

Motivating Learning, Performance, and Persistence: The Synergistic Effects of Intrinsic Goal Contents and Autonomy-Supportive Contexts

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Three field experiments with high school and college students tested the self-determination theory (E. L. Deci & R. M. Ryan, 2000) hypotheses that intrinsic (vs. extrinsic) goals and autonomy-supportive (vs. controlling) learning climates would improve students' learning, performance, and persistence. The learning of text material or physical exercises was framed in terms of intrinsic (community, personal growth, health) versus extrinsic (money, image) goals, which were presented in an autonomy-supportive versus controlling manner. Analyses of variance confirmed that both experimentally manipulated variables yielded main effects on depth of processing, test performance, and persistence (all $ps < .001$), and an interaction resulted in synergistically high deep processing and test performance (but not persistence) when both intrinsic goals and autonomy support were present. Effects were significantly mediated by autonomous motivation.

Students vary considerably in their engagement and enthusiasm for schoolwork and in the degree to which they go on to demonstrate lifelong interest in education and learning (Deci, Ryan, & Williams, 1996; Sheldon & Biddle, 1998). Self-determination theory (SDT) analyzes these differences by focusing on both the content of the goals people have for learning and the learning context within which the goals are pursued (Deci & Ryan, 1985; Ryan & Deci, 2000a). The present studies were designed explicitly to test that SDT formulation.

The Content of Goal Pursuits

Several studies, beginning with those of Kasser and Ryan (1993, 1996), have examined the content of people's goal pursuits. Using

SDT, investigators have argued that pursuing goals with strongly salient extrinsic content (e.g., wealth, image, and fame) tends to be associated with poorer mental health than does pursuing goals with strongly salient intrinsic content (e.g., relationships, growth, community, and health). Specifically, SDT proposes that intrinsic goal pursuits have positive effects on well-being because they promote satisfaction of the basic psychological needs for autonomy, competence, and relatedness; that is, they promote people's natural growth tendencies (Deci & Ryan, 2000; Sheldon, Elliot, Kim, & Kasser, 2001). In contrast, the vigorous pursuit of extrinsic goal contents is theorized to be less directly satisfying of the basic psychological needs. Rather, such pursuits tend to be aimed at external indicators of worth and thus tend to be associated with excessive social comparisons (Lyubomirsky & Ross, 1997) and unstable self-esteem (Kernis, Brown, & Brody, 2000), both of which are negatively associated with well-being. Further, extrinsic goals are likely to crowd out need-satisfying behaviors, such as affiliation and prosocial engagement (Ryan, Sheldon, Kasser, & Deci, 1996).

In line with this theorizing, several studies have shown that when the importance individuals place on extrinsic goals is high relative to the importance they place on intrinsic goals, these individuals tend to experience (a) less psychological well-being, as indexed by vitality, self-actualization, and self-esteem; (b) more psychological ill-being, as indexed by depression, anxiety, and narcissism; (c) greater likelihood of high-risk behaviors such as

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tobacco use; and (d) more conflicted relationships with friends and lovers (e.g., Kasser & Ryan, 2001; McHoskey, 1999; Ryan et al., 1999; Schmuck, Kasser, & Ryan, 2000; Sheldon & Kasser, 1995; Williams, Cox, Hedberg, & Deci, 2000).

To date, studies of intrinsic versus extrinsic goals have focused on the association of goal pursuit and attainment with well-being and adjustment outcomes (e.g., Kasser & Ryan, 1996, 2001; Ryan & Deci, 2000b). Few studies have related goal contents to actual behavior, and none has examined learning or achievement outcomes as a function of whether the learning is perceived as instrumental to the attainment of intrinsic goals (e.g., community contribution) versus extrinsic goals (e.g., monetary benefit). Furthermore, previous studies of intrinsic versus extrinsic goal contents have used only questionnaire measures of individual differences. No studies have involved the experimental manipulation of intrinsic versus extrinsic goals. Accordingly, the present three studies examined the effects of experimentally manipulated goal content on processing, performance, and persistence outcomes.

We hypothesized that when individuals learn concepts or activities for intrinsic goals, there will be deeper processing, better test performance, and greater persistence than when they learn for extrinsic goals. We reasoned that extrinsic goals, with their focus on external indicators of worth, would distract participants from the learning activity and thus result in poorer learning, whereas intrinsic goals involve learning in the service of inherent psychological needs and growth tendencies, which should facilitate the learning.

The Social Context of Goal Pursuits

Within SDT, learning is an active process that functions optimally when students' motivation is autonomous (vs. controlled) for engaging in learning activities and assimilating new information (Ryan & Deci, 2000a). Considerable research has examined qualities of the social contexts that undermine versus facilitate autonomous motivation (deCharms, 1976; Deci, Schwartz, Sheinman, & Ryan, 1981; Grolnick & Ryan, 1987). For example, social contexts that are controlling—that pressure people through use of incentives, deadlines, and punishments or through reliance on instructions that stress what people should do—have been found to diminish autonomous motivation (e.g., Deci, Koestner, & Ryan, 1999). This results in decreased persistence and poorer learning, especially conceptual learning, which requires deep processing of information (Benware & Deci, 1984; Grolnick & Ryan, 1987; McGraw & McCullers, 1979). Conversely, environments that are autonomy supportive—that is, that minimize the salience of external incentives and threats, avoid controlling language, and acknowledge the learners' frame of reference—have been found to enhance autonomous motivation and facilitate learning, test performance, and adjustment (Black & Deci, 2000; Ryan & Connell, 1989).

Although several experimental studies have examined the effects of autonomy-supportive versus controlling social contexts, no study has examined the effects of manipulating intrinsic versus extrinsic goal contents (e.g., community contribution vs. monetary benefit) within those contexts. That is, there is no evidence about whether, when people are learning material that is instrumental for intrinsic versus extrinsic goals, their learning is affected by whether the interpersonal environment within which they are do-

ing the learning is autonomy supportive versus controlling. We expect that the intrinsic goal content becomes more salient to people when it is provided in an autonomy-supportive (rather than a controlling) way, so that intrinsic goal content interacts with an autonomy-supportive context, resulting in unusually high levels of deep processing, conceptual learning, and persistence in the condition with intrinsic goal framing and an autonomy-supportive context.

Autonomous Motivation as a Mediating Variable

Studies in several domains have found the effects of autonomy-supportive versus controlling social contexts on learning and well-being outcomes to be mediated by participants' autonomous motivation while engaging in the behavior (e.g., Williams, Grow, Freedman, Ryan, & Deci, 1996). Accordingly, we expected autonomous motivation to significantly mediate the relation between the experimentally manipulated learning climate and the learning-related outcomes.

Further, it is possible that relative autonomy also mediates the effect of goal content, given that many studies have shown a correlation between intrinsic goal content and autonomous motivation (e.g., Sheldon, Ryan, Deci, & Kasser, 2004). Critics of the SDT perspective on goal content have maintained that the effects of intrinsic versus extrinsic goal contents on mental health can be explained by the type of motivation people typically have in pursuing those goals (Carver & Baird, 1998; Srivastava, Locke, & Bartol, 2001). For example, Carver and Baird (1998) argued that the effects of intrinsic versus extrinsic goals on well-being are merely a function of the fact that intrinsic goals are typically pursued for autonomous motives whereas extrinsic goals are typically pursued for controlled motives. However, a recent set of three studies (Sheldon et al., 2004) showed that although intrinsic (relative to extrinsic) goals were consistently correlated with autonomous motivation, goal contents (intrinsic vs. extrinsic) and goal motives (autonomous vs. controlled) accounted for significant independent variance in well-being outcomes. In other words, intrinsic goal contents explained variance in well-being outcomes over and above that accounted for by autonomous motivation.

Accordingly, in the current studies, we hypothesized (a) that autonomous motivation would significantly mediate the relation between experimentally manipulated intrinsic goal content and learning-related outcomes but (b) that intrinsic goal content would also predict significant variance in learning outcomes after removing the mediating effect of autonomous motivation.

Dependent variables in the three studies included (a) self-reports of superficial processing, (b) self-reports and a behavioral measure of deep processing, (c) graded performance on tests and in demonstrations, and (d) subsequent free-choice persistence at activities related to the learning (e.g., reading related books). All three experiments were conducted in naturalistic field settings involving learning text material in academic classes or learning a physical activity in gym class.

Study 1

All participants in Study 1 were college students who learned text material concerning recycling and pro-ecological behavior as a class activity. They were in one of four randomly assigned

experimental conditions. For half the participants, the learning was framed in terms of its instrumentality for an intrinsic goal, and for the other half, the learning was framed in terms of its instrumentality for an extrinsic goal. Further, half the participants who were in each goal-content condition were provided with a relatively autonomy-supportive interpersonal context, and the other half were provided with a controlling interpersonal context. As such, the factorial manipulation of these two variables resulted in the four learning conditions.

We hypothesized two main effects: (a) that intrinsic (relative to extrinsic) goal-framing would negatively affect self-reports of superficial processing and positively affect deep processing, test performance, and free-choice persistence and (b) that autonomy-supportive (relative to controlling) contexts would also negatively affect self-reports of superficial processing and positively affect deep processing, test performance, and free-choice persistence. We also expected that the two manipulated variables would interact such that intrinsic content would have a more positive effect on learning when pursued in an autonomy-supportive context. Finally, we expected that rated relative autonomy would mediate both the content effects and the context effects but that content would also predict independent variance in learning outcomes.

Method

Participants and Procedure

Participants were 200 first-year female Belgian college students, 19–20 years old, who were studying to become preschool teachers. The experiment took place during regular classes with 30 to 40 students in each class, and the learning was planned as a regular class activity. The teachers had been asked to participate, along with their students, in a research study. The teachers all agreed to do so, realizing that they would not know anything about what was being examined until the study was completed. The teachers distributed written instructions (in Dutch) that had been prepared by the experimenters to explain the procedure. There were four sets of instruction sheets, which included the actual experimental manipulations, and these were randomly distributed within each class. Thus, within each classroom, approximately one quarter of the students were in each of the four experimental conditions, determined by which of the four instruction sheets they had received. Neither the students nor the teachers were aware that there were different sets of instructions, and all instruction sheets were the same length, so anyone looking at them casually would not suspect there were differences among them. The students then engaged in the target activity of reading a text about recycling, which was presented as a regular class activity. There was a campuswide initiative on recycling at the time, so the activity fit with that initiative and had been planned by the teachers. Each student wrote his or her name at the top of his or her instruction sheet and turned it in at the end of the sessions (along with other materials explained below), and that was the way the experimenters knew which students were in which experimental condition. The total cell sizes ranged from 49 to 51 in the four conditions.

Instructions for participants in the intrinsic goal conditions stated that “reading the text could help you know how to teach your future toddlers that they can do something to help the environment,” which was intended to represent the intrinsic goal of contributing to the community. Participants in the extrinsic goal conditions were told that “reading the text could teach you how to save money by reusing materials,” which was intended to represent the extrinsic goal of attaining monetary benefit. Goal content was crossed with autonomy-supportive versus controlling learning climates. This experimental manipulation was also contained within the instruction sheet, with the two “learning contexts” being conveyed by

differences in the wording of seven phrases. Specifically, in the autonomy-supportive condition, the instructions used phrases such as, “you can,” “you might,” “if you choose,” and “we ask you to,” whereas in the controlling condition the wording involved phrases such as “you should,” “you have to,” “you’d better,” and “you must.” For example, it was stated in the autonomy-supportive condition, “You can decide to learn more about recycling strategies,” whereas in the controlling condition, participants were told, “You should learn more about recycling strategies.”¹

After reading the text, participants completed a series of questionnaires that assessed the degree to which (a) their motivation was autonomous versus controlled for reading the text, (b) they had engaged the material superficially, and (c) they had deeply processed the text material. Then, they were examined on their conceptual understanding of the text material. Subsequently, students were told that (a) there was additional material about recycling set aside at the library that they could read if they chose, and (b) they could visit a plant that recycles used materials to see how recycling is done. Finally, a week later, students were placed in randomly formed groups of 6 members to discuss the issue of recycling. All students were graded individually by their teachers regarding the quality of their personal contribution to the group discussion.

Pilot Study 1

Autonomy-supportive versus controlling contexts have been manipulated in many studies, but intrinsic versus extrinsic goals have not. Thus, we did a pilot study to ascertain whether the manipulations affected the importance of the students’ intrinsic and extrinsic goals for learning.

Pilot study methods. We gave the same instructions that were used for the actual Study 1 to a group of Belgian college students. Sixty received the intrinsic instructions, and 56 received the extrinsic instructions. After the participants had read the instructions, they read the following:

Now imagine that you are about to engage in learning about recycling and ecology, as was referred to in the instruction sheet you just read. We would like to know why it would be important to you to learn this material.

They used a 5-point scale to complete six items: Three concerned the importance of the intrinsic goal of saving the environment, and three concerned the importance of the extrinsic goal of saving money. All six items began with the stem, “Learning about recycling and ecology would be important for my future life because it would allow me to” An example of the intrinsic-goal items continued, “. . . help make the world a better place to live,” and an example of the extrinsic-goal items continued, “. . . save money so I could buy other things I want.” Factor analysis found two factors, one for intrinsic items ($\alpha = .88$) and one for extrinsic items ($\alpha = .82$). We thus had a 2×2 mixed (between- and within-persons) design in which students in the intrinsic condition and in the extrinsic condition each rated the importance of both the intrinsic and extrinsic goals for learning.

Pilot study results. The means for the factor composites of the importance of the two goals in the four conditions were 4.30 ($SD = 0.72$) for the intrinsic goal in the intrinsic condition, 4.18 ($SD = 0.57$) for the intrinsic goal in the extrinsic condition, 1.45 ($SD = 0.64$) for the extrinsic goal in the intrinsic condition, and 2.09 ($SD = 0.83$) for the extrinsic goal in the extrinsic condition. The ordering of means was as expected, and a 2×2

¹ According to SDT, controlled motivation can take the form of either compliance or defiance (Deci & Ryan, 2000). With *compliance*, people do what is asked of them, but they tend to do it in a pressured or alienated way, whereas with *defiance*, people resist doing what is asked. Defiance is similar to the process of psychological reactance (Brehm & Brehm, 1981), and the manipulation of a controlling context in this study is similar to reactance manipulations used in some attitude change studies.

analysis of variance (ANOVA) indicated that the interaction was significant, $F(1, 114) = 16.61, p < .001$. Protected t tests revealed that the extrinsic-goal ratings in the two conditions differed significantly, $t(113) = 4.78, p < .001$, but that the intrinsic-goal ratings did not, $t(113) = -0.98, ns$. Thus, for these participants, the interaction was carried primarily by the significant difference in the importance ratings between the two conditions for the extrinsic goal.

Measures for Study 1

Relative autonomy. Using the approach developed by Ryan and Connell (1989), we used 4-point scales to assess the extent to which participants engaged in the learning task for external reasons (caused by external forces or pressures; four items, e.g., "I read the text because others told me I should read it"), for introjected reasons (derived from internal pressures such as guilt or the intention to preserve one's self-esteem; four items, e.g., "I read the text because I would feel bad about myself if I did not read it"), for identified reasons (reflecting the person's self-endorsed values; three items, e.g., "I read the text because its content is personally meaningful to me"), and for intrinsic reasons (motivated by intrinsic task enjoyment; five items, e.g., "I read the text because I found it very interesting"). The four subscales were developed to fall along a relative-autonomy continuum ranging from external, which is most controlled, to intrinsic, which is most autonomous. The four subscales did form a reasonable simplex pattern (Guttman, 1954), with each subscale correlating more positively (or less negatively) with subscales closer to it and less positively (or more negatively) with subscales farther from it. The sum of the two controlled subscales correlated negatively with the sum of the two autonomous subscales, $r(200) = -.55, p < .01$.

With this assessment approach, the subscales can be combined into a relative-autonomy index by weighting each style in accord with its place on the relative-autonomy continuum (Ryan & Connell, 1989); they can be combined to form an autonomous motivation composite (intrinsic motivation + identified regulation) and a controlled motivation composite (introjection + external regulation), as was done by Sheldon et al. (2004), or the autonomous motivation composite can be used alone, as was done by Williams, McGregor, Zeldman, Freedman, and Deci (2004).

The assessment of autonomy was done because we hypothesized that participants' autonomous motivation for learning would significantly mediate the effects of the experimental manipulations on the learning outcomes. To determine which measure of autonomy was most appropriate, we examined whether the two manipulations affected each motivation subscale and whether each subscale related to the outcomes. It turned out that the two autonomous motivation subscales (intrinsic and identified) were significantly affected by both manipulations, as was the external subscale (in the opposite direction), but introjection was affected by only one. The autonomous subscales also related to all outcomes, as did the external subscale (in the opposite direction), but introjection related only to some outcomes. Thus, we used the autonomous motivation composite as a mediator because its two subscales were affected by both manipulations and related to all outcomes.

Self-reports of superficial processing and deep processing. Participants rated four items, using 4-point scales, concerning the degree to which they had engaged the material in a superficial way (e.g., "I skipped parts of the text that I did not understand very well") and four items concerning the extent to which they engaged the material deeply by questioning its underlying meaning and relating it to other concepts (e.g., "I studied the text by associating the things I read with what I already knew"). Factor analysis clearly distinguished the two learning strategies (Entwistle & Entwistle, 1991; Nolen, 1988). Alphas for the scales were .84 and .80, respectively.

Test performance. Students' performance on the initial written test of comprehension and their contribution to the group discussion were graded by their instructors on a scale from 1 (*Very bad*) to 10 (*Very good*). Exam questions focused on conceptual rather than rote learning. The teachers

were blind to students' conditions and knew nothing about the study's aims. Scores were averaged to form a performance index. The correlation between the two scores was .92.

Free-choice persistence. Students were offered two options for learning more about recycling and ecology: They could obtain additional information at the library or visit a plant that recycled used materials. An electronic card swipe recorded who went to the library during the days following the learning session on recycling, although there was no direct assessment of whether the students actually read the materials related to recycling. The visit to the recycling plant was offered as part of the campuswide initiative on pro-ecology, so students signed up with the college coordinator who provided the researchers with the names of people who went. The teachers did not go on this trip, and they did not know which students went. Each participant received a score for the number of free-choice opportunities taken advantage of (range was 0–2).

Results

Between-Groups Analyses

The means for all variables across conditions as well as the correlations between each pair of variables are presented in Table 1. Table 2 presents the means and standard deviations of the four cells for the mediating and outcome variables. First, we did a two-way between-subjects multivariate analysis of variance (MANOVA) on these variables (autonomous motivation, self-reported superficial processing and deep processing, test performance, and free-choice persistence). Results showed positive main effects for intrinsic goal content, $F(5, 192) = 105.16, p < .001$, and autonomy-supportive context, $F(5, 192) = 177.45, p < .001$, as well as an interaction, $F(5, 192) = 10.09, p < .001$.

We then performed five univariate ANOVAs. As shown in Table 2, it was found that both providing an intrinsic (relative to extrinsic) long-term rationale for learning the text material and providing these different rationales in an autonomy-supportive (relative to controlling) social context resulted in significant main effects of (a) more autonomous motivation for learning, (b) less superficial processing, (c) more deep processing, (d) better graded performance, and (e) more free-choice persistence. All of these main effects, which were highly significant ($p < .001$), are shown in Table 2, along with the effect sizes, which were calculated as the partial eta squared and varied between .12 and .59 for goal content and between .21 and .77 for social context.

Finally, the interaction between intrinsic goals and autonomy support was significant for autonomous motivation, $F(1, 196) = 25.92, p < .001, \eta^2 = .12$; superficial processing, $F(1, 196) = 14.23, p < .001, \eta^2 = .07$; deep processing, $F(1, 196) = 5.54, p < .001, \eta^2 = .03$.

Table 1
Means and Intercorrelations Among the Mediator and Outcome Variables: Study 1

Variable	M	1	2	3	4
1. Autonomous motivation	2.58	—			
2. Superficial processing	2.38	-.65***	—		
3. Deep processing	2.76	.67***	-.52***	—	
4. Test performance	6.07	.58***	-.43***	.43***	—
5. Persistence	1.13	.47***	-.31***	.31***	.71***

*** $p < .001$.

Table 2
Cell Means and Standard Deviations for the Four Experimental Conditions (Goal Content Crossed With Social Context), and Analysis of Variance (ANOVA) Results With the Goal-Content Effects (Top Half) and the Social Context Effects (Bottom Half): Study 1

Variable	Intrinsic goal		Extrinsic goal		ANOVA results	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i> (1, 196)	η^2
	Autonomy-supportive context				Intrinsic versus extrinsic goal effects	
Autonomous motivation	3.42	0.25	2.63	0.28	278.99***	.59
Superficial processing	1.62	0.47	2.48	0.53	80.33***	.29
Deep processing	3.42	0.34	2.65	0.40	140.12***	.42
Test performance	7.38	1.11	6.04	1.04	53.87***	.21
Persistence	1.94	0.16	1.16	0.49	27.61***	.12
	Controlling context				Autonomy-supportive versus controlling effects	
Autonomous motivation	2.33	0.24	1.91	0.25	637.21***	.77
Superficial processing	2.53	0.42	2.89	0.43	97.19***	.33
Deep processing	2.75	0.30	2.24	0.46	100.28***	.34
Test performance	5.75	0.82	5.14	0.90	83.22***	.30
Persistence	0.94	0.50	0.48	0.42	50.40***	.21

*** $p < .001$.

.05, $\eta^2 = .02$; and graded performance, $F(1, 196) = 7.12, p < .001, \eta^2 = .04$;² but not for free-choice persistence, $F(1, 196) = 1.88, p < .17$. Contrast analyses, with a Bonferroni correction, indicated that the autonomy-supportive/intrinsic-goal condition differed significantly from each of the other conditions on all outcomes ($ps < .001$).³ As an example of the interaction, Figure 1 shows the autonomy-supportive/intrinsic-goal condition to have a mean for test performance that is higher than would be the case with just two main effects.

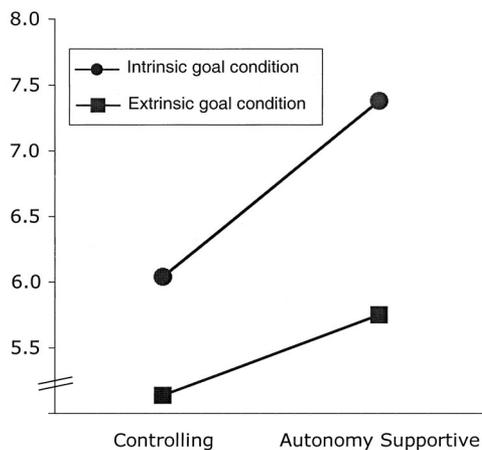


Figure 1. The interaction between intrinsic (relative to extrinsic) goals and autonomy-supportive (relative to controlling) learning climates on graded performance in Study 1.

Mediational Analyses

To examine the degree to which autonomous motivation mediated the effects of goal content, learning context, and their interaction on the four outcome variables, we did regression analyses using the procedure outlined by Kenny, Kashy, and Bolger (1998). Table 3 shows the results of these analyses. There are two sets of results reported, one for each set of main effects (i.e., one for intrinsic goal content as the independent variable and one for autonomy support as the independent variable).

First consider the main effect for intrinsic goal content. The relations of the independent variable to all four dependent variables were significant (shown in the top half of Table 3 as Step 1). Then, the relation from the independent variable to the mediating variable was significant ($\beta = .41, p < .001$). This represents Step 2 in the mediational analysis, although it is not shown in Table 3 because the value is the same for the relation of the independent variable to the mediating variable across all four dependent variables. Then, the relations of the mediating variable to the four

² Kaiser, Ranney, Hartig, and Bowler (1999) found that people's environmental knowledge predicts their ecological behavior. We assessed participants' environmental knowledge prior to the experimental manipulation, and after controlling for this variable, the results remained unchanged.

³ Even though the difference between the autonomy-supportive and controlling conditions appears to be less for people given the extrinsic goal than those given the intrinsic goal, analyses showed that for each dependent variable, the autonomy-supportive mean differed from the controlling mean within the extrinsic-goal condition as well as within the intrinsic-goal condition.

Table 3
Betas for the Paths in the Analyses of Autonomous Motivation as the Mediator in the Relations From the Independent Variables of Intrinsic Goal Content (Top Half) and Autonomy Support (Bottom Half) to the Four Learning Outcomes: Study 1

Variable	Step			Sobel's test	R^2 ^b
	1	3	4 ^a		
Intrinsic content					
Superficial processing	-.45***	-.56***	-.18***	5.96***	.44***
Deep processing	.56***	.51***	.31***	6.08***	.52***
Test performance	.40***	.51***	.14**	5.50***	.35***
Persistence	.32***	.42***	.11	4.69***	.23***
Autonomy support					
Superficial processing	-.50***	-.62***	-.04	6.86***	.42***
Deep processing	.48***	.70***	-.05	7.71***	.44***
Test performance	.50***	.47***	.15	5.07***	.34***
Persistence	.43***	.35***	.17	3.63***	.24***

Note. Step 1 refers to the path from the independent variable to the dependent variable; Step 3 refers to the path from the mediating variable to the dependent variable controlling for the independent variable; Step 4 refers to the path from the independent variable to the dependent variable controlling for the mediating variable.
^a Controlling for autonomy. ^b Total variance explained in outcome by independent variable and mediating variable.

** $p < .01$. *** $p < .001$.

dependent variables, after controlling for the independent variable, were significant (shown as Step 3 in the table). Finally, consider Step 4, in which we found a substantial drop in the path coefficient from the independent to the dependent variables from before to after entering the mediator into the equation. In each case, as shown in Table 3, Sobel's test indicated that the mediation was significant. Still, however, the independent variable of intrinsic goal content continued to account for significant independent variance in three of the four outcomes.

Next, consider autonomy support as the independent variable. Its relations to all four dependent variables were significant (shown in the bottom half of Table 3 as Step 1). Then, as Step 2 (not shown in the table), the relation from the independent variable to the mediating variable was found to be significant ($\beta = .73, p < .001$). Then, the relations of the mediating variable to the four dependent variables, after controlling for the independent variable, were significant in each case as shown in the table (Step 3). Finally, at Step 4, as shown in the table, there was significant mediation according to the Sobel's test for all four dependent variables, and the path from the independent to the dependent variables became nonsignificant in each case, thus indicating that the mediation by autonomous motivation was essentially full in each case.

A final issue concerns the mediational role of autonomous motivation in the relations between the interaction term and the outcomes. The conditions for mediation were not met for the outcomes of deep processing or persistence, but they were met for superficial processing and performance. Then, there was a significant drop in the link from the interaction to superficial processing (from $\beta = -.19$ to $-.10$) and in the link from the interaction to performance (from $\beta = .15$ to $.06$). Sobel's test in both cases yielded $z = 2.09, p < .05$.

The R^2 values shown in Table 3 refer to the amount of variance in each outcome variable explained by an independent variable and the mediating variable. In each of the 10 main-effect and interaction analyses, the independent variable and the mediating variable accounted for considerable variance in the dependent variables, ranging from 23% to 52% of the total variance.

Brief Discussion

Study 1 provided initial support for our predictions. First, a positive effect for intrinsic goal framing was observed on all four learning-related outcomes, including the behaviors of test performance and free-choice persistence. This is the first evidence that framing learning in terms of its instrumentality for intrinsic (relative to extrinsic) goals will lead to significantly better learning and performance. It is also the first study in which the intrinsic versus extrinsic goal content distinction has been experimentally manipulated, and all results were in line with SDT predictions. Second, there was a significant effect for autonomy-supportive versus controlling context on quality of self-reported depth of processing, test performance, and free-choice persistence, thus extending earlier SDT research (e.g., Grolnick & Ryan, 1987). Third, there was a significant interaction on four out of five variables, in which the most positive outcomes were obtained when the task was framed in terms of an intrinsic goal and was introduced in an autonomy-supportive way. This suggests that intrinsic goals are even more fully engaged and accepted by an individual when they are encountered in an autonomy-supportive climate. Thus, for intrinsic goals to be fully experienced by people and to promote the greatest involvement with the target activity, they need to be presented in an autonomy-supportive context.

Fourth, mediational analyses showed that participants' autonomous motivation significantly mediated the effects of goal content and interpersonal context and, to a lesser extent, the interaction of goal content and social context on learning outcomes. The analyses also showed, as expected, that goal content predicted significant variance in three outcomes over and above the mediator.

Study 2

Study 2, conducted with college students majoring in marketing, was intended to replicate and extend the results of Study 1. First, it included male as well as female participants to allow generalization of the results. Second, it used personal growth rather than community contribution as the intrinsic goal. Third, the content of the text material being learned was changed to "business communication styles." The content of the text in Study 1 (i.e., recycling) tends to be congruent with intrinsic goals, and teachers in training might be expected to place strong value on community goals. In contrast, the content of the text in Study 2 (i.e., business communications) tends to be congruent with extrinsic goals, and marketing students might be expected to place strong value on financial goals (Sagiv & Schwartz, 2000; Kasser & Ahuvia, 2002). Fourth, we added an unobtrusive measure of active engagement with the learning activity to supplement the measure of self-reported deep processing that we had used in Study 1. Specifically, we noted whether or not students underlined words in the text while studying the material.

As in Study 1, we hypothesized that both experimentally manipulated variables would yield main effects on each outcome. We also hypothesized an interaction between intrinsic content and autonomy-supportive context, suggesting that the positive impact of intrinsic-goal framing on learning will be enhanced if the goal is presented in an autonomy-supportive context. Again, we expected autonomous motivation to only partially mediate content effects.

Method

Participants and Procedure

One hundred eighty-one male and 196 female marketing students at a Belgian college, 18–19 years old, participated as a regular class activity (class sizes varied from 25 to 30). Four sets of written instructions, resulting from the factorial crossing of goal content with learning climate, were randomly distributed to the students. Students put their names on the instruction sheets and were unaware that the instructions varied. The four cell sizes ranged from 93 to 96.

In all four conditions, participants read a text about communications that they would have read even if the experiment were not being done. Those in the intrinsic-goal conditions were told that "carefully reading the text about communication styles can contribute to your personal development," which represents the intrinsic goal of personal growth. Those in the extrinsic-goal condition were told that "carefully reading the text about communication styles can help your chances of getting a well-paid job in the future (e.g., between 2,000 and 2,500 Euros per month)."

Just as in Study 1, manipulation of the autonomy-supportive versus controlling learning context was done by wording changes to the instructions in order to emphasize either choice or pressure. For example, it was stated in the autonomy-support condition that "you might decide to try to learn more about communication styles," whereas in the controlling con-

dition, participants were instructed that "you should learn more about communication styles."

After reading the text, participants completed a series of questionnaires measuring their autonomous motivation for the task and their self-reports of superficial processing and deep processing. They were then tested on conceptual understanding of the text material. After the texts were returned to the instructor, we noted whether each student had underlined points in the text. Five days later, students took part in a small-group presentation to the class on communications, and they were graded by the instructor on their individual contributions. Nine days after that, they took a second written test on the material. Four free-choice persistence measures, described in the *Measures* section, were obtained. Each concerned whether the students volunteered to engage the topic further.

Pilot Study 2

As in Study 1, we did a pilot study to ensure that the goal-content manipulation for Study 2 had a significant effect on the importance students placed on the intrinsic versus extrinsic goals for learning the material. Thirty-one business students were given the intrinsic-goal instructions used in Study 2, and 36 received the extrinsic-goal instructions. They completed a questionnaire very similar to that used in Pilot Study 1, with the wording changed as needed. Within each of the two goal conditions, they rated the importance of learning the material for the intrinsic goal of personal growth and for the extrinsic goal of financial success. Those in the extrinsic-goal condition were also asked how attractive they found the job that represented the extrinsic manipulation in Study 2. The average rating for the job was 4.11 on a 5-point scale, suggesting that this goal would be highly valued by the participants of Study 2.

The means for the factor composites of the importance of the two goals in the four conditions were 4.49 ($SD = 0.54$) for the intrinsic goal in the intrinsic condition, 3.96 ($SD = 1.03$) for the intrinsic goal in the extrinsic condition, 2.82 ($SD = 0.90$) for the extrinsic goal in the intrinsic condition, and 3.12 ($SD = 0.74$) for the extrinsic goal in the extrinsic condition. A 2×2 ANOVA indicated that the interaction was significant, $F(1, 65) = 6.76, p < .001$. Protected t tests revealed that the intrinsic-goal ratings in the two conditions differed significantly, $t(63) = -2.50, p < .05$, but that the extrinsic-goal ratings did not, $t(63) = -1.44, ns$. Thus, whereas in Pilot Study 1 the interaction was carried primarily by the difference in the extrinsic-goal ratings, here the interaction was carried primarily by the difference in the intrinsic-goal ratings.

Measures Used in Study 2

Autonomous motivation ($\alpha = .91$)⁴ and self-reports of superficial processing ($\alpha = .82$) and of deep processing ($\alpha = .80$) were assessed in the same way as in Study 1.⁵

Text engagement. We obtained a behavioral index of active engagement with the text to supplement the self-reports of deep processing. Specifically, we noted whether each participant had underlined words when reading the text (Howard-Rose & Winne, 1993; Wade & Trathen,

⁴ As in Study 1, the Identified Regulation and Intrinsic Motivation subscales were significantly affected by both manipulations and related significantly to all outcomes, as was the case for the External Regulation subscale. However, the results for Introjected Regulation were more mixed in Studies 2 and 3, so we used the autonomous motivation composite (intrinsic + identified) as the mediating variable for autonomy in both of these studies, as we did in Study 1.

⁵ We assessed effort as a second variable that might mediate the effects; however, it was so highly correlated with autonomous motivation that it did not account for additional variance.

Table 4
Means and Intercorrelations Among Mediator and Outcome Variables: Study 2

Variable	<i>M</i>	1	2	3	4	5
1. Autonomous motivation	2.56	—				
2. Superficial processing	2.32	-.59***	—			
3. Deep processing	2.77	.65***	-.55***	—		
4. Underlining	0.54	.68***	-.50***	.56***	—	
5. Test performance	5.94	.71***	-.56***	.55***	.67***	—
6. Persistence	2.24	.70***	-.52***	.51***	.76***	.71***

*** $p < .001$.

1989). They received a score of 0 (no underlining) or 1 (underlining) on this measure.

Test performance. There were two tests (immediately after reading the text and 2 weeks later). As in Study 1, the questions assessed conceptual understanding. Teachers graded their own students' test performance on the same 1–10 scales used in Study 1, and as in Study 1, the instructors had no idea the students were in different experimental conditions. Further, using the same scale, instructors graded the quality of each student's participation in the small-group presentations. The three ratings were averaged for each participant (Cronbach's $\alpha = .95$).

Free-choice persistence. Directly following the first test, the teacher, who was blind to the experimental conditions and was unfamiliar with the hypotheses, noted which students voluntarily picked up additional reading material on this topic at the time they handed in their instruction and tests. Instructors could do this easily because, with the class sizes of 25 to 30, they knew the students, and further, the students' names were on the tests they turned in. Three days later, the teachers gave that same supplemental text to each student who had not taken it voluntarily, and then the teacher

invited all students to solve some additional problems based on the new text. Students were told they could hand in the solutions if they chose to but that the additional work would not count toward their course grade. Instructors later recorded which students returned these problems. The first two persistence measures were thus whether the students took the text voluntarily and whether they handed in the extra problems. The third measure of persistence was taken 5 days after the initial reading period, when the students could participate in an optional communication exercise taught by a visiting expert. Finally, the fourth measure, like one used in Study 1, was whether the students visited the library in the days following the experimental manipulations. Each student's persistence measure was the number of free-choice activities taken advantage of, varying between 0 and 4.

Results

The means for all variables across experimental conditions as well as the correlations between each pair of variables are pre-

Table 5
Cell Means and Standard Deviations for the Four Experimental Conditions (Goal Content Crossed With Social Context) and Analysis of Variance (ANOVA) Results for Goal-Content Effects (Top Half) and Social Context Effects (Bottom Half): Study 2

Variable	Intrinsic goal		Extrinsic goal		ANOVA results	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i> (1, 373)	η^2
	Autonomy-supportive context				Intrinsic versus extrinsic goal effects	
Autonomous motivation	3.30	0.24	2.44	0.35	538.16***	.59
Superficial processing	1.63	0.42	2.45	0.47	162.25***	.30
Deep processing	3.45	0.34	2.65	0.38	201.29***	.35
Underlining	0.96	0.20	0.53	0.50	75.98***	.17
Test performance	7.38	1.18	5.93	1.08	99.15***	.21
Persistence	3.98	0.01	2.57	0.48	49.39***	.12
	Controlling context				Autonomy-supportive versus controlling effects	
Autonomous motivation	2.60	0.37	1.86	0.37	344.56***	.48
Superficial processing	2.46	0.38	2.77	0.44	169.44***	.31
Deep processing	2.69	0.31	2.28	0.55	179.76***	.33
Underlining	0.48	0.50	0.17	0.38	94.31***	.20
Test performance	5.59	1.02	4.82	1.01	168.94***	.31
Persistence	1.60	0.50	0.75	0.38	169.96***	.31

*** $p < .001$.

sented in Table 4. Table 5 presents the means and standard deviations of the four cells (intrinsic vs. extrinsic goals crossed with autonomy support vs. control) for the mediating and outcome variables.

ANOVAs were used to determine whether men and women differed on any of the outcome variables. No interactions emerged between gender and the goal content or learning context for any outcome. Thus, we did not control for gender in the analyses.

Between-Groups Analyses

A two-way MANOVA was performed on the mediating variable (autonomous motivation) and five dependent variables (superficial processing, deep processing, underlining, graded performance, and free-choice persistence). Results showed positive main effects for intrinsic goal content, $F(6, 368) = 96.82, p < .001$, and autonomy-supportive context, $F(6, 368) = 92.16, p < .001$, as well as an interaction, $F(6, 368) = 9.03, p < .001$.

We then conducted univariate 2×2 ANOVAs for each variable, and, as hypothesized, we found main effects for both independent variables on all six mediating and dependent variables (see Table 5). Specifically, intrinsic (relative to extrinsic) goal-framing and autonomy-supportive (relative to controlling) interpersonal context both resulted in more autonomous motivation, less superficial processing, more deep processing, a greater likelihood of underlining, better graded performances, and more persistence. As shown in Table 5, all main effects were highly significant ($p < .001$), and effect sizes varied between .12 and .59 for goal content and between .20 and .48 for social context.

Finally, intrinsic goal content and autonomy-supportive learning contexts worked synergistically to produce a positive effect on use of deep processing strategies, $F(1, 373) = 20.95, p < .001, \eta^2 = .05$, and test performance, $F(1, 373) = 8.99, p < .001, \eta^2 = .02$, whereas it produced the expected negative effect on superficial processing, $F(1, 373) = 33.19, p < .001, \eta^2 = .08$. The interaction for persistence was marginally significant, $F(1, 373) = 3.05, p < .08$, and there were nonsignificant interactions for autonomous motivation, $F(1, 373) = .68, ns$, and underlining, $F(1, 373) = 2.00, ns$. The nature of the significant interactions was the same as found in Study 1 and as shown in Figure 1 (viz., the autonomy-support/intrinsic-goals condition was greater than would be expected from two main effects).

Mediational Analyses

To examine mediation by autonomous motivation of the effects of goal content and learning climate on the five outcome variables, we used the same procedure (Kenny et al., 1998) as in Study 1. Table 6 presents these results. The table shows two sets of results, one for intrinsic-goal effects and one for autonomy-support effects. In both sets of analyses, all of the paths for the independent variables to the dependent variables were highly significant (shown in the table as Step 1). In both sets of analyses, the relations from the independent variables to the mediator were highly significant. The betas were .57 for goal content and .56 for social context (Step 2, not shown in the table). All relations from the mediating variable to the dependent variables, controlling for the independent variables, were highly significant (shown as Step 3).

First, consider the independent variable of intrinsic goal content. With the mediating variable of autonomous motivation, there were highly significant decreases in path coefficients for all five dependent variables, using Sobel's test (see Table 6). In addition, for superficial processing and deep processing, goal content predicted significant variance beyond that accounted for by autonomous motivation. (There was a suppression effect for the dependent variable of persistence.) The amount of variance in the outcomes accounted for by the independent and mediating variables was 37% or greater in all cases. Next, consider the independent variable of autonomy-supportive learning context. As shown in the table, with the mediating variable, there were significant decreases for the paths to all five dependent variables. The variance in the outcomes accounted for by the independent and mediating variables was 38% or greater in all cases. Finally, we considered the interaction effects, although they are not shown in the table. The interaction did not have a significant effect on autonomous motivation, so that could not mediate the interaction effects.

Brief Discussion

Study 2 showed main effects for both experimental factors on all mediating and dependent variables and an interaction on superficial processing, deep processing, and test performance. This provides further evidence that conceptual learning tends to be greater when the learning is instrumental to intrinsic goals and the learning climate is autonomy supportive. Further, autonomous motivation significantly mediated the main effects on all learning-related outcomes, and intrinsic goal content predicted significant variance in superficial processing and deep processing beyond that accounted for by the autonomy mediator.

Study 2 supplemented the results of Study 1 in several ways. First, it extended the results to men as well as women. It used participants with a different major (marketing rather than education) who learned different material (communication skills rather than recycling). It used a different intrinsic goal (personal growth rather than community contribution). Thus, the second study greatly enhanced the generalizability of Study 1 with respect to participants, learning content, and goal content.

Study 3

Study 3 was designed to replicate and further extend the results of Studies 1 and 2. First and most important, rather than focusing on the learning of text material as was done in the first two studies, Study 3 involved students' learning exercises from the Asian sport of Tai-bo. Second, we used younger participants (high school rather than college students). Third, we used different intrinsic and extrinsic goals. Some participants were told that doing Tai-bo was useful for remaining physically fit, which is an intrinsic goal, whereas the others were told that doing Tai-bo would help them remain physically attractive, which is an extrinsic goal (Kasser & Ryan, 1996). Further, the instructions were presented in either an autonomy-supportive or a controlling way. In this study, we again examined autonomous motivation as a mediator of the main effects and interaction effect.

Table 6
Betas for the Paths in the Regression Analyses With Autonomous Motivation as a Mediator in the Relations Between the Independent Variables of Intrinsic-Goal Content (Top Half) and Autonomy-Supportive Context (Bottom Half) and Each Dependent Variable: Study 2

Variable	Step			Sobel's test	R^{2b}
	1	3	4 ^a		
Intrinsic content					
Superficial processing	-.47***	-.47***	-.20***	7.74***	.37***
Deep processing	.51***	.53***	.21***	8.72***	.45***
Underlining	.38***	.69***	-.03	10.06***	.46***
Test performance	.39***	.73***	-.03	10.52***	.51***
Persistence	.29***	.80***	-.17**	10.76***	.51***
Autonomy support					
Superficial processing	-.48***	-.46***	-.22***	7.61***	.38***
Deep processing	.48***	.55***	.18**	8.80***	.46***
Underlining	.42***	.65***	.06	9.58***	.46***
Test performance	.51***	.62***	.17***	9.44***	.53***
Persistence	.54***	.58***	.21***	9.67***	.52***

Note. Step 1 refers to the path from the independent variable to a dependent variable; Step 3 refers to the path from the mediating variable to a dependent variable controlling for the independent variable; Step 4 refers to the path from the independent variable to a dependent variable controlling for the mediating variable.

^a Controlling for autonomy. ^b Total amount of variance explained in a dependent variable after entering the independent variable and the mediating variable.

** $p < .01$. *** $p < .001$.

Method

Participants and Procedure

One hundred eleven female and 113 male 10th- and 11th-grade students ($N = 224$) in a Belgian high school were taught Tai-bo exercises by certified instructors during their regular physical education classes. Again, participants were randomly placed in one of the four conditions, with cell sizes ranging from 54 to 58. Instructors handed out written material that included a set of instructions containing the experimental manipulations and a brief overview of Tai-bo. Students wrote their names on these before returning them.

Participants in the intrinsic goal condition were told that doing Tai-bo exercises could help them attain the goals of physical fitness, remaining healthy, and avoiding illness throughout their lives. Participants in the extrinsic goal condition were told that doing Tai-bo was useful for attaining the goals of appearing physically attractive, looking appealing to others, and avoiding gaining weight. As in the first two studies, intrinsic versus extrinsic goal content was crossed with an autonomy-supportive versus controlling context. Again, this was done by making similar changes to the wording, as had been done in the first two studies.

After reading the text, students learned Tai-bo exercises during the next two physical education classes, which they would have done whether or not the experiment was conducted. At the end of the first class, participants filled out a questionnaire that assessed their autonomous motivation for the exercises. At the end of the second class, held 3–5 days later, participants performed Tai-bo exercises and were graded on their performance by the instructor, who was blind to the experimental conditions and the purpose of the study. Students were invited to demonstrate Tai-bo exercises on two subsequent occasions.

Pilot Study 3

We did a third pilot study ($N = 120$) to examine the effectiveness of the goal-content instructions used in Study 3. The means for the factor com-

posites of the importance of the two goals in the four conditions were 4.95 ($SD = 0.22$) for the intrinsic goal in the intrinsic condition, 1.67 ($SD = 0.98$) for the intrinsic goal in the extrinsic condition, 1.68 ($SD = 1.09$) for the extrinsic goal in the intrinsic condition, and 4.90 ($SD = 0.30$) for the extrinsic goal in the extrinsic condition. A 2×2 ANOVA indicated a significant crossover interaction, $F(1, 118) = 1,073.49$, $p < .001$, and protected t tests revealed that both the intrinsic-goal ratings and the extrinsic-goal ratings differed in the two conditions, $t(116) = -31.25$, $p < .001$, and $t(116) = -21.77$, $p < .001$, respectively. Thus, whereas in Pilot Study 1, the interaction was carried primarily by the difference in the extrinsic-goal ratings, and in Pilot Study 2 it was carried primarily by the difference in the intrinsic-goal ratings, here there were significant effects for both sets of ratings.

Measures

Autonomous motivation. This was assessed using the same approach as in Studies 1 and 2, but the questionnaire was slightly different because of the different activity (Mullan, Markland, & Ingledew, 1997). Items were answered on a 4-point Likert scale. The alpha was .91.

Graded performance. The students' physical education teachers, who had taught the Tai-bo exercises, graded the quality of the students' performance on a scale varying from 1 (*Very bad*) to 10 (*Very good*). As noted, teachers were blind to the participants' condition assignments.

Free-choice behavior. The persistence measure was whether participants volunteered to demonstrate Tai-bo exercises to other students 2–3 days after their second lesson and/or to visitors during an open school day 2–4 days after that. For each participant, we counted the number of demonstrations they volunteered for (varying between 0 and 2).

Results

The means for all variables across experimental conditions, as well as the correlations between pairs of variables, are presented in

Table 7
Means and Intercorrelations Among Mediator and Outcome Variables: Study 3

Variable	M	1	2
1. Autonomous motivation	2.58	—	
2. Test performance	5.99	.43***	—
3. Persistence	1.00	.31***	.36***

*** $p < .001$.

Table 7. Table 8 shows the means and standard deviations of the four cells for the mediating and outcome variables.

Preliminary Analyses

ANOVAs were used to determine that boys and girls did not differ on any outcome variables and that gender did not interact with goal-content or learning climate, so gender was not included in further analyses.

A two-way MANOVA was performed on the mediating variable (autonomous motivation) and the two dependent variables (graded performance and free-choice persistence). Results showed positive main effects for intrinsic goal content, $F(3, 218) = 99.78, p < .001$, and autonomy-supportive context, $F(3, 218) = 84.75, p < .001$, as well as an interaction, $F(3, 218) = 11.09, p < .01$.

We then conducted univariate two-way ANOVAs for each mediating and dependent variable, and, as hypothesized, we found main effects for both independent variables on all three mediating and dependent variables (see Table 8). Framing the task in terms of intrinsic (relative to extrinsic) goals and providing those different goals in an autonomy-supportive rather than controlling fashion both led to more autonomous motivation, better performance, and more persistence, fully replicating Study 2 results. Table 8 also

shows the effect sizes, which varied from .09 to .50 for goal content and from .21 to .32 for social context.

Finally, autonomy support and intrinsic goals interacted to produce an additional positive effect on people’s autonomous motivation, $F(1, 220) = 26.99, p < .001, \eta^2 = .11$, and graded performance, $F(1, 220) = 4.10, p < .001, \eta^2 = .02$. The interaction was not significant for persistence, $F(1, 220) = 1.11, p < .29$.

Mediational Analyses

To examine the degree to which autonomous motivation mediated the effects of goal content and learning climate on performance and persistence, we used the same regression procedure (Kenny et al., 1998). Table 9 presents these results, with those for the independent variable of goal content preceding those for social context. As shown in the table, the direct effects of the independent variables on the dependent variables (Step 1) were highly significant. The paths from the two independent variables to the mediating variable were highly significant, with betas of .62 for goal content and .41 for social context (Step 2, not shown in the table). The paths for Step 3 (the mediator to the dependent variables controlling for the independent variables) were all significant, as shown in the table. Then we did Step 4, which concerned the drop in the relations from the independent variables to the dependent variables when controlling for the mediator.

First, consider the independent variable of intrinsic goal content. With the mediating variable of autonomous motivation, there were significant decreases in the path coefficients for both dependent variables, using Sobel’s test, as shown in the table. For performance, goal content predicted significant variance beyond that accounted for by the autonomous-motivation mediator. Next, consider the independent variable of autonomy support versus control. With the mediating variable of autonomous motivation, there were substantial decreases for the paths to both dependent variables, resulting in significant mediation, according to Sobel’s test, al

Table 8
Cell Means and Standard Deviations for the Four Experimental Conditions (Goal Content Crossed With Social Context) and Analysis of Variance (ANOVA) Results With the Goal-Content Effects (Top Half) and Social Context Effects (Bottom Half): Study 3

Variable	Intrinsic goal		Extrinsic goal		ANOVA results	
	M	SD	M	SD	F(1, 220)	η^2
	Autonomy-supportive context				Intrinsic versus extrinsic goal effects	
Autonomous motivation	3.33	0.31	2.32	0.40	221.05***	.50
Test performance	7.08	1.05	5.91	1.08	42.77***	.16
Persistence	1.80	0.55	1.17	0.98	22.08***	.09
	Controlling context				Autonomy-supportive versus controlling effects	
Autonomous motivation	2.56	0.43	2.08	0.35	100.94***	.32
Test performance	5.76	1.06	5.14	0.90	57.81***	.21
Persistence	0.69	0.95	0.29	0.72	81.68***	.27

*** $p < .001$.

Table 9
Betas for the Paths in the Regression Analyses With Autonomous Motivation as the Mediator in the Relations Between the Independent Variables of Intrinsic-Goal Content (Top Half) and Autonomy-Supportive Context (Bottom Half) and Each Dependent Variable: Study 3

Variable	Step			Sobel's test	R^2 ^b
	1	3	4 ^a		
Intrinsic content					
Graded performance	.36***	.34***	.15**	4.09***	.20***
Persistence	.25***	.26***	.10	3.04***	.10***
Autonomy support					
Graded performance	.42***	.31***	.29***	3.93***	.25***
Persistence	.50***	.13*	.44***	1.98*	.26***

Note. Step 1 refers to the path from the independent variable to a dependent variable; Step 3 refers to the path from the mediating variable to a dependent variable controlling for the independent variable; Step 4 refers to the path from the independent variable to a dependent variable controlling for the mediating variable.

^a Controlling for autonomy. ^b Total amount of variance explained in a dependent variable after entering the independent variable and the mediating variable.

* $p < .05$. ** $p < .01$. *** $p < .001$.

though in both cases the mediation was only partial. Table 9 shows that the amount of total variance explained in the dependent variables by the independent and mediating variables ranged from .10 to .26, all being highly significant.

Finally, consider the interaction of goal content and learning context. There was not an effect of the interaction on persistence to be mediated. Further, although the ANOVA showed a significant interaction on performance, the beta that resulted in the regression analysis was only marginal, so we did not proceed with the mediational analyses.

Brief Discussion

In Study 3, instrumentalities to the goals of health versus image represented the instantiation of intrinsic versus extrinsic goals (Kasser & Ryan, 1996). This was different content from that used in Studies 1 and 2, yet the significant differences in performance and persistence appeared as they had in the previous studies. Further, in this study, the main effects for both goal content and learning climates appeared when the participants were learning to do a physical activity rather than learning text material, and the positive interaction for intrinsic goal content and autonomy-supportive learning climate appeared again for autonomous motivation and for test performance but not for persistence. Thus, the results of Study 3 provide strong replications and important extensions of the findings of the first two studies. Further, the current study showed that autonomous motivation partially mediated the experimental results. For the outcome of performance, intrinsic goal content predicted independent variance beyond that accounted for by autonomous motivation.

General Discussion

Three studies provide strong evidence for our primary hypotheses that the experimental manipulation of both intrinsic goal framing and autonomy-supportive climates would result in adap-

tive, learning-related outcomes. In all studies, there were significant main effects for both intrinsic goals and autonomy-supportive climates on all outcomes related to students' learning of either text material or a new activity. Further, on the outcomes of superficial processing, deep processing, and test performance, there were interactions indicating that the two experimental manipulations worked synergistically to yield less superficial processing, more deep processing, and better performance. Together, the findings extend previous work, as discussed below.

Intrinsic Versus Extrinsic Goal Effects

Past studies have related intrinsic (relative to extrinsic) life goals to better mental health (e.g., Kasser & Ryan, 1993, 1996; Sheldon et al., 2004) and to healthier behaviors, such as less smoking and drinking and having less conflict in close relationships (e.g., Kasser & Ryan, 2001; McHoskey, 1999; Williams et al., 2000). Ryan et al. (1996) interpreted such results as indicating that pursuit and attainment of intrinsic (relative to extrinsic) goals allow greater satisfaction of the basic psychological needs for autonomy, competence, and relatedness, resulting in greater well-being and healthier behaving.

Prior to the current studies, intrinsic versus extrinsic goal contents had not been examined in relation to achievement outcomes. Thus, the result that engaging in learning behaviors with an intrinsic goal (viz., personal growth, health, or community contribution) resulted in more learning and better performance than did engaging in the behaviors with an extrinsic goal (viz., money or an attractive image) is a new finding and represents a significant advance over previous studies.

The current results are the first in which intrinsic versus extrinsic goals were manipulated experimentally rather than treated as individual differences. A causal interpretation thus suggests that framing activities as being instrumental for attainment of intrinsic rather than extrinsic goals will lead to better learning and perfor-

mance. On the basis of the pilot studies, the effects of the goal manipulation on learning may occur either because it was successful in affecting people's extrinsic goals (Pilot Study 1), their intrinsic goals (Pilot Study 2), or both (Pilot Study 3).

An alternative interpretation suggests that the goal effects on learning may have resulted from greater total importance being placed on learning in the intrinsic-goal condition than the extrinsic-goal condition. Data analyses from the three pilot studies examined this possibility. We calculated the total importance to participants of learning with intrinsic plus extrinsic goals in the intrinsic versus extrinsic experimental conditions. The results of Pilot Study 1 show that the average total importance placed on learning in the extrinsic condition was greater than in the intrinsic condition. In Pilot Studies 2 and 3, there were no differences in total importance in the two experimental conditions. Thus, the results indicate that the enhanced learning in the intrinsic-goal condition relative to the extrinsic-goal condition cannot be accounted for by the total importance placed on learning being greater in the intrinsic condition.

The Interaction of the Goal and Social Context Manipulations

Previous studies have shown main effects for autonomy-supportive versus controlling social contexts on learning and well-being (e.g., Grolnick & Ryan, 1987). The current studies were the first to show a positive interaction when intrinsic (vs. extrinsic) goals are pursued in an autonomy-supportive (vs. controlling) interpersonal context. It appears that people are more able to fully attend to and grasp the importance of an intrinsic goal for their learning when they feel free to decide for themselves to learn rather than feeling forced to do so. In other words, although intrinsic goals had a main effect when administered in a controlling context, they had a synergistically positive effect when administered in an autonomy-supportive context because the context allowed people to experience the congruence of pursuing an intrinsic goal that is closely aligned with their basic psychological needs. Thus, in the intrinsic-goal/autonomy-support condition of the current experiments, we observed the synergistic effect on learning of engaging the intrinsic goal more fully because of the supportive context, over and above the contributions made by main effects for the intrinsic goal and for the autonomy-supportive context.

Notably, this account of the interaction does not represent a match hypothesis, which would also imply that the match of an extrinsic goal and a controlling context would have better outcomes than the intrinsic/controlling or the extrinsic/autonomy-support conditions. Nor does it imply that the extrinsic/controlling condition would have worse outcomes than would be expected from two main effects. It is only the intrinsic/autonomy-support condition that accounts for the synergy, because this condition provides the most fertile ground for learning.

The findings that both intrinsic goals and autonomy support produced more free-choice persistence is a strong finding in that the measurement of persistence included behaviors that required substantial additional time and effort (e.g., demonstrating Tai-bo over a weekend or doing additional homework). It is interesting to note that persistence was the one outcome where there was consistently not an interaction effect. It is difficult to provide a clear

interpretation of this. What makes persistence different from learning and performance (for which there were interactions) is that persistence involved doing additional work—that is, doing tasks that were not part of the learning activity itself but went above and beyond it. Content and context both mattered even for these extra behaviors, but their combination did not promote a synergistic effect on persistence.

Autonomous Motivation as a Mediator

A final set of results concerns mediation of the experimental effects on learning-related outcomes by autonomous motivation. It was used in all three studies and significantly mediated all 22 main effects where it was examined. However, the interaction was not consistently mediated. In Study 1, autonomous motivation mediated the interaction on two variables, but in Studies 2 and 3 there was no mediation.

We hypothesized that although autonomous motivation would significantly mediate the main effects from the goal manipulation to the outcomes, there would still be a significant relation between goal content and outcomes even after the mediator had been controlled for. In Study 1, the goal manipulation was a significant predictor of three out of the four effects after controlling for autonomous motivation. In Study 2, the goal manipulation was a significant predictor of two out of five outcomes after controlling for the mediator. In Study 3, the goal manipulation was a significant predictor of one out of the two outcomes after controlling for the mediator. As already noted, a set of three studies (Sheldon et al., 2004) showed that although intrinsic goal content and autonomous motivation are typically correlated, intrinsic goals had significant unique effects on well-being over and above the effects of autonomous motivation. In the current studies, this finding was replicated in 6 of the 11 cases. As such, results of the current studies extend the finding to learning outcomes.

As for mediation by autonomous motivation of the link from autonomy support to outcomes, we also found that in 6 of the 11 cases there was a significant relation from autonomy support to the outcomes after controlling for the mediator. Past studies have shown both partial and full mediation of this link by autonomous motivation, with perceived competence improving the mediation (Williams et al., 2004). Future studies might also include this variable as a mediator.

Limitation

A limitation of these studies worth noting is that there was not a no-goal condition, so it is not possible to know if intrinsic-goal framing increased learning outcomes relative to no goals, if extrinsic-goal framing decreased learning, or if both of these effects occurred. Further studies that use a no-goals control group will be necessary to clarify this issue.

Conclusions

Using multiple extrinsic and intrinsic goals (money and image vs. community, growth, and health), various preprofessional samples (preschool teachers in training, college students majoring in marketing, and high school students), multiple tasks (learning text material and learning new exercises), and multiple outcomes (su-

perfunctory vs. deep processing, performance, and persistence), the present study results were highly consistent with each other and with SDT's predictions (Deci & Ryan, 2000). Presenting tasks in terms that are consistent with satisfaction of basic psychological needs (whether via the content or the context of the task) led to positive learning-related outcomes. Moreover, we consistently found an interaction such that when these facilitating factors were provided together, there was an additional positive effect on people's self-reports of superficial versus deep processing and on objectively measured achievement. Finally, the effects of these experimentally manipulated facilitating factors were found to be mediated to a significant degree by autonomous motivation.

It appears that teachers' use of intrinsic goals for framing learning activities and their providing autonomy-supportive learning climates have significant effects for students becoming more fully dedicated and more genuinely engaged in learning activities. Thus, the findings have important implications for designing optimal learning environments.

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