satisfactory values of fit completed the analysis (model 4).

This resulted in a total of three scales of perceived competence: perceived personal competence, measured with five items (Cronbach’s  $\alpha = 0.81$ ); perceived organisational competence ‘quality of teacher help’, measured with ten items (Cronbach’s  $\alpha = 0.94$ ); and

Table 1. Fit values of four models from confirmatory factor analyses on aspects of competence

| Model | Chi <sup>2</sup> (df), p | CFI   | NNFI  | RMSEA |
|-------|--------------------------|-------|-------|-------|
| 1     | 276.58 (163) < 0.0001    | 0.95  | 0.94  | 0.056 |
| 2     | 378.07 (166) < 0.0001    | 0.91  | 0.90  | 0.075 |
| 3     | 207.94 (157) 0.004       | 0.98  | 0.97  | 0.038 |
| 4     | 293.62 (325) 0.894       | 1.000 | 1.036 | 0.000 |

perceived organisational competence ‘help with information’, consisting of six items (Cronbach’s  $\alpha = 0.86$ ).

### **Grades and absenteeism**

The mean grade over one year provided by the school for the vocational subject and Dutch language, were also taken into account. The tests that underlie these grades are identical for both learning environments. Grades can take the value of 1 (poor) to 10 (excellent), with a value of 5.5 and above as a passing grade.

Absenteeism involved the number of hours absent during the school year, recorded by the school in the same way for both learning environments. A distinction was made between non-permitted absenteeism (NA) and permitted absenteeism (PA). Three NA values and one PA value were identified as outliers and excluded.

### **Statistical Analyses**

The main purpose of this article is to attribute differences in need fulfilment and motivation to different learning environments. However, outcome variance may be determined by class membership; the data are nested. Accordingly, multi-level analyses were performed (Hox 2002). Sixteen classes is a small but sufficient number (Snijders and Boskers 2011) and we used the restricted function (RML) of MIWin 2.0, which is suitable for a small number of classes (Rasbach et al. 2003).

We deal with two levels and in the case of a multivariate response (e.g. different aspects of competence), a third level is added that represents variance resulting from differences between variables. Categorical variables were represented by dummy variables (SLE = 1, TLE = 0; boys = 1, girls = 0). To assure comparability between different variables their scores were standardised. As a first step the unconditional model is estimated. Explanatory terms are added stepwise, and the final model includes only significant main and interaction effects. Interpretation of the results is based on explained variance and differences between models that were tested.

### **Results**

Means, standard deviations, and correlations for the variables on motivation and perceived needs are presented in Table 2. The descriptive statistics for grades and absenteeism are presented in Table 3.

Effort and pleasure are moderately to highly correlated; they also correlate with perceived needs, and especially with perceived personal competence. Furthermore, results show a strong relation between perceived relatedness and perceived organisational competence; that is, ‘quality of teacher help’. A multicollinearity check showed variance inflation factors with permissible values ranging from 1.4 to 1.9 (Kutner et al. 2004).

### **Multi-Level Analyses**

#### **Motivation: effort and pleasure**

Effort and pleasure are both indicators of motivation and therefore analysed together. To distinguish between the effort and pleasure score, a dummy variable

Table 2. Means, standard deviations and intercorrelation coefficients for motivation and perceived needs

| Variable                                 | SLE         | TLE         | 1      | 2      | 3      | 4      | 5      | 6      |
|--|-------------|-------------|--------|--------|--------|--------|--------|--------|
|  | M (SD)      | M (SD)      |        |        |        |        |        |        |
| 1. Pleasure                              | 3.19 (0.87) | 2.78 (0.87) |        |        |        |        |        |        |
| 2. Effort                                | 3.95 (0.82) | 3.66 (0.93) | 0.59** |        |        |        |        |        |
| 3. Autonomy                              | 3.51 (0.81) | 3.26 (0.74) | 0.42** | 0.36** |        |        |        |        |
| 4. Relatedness                           | 3.34 (0.99) | 2.65 (0.89) | 0.47** | 0.35** | 0.37** |        |        |        |
| 5. Personal competence                   | 3.71 (0.73) | 3.46 (0.76) | 0.53** | 0.55** | 0.49** | 0.37** |        |        |
| 6. Organisational competence quality     | 3.54 (0.89) | 3.07 (0.86) | 0.42** | 0.35** | 0.32** | 0.81** | 0.38** |        |
| 7. Organisational competence information | 3.27 (0.93) | 2.80 (0.99) | 0.44** | 0.28** | 0.36** | 0.55** | 0.33** | 0.60** |

\* $p < 0.05$ ; \*\* $p < 0.01$ .

Table 3. Means, and standard deviations for grades and absenteeism

| Variable                  | SLE           | TLE           |
|---------------------------|---------------|---------------|
|                           | M (SD)        | M (SD)        |
| Grade Dutch               | 6.67 (0.93)   | 6.67 (0.87)   |
| Grade vocational practice | 6.23 (0.87)   | 6.63 (0.81)   |
| Permitted absenteeism     | 41.95 (33.27) | 54.73 (45.47) |
| Non-permitted absenteeism | 4.47 (6.00)   | 6.38 (7.89)   |

was used (effort = 1, pleasure = 0). A three-level analysis was carried out, with the variables at the first level, the respondents on the second level and the classes on the third level.

The unconditional model (Table 4) showed that part of the variance in motivation can be explained at class level with an intra-class correlation (ICC) of 0.119, and a larger part of the variance can be attributed at the respondent level (ICC = 0.471). In the final model the predicting variables learning environment and gender explained part of the variance at class level (ICC = 0.028). The log-likelihood-ratio test shows that the final model is significantly better than the unconditional model ( $\chi^2(3) = 28.46, p < 0.001$ ), with a significantly higher level of motivation on the whole in the SLE ( $t$ -ratio = 2.60,  $p = 0.018$ ). Also, there is a significant but negative relation between gender and motivation ( $t$ -ratio = -3.59,  $p < 0.001$ ); boys are less motivated than girls.

**Personal and organisational competence**

Perceived personal competence and the two forms of organisational competence were distinguished with two dummy variables. Personal competence is coded 1 on the first dummy variable and 0 on the second dummy variable. Quality of teacher help is coded 0 on the first dummy variable and 1 on the second dummy variable. Help with information, finally, is coded 0 on both first and second dummy variable.

Table 4. Multi-level analysis of motivation (effort and pleasure)

|                            | Model         |                               |
|----------------------------|---------------|-------------------------------|
|                            | Unconditional | Final                         |
| <i>Coefficients</i>        |               |                               |
| Intercept                  | 0.000 (0.103) | 0.086 (0.118)                 |
| Learning environment       |               | 0.367 (0.141), $p = 0.018$    |
| Gender                     |               | -0.439 (0.122), $p < 0.001$   |
| <i>Variance components</i> |               |                               |
| Class                      | 0.119         | 0.028                         |
| Respondent                 | 0.471         | 0.472                         |
| Response                   | 0.407         | 0.407                         |
| N responses                | 460           | 460                           |
| Deviance                   | 1186.556      | 1172.786                      |
| $\Delta$                   |               | 13.77, $df = 2$ , $p = 0.001$ |

Table 5. Multi-level analysis of perceived personal and organisational competence

|                            | Model          |                                |
|----------------------------|----------------|--------------------------------|
|                            | Unconditional  | Final                          |
| <i>Coefficients</i>        |                |                                |
| Intercept                  | -0.010 (0.090) | -0.013 (0.097)                 |
| Learning environment       |                | 0.431 (0.110), $p < 0.001$     |
| Gender                     |                | -0.322 (0.104), $p = 0.002$    |
| <i>Variance components</i> |                |                                |
| Class                      | 0.089          | 0.009                          |
| Respondent                 | 0.353          | 0.357                          |
| Response                   | 0.561          | 0.561                          |
| N responses                | 686            | 686                            |
| Deviance                   | 1810.501       | 1795.012                       |
| $\Delta$                   |                | 15.489, $df = 2$ , $p < 0.001$ |

The unconditional model shows (Table 5) that a small part of the variance can be explained at class level ( $ICC = 0.089$ ) and a substantial part of the variance can be attributed to the respondent ( $ICC = 0.353$ ). The results show that the learning environment is a very significant predictor of perceived competence on the whole ( $t$ -ratio = 3.92,  $p < 0.001$ ). Also, there is a significant but negative relation between gender and perceived competence on the whole; boys have significantly lower perceptions of competence than girls ( $t$ -ratio = -3.10,  $p = 0.002$ ).

### Autonomy

Autonomy is a single variable and thus we performed a two-level analysis. The unconditional model shows (Table 6) that a very small part of the variance can be explained at class

Table 6. Multi-level analysis of autonomy

|                            | Model         |                               |
|----------------------------|---------------|-------------------------------|
|                            | Unconditional | Final                         |
| <i>Coefficients</i>        |               |                               |
| Intercept                  | 0.000 (0.074) | -0.150 (0.090)                |
| Learning environment       |               | 0.322 (0.131), $p = 0.014$    |
| <i>Variance components</i> |               |                               |
| Class                      | 0.017         | 0.000                         |
| Respondent                 | 0.984         | 0.978                         |
| <i>N</i> responses         | 228           | 228                           |
| Deviance                   | 645.764       | 640.067                       |
| $\Delta$                   |               | 5.697, $df = 1$ , $p = 0.017$ |

level ( $ICC = 0.017$ ). Adding learning environment as a predicting variable, there is a significantly higher level of autonomy in the SLE ( $t$ -ratio = 2.46,  $p = 0.014$ ). There is no effect for gender.

### Relatedness to teachers

Relatedness is measured as a single variable, which leads to a two-level analysis. The unconditional model shows (Table 7) that a fair amount of the variance ( $ICC = 0.119$ ) can be attributed to class level. Still, the learning environment has a significant effect on relatedness ( $t$ -ratio = 3.41,  $p < 0.001$ ), implying relatedness to teachers is much stronger in the SLE. Gender had no significant effect.

### Practise-based outcomes: absenteeism and achievement

Absenteeism is measured by the number of hours absent during the school year. PA covers permitted absence; NA covers non-permitted absence. Four subjects with extreme

Table 7. Multi-level analysis of relatedness to teachers

|                            | Model          |                              |
|----------------------------|----------------|------------------------------|
|                            | Unconditional  | Final                        |
| <i>Coefficients</i>        |                |                              |
| Intercept                  | -0.043 (0.128) | -0.328 (0.130)               |
| Learning environment       |                | 0.661 (0.194), $p < 0.001$   |
| <i>Variance components</i> |                |                              |
| Class                      | 0.199          | 0.087                        |
| Respondent                 | 0.814          | 0.816                        |
| <i>N</i> responses         | 227            | 227                          |
| Deviance                   | 619.627        | 610.377                      |
| $\Delta$                   |                | 9.25, $df = 1$ , $p = 0.002$ |

Table 8. Multi-level analysis of non-permitted absenteeism

|                             | Model           |                               |
|-----------------------------|-----------------|-------------------------------|
|                             | Unconditional   | Final                         |
| <i>Coefficients</i>         |                 |                               |
| Intercept                   | 1.7017 (0.1164) | 1.5398 (0.1682)               |
| Gender                      |                 | 0.5640 (0.2179), $p = 0.001$  |
| Gender*learning environment |                 | -0.7470 (0.2806), $p = 0.008$ |
| <i>Variance components</i>  |                 |                               |
| Class                       | 0.2011          | 0.3024                        |
| Gender                      |                 | 0.2855                        |
| <i>N</i> responses          | 218             | 218                           |
| Deviance                    | 1460.186        | 1398.169                      |
| $\Delta$                    |                 | 62.017 (df=4), $p < 0.0001$   |

values were excluded. Both variables were analysed with generalised linear mixed modelling using the log link function for the Poisson distribution. We performed these analyses with the lmer function of the lme4 R package. The models were fit by the Laplace approximation. With respect to PA, none of the predictors contributed significantly. In the final model for NA, however, gender ( $z = 2.59$ ,  $p = 0.0097$ ) and the interaction between gender and the learning environment ( $z = -2.66$ ,  $p = 0.0078$ ) were significant; boys are less absent in the new learning environment (Table 8). Grades, finally, showed no differences between the SLE and the TLE.

### Discussion

Currently, student-centred learning environments (SLEs) are designed to enhance and increase students' motivation, especially in vocational education. According to Self Determination Theory, the fulfilment of the need for autonomy, competence and relatedness is essential for motivation; SLEs seem to fulfil these needs. However, SLEs can also be quite demanding, granting students too much autonomy and, consequently, having a less positive or even detrimental effect on motivation. Our goal was to examine to what extent students' motivation and perceived need fulfilment differ in a SLE and a TLE.

The results of this study are in favour of the SLE. First, students in the SLE, compared with the students in the TLE, perceive more autonomy (Hypothesis 1a), more relatedness with teachers (Hypothesis 1b), more personal competence (Hypothesis 1c) and more organisational competence (Hypothesis 1d). Furthermore, students report more pleasure and effort (Hypothesis 2). Gender differences were seen for non-permitted absenteeism; boys demonstrated less non-permitted absenteeism in the SLE compared to boys in the TLE (Hypotheses 3 and 4). Achievement, finally, showed no significant differences between learning environments.

Returning to the discussion regarding autonomy and lack of structure, the results of this study justify questioning Kirschner et al.'s (2006) article, which automatically relates new forms of learning to minimal guidance. First, the present study shows that students in the SLE, based on constructivist learning theories, simultaneously perceive more autonomy and more organisational competence. This is consistent with new forms of learning described

by Simons et al. (2000); the guiding role of the teacher and the organisational support from the learning environment are essential aspects of SLEs. Hmelo-Silver et al., too, state that ‘both problem based learning and inquiry learning employ scaffolding extensively’ (2007: 99).

Second, students in the SLE also perceive more relatedness with teachers. Several studies emphasise the importance of relatedness in relation to autonomy; making autonomous behaviour possible is in itself supportive (e.g. Assor et al. 2002). Finally, according to this study students can simultaneously perceive more autonomy and feel competent to a larger extent. To put it more clearly, increased perceived autonomy goes hand in hand with perceived relatedness and perceived competence.

We do not deny that new forms of learning can and do coincide with students being left to their own devices. We do argue, however, against the statement that new forms of learning are equal to leaving students to their own devices. What are the underlying reasons for this statement about SLEs? The implementation of SLEs is essential in order to establish the intended learning effects but often is poor (Boekaerts 2002). Mayer speaks of ‘a naive interpretation of constructivism’ (2004: 18) and the underestimation of the complexity of learning concepts based on constructivist principles.

One could also argue that the concept of autonomy is interpreted too naïvely and in too straightforward a manner. We support research that takes more complex relations into account, reporting that fulfilling students’ need for autonomy also involves teachers taking students seriously (Assor et al. 2002) and providing rationales for learning (Jang et al. 2010). Hansson (2010) and Slavich and Zimbardo (2012) transferred social constructivism to the instructional practice of the classroom, including both active involvement of students and development of their responsibility for learning and teachers’ responsibility to provide content and support. It goes without saying that, although it appears paradoxical, SLEs put great demands on teachers. This has to be taken into account when implementing such an environment.

In this research we also studied absenteeism, achievement and gender. Grades between the learning environments do not differ. This means that the SLE does not necessarily have detrimental effects on motivation, as suggested by Lehtinen et al. (1995), but clearly neither does it boost students’ achievement. Hebb’s (1955) principle of optimal arousal could explain this result; people thrive on challenges as long as they are not too difficult. Motivational challenges of the SLE might have a positive effect on students’ motivation and simultaneously have no effect on achievement; it is motivating, but too difficult to obtain high grades. Finally, results show that non-permitted absenteeism is more explicit for boys. This is an important finding: boys generally are less motivated than girls (Martin 2004) and show higher drop-out rates (CBS 2011). The SLE seems to be more inviting, prompting boys to attend the lessons.

The results of this exploratory study are interesting, but some limitations have to be taken into account. First, this research has been executed in one school; therefore results cannot be generalised to other schools. Second, the research design shows some weaknesses. We compared the students in the two learning environments with a one-time measurement, which makes determination of causal relations difficult. Also, students were not randomly assigned to the learning environments. Comprehensive changes in real-life educational settings make random assignment to conditions almost impossible. We recommend that schools regularly monitor their students to enable the evaluation of educational innovations using longitudinal research.

The third limitation concerns external validity (Kazdin 1999). The novelty of the SLEs might influence the enthusiasm of those involved. However, enthusiasm is part of the SLE, as can be inferred from its description. Nonetheless, longitudinal research is necessary to test the stability of the results reported in this study. Furthermore, we question the use of grades as an outcome measure; previous research showed mixed results. Moreover, the tests underlying the grades stem from TLEs and mainly require rote learning, which does not give credit to the knowledge and skills students learn in SLEs. We recommend the development of tests that measure knowledge and skills, both on the level of rote learning and deep-level learning.

Finally, the SLE in this study focused mainly on the role of the learning environment in terms of students' motivation. To shift students' motives for learning from external sources to the individual even further, SLEs should also focus on motivational processes within the person (Slavich and Zimbardo 2012); for example, students' goals (Ford 1992) and motivational strategies (Wolters 2004; Boekaerts and Corno 2005), thereby unlocking students' full potential to become active, self-regulated learners (Bandura 1986, 1994).

In conclusion, although we do not want to trivialise the findings on achievement, being present at school and perceiving school as pleasurable have proved to be important. A more appealing learning environment that supports need fulfilment is highly desirable. An SLE can be such an appealing learning environment.

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