# Differences between students' and teachers' perceptions of education: profiles to describe congruence and friction

Instr Sci (2014) 42:11–30
DOI 10.1007/s11251-013-9294-1

# Differences between students' and teachers' perceptions of education: profiles to describe congruence and friction

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Received: 16 August 2012 / Accepted: 21 September 2013 / Published online: 2 October 2013


**Abstract** Teachers and students have their own perceptions of education. Congruent perceptions contribute to optimal teaching–learning processes and help achieving best learning outcomes. This study investigated patterns in differences between students' and teachers' perceptions of their learning environment. Student profiles were identified taking into account the degree of congruence/friction with teachers' perceptions. Teacher profiles were identified based on their differences in perceptions to students. Profiles were validated with regard to learning-related student characteristics and approaches to teaching. Tenth graders ($N = 994$) of four secondary schools filled out the Inventory of Perceived Study Environment-Extended (IPSEE) and the Inventory of Learning Styles. Their teachers ($N = 136$) filled out the teacher version of the IPSEE and the Approaches to Teaching Inventory. Latent class analyses were conducted to define profiles with respect to the magnitude of differences in perceptions. Results showed three student profiles: Closest match profile (30 %), intermediate profile (59 %), and distal profile (11 %). While closest match students had desirable learning-related characteristics, others did not and are at risk for destructive friction. Two teacher profiles described idealistic teachers (70 %) and adaptive teachers (30 %), which related to approaches to teaching. Subgroups of students and teachers provide a comprehensive picture of those who are at risk because of too large differences in perceptions. This study stresses that differences in perceptions deserve detailed attention for optimising learning environments. Involving both students and

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teachers in the instructional design process could be a way to better account for perceptions of both stakeholders.

**Keywords** Student perceptions · Teacher perceptions · Congruence · Friction · Latent class analyses · Learning environment

## Introduction

According to Elen et al. (2007), students should be encouraged to work independently in an environment that provides proper safeguards and ample support. Van Merriënboer and Kirschner (2012) agreed and argued further that teachers should fulfil roles like challenger, model, diagnostician, monitor and evaluator (see also, Vermunt 2007). The teaching–learning process is more and more a collaborative process among teachers and students. This transactional view of education emphasizes a continuous mutual adaptation of teachers' and students' responsibilities, while both teachers and students—given their distinct roles—are aiming at realizing the same goals (Elen et al. 2007). For an effective collaboration, congruence between the way a learning environment is interpreted by teachers and students is very important (Bargh et al. 1996; Elen and Lowyck 1999; Entwistle and Tait 1990; Norman 1986; Vermunt and Verloop 1999). Therefore, the current study focuses on perceptions of both stakeholder groups in a learning environment. The main aim is to investigate to what extent students' and teachers' perceptions differ. For designing flexible, adaptive learning environments that suit both the needs of students and teachers, it is not enough to compare only mean perception scores of both stakeholder groups. Within the stakeholder group of students, all individuals have different perceptions. The same holds for teachers. They will all have different perceptions and this variability has to be acknowledged. In this study patterns in the differences between students' and teachers' perceptions will be studied. Both for students and for teachers profiles will be defined indicating the degree of congruence/difference with the other stakeholder, enabling the researchers to characterise those sub groups that are at risk for detrimental effects of too large differences.

Teachers and students are the main stakeholders while implementing a learning environment. Both, however, have their own perspectives on how this should be done. Teachers' conceptions about teaching and learning influence the way they implement an instructional design into the real lessons in the classroom (Trigwell et al. 1999). Students have much experience with attending lessons and have developed conceptions about the way in which instruction may help or hinder their learning (Elen and Lowyck 1999). This makes the subjectively experienced environment an important focus of study when trying to optimise learning environments. While having different backgrounds and perceptions, students and teachers work together as different stakeholders within the same environment.

Getting a complete picture of the differences between students' and teachers' perceptions of an environment is important for several reasons. First, differences between perceptions might hamper good fine-tuning of teacher's behaviour with students' behaviour in the learning environment and might have negative consequences for the effectiveness of teaching and learning (Vermetten et al. 2002). For example, if students perceive a high amount of emphasis on the reproduction of knowledge in a non-reproduction-oriented learning environment, this would be an undesirable situation. It is possible that the teacher

gives unintended signals to students that reproduction is a good learning strategy. It could also be that students do not always have an accurate perception of teachers' intentions in the instruction (Broekkamp et al. 2002). For instance, a teacher might have the intention to be clear about learning goals, but if students do not pick up relevant signals from the teacher this will not have the intended effect. Another example is that students perceive little differentiation in a learning environment. All students do the same things: Excellent students do not perform extra assignments and students getting bad marks do not perform extra exercises. It is conceivable that the learning environment gives opportunities for differentiation, but students do not use them and by consequence do not benefit from them. Human factors engineering stresses that the designers' and users' interpretation of any system has to be more or less the same for its optimal functioning and effectiveness (Norman 1986). This suggests that congruence between teachers' and students' perceptions of a learning environment is of central importance for an optimal teaching–learning process. Perceptions are known to trigger corresponding behaviour (Bargh et al. 1996). Students' perceptions of a learning environment influence their learning and study behaviour, and determine the nature and quality of learning processes (Elen and Lowyck 1999; Entwistle and Tait 1990). Teachers' perceptions are related to their teaching behaviour (Roelofs and Terwel 1999). Differences between teachers' and students' perceptions thus imply that their behaviours are likely to be incongruent and not directed at the same goals. This incongruence is also called "friction" (Vermunt and Verloop 1999). Small differences between students' learning strategies and teachers' teaching strategies may represent a challenge for students to increase learning and thinking skills. These "constructive frictions", however, may evolve into "destructive frictions" if the differences are so large that they cause a decrease in students' learning and thinking skills (ibid).

Second, insight in differences in perceptions is important because disharmony between students and their learning environment may affect motivation and well-being. A good fit between person and environment results in positive experiences like higher self-efficacy, more intrinsic interest in learning, and higher task commitment and productivity (Eccles et al. 1993; Renzulli and Dai 2001; Seidel 2006). A causal relation has been found between fit, experienced satisfaction and outcome variables like GPA and class absenteeism (Schmitt et al. 2008). Thus, differences in students' and teachers' perceptions are likely to have negative effects on motivational and affective variables, which subsequently can affect students' performances.

Third, insight in perceptions of different stakeholders triggers adaptation and improvement of education. "Defining the classroom environment in terms of the shared perceptions of the students and teachers had the dual advantage of characterising the seeing through the eyes of the participant themselves and capturing data which the observer could miss or consider unimportant" (Fraser 1998, p. 8). A learning environment is not an objective entity, but is built from the perspectives of teachers and students (Elen et al. 2007). Teachers' perceptions constitute an important component to describe the learning environment (Lee and Tsai 2005). However, as students' perceptions of the environment are not easily predictable for teachers and instructional designers, it is of great value to determine students' perspectives explicitly (Donaldson 1978; Kershner and Pointon 2000). Listening to students and sharing their perspectives can help teachers and designers rethink learning processes and the design of learning environments (Cook-Sather 2003).

Research has shown that teachers and students differ in their perceptions of the same learning environment (see Den Brok et al. 2006, for an overview; Murphy et al. 2011). Teachers tend to perceive a learning environment more favourably than their students do (Fraser 1982; Fraser and O'Brien 1985) and they have little insight in the perspectives of

their students (Doppelt 2004; Watkins 2004). Investigations of differences between students' and teachers' perceptions, however, mostly describe differences between *mean* perception scores of both stakeholders. Although this is interesting information, it gives a oversimplified picture of the situation as all students are considered to have comparable perceptions. The same holds for teachers. Reality is more complex and detailed information is needed about types of students and teachers who are at highest risk to experience large differences with potentially detrimental effects (i.e., destructive friction). We are not aware of any study in which diversity in differences of perception is studied. The dynamic interaction between stakeholders with all different backgrounds has to be acknowledged. The challenge is to do research "on complex but meaningful patterns of commonality among people, not in terms of the average person or effects, but in terms of coherent, distinct, and relatively homogenous subgroups of people" (Feinstein and Peck 2008, p.1).

The current study defined profiles or meaningful patterns of differences between students' and teachers' perceptions from the side of students and teachers, as both their perspectives are driven by different levels of professional knowledge about learning and teaching and different experiences in the classroom. Profiles enabled us to categorise individuals showing similar patterns of differences to the perceptions of the other stakeholder (i.e., teachers or students). Subsequently, subgroups of students and teachers were described according to, respectively, their learning-related characteristics and their conceptions of teaching. Students' perceptions can be seen as the result of the interaction between the student (with his learning-related characteristics) and the learning environment (Luyten et al. 2001). Therefore, learning-related student characteristics were expected to be relevant regarding differences between students' and teachers' perceptions. Five different learning-related student characteristics were described by Vermunt and Vermetten (2004): Cognitive activities that students use to process the content to be learned (i.e., cognitive processing strategies), the way in which students regulate and steer their learning process (i.e., regulation strategies), personal goals or motives students have for learning and going to school (i.e., motivational orientations), students' conceptions about learning, and finally, emotions and affective states that influence students' learning processes (i.e., affective processing strategies). Additionally, teachers' perceptions are known to be related to their approaches to teaching: Teachers reporting a conceptual-change/student-focused approach perceive a more powerful learning environment, while teachers reporting the information-transmission/teacher-focused approach perceive a less powerful environment (Könings et al. 2007a). This makes teaching approach a relevant variable for characterising profiles/subgroups of teachers with respect to their differences to students' perceptions of education. Perceptions of students and teachers were studied with respect to the main components of modern education and powerful learning environments. These components have been shown to be beneficial for student learning: Fascinating contents, productive learning, integration, student autonomy, interactive learning, differentiation, clarity of learning goals, and support by teachers (see De Corte et al. 2003; Könings et al. 2005, for an overview).

The proposed concepts involved in this study are depicted in Fig. 1. Students' and teachers' perceptions will be compared on eight aspects of a learning environment. Profiles will be defined for subgroups of students having the same degree of congruence/friction with teachers' perceptions. Additionally, profiles for teachers will indicate subgroups with comparable differences to students' perceptions. Subsequently, the subgroups are described

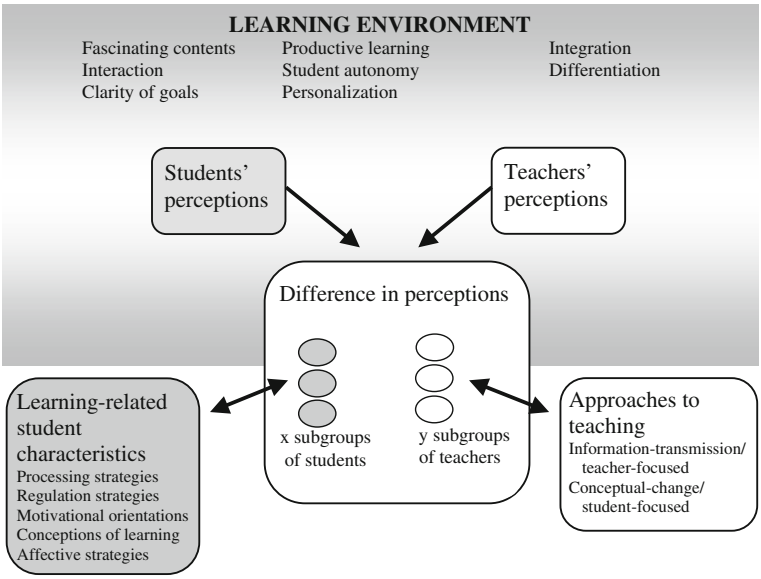


**Fig. 1** Visualisation of the variables involved in the study

in terms of their learning-related student characteristics and teachers' conceptions of teaching. In summary, the current study will answer the following research questions:

1a. Which student profiles can be defined taking into account differences between students' and teachers' perceptions of a learning environment?
1b. Which students are at highest risk for large differences? How can students with different profiles be described with respect to their learning-related characteristics and performances?
2a. Which teacher profiles can be defined taking into account differences between teachers' and students' perceptions from their perspective?
2b. Which teachers are at highest risk for large differences? Do teachers with specific difference profiles differ with regard to their approaches to teaching?

## Method

### Participants

The participants were 994 tenth grade students (mean age = 16.32 years, $SD = .61$) and 136 teachers from four schools for secondary education in the Netherlands. The schools voluntarily participated in this study. The sample of students consisted of 52.4 % girls and 47.6 % boys. The participating teachers (33.1 % female, 66.9 % male) were all teaching 10$^{th}$ grade students. Their mean age was 44.43 years ($SD = 9.71$), having an average of 18.37 years ($SD = 10.20$) of teaching experience. The courses teachers taught were representative of the whole curriculum. Students were not taking courses from all participating teachers at their school and teachers were not necessarily teaching all students in the sample from their school.

## Materials

### *The learning environment*

The context of this study is a nationwide innovation in Dutch secondary education, called the Second Phase. The learning environment requires students to independently acquire skills and knowledge to better prepare them for higher education. Students learn in a self-directed way with possibilities for collaborative learning. There is more room for adaptation to individual differences than in the traditional educational system and teachers have to take these differences into account. The teacher's role is more like a coach and less like an instructor, which creates more possibilities for interaction between students and the teacher. The learning process is not only directed to knowledge acquisition, but also to the selection and processing of the vast amounts of information available today. Furthermore, learning contents are actualized and broadened. In addition, the coherence between knowledge and skills and the application of knowledge in subject-matter domains are emphasized.

### *Inventory of Perceived Study Environment Extended (IPSEE)*

The IPSEE measures students' perceptions of the current learning environment and their preferences for the design of an environment. The IPSEE consists of 67 items. Thirty-one of these items originate from the Inventory of Perceived Study Environment (IPSE; Wierstra et al. 1999). To measure the characteristics of powerful learning environments as described by Könings et al. (2005) more completely, another 36 items were constructed. The items are covering eight internally consistent scales (Cronbach's alpha coefficients ranging from .66 to .85, all but one above .70; see Könings et al. 2008) that are considered as characteristics of powerful learning environments. The scale *fascinating contents* contains items about the extent to which the learning contents are interesting, challenging, and personally relevant for students. The scale *productive learning* indicates little emphasis on the sole reproduction of learning contents. The scale *integration* concerns integration of new knowledge with prior knowledge, different knowledge domains, and knowledge and skills. The scale *student autonomy* measures attention paid to students' self-steering concerning the content of learning, the way of learning, and time planning. The scale *interaction* incorporates collaboration with peers and interaction with the teacher. The scale *differentiation* inquires about opportunities for students to choose and make different tasks, solve problems in different ways, and use different learning materials. The scale *clarity of goals* includes items about the clarity of instructional goals and task demands. The scale *personalization* measures the distance between teachers and students, and the availability of support of teachers.

A sample item of each scale is included in Table 1. All items of the IPSEE contain a description of one of the characteristics of a learning environment and a statement related to its presence. For example:

All students do the same work at the same moment.

This happens ☐ ☐ ☐ ☐ ☐ ☐

Students were asked to which extent statements apply to their classes in the 10th grade in general. Statements are rated on a 6-point scale, ranging from totally disagree (1) to totally agree (6).

**Table 1** Sample items for all scales of the IPSEE

| IPSEE Scale | Number of items | Sample item |
|---|---|---|
| Fascinating contents | 9 | The assignments students have to make clearly relate to topics in everyday life. |
| Productive learning | 5 | The teacher expects the students to get the meaning of the concepts into their mind one by one |
| Integration | 11 | The teacher expects students to connect the various aspects of the subject matter on their own. |
| Student autonomy | 15 | I am given the opportunity to pursue my particular interest in the course. |
| Interaction | 11 | During classes, the subject matter is discussed with the students. |
| Differentiation | 6 | All students solve their assignments in the same way. (reverse coded) |
| Clarity of goals | 4 | Students are informed what to expect of the examination. |
| Personalization | 6 | Students can always rely on the teacher for help. |

*Inventory of perceived study environment extended-teacher version (IPSEE-T)*

This questionnaire is a parallel version of the IPSEE and measures teachers' perceptions with respect to a learning environment. Some of the 67 items are slightly reformulated to reflect the teachers' perspective. For example, the item on student autonomy (Table 1) was changed into "The students are given the opportunity to pursue their particular interests in the course". Internal consistencies of all scales of the IPSEE-T are acceptable (Cronbach's alpha coefficients ranging from .64 to .87, all but two above .70; see Könings et al. 2007a).

*Inventory of learning styles for secondary education (ILS-SE)*

The ILS measures learning-related characteristics of students, based on their usual way of learning. It was originally developed to measure higher education students' learning styles (Vermunt 1992) and was adapted for secondary education by Vermunt et al. (2003). The ILS-SE consists of 100 items, divided in five clusters and each contains several scales (within brackets): (1) Processing strategies, indicating the cognitive activities students use to process learning contents (deep processing, 12 items; stepwise processing, 8 items), (2) Regulation strategies, reflecting the way students regulate their own learning process (self-regulation, 8 items; external regulation, 6 items; lack of regulation, 4 items), (3) Motivational orientations, indicating the personal goals or motives students have for learning and going to school (intrinsic motivation, 4 items; certificate oriented, 5 items; vocation oriented, 4 items; ambivalent, 5 items), (4) Conceptions of learning, or students' mental models about learning (construction and use of knowledge, 8 items; intake of knowledge, 4 items; cooperative learning, 3 items; stimulating education, 5 items), and (5) Affective processing strategies, indication emotional aspects of learning (motivation/concentration problems, 7 itesm; fear of failure, 8 items; keeping a good state of mind, 8 items). For each item, students rate the degree to which a statement corresponds to their own learning on a 5-point scale.

*Student performances*

The marks students obtained on their school reports were available from school administrations. These were the marks students received in all classes they were taking in the 10th grade. An average score was computed of marks on the report students got in April, as this was also the moment they filled out the questionnaires. Scores range from 10 (i.e., very bad) to 100 (i.e., excellent).

*Approaches to teaching inventory (ATI)*

The ATI (Prosser and Trigwell 1997) aims to measure teaching approaches. The questionnaire contains two scales: Information-transmission/teacher-focused (ITTF, 5 items) and conceptual-change/student-focused (CCSF, 6 items), representing the extreme teaching approaches on a scientifically well known continuum of approaches between a teacher-centered/content-oriented pole and a student-centered/learning-oriented pole (see Kember 1997; Prosser and Trigwell 1993). The ATI has been translated in Dutch and scales were sufficiently reliable ($\alpha_{ITTF} = .66$, $\alpha_{CCSF} = .72$; Könings et al. 2007a). Items are rated on a 6-point scale, ranging from totally disagree to totally agree.

## Procedure

The students filled out the IPSEE and the ILS-SE during regular school hours. Preceding the completion of the questionnaires, the experimenter gave oral information about its goal and contents. It was explained to students that they were expected to report on their general perceptions and learning strategies in the 10th grade. They were asked not to think about specific classes, but to give an overall impression. The IPSEE took 30–40 min to complete. The completion of the ILS-SE lasted 20–30 min. Because data collection took place during regular school hours, the response rate was very high (almost 100 %, i.e., all students that were present in a particular classroom at the time of data collection).

All teachers who were teaching 10th graders received a written invitation, accompanied by the IPSEE-T and the ATI, to take part in the study. The first page of the questionnaire contained a description of the aim and the contents of the questionnaire, and instructions for scoring the items. In total 136 of the 213 teachers returned the questionnaires (i.e., 63.8 %).

## Data analysis

Difference scores were computed on each IPSEE scale, both for students and teachers. For each student, the difference was computed between his or her perception score on a scale and the mean score of the teachers at the same school on the corresponding scale. For each teacher, the difference was computed between his or her perception score on a scale and the mean score of the students at the same school on the corresponding scale. The former differences will be called ‘student differences’, and the latter are ‘teacher differences’.

Using Latent Class Analysis (LCA) we were able to define student profiles with respect to student differences. In the same way, profiles in the teacher differences were defined. LCA was performed by using the software WINMIRA (Von Davier 1999). Based on BIC and CAIC indices the best fitting solution was selected, representing the optimal number of

profiles to be used, both for student differences and teacher differences. Using ANOVAs, it was investigated (1) whether students' learning-related characteristics and performances were different for students with these defined profiles, and (2) whether teachers' approaches to teaching, their age, and the number of years of teaching experience differed between profiles on teacher differences.

## Results

Table 2 presents the means and standard deviations of students' and teachers' perception scores and the student difference scores as well as the teacher difference scores. Results are described separately for student and teacher data.

### Student differences: identification of latent class analysis profiles

Table 3 provides the results of the LCA solutions using 1–10 profiles for describing the data about student differences. The match between model and data was judged by the BIC and CAIC indices (Rost 2004). BIC and CAIC compare the function of likelihood (Log *L*) of the data with the sample size (*N*) and the number of parameters to be estimated (*k*). Empirical distributions were generated using the bootstrapping method. The estimated parameters served as a basis for the re-simulated data sets. All solutions with three or more classes showed fits larger than zero. For all these solutions, it can be assumed that the observed data and the model match (Von Davier 1999). In the next step, the BIC and CAIC indices of the solutions were compared. The solution with three latent classes showed the lowest BIC and CAIC indices and, therefore, fits the data best (see Table 3, printed in bold). Additionally, the probability of expected profile membership was satisfactory (respectively, .87, .92, and .87) which supports the choice for a three-class solution for further analyses.

Figure 2 presents the statistically expected scores for students in the three LCA profiles. These three student profiles vary in the degree to which student perceptions differ from teacher perceptions. As can be seen from the Figure almost all student difference scores were negative, indicating that students predominantly perceived the learning environment as less positive than teachers did. The first profile represented 29.6 % of students

**Table 2** Means and standard deviations of students' and teachers' perception scores, and student difference scores, as well as teacher difference scores

| | Teachers | | Students | | Student difference | | Teacher difference | |
|---|---|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Fascinating contents | 4.08 | .62 | 3.10 | .86 | −.97 | .86 | .99 | .61 |
| Productive learning | 3.77 | .92 | 2.91 | 1.02 | −.84 | .97 | .86 | .89 |
| Integration | 4.45 | .60 | 3.75 | .69 | −.68 | .69 | .69 | .59 |
| Student autonomy | 3.31 | .71 | 3.31 | .71 | .03 | .75 | .01 | .72 |
| Interaction | 4.09 | .57 | 3.71 | .65 | −.35 | .67 | .39 | .58 |
| Differentiation | 3.28 | .86 | 3.13 | .76 | −.12 | .76 | .14 | .85 |
| Clarity of goals | 5.24 | .54 | 3.85 | .96 | −1.39 | .96 | 1.40 | .55 |
| Personalisation | 5.11 | .47 | 3.96 | .85 | −1.13 | .86 | 1.16 | .50 |

**Table 3** Indices for 1–10 LCA solutions, with eight scales with respect to student differences

| Class | Log $L$ | $k$ | BIC | CAIC | Cressie-read $p_{emp.}$ | Pearson $p_{emp.}$ |
|---|---|---|---|---|---|---|
| 1 | −5,189.33 | 24 | 10,542.52 | 10,566.52 | .000 | .000 |
| 2 | −4,792.46 | 49 | 9,919.47 | 9,968.47 | .000 | .003 |
| **3** | **−4,643.64** | **74** | **9,792.51** | **9,866.51** | **.013** | **.028** |
| 4 | −4,604.79 | 99 | 9,885.52 | 9,984.52 | .008 | .028 |
| 5 | −4,582.31 | 124 | 10,011.24 | 10,135.24 | .048 | .083 |
| 6 | −4,565.80 | 149 | 10,148.92 | 10,297.92 | .018 | .030 |
| 7 | −4,546.94 | 174 | 10,281.89 | 10,455.89 | .008 | .018 |
| 8 | −4,532.51 | 199 | 10,423.72 | 10,622.72 | .048 | .065 |
| 9 | −4,530.25 | 224 | 10,589.90 | 10,813.90 | .020 | .048 |
| 10 | −4,523.93 | 249 | 10,747.94 | 10,996.94 | .003 | .005 |

($N = 273$). Students in this '*closest match profile*' showed smaller student difference scores than the other profiles. Inspection of the Figure showed that on three scales there was an almost perfect match with teacher perceptions (on fascinating contents, integration, and differentiation). They perceived the environment more negative than teachers on scales productive learning, clarity of goals, and personalization, but student perceptions on student autonomy and interaction were even higher than those of the teachers. So, the closest match profile is the profile with the smallest differences between students' and teachers' perceptions.

The second profile represents the largest group of students: 59.0 % of the students ($N = 545$). This profile is called the '*intermediate profile*', since the students difference scores were lower than in the closest match profile, but higher than in the third profile. On the scales student autonomy and differentiation students' perceptions were (almost) fully in line with teachers' perceptions. On all other scales, students had more negative perceptions than teachers. Overall, Fig. 2 shows that student difference scores of the intermediate profile were lower than the closest match profile, indicating less congruence between students' and teachers' perceptions.

The third profile represents students with the largest discrepancy to teachers' perceptions. This '*distal profile*' represented 11.4 % of students ($N = 105$). Of all profiles, the students in the distal profile had the largest student difference scores: They perceived the learning environment much more negatively in comparison to their teachers (on all scales, except differentiation).

## Characteristics of students in the different profiles

Analyses of variance were conducted to determine the differences in learning-related characteristics (measured with the ILS-SE) and the marks students received in their classes between students with the defined profiles (for descriptives see "Appendix"). Effect sizes in terms of Cohen's $d$ of .2 to .3 are considered small effects, around .5 as medium effects and larger than .8 as large effects (Cohen 1988). Figure 3 presents an overview of the most important differences between the characteristics of the profiles, by summarizing the results of the post hoc analyses with an effect size $\geq$ .40. As can be seen from the Figure substantial differences were found the learning-related student characteristics of closest

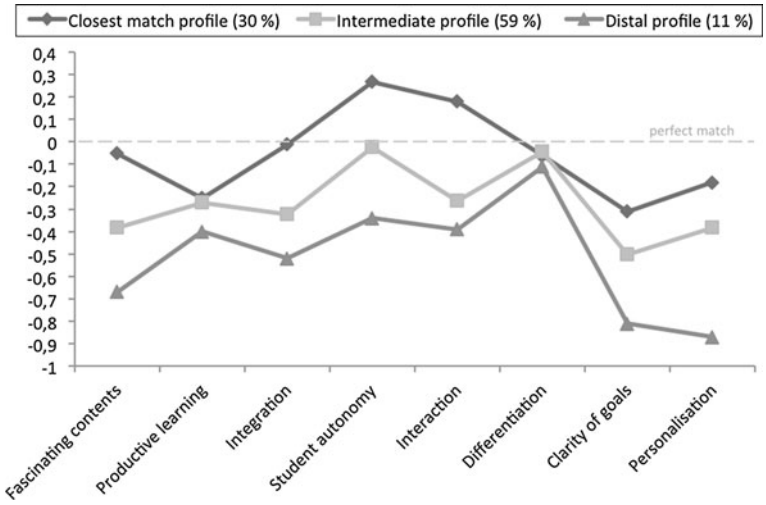


**Fig. 2** LCA profiles for student difference scores. Statistically expected student scores for the difference between own perceptions and teachers' perceptions, with respect to the presence of fascinating contents, productive learning, integration, student autonomy, interaction, differentiation, clarity of goals, and personalisation in the learning environment

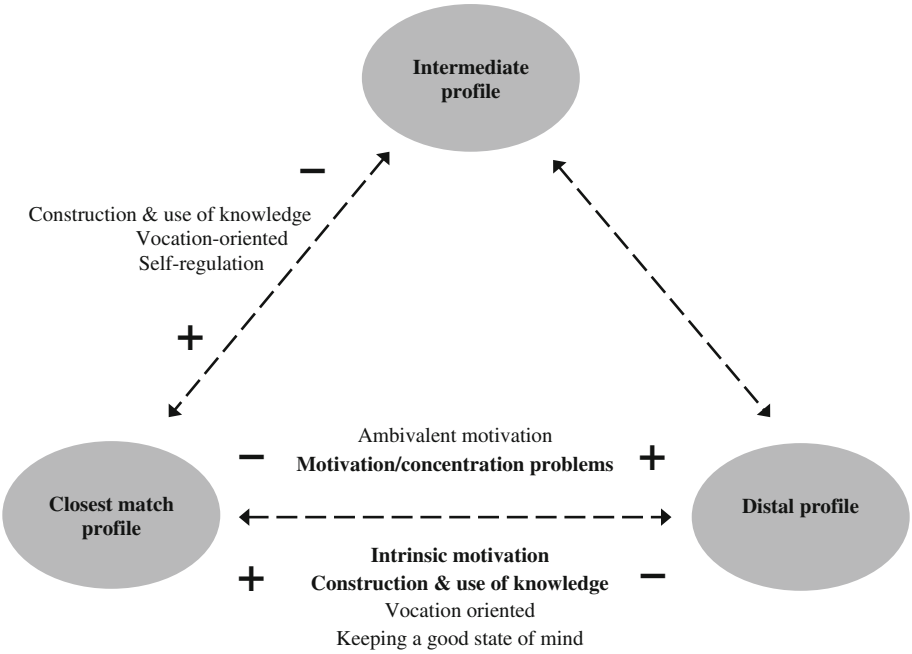


**Fig. 3** Visualisation of the main differences between student profiles. Note that for student characteristics printed in bold the effect size was > .60

match students and distal students, and between closest match students and intermediate students. There were no medium or large sized differences between the learning-related characteristics of intermediate students and distal students.

A complete overview of all significant differences between the three profiles is provided below. For all analyses of variance $df = 2$. Also, the results of post hoc analyses are described in the text; Statistics of these analyses are presented in Table 4.

*Closest match profile compared to intermediate profile*

Students with the closest match profile reported more use of deep processing strategies ($F = 12.63$, $p < .01$) and also more stepwise processing ($F = 12.72$, $p < .01$) than students with intermediate profile. On regulation scales, they reported more use of self-regulation strategies ($F = 14.81$, $p < .01$) than intermediate students. Additionally, they used more external regulation strategies ($F = 9.64$, $p < .01$) than intermediate students. With respect to motivational orientation, closest match students were more vocation oriented ($F = 17.59$, $p < .01$) than intermediate students. Closest match students were more

**Table 4** Results of ANOVA's with post hoc analyses on student difference scores, comparing students' performances and scores on the ILS-SE between the different profiles

| | F | Closest match compared to intermediate | | | Distal compared to intermediate | | | Closest match compared to distal | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Δ | *SD* | *d* | Δ | *SD* | *d* | Δ | *SD* | *d* |
| Performances | 4.93** | 0.06 | 0.45 | | −1.97** | 0.65 | 0.33 | 2.04** | 0.70 | 0.33 |
| Deep processing | 12.63** | 0.22** | 0.05 | 0.37 | 0.00 | 0.07 | | 0.22** | 0.07 | 0.35 |
| Stepwise processing | 12.72** | 0.26** | 0.05 | 0.38 | 0.14 | 0.08 | | 0.12 | 0.08 | |
| Self-regulation | 14.81** | 0.24** | 0.04 | 0.40 | 0.04 | 0.06 | | 0.20** | 0.07 | 0.29 |
| External regulation | 9.64** | 0.20** | 0.05 | 0.33 | −0.01 | 0.07 | | 0.21* | 0.07 | 0.30 |
| Lack of regulation | 5.85** | −0.12 | 0.06 | | 0.20 | 0.09 | | −0.33** | 0.10 | 0.37 |
| Vocation oriented | 17.59** | 0.32** | 0.06 | 0.44 | −0.04 | 0.08 | | 0.36** | 0.09 | 0.44 |
| Ambivalent | 12.31** | −0.16** | 0.06 | 0.22 | 0.26** | 0.08 | 0.31 | −0.42** | 0.09 | 0.51 |
| Intrinsic motivation | 24.21** | 0.26** | 0.05 | 0.39 | −0.24** | 0.07 | 0.32 | 0.50** | 0.08 | 0.68 |
| Certificate oriented | 5.81** | 0.11* | 0.04 | 0.20 | 0.16* | 0.06 | 0.30 | −0.05 | 0.06 | |
| Construction and use of knowledge | 24.48** | 0.27** | 0.05 | 0.49 | −0.14 | 0.07 | | 0.41** | 0.07 | 0.62 |
| Stimulating education | 1.06 | −0.07 | 0.06 | | −0.08 | 0.08 | | 0.01 | 0.09 | |
| Intake of knowledge | .53 | 0.06 | 0.06 | | 0.02 | 0.08 | | 0.04 | 0.09 | |
| Cooperative learning | 7.67** | 0.24** | 0.06 | 0.31 | 0.02 | 0.09 | | 0.22 | 0.10 | |
| Motivation/ concentration problems | 18.57** | −0.33** | 0.07 | 0.37 | 0.24* | 0.10 | 0.25 | −0.57** | 0.10 | 0.61 |
| Fear of failure | 3.41* | −0.03 | 0.05 | | 0.17 | 0.07 | | −0.20* | 0.08 | 0.28 |
| Keeping a good state of mind | 12.10** | 0.23** | 0.05 | 0.35 | −0.05 | 0.07 | | 0.27** | 0.08 | 0.40 |

$df = 2$. * $p < .05$. ** $p < .01$. Effect sizes are only included for significant effects

intrinsically motivated ($F = 24.21$, $p < .01$) and more certificate oriented ($F = 5.81$, $p < .05$) than students with the intermediate profile. They were *less* ambivalently motivated ($F = 12.13$, $p < .01$) than students with the intermediate profile. Students with the closest match profile conceived learning more as construction and use of knowledge ($F = 24.48$, $p < .01$) and as a cooperative activity ($F = 7.67$, $p < .01$) than intermediate students. Finally, on affective learning strategies it showed that closest match students experienced *less* motivation/concentration problems ($F = 18.57$, $p < .01$) and better strategies to keep a good state of mind ($F = 12.01$, $p < .01$) than intermediate students.

*Distal profile compared to intermediate profile*

Students with the distal profile received lower marks in their classes ($F = 4.93$, $p < .01$) than students with the intermediate profile. Additionally, they were more often ambivalently motivated ($F = 12.13$, $p < .01$) and less intrinsically motivated ($F = 24.21$, $p < .01$) than intermediate students. They were more certificate oriented ($F = 5.81$, $p < .05$) than intermediate students. Finally, they reported more motivation/concentration problems ($F = 18.57$, $p < .05$) than intermediate students.

*Closest match profile compared to distal profile*

Students with the closest match profile received higher marks in their classes ($F = 4.93$, $p < .01$) than students with the distal profile. They reported more use of deep processing strategies ($F = 12.63$, $p < .01$) than students with the distal profile. On regulation scales, they reported more use of self-regulation strategies ($F = 14.81$, $p < .01$) as well as more external regulation strategies ($F = 9.64$, $p < .05$) than distal students. They reported *less* lack of regulation ($F = 5.85$, $p < .01$) than distal students. With respect to motivational orientation, closest match students were more vocation oriented ($F = 17.59$, $p < .01$) and more intrinsically motivated ($F = 24.21$, $p < .01$) than distal students. Additionally, they were *less* ambivalently motivated ($F = 12.13$, $p < .01$) than students with the distal profiles. Students with the closest match profile conceived learning more as construction and use of knowledge ($F = 24.48$, $p < .01$) than distal students. Finally, on affective learning strategies it showed that closest match students experienced *less* motivation/concentration problems ($F = 18.57$, $p < .01$) than distal students. They displayed *less* fear of failure ($F = 3.41$, $p < .05$) and had better strategies to keep a good state of mind ($F = 12.01$, $p < .01$) compared to distal students.

Teacher differences: identification of latent class analysis profiles

Table 5 provides the results of the LCA solutions using 1–10 profiles for describing the data about teacher differences. All solutions showed fits larger than zero, indicating that the observed data and the model match (Von Davier 1999). The solution with two classes showed the lowest BIC and CAIC indices and, therefore, fits the data best (see Table 5, printed in bold). Additionally, the probability of expected profile membership was good (.90 for profile 1; .94 for profile 2). Thus, the two-class solution was chosen for further analyses.

Figure 4 presents the statistically expected scores for teachers in the two LCA profiles. These two teacher profiles vary in the difference between teachers' and students' perceptions regarding several aspects of the learning environment. The first profile represented 70 % of the teachers ($N = 72$). Teachers with this rather *'idealistic profile'* perceived the learning environment as more positive than students on all scales: They perceived the

learning contents as more fascinating than students did, they perceived more emphasis on productive learning, more integration, more room for student autonomy, more interaction during learning, more differentiation, higher clarity of learning goals, and more teacher support (i.e., personalisation).

The *'adaptive profile'* represented 30 % of the teachers ($N = 31$). This group showed a probability pattern of mixed differences with students' perceptions: On five scales teacher perceptions were higher than students' perceptions (on fascinating contents, productive learning, integration, clarity of goals, and personalisation) and on three other scales their perceptions were lower than students' perceptions (on student autonomy, interaction, and differentiation). Inspecting Fig. 4 shows that it seemed that the discrepancy between teachers' and students' perceptions (i.e., difference per scale to 0-axis in Fig. 4) was

**Table 5** Indices for 1–10 LCA solutions, with eight scales with respect to teacher differences

| Class | Log $L$ | $k$ | BIC | CAIC | Cressie-read $p_{emp.}$ | Pearson $p_{emp.}$ |
|---|---|---|---|---|---|---|
| 1 | −331.91 | 8 | 700.90 | 708.90 | .008 | .020 |
| **2** | **−306.13** | **17** | **691.06** | **708.06** | **.130** | **.210** |
| 3 | −295.50 | 26 | 711.50 | 737.50 | .133 | .158 |
| 4 | −290.29 | 35 | 742.81 | 777.81 | .338 | .343 |
| 5 | −286.55 | 44 | 777.02 | 821.02 | .098 | .100 |
| 6 | −285.36 | 53 | 816.37 | 869.37 | .068 | .078 |
| 7 | −281.26 | 62 | 849.88 | 911.88 | .343 | .345 |
| 8 | −284.57 | 71 | 898.21 | 969.21 | .068 | .075 |
| 9 | −279.20 | 80 | 929.18 | 1,009.18 | .188 | .178 |
| 10 | −280.21 | 89 | 972.91 | 1,061.91 | .088 | .085 |

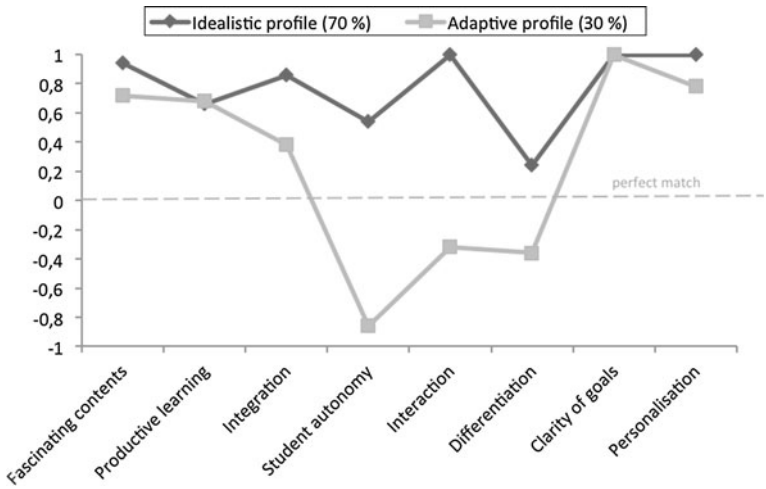


**Fig. 4** LCA profiles for teacher difference scores. Statistically expected teacher scores for the difference between own perceptions and students' perceptions

**Table 6** Results of *t*-tests on teacher difference scores, comparing teachers' approaches to teaching, age and years of teaching experience

| | *T* | *df* | *d* | Idealistic | | Adaptive | |
|---|---|---|---|---|---|---|---|
| | | | | *M* | *SD* | *M* | *SD* |
| Information transmission | −2.31* | 100 | 0.53 | 4.09 | 0.73 | 4.45 | 0.63 |
| Conceptual change | 3.23** | 98 | 0.69 | 4.03 | 0.70 | 3.54 | 0.72 |
| Age (in years) | −0.13 | 95 | 0.03 | 44.61 | 9.41 | 44.89 | 9.75 |
| Years of experience | −0.70 | 95 | 0.16 | 18.47 | 10.39 | 20.03 | 9.20 |

* $p < .05$. ** $p < .01$

smaller for teachers with the adaptive profile than the idealistic profile. Indeed, unpaired *t*-tests confirmed that differences were smaller for teachers in the adaptive profile than in the idealistic profile on four scales: Fascinating contents, integration, interaction, and personalisation ($p < .05$ for all test). So, teachers with the adaptive profile overall were more in congruence with their students' perceptions.

### Characteristics of teachers in the two profiles

T-tests were conducted to investigate the differences in approaches to teaching between teachers with the idealistic profile and the adaptive profile. Additionally, possible differences in age and years of teaching experiences were explored. The results are presented in Table 6 and show that teachers with the idealistic profile had lower scores on information transmission than teachers with an adaptive profile. Teachers with the idealistic profile, additionally, had higher scores on conceptual change than teachers with an adaptive profile. There were no differences with respect to age or years of experience between teachers in both profiles.

## Conclusions and discussion

This study investigated the differences between students' and teachers' perceptions of a learning environment. More specifically, profiles were identified of students who share the same degree of congruence/friction with teachers' perceptions. Additionally, teacher profiles were identified based on their differences in perceptions to students. Profiles have been validated by learning-related student characteristics and approaches to teaching.

The majority of the students experience substantial differences to their teachers' perceptions. Three student profiles are described, varying from a closest match profile, having most shared perceptions with their teachers, to a distal profile with least shared perceptions and highest risk to experience destructive friction. Learning-related characteristics of the rather small group of students with the distal profile (11 %) show negative correlates of large differences in perceptions between students and teachers: Students report much more motivational and affective problems, have less constructivistic conceptions of learning, and additionally perform worse, compared to the closest match profile. The intermediate profile contains the largest group of students (59 %). Their learning-related characteristics do not substantially differ from those of the distal profile, indicating that differences in perceptions for intermediate students are also linked to the above-mentioned undesirable learning-related characteristics. From the five categories (Vermunt and Vermetten 2004) of

learning-related student characteristics, motivational orientation, affective processing strategies, and conceptions of learning are particularly related to differences in perceptions, which supports and extents earlier reported relations with perceptions from solely the student perspective.

Two teacher profiles are identified. Teachers with the idealistic profile have much more positive perceptions than do students and they report a conceptual change-approach to teaching. In the adaptive profile, teachers have perceptions that are more close to students' perceptions and report an information transmission-approach to teaching. Differences in perceptions clearly relate to approaches to teaching, which also adds to earlier findings about relations with teachers' perceptions.

This newly acquired knowledge about profiles in differences of students' and teachers' perceptions creates a more detailed picture of those students and teachers who experience constructive friction or might be at risk for destructive friction. The findings of our study are summarized in Fig. 5 with regard to possible interpretations. Distal students may be more likely to experience friction when taught by idealistic teachers than by adaptive teachers. As both distal students and idealistic teachers have highest differences in perceptions and conflicting learning/teaching-related characteristics, risk on destructive friction is high. Differences with adaptive teachers are lower, increasing the likelihood for constructive friction. The intermediate students are likely to be an in-between group with respect to congruence/friction as well, but with a serious risk for destructive friction with idealistic teachers, as they share many learning-related characteristics with distal students. Closest match students, however, are likely to experience constructive friction with the idealistic teachers. With their constructive and highly motivated learning-related characteristics they might not feel constructively stimulated by adaptive teachers, who mostly have an information-transmission/teacher-focused teaching approach. The new term 'destructive congruence' is introduced here, as perception differences between these students and teachers seem too small for a challenging, productive collaboration in the learning environment. This finding expands the original theory on constructive and destructive friction by Vermunt and Verloop (1999). How small these difference have to be in order to cause destructive congruence instead of constructive friction, has to be determined in future research.

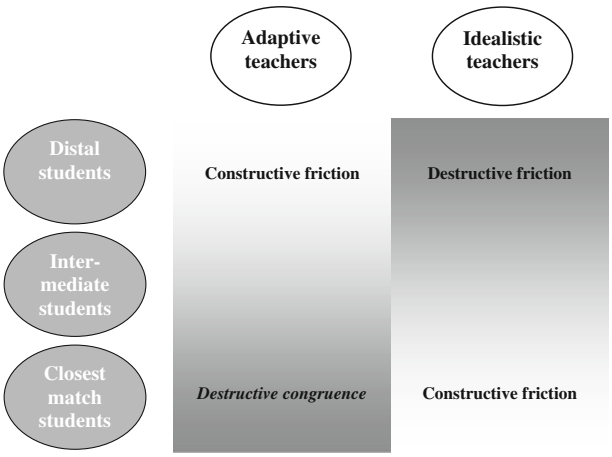


**Fig. 5** Congruence and Friction between Student and Teacher Profiles: Summary of Results

The relevance of the differences between students' and teachers' perceptions for their combined functioning in a learning environment is stressed by these findings. Theoretically, this study implies that studying global differences in more detail by identifying homogenous subgroups is of high added value (cf. Shavelson and Seidel 2006). It provides deeper understanding of existing discrepancies between perceptions of stakeholders, as profiles are well interpretable, also in the light of students' learning-related characteristics and teachers' approaches to teaching. Subgroups that are at risk with respect to effectiveness of the learning environment or may experience negative consequences on motivation or well-being can be better identified now. They can be subject of further theoretical studies and/or trigger practical improvements or adaptations in the environment.

Practically, this study has several implications. First, it stresses the importance of immersion in the students' perspective by asking for their perceptions and comparing them to teachers' perceptions in order to prevent losing students during their school careers. This seems even more important when implementing educational innovations. Second, perception differences can function as an indicator for the effectiveness of (the implementation) of a learning environment, as there is a strong relation between student perceptions and their behaviour. This can stimulate reflection on educational practices at school level, but also by individual teachers. It gives insight in bottlenecks and opportunities for improvement. Focusing on differences between stakeholders can also promote innovation of education by using all available experiences and joining them into a shared initiative (i.e., participatory instructional design) to improve the design of a learning environment. Finally, identifying profiles of differences in perception enables teachers to better identify students who might be at risk for destructive congruence or destructive friction. They can adapt their instruction, for example by making explicit their teaching strategies, explaining to students how they promote learning and why they are relevant, differentiating their teaching for different groups of students or improving meta-cognitive skills of students.

The current study investigated general perceptions of the learning environment. It was impossible to directly match students and their teachers. This fits the goal of the current study, but can be a limitation if one wants to draw conclusions at class level. If students could be directly linked to their teachers, it would also be possible to account for the nested nature of the data. Another limitation is that the identified relations between perception differences and learning-related student characteristics and approaches to teaching do not allow any conclusions about direction of causality. Future research is needed to find out whether adapting a learning environment to decrease differences between students' and teachers' perceptions leads to improvements of the effectiveness of the environment, motivation, and well-being. Participatory design by teachers and students could be an appropriate approach to account for perceptions of both stakeholders (Könings et al. 2007b).

To conclude, this study underlined the importance of both students' and teachers' perceptions of education. The identified subgroups of students and teachers provide a more comprehensive picture of differences between stakeholders, which are only studied in terms of group means until now. By means of the identified profile both for students and teachers important interpretations with regard to congruence and frictions in classroom teaching and learning could be drawn. Thereby, a special educational challenge is seen to prevent destructive friction between idealistic teachers and distal students, but also preventing destructive congruence between adaptive teachers and closest match students.

## Appendix

See Table 7.

**Table 7** Means and Standard Deviations of Students' Learning-Related Characteristics and Marks Received in Their Classes, Separately for the Different Profiles

| | Closest match profile | | Intermediate profile | | Distal profile | |
|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Performances: Marks | 65.99 | 6.46 | 65.92 | 5.82 | 63.95 | 6.00 |
| Deep processing | 2.53 | .64 | 2.30 | .59 | 2.31 | .63 |
| Stepwise processing | 3.01 | .70 | 2.75 | .68 | 2.89 | .77 |
| Self-regulation | 2.45 | .65 | 2.21 | .55 | 2.26 | .66 |
| External regulation | 3.27 | .59 | 3.07 | .62 | 3.07 | .75 |
| Lack of regulation | 2.24 | .84 | 2.36 | .81 | 2.57 | .92 |
| Vocation oriented | 3.99 | .68 | 3.67 | .77 | 3.63 | .94 |
| Ambivalent | 1.96 | .71 | 2.12 | .73 | 2.38 | .92 |
| Intrinsic motivation | 2.86 | .65 | 2.60 | .67 | 2.37 | .78 |
| Certificate oriented | 4.09 | .51 | 3.98 | .58 | 4.15 | .55 |
| Construction and use of knowledge | 3.54 | .54 | 3.26 | .61 | 3.13 | .76 |
| Stimulating education | 2.86 | .73 | 2.93 | .74 | 2.85 | .91 |
| Intake of knowledge | 3.45 | .73 | 3.39 | .75 | 3.41 | .89 |
| Cooperative learning | 3.42 | .76 | 3.17 | .86 | 3.20 | 1.01 |
| Motivation/concentration problems | 2.25 | .82 | 2.57 | .91 | 2.82 | 1.05 |
| Fear of failure | 1.79 | .68 | 1.82 | .65 | 1.99 | .77 |
| Keeping a good state of mind | 3.21 | .67 | 2.98 | .65 | 2.94 | .68 |

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