Students' effort allocation to their perceived strengths and weaknesses

Hiemstra, Djoerd; Van Yperen, Nico W.; Timmerman, Marieke E.

Published in:
Learning and Instruction

DOI:
10.1016/j.learninstruc.2018.01.003

Learning and Instruction 60 (2019) 180–190

Contents lists available at ScienceDirect

Learning and Instruction

journal homepage: www.elsevier.com/locate/learninstruc

Students’ effort allocation to their perceived strengths and weaknesses: The moderating effect of instructional strategy

Djoerd Hiemstra*, Nico W. Van Yperen, Marieke E. Timmerman

University of Groningen, Department of Psychology, The Netherlands

ARTICLE INFO

Keywords:
Strengths
Self-directed learning
Testing
Effort allocation
Multiple tasks and subjects

ABSTRACT

To become competent professionals, students should work on both their strengths and weaknesses. Considering students' limited amount of time and energy to work on multiple subjects, it is important to know what determines their allocation of effort to their perceived relative strengths or weaknesses. In a series of five studies, we examined the moderating effect of instructional strategy (i.e., self-directed versus test-directed) on the within-person relation between perceived relative strength (i.e., strengths versus weaknesses) and allocated effort across multiple subjects. We used different methodologies (scenario, field, and experimental studies), research designs (within-person and mixed factorial), populations (secondary school, college, and university students), and measures of effort (intentions, self-reported, and behavioral). The results consistently indicate that students in a self-directed instructional strategy condition tend to allocate more effort to their relative strengths, whereas students in a test-directed instructional strategy condition tend to allocate more effort to their relative weaknesses.

1. Introduction

To become competent professionals who are attractive on the competitive job market, students should work on both their strengths and weaknesses. By definition, students are no experts: typically, there is ample room for improvement, both in the subjects they believe they are relatively good at (i.e., their perceived relative strengths) and in those they believe they are relatively not good at (i.e., their perceived relative weaknesses). On the one hand, improving weaknesses is indispensable for mastering a profession. Students need to diminish the gap between their present level of competency and the prevailing standard for a particular profession or degree. On the other hand, further improving their strengths enables students to excel in specific subjects, which may be a valuable asset for their future careers (Hiemstra & Van Yperen, 2015).

To guide students in their competence development, it is important for educators to know what determines students' effort allocation to their perceived relative strengths and weaknesses. Effort is key for developing competence (Ericsson & Lehmann, 1996; Ericsson, Krampe, & Tesch-Römer, 1993). Therefore, students’ effort allocation to their perceived relative strengths and weaknesses amply determines how their competence evolves in the course of their education: which subjects they will be good and less good at and whether they will be more specialists or generalists by the time they graduate.

Unfortunately, the extant literature is incomprehensive on the role of perceived relative strengths and weaknesses in allocated effort. In achievement settings, both working on perceived strengths and working on perceived weaknesses can be motivating. On the one hand, perceiving a subject as a strength may foster individuals’ expectations and encourage them to set their standards even higher (Atkinson, 1964; Bandura, 1997; Ryan & Deci, 2000; Weiner, 1974). On the other hand, perceiving a subject as a weakness may signal that more effort is needed to achieve a certain goal, such as passing an exam (Carver & Schreier, 1981; Dunlosky & Ariel, 2011; Son & Metcalfe, 2000; Vancouver, More, & Yoder, 2008). Hence, we do not know under which conditions students who have a limited amount of time and energy to work on multiple tasks or subjects tend to allocate more effort to their strengths or their weaknesses.

1.1. Perceived relative strength

Perceived relative strengths and weaknesses are competence self-perceptions that result from dimensional within-person comparisons (Möller & Marsh, 2013). Dimensional comparison entails that individuals use their competence in one dimension (e.g., spelling) as a reference for judging their competence in another dimension (e.g., calculating). Although individuals' self-evaluations are typically based on social comparison information (Klein, 1997; Van Yperen & Leander,

* Corresponding author. University of Groningen, Department of Psychology, Grote Kruisstraat 2/1, 9712 TS Groningen, The Netherlands.
E-mail addresses: d.hiemstra@nhl.nl (D. Hiemstra), n.van.yperen@rug.nl (N.W. Van Yperen), m.e.timmerman@rug.nl (M.E. Timmerman).

https://doi.org/10.1016/j.learninstruc.2018.01.003
Received 24 January 2017; Received in revised form 4 December 2017; Accepted 8 January 2018
Available online 13 February 2018
0959-4752/

2014; Wheeler & Miyake, 1992; White, Langer, Yariv, & Welch, 2006), research shows that students engage in dimensional comparisons as well. For example, in a diary study among 67 university students, a total of 436 dimensional comparisons (M = 6.51) over a 14-day period was reported (Möller & Husemann, 2006). It is likely that these self-perceptions of intra-personal strengths and weaknesses affect students' learning behavior. Education is typically a multiple-tasks context, in which students work on different subjects during the same period of time. When attending lectures, following classes, doing homework, or preparing for tests, multiple subjects place competing demands on students' limited time and energy. To regulate their effort allocation, students may apply a range of strategies, including attending or skipping lectures, paying more or less attention in class, working more or less concentratedly on their homework, or spending more or less time on preparing for their tests. In such a multiple-tasks context, self-perceptions of strengths and weaknesses are likely to guide students' allocation of effort across different subjects.

1.2. Perceived relative strength and allocated effort

Students who believe they are good at a school subject tend to be more willing to put effort into that subject than students who believe they are less good at that subject. That is, at the between-person level, self-perceived competence is typically positively related to effort (e.g., Bandura & Locke, 2003; Latham & Pinder, 2005; Multon, Brown, & Lent, 1991; Sadri & Robertson, 1993). However, at the within-person level, both positive and negative relations between competence self-perceptions and effort have been observed. For example, in a study in which participants engaged in a series of trials in a stock investment simulation, a positive within-person relation between self-efficacy and allocated effort was found (Seo & Ilies, 2009). In contrast, in a study on the relationship between students' self-efficacy and effort across a series of tests over an introductory course, a negative within-person relation was observed (Vancouver & Kendall, 2006). Furthermore, in a study in which participants' self-efficacy and effort allocation were assessed across successive trials of a board-hitting game, Vancouver et al. (2008) found both positive and negative within-person relations between self-efficacy and allocated effort, depending on the level of task difficulty. Similarly, across a series of anagram tasks, both positive and negative within-person relations between self-efficacy and allocated effort were found, depending on the level of performance ambiguity of the task (Schmidt & DeShon, 2010).

These findings indicate that, at the within-person level, both positive and negative within-person relations between competence self-perceptions and allocated effort exist. However, a shared characteristic of these studies is the reliance on *temporal* within-person designs. That is, participants' competence self-perceptions and allocated effort were assessed on a *single task* across *multiple occasions* (i.e., a series of subsequent occasions). In contrast, educational contexts are typically multiple-tasks contexts in which students have a limited amount of time to work on a number of competing subjects. To assess the within-person relations between competence self-perceptions and allocated effort across multiple competing tasks, a *dimensional* within-person design is required, which entails that participants' competence self-perceptions (i.e., their perceived relative strengths versus weaknesses) and allocated effort are assessed across *multiple tasks* on a *single occasion* (Möller & Marsh, 2013).

To date, there is surprisingly little empirical information on the dimensional within-person relations between self-perceived competence and effort allocation across multiple tasks (Sun & Frese, 2013). In one study, in which students were instructed to self-direct their learning, a positive relation was found. Specifically, Hiemstra and Van Yperen (2016) found that students who worked on multiple online learning tasks tended to allocate more effort to the tasks that they perceived as their relative strengths rather than their weaknesses. In another study, in which participants were primed on external standards, a negative relation was found. That is, Schmidt and Dolis (2009) found that participants who worked on two different scheduling tasks tended to allocate more effort to the task they perceived as harder to complete. Furthermore, in a study on the relation between perceived goal-performance discrepancies and allocated effort to multiple tasks, controlling incentives were found to moderate this relation (Schmidt & DeShon, 2007). Hence, we suspected that self-directed versus externally-directed instructions may play a moderating role in individuals' effort allocation to their relative strengths and weaknesses.

1.3. Instructional strategy and allocated effort

Instructional strategies refer to the approaches and methods that teachers use to achieve the aims of instruction (Akdeniz, 2016; Moore, 2014). In education, the extent to which students are instructed to pursue self-directed versus test-directed learning goals and activities may vary across time, situations, teachers, and schools. For example, at the beginning of a semester, teachers may apply a self-directed instructional strategy (Candy, 1991; Loyens, Magda, & Rikers, 2008; Valjataga & Laanpere, 2010), by offering students a choice of readings, assignments, and exercises, and encouraging them to pursue their own interests. In contrast, toward the end of the semester, teachers may apply a test-directed instructional stategy (Roediger, Putnam, & Smith, 2011; Rohrer & Pashler, 2010), by informing students of the standards they will have to meet, and instructing them to prepare for the upcoming test-week. Similarly, some schools may apply a more self-directed instructional approach, in which students are allowed a fair amount of choice in what and how to learn. Other schools may apply a more test-directed approach, in which students are educated to pass the tests of a fixed curriculum. It is likely that these different instructional strategies (i.e., self-directed versus test-directed) affect students' effort allocation to their strengths and weaknesses.

Interestingly, the extant literature suggests that both self-directed and test-directed instructional strategies may have both positive and negative consequences for students' effort allocation (for reviews, see Black & Wiliam, 1998; Guay, Ratelle, & Chanal, 2008; Lee, 2008; Loyens et al., 2008; Roediger et al., 2011; Sheldon & Biddle, 1998). For example, students have been shown to put more effort into their learning as they pursued more self-directed learning goals (Sheldon & Elliot, 1998). However, students have also been shown to waste more time once their self-direction exceeded a moderate level (Wielenga-Meijer, Taris, Wigboldus, & Kompier, 2011). Similarly, students have been found to invest more effort as they were tested more frequently (Mawhinney, Bostow, Laws, Blumenfeld, & Hopkins, 1971), but students have also been shown to prefer less effortful learning tasks when they were motivated by external rather than intrinsic incentives (Pittman, Emery, & Boggiano, 1982). A important limitation of previous studies on the role of self-direction and test-direction in effort allocation is their reliance on single-task designs. This is a misalignment with educational practice, which is a multiple-tasks context. In multiple-tasks contexts, the positive effect of an intervention on one task may come at the expense of another task. For example, a teacher's decision to test students more frequently may boost students' effort in that particular class, but simultaneously diminish students' effort in another class without more frequent testing (Mawhinney et al., 1971; Wielenga-Meijer et al., 2011). When a single task design is used in a multiple-tasks context (e.g., only considering the class in which students are tested more frequently), these adverse side effects (e.g., the negative effects on effort in another class) remain unobserved, which may lead to invalid conclusions. Therefore, in the present research, we used multiple-tasks designs to examine the effects of instructional strategy (i.e., self-directed versus test-directed) on students' allocated effort across multiple subjects.

1.4. The present research

In the present research, we examined under which conditions students, who have a limited amount of time and energy to work on multiple subjects, tend to put more effort into their strengths or their weaknesses. We hypothesized that in a self-directed instructional strategy condition (i.e., a condition in which students were instructed to pursue their own interests), students would tend to allocate more effort to their relative strengths. Conversely, in a test-directed instructional strategy condition (i.e., a condition in which students were instructed to pursue test results), students were expected to allocate more effort to their relative weaknesses. That is, in a self-directed condition, self-perceptions of relative strengths represent a signal that more intrinsic gratification (Ryan & Deci, 2000) or a higher level of performance (Locke & Latham, 2002) is attainable in the subject concerned, whereas self-perceptions of relative weaknesses signal the likelihood of less intrinsic gratification or poor future performance. In contrast, in a test-directed condition, self-perceptions of relative strengths signal that less effort is required to meet the external standards on the tasks concerned (Carver & Schreier, 1981; Vancouver et al., 2008), whereas self-perceptions of relative weaknesses signal that more effort is needed to meet the standards.

Across five studies, we used a variety of methods and measures to test our hypothesis. Studies 1 and 2 are vignette studies in which we examined the effects of instructional strategy (i.e., self-directed versus test-directed) on students' self-reported effort allocation to their strengths and weaknesses. In Study 3, we used a repeated measures design in a field setting to examine students' self-reported effort allocation to their strengths and weaknesses as a function of changes in the instructional strategy. Finally, Studies 4 and 5 are experiments in which we tested the impact of instructional strategy on the relation between perceived relative strengths versus weaknesses and behavioral effort.

2. Study 1

2.1. Method study 1

2.1.1. Participants

A total of 95 undergraduate psychology students (34 men, 61 women; mean age = 19.27 years, *SD* = 1.29) of a university in the Netherlands, who were recruited through the university's psychology experiment management system, participated in the study for course credits.

2.1.2. Procedure

After indicating their self-perceptions of relative strength on five school subjects[1] (Math, Economy, Dutch, History, and Biology), the participants were randomly assigned to one of four conditions: one self-directed instructional strategy condition and three variants of a test-directed instructional strategy[2] condition. In each condition they read: “Imagine you had a total of 50 h to spend on these five school subjects: how would you allocate your time across these subjects … " In the *self-directed instructional strategy* condition, participants read, " … if you were free to spend this time on elective classes for extra course credit?”; in the *no fail test-directed instructional strategy* condition they read, " … if you were preparing for exams in which you had to score a minimum of 5.5[3] on each subject?”; in the *compensate test-directed instructional strategy* condition they read, " … if you were preparing for exams in which you had to score a minimum of 5.5[3] on average across all subjects?”; and in the *excellence test-directed instructional strategy* condition they read, " … if you were preparing for exams in which you aimed to score 8[3] or higher on as many subjects as possible?” Note that all situations were imagined.

2.1.3. Measures

Perceived relative strength and allocated effort. Participants were asked to rank five school subjects - Math, Economy, Dutch, History, and Biology - ranging from strength #1 (*my relative strength*) to strength #5 (*my relative weakness*) and, subsequently, to allocate 50 h across these subjects. For each school subject, the ranking was used as an index of perceived relative strength (where a lower ranking indicates a higher level of perceived relative strength: #1 is the highest level). Allocated effort was subsequently computed as the proportion of time, from the total of 50 h, allocated to each level of perceived relative strength (i.e., #1 through #5).

2.2. Results study 1

The means and standard deviations of allocated effort per ranking of perceived relative strength by instructional strategy are shown in Table 1. First, we examined whether any evidence could be found for differences between the three variants of the test-directed instructional strategy condition. A repeated measures multivariate analysis of variance (RM-MANOVA) could not be performed directly on the five proportions of allocated effort per level of perceived relative strength, because of their inherent dependencies (1.00 in total). Therefore, we conducted five separate analyses of variance (ANOVAs), with test-directed instructional strategy (*no fail* versus *compensate* versus *excellence*) as the independent variable and allocated effort at each level of perceived relative strength (#1 through #5) as the dependent variables. In order to reduce the chances of a type II error (i.e., false negative), we tested the effects at the $p < .10$ level, and considered whether the effect size was very small ($\eta^2 < 0.10$). No significant differences between the three variants of the test-directed instructional strategy condition were found. That is, the differences between participants' strength #1, $F(2, 65) = 0.13$, $p = .88$, $\eta^2 = 0.00$, strength #2, $F(2, 65) = 1.92$, $p = .16$, $\eta^2 = 0.06$, strength #3, $F(2, 65) = 0.21$, $p = .81$, $\eta^2 = 0.00$, strength #4, $F(2, 65) = 0.35$, $p = .71$, $\eta^2 = 0.01$, and strength #5, $F(2, 65) = 2.24$, $p = .12$, $\eta^2 = 0.07$ were all nonsignificant with respect to allocated effort and had a very small effect size.

Second, because no differences were found between the three variants of the test-directed instructional strategy, we merged the test-directed instructional strategy conditions and tested our focal hypothesis, which posited that the self-directed versus test-directed instructional strategy moderates the within-person relation between perceived relative strength and allocated effort. Fig. 1 graphically displays the mean proportions of allocated effort for each of the five levels of perceived relative strength by self-directed versus test-directed instructional strategy. Because a RM-MANOVA could not be performed directly, due to the inherent dependencies of the five proportions, we conducted two separate paired t-tests, testing in each condition (i.e., the self-directed instructional strategy and the test-directed instructional strategy) the within-person differences between strength #1 and strength #5. To reduce possible capitalization on chance, we tested these differences at the $p < .01$ level. Bias-corrected and accelerated (BCa) confidence intervals (CIs), based on 5000 bootstrap samples, were used to

[1] We used secondary school subjects, because students have experience-based competence self-perceptions for these subjects. The five subjects were selected to include a range of both science and humanities subjects.

[2] We used these three variants of the test-directed instructional strategy condition to examine whether avoidance-oriented (i.e., the *no fail test-directed instructional strategy*) versus approach-oriented (i.e., the *excellence test-directed instructional strategy*) framing of the instructional strategy affected students' effort allocation. Our results showed no differences in students' effort allocation across strengths versus weaknesses between the three variants of the test-directed instructional strategy condition.

[3] The grading system in the Netherlands counts from 1 (lowest) through 10 (highest). Schools typically require students to score 5.5 to pass a single test, and to have an overall average of 5.5 on all subjects to be promoted to the next grade. High exam marks increase students' chances of admission to studies that have limited admittance (i.e., numerus fixus).

Table 1
Means and standard deviations of allocated effort (allocated proportions of time) per level of perceived strength by instructional strategy, study 1.

Perceived relative strength	Self-directed (*n* = 27)		Test-directed aggregated (*n* = 68)		Test-directed no fail (*n* = 19)		Test-directed compensate (*n* = 25)		Test-directed excellence (*n* = 24)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
#1	0.33	0.18	0.14	0.09	0.14	0.07	0.15	0.07	0.14	0.12
#2	0.23	0.13	0.16	0.07	0.14	0.07	0.18	0.04	0.16	0.09
#3	0.16	0.09	0.21	0.07	0.20	0.06	0.20	0.07	0.21	0.08
#4	0.15	0.11	0.23	0.13	0.24	0.09	0.24	0.07	0.22	0.10
#5	0.12	0.13	0.25	0.09	0.28	0.09	0.23	0.08	0.26	0.09

Note. Within each column, the sum of the mean proportions of allocated effort is 1. The test-directed aggregated column (*n* = 68) displays the aggregated data of the test-directed no fail (*n* = 19), the test-directed compensate (*n* = 25), and the test-directed excellence (*n* = 24) conditions.

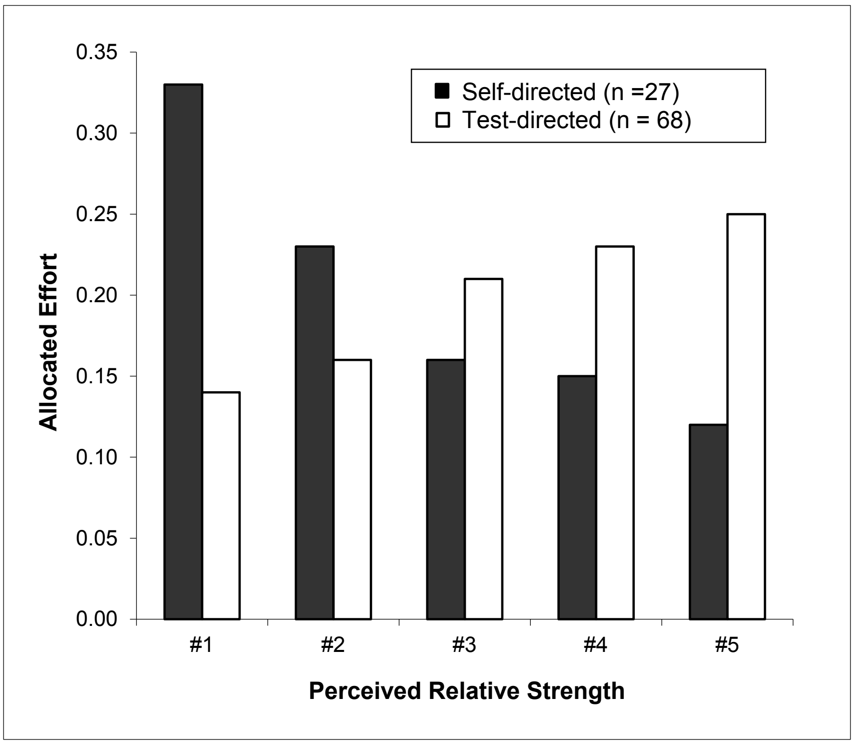

Fig. 1. Allocated effort (mean proportions of allocated time) across the five levels of perceived relative strength by instructional strategy, Study 1.

accommodate possible deviations from normality. The results showed that the participants in the self-directed instructional strategy condition allocated significantly more effort to their strengths ($M_{\#1}$ = 0.33, *SD* = 0.18) than to their weaknesses ($M_{\#5}$ = 0.12, *SD* = 0.13), 99% BCa CI of difference [06; 0.36], $t(26) = 3.96$, $p = .00$. In contrast, participants in the test-directed instructional strategy condition allocated significantly more effort to their weaknesses ($M_{\#5}$ = 0.25, *SD* = 0.09) than to their strengths ($M_{\#1}$ = 0.14, *SD* = 0.09), 99% BCa CI of difference [–0.16; −0.05], $t(67) = -5.79$, $p = .00$. Thus, we concluded that instructional strategy (i.e., self-directed versus test-directed) moderated the within-person relation between perceived relative strength and allocated effort.

3. Study 2

3.1. Method study 2

The aim of Study 2 was to provide additional support for our hypothesis by replicating the findings of Study 1 with a different group of students and a different set of school subjects.

3.1.1. Participants

A total of 116 college students (65 men, 51 women; mean age = 22.64 years, *SD* = 6.52) of a university of applied sciences in the Netherlands, who were recruited via an email sent by their school, volunteered to take part in the study.

3.1.2. Procedure and measures

The procedure and measures were identical to those in Study 1, except for the set of school subjects, which were Math, Economy, Dutch, English, and Physics (instead of Math, Economy, Dutch, History, and Biology).

3.2. Results study 2

The results of Study 2 replicated the findings of Study 1. Table 2 shows the means and standard deviations of allocated effort per level of perceived relative strength by instructional strategy (i.e., self-directed versus test-directed). Again, no differences between the three test-directed conditions were found. Five separate ANOVAs, with test-directed instructional strategy (*no fail* versus *compensate* versus *excellence*) as the independent variable and allocated effort to each level of perceived

Table 2
Means and standard deviations of allocated effort (allocated proportions of time) per level of perceived strength by instructional strategy, study 2.

Perceived relative strength	Self-directed (n = 31)		Test-directed aggregated (n = 85)		Test-directed no fail (n = 31)		Test-directed compensate (n = 26)		Test-directed excellence (n = 28)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
#1	0.29	0.20	0.12	0.08	0.11	0.06	0.13	0.07	0.12	0.10
#2	0.28	0.17	0.14	0.08	0.14	0.06	0.16	0.07	0.14	0.10
#3	0.17	0.12	0.18	0.06	0.18	0.07	0.20	0.06	0.17	0.06
#4	0.14	0.14	0.25	0.12	0.27	0.16	0.23	0.09	0.25	0.10
#5	0.12	0.14	0.31	0.11	0.31	0.11	0.28	0.11	0.33	0.11

Note. Within each column, the sum of the mean proportions of allocated effort is 1. The test-directed aggregated column (n = 85) displays the aggregated data of the test-directed no fail (n = 31), the test-directed compensate (n = 26), and the test-directed excellence (n = 28) conditions.

relative strength (#1 through #5) as the dependent variables, yielded no significant ($p < .10$) differences in allocated effort to strength #1, $F(2, 82) = 0.69$, $p = .50$, $\eta^2 = 0.02$, strength #2, $F(2, 82) = 0.73$, $p = .49$, $\eta^2 = 0.02$, strength #3, $F(2, 82) = 1.04$, $p = .36$, $\eta^2 = 0.03$, strength #4, $F(2, 82) = 0.80$, $p = .45$, $\eta^2 = 0.02$, and strength #5, $F(2, 82) = 1.27$, $p = .29$, $\eta^2 = 0.03$.

As in Study 1, we subsequently merged the three test-directed instructional strategy conditions (see Fig. 2), and conducted two separate paired t-tests, testing in each condition the within-person differences in allocated effort between strengths #1 and #5. The BCa CIs showed that the participants in the self-directed instructional strategy condition allocated significantly more effort to their strengths ($M_{\#1} = 0.29$, $SD = 0.20$) than to their weaknesses ($M_{\#5} = 0.12$, $SD = 0.14$), 99% BCa CI of difference [0.04; 0.31], $t(30) = 3.38$, $p = .00$. The participants in the test-directed instructional strategy condition allocated more effort to their weaknesses ($M_{\#5} = 0.31$, $SD = 0.11$) than to their strengths ($M_{\#1} = 0.12$, $SD = 0.08$), 99% BCa CI of difference [–0.23; −0.15], $t(84) = -11.06$, $p = .00$. Thus, in Study 2, instructional strategy was also found to moderate the within-person relation between perceived relative strength and allocated effort.

3.3. Discussion studies 1 and 2

The results of Studies 1 and 2 indicate that, in multiple-tasks contexts, when students pursue multiple subjects, instructional strategy (i.e., self-directed versus test-directed) moderates the relation between perceived relative strength and allocated effort. However, a limitation of Studies 1 and 2 is that we tested the effects of instructional strategy on students' effort allocation under fully imagined conditions. To provide additional and ecologically more valid support for our hypothesis, we tested it under more natural conditions in Study 3.

4. Study 3

4.1. Method study 3

In Study 3, we sought to replicate the finding of Studies 1 and 2 in a secondary school setting, using a 3 × 3 factorial within-subjects design. We asked students to indicate their strongest school subject, a neutral school subject, and their weakest school subject. We then assessed their effort allocation across these subjects under three repeated measures conditions: (1) when free to pursue their own interests (*self-directed*

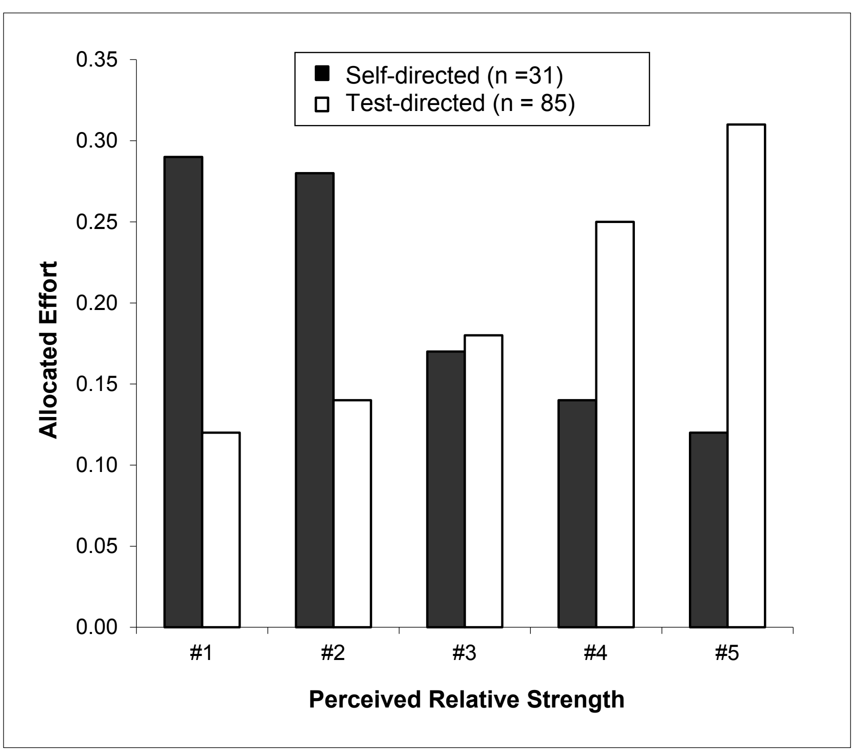

Fig. 2. Allocated effort (mean proportions of allocated time) across the five levels of perceived relative strength by instructional strategy, Study 2.

instructional strategy); (2) at the beginning of the first quarter (*intermediate instructional strategy*); and (3) at the end of the first quarter, during the first exam week (*test-directed instructional strategy*). We reasoned that from Conditions 1 to 3, the learning conditions would be progressively less self-directed and more test-directed. Hence, we expected that the relation between perceived relative strength and allocated effort would switch from positive (in Condition 1) to negative (in Condition 3).

4.1.1. Participants

The participants were 46 students (19 male, 27 female) from a secondary school[4] in the Netherlands, who were recruited through their teacher and participated voluntarily in the study. Their mean age was 16.35 years ($SD = 0.60$).

4.1.2. Procedure

First, the participants listed their school subjects, indicated which of these they perceived as their strongest, neutral and weakest subjects, and completed the perceived competence measures. Second, in each of the following conditions, the participants completed the perceived instructional strategy and allocated effort measures.

Condition 1: Self-directed instructional strategy. On the last day of the second week of the first quarter, the participants imagined that they were attending a school that allowed them to follow their own interests completely. They then indicated their perceived self-direction and allocated effort at that school.

Condition 2: Intermediate instructional strategy. Immediately following this, the participants looked back at their current week at school (i.e., the second week of the first quarter) and indicated their perceived self-direction and allocated effort during that week.

Condition 3: Test-directed instructional strategy. Nine weeks later, on the last day of the exam week of the first quarter, the participants once more looked back at their current week at school and indicated their perceived self-direction and allocated effort during that week (i.e., the exam week).

4.1.3. Measures

Perceived relative strength. After listing their school subjects for the first quarter, participants were asked: “Which of these subjects do you see as … " "(a) … your strongest subject,” "(b) … a neutral subject, that is, a subject in between your strongest and your weakest subject,” "(c) … your weakest subject.” Each participant's strongest subject was coded as strength #1, the neutral subject as strength #2, and the weakest subject as strength #3.

Perceived competence. Participants' self-perceived competence in their strongest versus weakest subjects was assessed using the following item (Bandura, 2006): “Please rate, for each of the following subjects, how certain you are that you *can do* the upcoming tests,” after which the participants' strongest, neutral, and weakest subjects were displayed. Response categories ranged from 0 (*cannot do at all*) to 100 (*highly certain can do*).

Perceived self-direction. Perceived self-direction was assessed by asking the participants how true the following statement was for them: “At this imagined school … " (Condition 1), or “During the past week at school … " (Conditions 2 and 3), " … I could spend my time studying in accordance with my own interests.” Response categories ranged from 1 (*completely true*) to 7 (*completely not true*).

Allocated effort. Allocated effort was assessed by asking the participants: “Please assign 100% of your time across the following school subjects,” after which the three subjects that they had indicated as their strongest, neutral, and weakest subjects (i.e., strengths #1, #2, and #3) were displayed. In the self-directed instructional strategy condition (Condition 1), the general stem was: “At this imagined school, how would you allocate your time across the following subjects?” In the intermediate (Condition 2) and the test-directed (Condition 3) instructional strategy conditions, the general stem was: “During the past week at school, how did you actually allocate your time across the following subjects?"

4.2. Results study 3

4.2.1. Perceived relative strength

To check whether the students felt most competent in their strength #1 (their strongest subject), and least competent in their strength #3 (their weakest subject), we conducted a RM-MANOVA with perceived relative strength as the within-person factor and perceived competence as the dependent variable. The results revealed a significant overall difference in perceived competence between the three levels of perceived relative strength ($M_{\#1} = 82.52$, $SD = 20.83$; $M_{\#2} = 64.30$, $SD = 19.97$; $M_{\#3} = 45.85$, $SD = 21.65$), $F(2, 44) = 85.23$, $p < .001$, $\eta^2 = 0.80$. Follow-up analyses indicated that all pairwise comparisons were significant at the $p < .001$ level and in the hypothesized direction. Thus, the participants perceived themselves as most competent in their strongest subject, less competent in the neutral subject, and least competent in their weakest subject.

4.2.2. Perceived self-direction

To check whether the participants felt most self-directed in the self-directed instructional strategy condition and least self-directed in the test-directed instructional strategy condition, we conducted a RM-MANOVA with instructional strategy (i.e., self-directed versus intermediate versus test-directed instructional strategy) as the within-person factor and perceived self-direction as the dependent variable. The results showed a significant decrease in perceived self-direction from the self-directed condition to the test-directed condition ($M_{C1} = 4.74$, $SD = 1.32$; $M_{C2} = 3.72$, $SD = 1.57$; $M_{C3} = 3.17$, $SD = 1.76$), $F(2,44) = 25.74$, $p < .001$, $\eta^2 = 0.54$. All pairwise comparisons were significant at the $p < .001$ level and in the hypothesized direction. Therefore, we concluded that participants felt most self-directed in the self-directed instructional strategy condition and least self-directed in the test-directed instructional strategy condition.

4.2.3. Tests of hypothesis

The means and standard deviations of allocated effort per level of perceived relative strength by instructional strategy are shown in Table 3. To test whether instructional strategy moderated the relation between perceived relative strength and allocated effort, we conducted three separate paired t-tests, investigating in each condition (i.e., self-directed versus intermediate versus test-directed) the within-person differences in allocated effort between strength #1 (i.e., the strongest subject) and strength #3 (i.e., the weakest subject); for the analysis approach, see Study 1. In line with the findings of Studies 1 and 2, BCa CIs showed that in the self-directed instructional strategy condition, the participants allocated significantly more effort to their strongest subject ($M_{\#1} = 0.42$, $SD = 0.22$) than to their weakest subject ($M_{\#3} = 0.26$, $SD = 0.18$), 99% BCa CI of difference [0.01; 0.31], $t(45) = 2.85$, $p = .00$. In the intermediate instructional strategy condition, no significant differences were found between the strongest subject ($M_{\#1} = 0.38$, $SD = 0.20$) and the weakest subject ($M_{\#3} = 0.31$, $SD = 0.19$), 99% BCa CI of difference [–0.19; 0.06], $t(45) = -1.32$, $p = .20$. In the test-directed instructional strategy condition, the participants allocated significantly more effort to their weakest subject ($M_{\#3} = 0.40$, $SD = 0.17$) than to their strongest subject ($M_{\#3} = 0.25$, $SD = 0.13$), 99% BCa CI of difference [–0.24; −0.07], $t(45) = -4.40$, $p = .00$. Thus, from the self-directed through the test-directed instructional strategy condition, the relation between perceived relative

[4] The participants were students from a VWO school (i.e., preparatory academic education). VWO schools have 6 grades. 1st grade students are typically 12 years old; 6th grade students are typically 18 years old. After passing the final exams at the end of year 6, students are admissible to university. At this school, the academic year was divided into quarters of approximately 10 weeks of classes, followed by an exam week.

Table 3
Means and standard deviations of allocated effort (allocated proportions of time) per level of perceived strength by instructional strategy, study 3.

Perceived relative strength	Self-directed (n = 46)		Inter-mediate (n = 46)		Test-directed (n = 46)	
	M	*SD*	*M*	*SD*	*M*	*SD*
#1	0.42	0.22	0.31	0.19	0.25	0.13
#2	0.32	0.14	0.31	0.17	0.35	0.18
#3	0.26	0.18	0.38	0.20	0.40	0.17

strength and allocated effort changed progressively from positive to negative.

4.3. Discussion study 3

The results of Study 3 replicate those of Studies 1 and 2 in a more naturalistic secondary school setting. However, a limitation of Study 3 is that the self-directed instructional strategy condition was an imagined condition instead of an actual learning condition. Furthermore, we used a repeated measures design, which does not allow causal inference. Moreover, we relied on self-reports rather than behavioral measures of allocated effort. To address these limitations, in Studies 4 and 5, we experimentally manipulated instructional strategy (i.e., self-directed versus test-directed) and assessed participants' actual effort allocation to their strengths and weaknesses.

5. Study 4

5.1. Method study 4

In Study 4, we used a 2 × 2 mixed factorial design with instructional strategy (i.e., self-directed versus test-directed) as the between-person factor and perceived relative strength (i.e., perceived relative strength versus weakness) as the within-person factor. The dependent variable was participants' actual effort allocated to their strengths and weaknesses.

5.1.1. Participants

The participants were 148 psychology undergraduates (33 men; 115 women) from a university in the Netherlands. Students were recruited via the university's psychology experiment management system and voluntarily signed up for course credits. Their mean age was 19.43 years (SD = 2.68).

5.1.2. Procedure

Participants were randomly assigned to either a self-directed (n = 79) or a test-directed (n = 69) instructional strategy condition. In the self-directed instructional strategy condition, they read, “The aim of the following practice session is to further develop your skills in accordance with your own interests.” In the test-directed instructional strategy condition, participants read, “The aim of the following practice session is to prepare for a test, which will be administered right after this session.” Next, the participants were shown two examples of spelling and two examples of calculus exercises, and indicated which type of skill, spelling or calculus, they perceived as their relative strength. After this, the practice session started. Participants were given a total of 30 exercises, which they could divide among spelling and calculus exercises as they deemed fit. After each exercise, they were asked: “Which type of exercise do you want to do next, a spelling exercise or a calculus exercise?” They were then presented with an exercise according to their choice. After completing 30 exercises, the participants filled in the perceived competence and the perceived self-direction scales.

5.1.3. Measures

Perceived relative strength. After being shown two examples of spelling exercises and two examples of calculus exercises, the participants responded to the following statement: “Which is your relative strength, spelling or calculus?” Response categories were *spelling* or *calculus*. The skill that the participants indicated as their relative strength was coded as their strength #1, the other skill was coded as their strength #2.

Perceived competence. Participants' perceived competence was assessed using a 6-item scale (Ryan, 1982). A sample item was: “I think I am pretty good at this.” Response categories ranged from 1 (*not at all true*) to 7 (*very true*). The items were averaged to calculate a perceived competence index. Participants' perceived competence was assessed in both their strength #1 and strength #2. The general stem was: “How true is the following statement for your … ?" after which their strength #1 and strength #2 were displayed respectively.

Perceived self-direction. Participants' perceived self-direction was assessed using a 9-item scale with the general stem: “How true is the following statement for you? While I was practicing the exercises … " A sample item was (Reeve, 2002): " … I was pursuing my own goals.” Response categories ranged from 1 (*completely true*) to 6 (*completely not true*). The items were averaged to create an index for perceived self-direction (Cronbach's alpha = 0.87).

Allocated effort. Participants' allocated effort was assessed by calculating the proportion of exercises from the total of 30 exercises that the participants conducted on their strength #1 and on their strength #2.

5.2. Results study 4

5.2.1. Manipulation check

The results of an independent samples t-test showed that the participants in the self-directed instructional strategy condition (M = 4.92, SD = 0.90) were higher in perceived self-direction than the participants in the test-directed instructional strategy condition (M = 4.22, SD = 1.04), 99% BCa CI of difference [0.28; 1.12], $t(146)$ = 4.36, p = .00.

5.2.2. Perceived competence

The results of a paired samples t-test revealed that the participants were higher in perceived competence in their strength #1 (M = 5.36, SD = 0.79) than in their strength #2 (M = 4.15, SD = 0.99), 99% BCa CI of difference [0.99; 1.44], $t(147)$ = 15.07, p = .00.

5.2.3. Tests of hypothesis

The means and standard deviations of allocated effort per level of perceived relative strength by instructional strategy are shown in Table 4. To test whether instructional strategy (i.e., self-directed versus test-directed) moderated the relation between perceived relative strength and allocated effort, we conducted two separate paired t-tests, investigating in each instructional strategy condition the within-person differences in effort allocated to participants’ strengths #1 and strengths #2 (for the analysis approach, see Study 1). BCa CIs showed

Table 4
Means and standard deviations of allocated effort (allocated proportions of the total number of exercises) per level of perceived relative strength by instructional strategy, study 4.

Perceived relative strength	Self-directed (n = 79)		Test-directed (n = 69)	
	M	*SD*	*M*	*SD*
#1	0.64	0.19	0.36	0.18
#2	0.36	0.19	0.64	0.18

that participants in the self-directed instructional strategy condition allocated significantly more effort to strength #1 ($M = 0.64$, $SD = 0.19$) than to strength #2 ($M = 0.36$, $SD = 0.19$), 99% BCa CI of difference [0.17; 0.39], $t(78) = 6.49$, $p = .00$. In contrast, participants in the test-directed instructional strategy condition allocated significantly more effort to strength #2 ($M = 0.64$, $SD = 0.18$) than to strength #1 ($M = 0.36$, $SD = 0.18$), 99% BCa CI of difference [–0.39; −0.17], $t(68) = -0.58$, $p = .00$. Thus, in support of our hypothesis, instructional strategy moderated the relation between perceived relative strength and allocated effort.

6. Study 5

6.1. Method study 5

6.1.1. Participants, procedure, and measures

The aim of Study 5 was to replicate the findings of Study 4 with a different group of students and, accordingly, to provide additional support for our hypothesis. A sample of 78 college students, 39 men and 39 women, from different schools of a Dutch university of applied sciences, were recruited via social media and bulletin board adverts, and volunteered to take part in the study for a €10 allowance. Ages ranged from 17 to 33, with a mean of 21.19 ($SD = 3.01$). The experimental procedure and the measures were identical to those of Study 4.

6.2. Results study 5

6.2.1. Manipulation check

The results of an independent samples *t*-test showed that the participants in the self-directed instructional strategy condition ($M = 5.09$, $SD = 0.70$) were higher in perceived self-direction than the participants in the test-directed instructional strategy condition ($M = 4.66$, $SD = 0.95$), 95% BCa CI of difference [0.05; 0.83], $t(76) = 2.26$, $p = .03$.

6.2.2. Perceived competence

The results of a paired *t*-test revealed that the participants were higher in perceived competence on their strength #1 ($M = 5.49$, $SD = 0.89$) than on their strength #2 ($M = 4.18$, $SD = 1.11$), 99% BCa CI of difference [1.00; 1.65], $t(77) = 10.53$, $p = .00$.

6.2.3. Tests of hypothesis

The results of Study 5 (see Table 5), like those of Study 4, yielded clear support for our hypothesis. BCa CIs indicated that participants in the self-directed instructional strategy condition allocated significantly more effort to strength #1 ($M = 0.68$, $SD = 0.19$) than to strength #2 ($M = 0.32$, $SD = 0.19$), 99% BCa CI of difference [0.20; 0.51], $t(40) = 6.07$, $p = .00$. In contrast, the participants in the test-directed instructional strategy condition allocated significantly more effort to strength #2 ($M = 0.66$, $SD = 0.16$) than to strength #1 ($M = 0.34$, $SD = 0.16$), 99% BCa CI of difference [–0.46; −0.18], $t(36) = -0.22$, $p = .00$. Thus, the findings of Study 5 are consistent with those of Studies 1 to 4, showing that instructional strategy moderated the within-person relation between perceived relative strength and allocated effort.

Table 5
Means and standard deviations of allocated effort (allocated proportions of the total number of exercises) per level of perceived relative strength by instructional strategy, study 5.

Perceived relative strength	Self-directed (n = 41)		Test-directed (n = 37)	
	M	*SD*	*M*	*SD*
#1	0.68	0.19	0.34	0.16
#2	0.32	0.19	0.66	0.16

6.3. Discussion studies 4 and 5

Studies 4 and 5 yielded additional support for our hypothesis. Across both studies, we found that in a test-directed instructional strategy condition students tend to allocate more actual effort to their weaknesses, whereas in an self-directed instructional strategy condition students tend to allocate more actual effort to their strengths. These results replicate and extend the findings of Studies 1, 2, and 3. Because we experimentally manipulated instructional strategy (i.e., self-directed versus test-directed) and assessed behavioral measures of allocated effort in Studies 4 and 5, we may conclude that instructional strategy *affects* the amount of *actual* effort that students allocate to their strengths and weaknesses.

7. Conclusions and general discussion

In the present research, we examined the effect of instructional strategy on the within-person relation between students' perceived relative strength (i.e., perceived relative strengths versus weaknesses) and allocated effort to multiple subjects. We conducted a series of five studies, using different methodologies (scenario, field, and experimental studies), research designs (within-person and mixed factorial), populations (secondary school, college, and university students), and measures of effort (intentions, self-reported, and behavioral). The results consistently showed that, in a self-directed instructional strategy condition (i.e., a condition in which students' were instructed to pursue their own interests), students tended to allocate more effort to their perceived relative strengths. In contrast, in a test-directed instructional strategy (i.e., a condition in which students were instructed to pursue test results), students tended to allocate more effort to their perceived relative weaknesses. Hence, we conclude that instructional strategy (i.e., self-directed versus test-directed) moderates the within-person relations between perceived relative strength (i.e., perceived relative strengths versus weaknesses) and allocated effort to multiple subjects.

7.1. Theoretical contributions

These findings build on and contribute to the extant literature in several ways. First, our findings extend the literature on the role of competence self-perceptions in motivation. Building on Möller and Marsh (2013), we examined the concept of *perceived relative strength,* which we defined as competence self-perceptions that result from dimensional (within-person) comparison, rather than temporal (within-person) or social (between-persons) comparison. Our findings contribute to the extant literature by showing that not only *temporal* comparison (i.e., across a series of trails on *a single* task; Vancouver et al., 2008; Schmidt & DeShon, 2010), but also *dimensional* comparison (i.e., across multiple tasks, on a single occasion) may result in either positive or negative relationships between self-perceived competence and allocated effort. This is an important annotation to the literature because most research on the role of competence perceptions in learning effort has been done at the *between-person* level, and quite consistently demonstrates positive links between self-perceived competence and effort expenditure (e.g., Bandura & Locke, 2003; Latham & Pinder, 2005; Multon et al., 1991; Sadri & Robertson, 1993). Our findings amend the evidence-based belief that self-perceived competence enhances learning effort (Bandura, 1997; Colquitt, LePine, & Noe, 2000; Multon et al., 1991; Richardson, Abraham, & Bond, 2012; Ryan & Deci, 2000; Sitzmann & Ely, 2011). That is, at the dimensional within-person level, when students pursue multiple subjects, and are instructed to pursue test results, self-perceived competence appears to be *negatively* related to effort. Under these specific conditions, students prefer to allocate their effort to their relative weaknesses.

Second, a few studies have provided indirect evidence that self-directed versus externally-directed instructions may moderate the within-person relation between self-perceived competence and allocated effort to multiple tasks. Specifically, Hiemstra and Van Yperen (2016) found that students who self-directed their pursuit of multiple online learning tasks tended to allocate more effort to the tasks that they perceived as their relative strengths rather than their weaknesses. In contrast, Schmidt and Dolis (2009) found that participants who pursued external standards on multiple scheduling tasks tended to allocate more effort to the task they perceived as harder to complete. The present research explains these inconsistent findings by demonstrating that instructional strategy (i.e., self-directed versus test-directed) moderates the dimensional within-person relation between students' self-perceived competence and allocated effort to multiple tasks. Specifically, when individuals pursue their own interests, the motivating effect of perceived competence tends to be more powerful. This is in line with self-efficacy theory (Bandura, 1997) and self-determination theory (Ryan & Deci, 2000). In contrast, when individuals pursue external standards, the motivating effect of perceived discrepancies tends to prevail, which is in line with control theory (Carver & Schreier, 1981; Vancouver et al., 2008).

Third, our findings add to the literature on the effects of self-directed and test-directed instructional strategies on effort. The extant literature documents both positive (Pittman et al., 1982; Sheldon & Elliot, 1998) and negative (Mawhinney et al., 1971; Wielenga-Meijer et al., 2011) relations between each type of instructional strategy and effort (Guay et al., 2008; Loyens et al., 2008; Roediger et al., 2011; Sheldon & Biddle, 1998). However, due to their reliance on single-task designs, previous studies are misaligned with common educational practice as a multiple-tasks context. Single task designs do not consider - and therefore overlook - side-effects on other tasks which are likely to occur. Indeed, our findings indicate that, in multiple-tasks contexts, a positive effect on one task may come at the expense of another task. Therefore, in the context of education, we strongly suggest that future studies rely on multiple-tasks designs to examine students' self-regulation.

7.2. Strengths and limitations

To the best of our knowledge, this series of studies is the first to demonstrate that, at the dimensional within-person level, both positive and negative relations exist between self-perceived competence and allocated effort to multiple tasks, depending on instructional strategy (i.e., self-directed versus test-directed). Our findings are remarkably consistent across the studies, which strengthens our confidence in the accuracy and validity of the observed pattern.

A number of limitations should also be noted. First, we focused on one specific aspect of self-directed versus test-directed instructional strategies. That is, we defined instructional strategy as a condition in which students are instructed to pursue their own interests (i.e., self-directed) versus test results (i.e., test-directed). Self-directed and test-directed instructional conditions are broad concepts that can be defined by a range of characteristics, including physical, social, and psychological variables (Candy, 1991; Roediger et al., 2011). Hence, our results refer to a specific aspect of self-directed versus test-directed instructional conditions. Also, it is important to note that we do not claim that there is an inherent, one-on-one, association between self-directed versus test-directed instructional strategies and effort allocation to students' strengths versus weaknesses. Rather, we argue and demonstrate that students who are instructed to pursue their own interests tend to allocate more effort to their relative strengths, whereas students who are instructed to pursue test results tend to allocate more effort to their relative weaknesses.

Second, in the present research, we assessed the effects of instructional strategy on students' short-term effort allocation, which may differ from effects in the long term. For example, self-directed rather than externally-directed learning has been associated with persistence and sustained effort (Hardré & Reeve, 2003; Vallerand & Bissonnette, 1992; Vallerand, Fortier, & Guay, 1997). Research also indicates that, relative to self-directed learning, test-directed learning may advance students' short-term rather than long-term learning performance (Grolnick & Ryan, 1987; Sheldon & Biddle, 1998).

Third, we did not assess the quality of students' learning effort. Several studies indicate that self-directed learning may promote conceptual learning and deep information processing, whereas externally-directed learning has been associated with rote learning (Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004; Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005). On the other hand, it is also conceivable that strengths-oriented students in a self-directed learning condition ineffectively rehearse knowledge and skills they already master, resulting in no or minimal learning gains. Therefore, future research should also consider the quality of students' effort allocation and learning performance.

Relatedly, a fourth limitation is that we relied on effort rather than learning performance as an outcome variable. Students' effort expenditure is an important variable because it is a major and controllable determinant of learning performance (Ericsson & Lehmann, 1996; Ericsson et al., 1993; Weiner, 1994). In follow-up studies, the current research model may be extended with learning performance as the outcome variable so that the quality of students' effort can be tested as a mediator.

Fifth, each individual study has its own limitations and strengths. Together, however, these studies build a solid case for the moderating effect of instructional strategy on students' effort allocation to their perceived relative strengths versus weaknesses. For example, in Studies 1 and 2 (and Study 3, Condition 1), we used vignettes, but Studies 4 and 5 (and Study 3, Conditions 2 and 3) were real situations. In Studies 4 and 5, we examined students' effort allocation to only two different subjects, but in Studies 1, 2, and 3, we considered more than two different subjects.

Finally, because we found consistent results across different groups of students, we are confident that our findings are not limited to a specific type of education (i.e., secondary school, college, or university). However, more research is needed to replicate our findings across different educational institutions.

7.3. Practical implications

The present research helps to clarify two phenomena that are commonly observed in classrooms, but have not yet been fully understood. The first is that sometimes students seem to work harder when they believe they are good at something, while at other times they seem to work harder when they believe they are *not* good at something. The second is that sometimes students seem to work harder when they pursue their own interests, while at other times they seem to work harder when they pursue test results. The present research provides a clear answer. That is, students tend to work harder on the subjects they believe they are relatively good at when they are pursuing their own interests. However, when pursuing test results, they show a tendency to work harder on subjects they believe they are relatively not good at.

These findings have practical implications for learning and instruction. In education, both improving strengths and improving weaknesses are legitimate objectives. On the one hand, an important goal of education is to help students discover and explore their talents and interests. Allocating effort to subjects they are relatively good at may enable students to cultivate their personal qualities and further develop their strengths, which may help them to stand out. On the other hand, helping students to improve their shortcomings is an important educational goal as well. Students need to improve their weaknesses in order to meet the prevailing standards for a degree or profession. Our findings give teachers a better understanding of students' effort allocation to their relative strengths and weaknesses as a function of different instructional strategies. This understanding may help teachers to support students' learning efforts, and may guide teachers in directing students' learning endeavors. When teachers' aim is to stimulate students to work on their strengths, they may apply a self-directed instructional strategy, by offering students a choice of learning activities, and encourage them to pursue their own interests. In contrast, when teachers' aim is to stimulate students to work on their weaknesses, one option may be to instruct them to prepare for tests, since this tends to stimulate students to allocate more effort to their weaknesses.

Obviously, a strong emphasis on test requirements may be perceived as controlling by students, which may encourage rote learning rather than deep learning (Vansteenkiste et al., 2004, 2005), and short-term effort rather than sustained effort (Hardré & Reeve, 2003; Vallerand & Bissonnette, 1992; Vallerand et al., 1997). This pitfall should be avoided when implementing the outcomes of the present research.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.learninstruc.2018.01.003.

References

Akdeniz, C. (2016). Instructional strategies. In C. Akdeniz (Ed.). *Instructional process and concepts in theory and practice (pp. 57–105)*. Singapore: Springer.

Atkinson, J. W. (1964). *An introduction to motivation.* Oxford, England: Van Nostrand.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York, NY: Freeman.

Bandura, A. (2006). Guide for constructing self-efficacy scales. In F. Pajares, & T. Urdan (Eds.). *Self-efficacy beliefs of adolescents*. Greenwich, CT: Information Age.

Bandura, A., & Locke, E. A. (2003). Negative self-efficacy and goal effects revisited. *Journal of Applied Psychology, 88*, 87–99. http://dx.doi.org/10.1037/0021-9010.88.1.87.

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice, 5*, 7–74. http://dx.doi.org/10.1080/0969595980050102.

Candy, P. C. (1991). *Self-direction for lifelong learning. A comprehensive guide to theory and practice.* San Francisco, CA: Jossey-Bass.

Carver, C., & Schreier, M. (1981). *Attention and self-regulation: A control theory approach to human behavior.* New York, NY: Springer-Verlag.

Colquitt, J. A., LePine, J. A., & Noe, R. A. (2000). Toward an integrative theory of training motivation: A meta-analytic path analysis of 20 years of research. *Journal of Applied Psychology, 85*, 678.

Dunlosky, J., & Ariel, R. (2011). Self-regulated learning and the allocation of study time. In B. H. Ross, & B. H. Ross (Vol. Eds.), *The psychology of learning and motivation: Advances in research and theory: Vol. 54*, (pp. 103–140). San Diego, CA: Elsevier.

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*, 363–406. http://dx.doi.org/10.1037/0033-295X.100.3.363.

Ericsson, K. A., & Lehmann, A. C. (1996). Expert and exceptional performance: Evidence of maximal adaptation to task constraints. *Annual Review of Psychology, 47*, 273–305. http://dx.doi.org/10.1146/annurev.psych.47.1.273.

Grolnick, W. S., & Ryan, R. M. (1987). Autonomy in children's learning: An experimental and individual difference investigation. *Journal of Personality and Social Psychology, 52*, 890–898. http://dx.doi.org/10.1037/0022-3514.52.5.890.

Guay, F., Ratelle, C. F., & Chanal, J. (2008). Optimal learning in optimal contexts: The role of self-determination in education. *Canadian Psychology, 49*, 233–240. http://dx.doi.org/10.1037/a0012758.

Hardré, P. L., & Reeve, J. (2003). A motivational model of rural students' intentions to persist in, versus drop out of, high school. *Journal of Educational Psychology, 95*, 347–356. http://dx.doi.org/10.1037/0022-0663.95.2.347.

Hiemstra, D., & Van Yperen, N. W. (2015). The effects of strength-based versus deficit-based self-regulated learning strategies on students' effort intentions. *Motivation and Emotion, 39*, 656–668. http://dx.doi.org/10.1007/s11031-015-9488-8.

Hiemstra, D., & Van Yperen, N. W. (2016). *Self-regulated online Learning: The role of perceived relative strengths and weaknesses in effort expenditure* (under review).

Klein, W. M. (1997). Objective standards are not enough: Affective, self-evaluative, and behavioral responses to social comparison information. *Journal of Personality and Social Psychology, 72*, 763–774. http://dx.doi.org/10.1037/0022-3514.72.4.763.

Latham, G. P., & Pinder, C. C. (2005). Work motivation theory and research at the dawn of the twenty-first century. *Annual Review of Psychology, 56*, 485–516. http://dx.doi.org/10.1146/annurev.psych.55.090902.142105.

Lee, J. (2008). Is test-driven external accountability effective? Synthesizing the evidence from cross-state causal-comparative and correlational studies. *Review of Educational Research, 78*, 608–644.

Locke, E. A., & Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist, 57*, 705–717. http://dx.doi.org/10.1037/0003-066X.57.9.705.

Loyens, S. M., Magda, J., & Rikers, R. P. (2008). Self-directed learning in problem-based learning and its relationships with self-regulated learning. *Educational Psychology Review, 20*, 411–427. http://dx.doi.org/10.1007/s10648-008-9082-7.

Mawhinney, V. T., Bostow, D. E., Laws, D. R., Blumenfeld, G. J., & Hopkins, B. L. (1971). A comparison of students studying: Behavior produced by daily, weekly, and three-week testing schedules. *Journal of Applied Behavior Analysis, 4*, 257–264. http://dx.doi.org/10.1901/jaba.1971.4-257.

Möller, J., & Husemann, N. (2006). Internal comparisons in everyday life. *Journal of Educational Psychology, 98*, 342–353. http://dx.doi.org/10.1037/0022-0663.98.2.342.

Möller, J., & Marsh, H. W. (2013). Dimensional comparison theory. *Psychological Review, 120*(3), 544–560. http://dx.doi.org/10.1037/a0032459.

Moore, K. D. (2014). *Effective instructional strategies: From theory to practice.* Thousand Oaks, CA: Sage.

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology, 38*, 30–38. http://dx.doi.org/10.1037/0022-0167.38.1.30.

Pittman, T. S., Emery, J., & Boggiano, A. K. (1982). Intrinsic and extrinsic motivational orientations: Reward-induced changes in preference for complexity. *Journal of Personality and Social Psychology, 42*, 789–797. http://dx.doi.org/10.1037/0022-3514.42.5.789.

Reeve, J. (2002). Self-determination theory applied to educational settings. In E. L. Deci, R. M. Ryan, E. L. Deci, & R. M. Ryan (Eds.). *Handbook of self-determination research (pp. 183–203)*. Rochester, NY, US: University of Rochester Press.

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin, 138*, 353–387. http://dx.doi.org/10.1037/a0026838.

Roediger, H. I., Putnam, A. L., & Smith, M. A. (2011). Ten benefits of testing and their applications to educational practice. In J. P. Mestre, B. H. Ross, J. P. Mestre, B, & H. Ross (Eds.). *The psychology of learning and motivation (Vol 55): Cognition in education (pp. 1–36)*San Diego, CA, US: Elsevier Academic Press. http://dx.doi.org/10.1016/B978-0-12-387691-1.00001-6.

Rohrer, D., & Pashler, H. (2010). Recent research on human learning challenges conventional instructional strategies. *Educational Researcher, 39*, 406–412. http://dx.doi.org/10.3102/0013189X10374770.

Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43*, 450–461. http://dx.doi.org/10.1037/0022-3514.43.3.450.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*, 68–78. http://dx.doi.org/10.1037/0003-066X.55.1.68.

Sadri, G., & Robertson, I. T. (1993). Self-efficacy and work-related behaviour: A review and meta-analysis. *Applied Psychology: International Review, 42*, 139–152. http://dx.doi.org/10.1111/j.1464-0597.1993.tb00728.x.

Schmidt, A. M., & DeShon, R. P. (2007). What to do? The effects of discrepancies, incentives, and time on dynamic goal prioritization. *Journal of Applied Psychology, 92*, 928–941. http://dx.doi.org/10.1037/0021-9010.92.4.928.

Schmidt, A. M., & DeShon, R. P. (2010). The moderating effects of performance ambiguity on the relationship between self-efficacy and performance. *Journal of Applied Psychology, 95*, 572–581. http://dx.doi.org/10.1037/a0018289.

Schmidt, A. M., & Dolis, C. M. (2009). Something's got to give: The effects of dual-goal difficulty, goal progress, and expectancies on resource allocation. *Journal of Applied Psychology, 94*, 678–691. http://dx.doi.org/10.1037/a0014945.

Seo, M., & Ilies, R. (2009). The role of self-efficacy, goal, and affect in dynamic motivational self-regulation. *Organizational Behavior and Human Decision Processes, 109*, 120–133. http://dx.doi.org/10.1016/j.obhdp.2009.03.001.

Sheldon, K. M., & Biddle, B. J. (1998). Standards, accountability, and school reform: Perils and pitfalls. *Teachers College Record, 100*, 164–180.

Sheldon, K. M., & Elliot, A. J. (1998). Not all personal goals are personal: Comparing autonomous and controlled reasons for goals as predictors of effort and attainment. *Personality and Social Psychology Bulletin, 24*, 546–557. http://dx.doi.org/10.1177/0146167298245010.

Sitzmann, T., & Ely, K. (2011). A meta-analysis of self-regulated learning in work-related training and educational attainment: What we know and where we need to go. *Psychological Bulletin, 137*, 421–442. http://dx.doi.org/10.1037/a0022777.

Son, L. K., & Metcalfe, J. (2000). Metacognitive and control strategies in study-time allocation. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26*, 204–221. http://dx.doi.org/10.1037/0278-7393.26.1.204.

Sun, S. H., & Frese, M. (2013). Multiple goal pursuit. In E. A. Locke, & G. P. Latham (Eds.). *New developments in goal setting and task performance (pp. 177–194)*. New York, US: Routledge/Taylor & Francis Group.

Valjataga, T., & Laanpere, M. (2010). Learner control and personal learning environment: A challenge for instructional design. *Interactive Learning Environments, 18*, 277–291. http://dx.doi.org/10.1080/10494820.2010.500546.

Vallerand, R. J., & Bissonnette, R. (1992). Intrinsic, extrinsic, and amotivational styles as predictors of behavior: A prospective study. *Journal of Personality, 60*, 599–620. http://dx.doi.org/10.1111/j.1467-6494.1992.tb00922.x.

Vallerand, R. J., Fortier, M. S., & Guay, F. (1997). Self-determination and persistence in a real-life setting: Toward a motivational model of high school dropout. *Journal of Personality and Social Psychology, 72*, 1161–1176. http://dx.doi.org/10.1037/0022-3514.72.5.1161.

Van Yperen, N. W., & Leander, N. P. (2014). The overpowering effect of social comparison information: On the misalignment between mastery-based goals and self-evaluation criteria. *Personality and Social Psychology Bulletin, 40*, 676–688. http://dx.doi.org/10.1177/0146167214523475.

Vancouver, J. B., & Kendall, L. N. (2006). When self-efficacy negatively relates to motivation and performance in a instructional strategy. *Journal of Applied Psychology, 91*, 1146–1153. http://dx.doi.org/10.1037/0021-9010.91.5.1146.

Vancouver, J. B., More, K. M., & Yoder, R. J. (2008). Self-efficacy and resource allocation: Support for a nonmonotonic, discontinuous model. *Journal of Applied Psychology, 93*, 35–47. http://dx.doi.org/10.1037/0021-9010.93.1.35.

Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K. M., & Deci, E. L. (2004). Motivating learning, performance, and persistence: The synergistic effects of intrinsic goal contents and self-directed contexts. *Journal of Personality and Social Psychology, 87*, 246–260. http://dx.doi.org/10.1037/0022-3514.87.2.246.

Vansteenkiste, M., Simons, J., Lens, W., Soenens, B., & Matos, L. (2005). Examining the motivational impact of intrinsic versus extrinsic goal framing and autonomy-supportive versus internally controlling communication style on early adolescents' academic achievement. *Child Development, 76*, 483–501. http://dx.doi.org/10.1111/j.1467-8624.2005.00858.x.

Weiner, B. (1974). *Achievement motivation and attribution theory.* Morristown, NJ: General Learning Press.

Weiner, B. (1994). Integrating social and personal theories of achievement striving. *Review of Educational Research, 64*, 557–573. http://dx.doi.org/10.2307/1170587.

Wheeler, L., & Miyake, K. (1992). Social comparison in everyday life. *Journal of Personality and Social Psychology, 62*, 760–773. http://dx.doi.org/10.1037/0022-3514.62.5.760.

White, J. B., Langer, E. J., Yariv, L., & Welch, J. I. (2006). Frequent social comparisons and destructive emotions and behaviors: The dark side of social comparisons. *Journal of Adult Development, 13*, 36–44. http://dx.doi.org/10.1007/s10804-006-9005-0.

Wielenga-Meijer, E. A., Taris, T. W., Wigboldus, D. J., & Kompier, M. J. (2011). Costs and benefits of autonomy when learning a task: An experimental approach. *The Journal of Social Psychology, 151*, 292–313. http://dx.doi.org/10.1080/00224545.2010.481688.