

Academic Motivation of Elementary School Children in Two Educational Approaches — Innovative and Traditional

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The school must teach how to think.
—Ewald Il'enkov

Background. While the current literature provides valuable insight into how school climate perceptions and student motivation impact academic achievement, research examining the mediating effects of motivation in the linking of an innovative educational system, school climate, and achievement is limited. This study considers the potential of the El'konin–Davydov system of developmental education as a basis for educational innovation. Self-determination theory is applied as a useful theoretical framework that allows for consideration of both the intensity and the quality of academic motivation.

Objective. The study examines a model that illustrates the role of intrinsic and different types of extrinsic motivation in linking the El'konin–Davydov system of developmental education (DE) and school climate to the academic achievement of elementary schoolchildren.

Design. Participants were 345 third and fourth graders drawn from four public schools in Moscow, with some ($N = 192$, 2 schools) educated in the traditional system and others ($N = 153$, 2 schools) in one that follows the DE system. A cross-sectional design was implemented.

Results. Students in the DE system showed significantly lower external motivation for all three subscales (Parents, Teachers, General) and perceived school climate more favorably. Structural equation modeling showed that the hypothesized model fit the data well, supporting the hypothesis that student external motivation plays a mediating role in linking educational system (innovative vs. traditional) with academic achievement. Students' autonomous motivation was shown to play a mediating role in linking positive perceptions of school climate with academic achievement.

Conclusion. The elementary school students from developmental education classes compared to their peers from traditional education classes demonstrate more positive profile of academic motivation including lower external motivation, more positive attitude towards school and study; however, the two groups do not differ in the level of intrinsic, identified, and introjected motivations.

Keywords: Intrinsic motivation, extrinsic motivation, self-determination theory, El'konin–Davydov developmental educational system, school climate, academic achievement, elementary schoolchildren

Introduction

A body of research has been dedicated to identifying the factors, both environmental and personal, that influence student academic achievement. Two significant lines of research in educational psychology are the study of (a) characteristics of school climate and educational system, and (b) motivational processes, such as intrinsic motivation, persistence, and academic self-efficacy. Studies have found that both school climate and student motivation are consistently associated with academic achievement (Gustafsson & Nilsen, 2016; Hardre & Reeve, 2003; Roeser & Eccles, 1998; Scherer & Nilsen, 2016). However, while current research provides valuable insight into how school climate and innovative educational systems impact academic achievement, less is known about the mechanisms that link innovative educational systems based on psychological theories with academic achievement, and in particular the mediating role of motivation in this process. The present study applies self-determination theory (SDT) to investigate the role of different types of motivation (e.g., intrinsic and identified versus external) in the link between learning environment (educational system and school climate) and academic achievement.

A Differentiated Approach to Learning Motivation: Self-Determination Theory (SDT)

According to SDT, motivation refers to the reasons that underlie behavior; motivation differs not only in quantity, but also in quality (types of motivation) (Ryan & Deci, 2000b). Applied to education, this refers to the reasons that students engage in learning activity (Ryan & Deci, 2000a). SDT distinguishes among intrinsic motivation and different types of extrinsic motivation, which vary in terms of their self-determination—i.e., the extent to which behavior originates from the self. Intrinsic motivation refers to engaging in an activity for its own sake, for the interest or enjoyment derived from mastering optimal challenges. By contrast, extrinsic motivation refers to engaging in an activity for instrumental reasons such as receiving rewards, avoiding punishments, boosting one's self-worth, or reaching personally valued goals.

According to SDT, there are four subtypes of extrinsic motivation that vary in the degree of self-determination; these four subtypes can be placed along a continuum of relative autonomy — external, introjected, identified, and integrated (Ryan & Connell, 1989).

External motivation is completely noninternalized (see Fig. 1 from Sheldon & Gordeeva, 2018), the least autonomous form of motivation. It refers to doing an

activity because one feels controlled by external contingencies involving threats of punishments, demands and criticism or, alternatively, approval and material rewards bestowed by others. Next in terms of degree of relative autonomy, *introjected motivation* refers to the regulation of behavior by internal forces, such as feelings of obligation and contingent self-esteem. The individual somewhat endorses the reasons for learning, but still in a controlled way. Within the introjected subtype of extrinsic motivation, positive introjected and negative introjected motivations can be reliably distinguished: the former is related to feelings of self-worth and pride, and the latter to feelings of shame, guilt, and obligation (Assor, Vansteenkiste, & Kaplan, 2009; Sheldon, Osin, Gordeeva, Suchkov, & Sychev, 2017). The next motivational type, *identified motivation*, is a self-determined form of extrinsic motivation, because the behavior originates from the self in a non-contingent way. It is observed when students identify with the reasons for performing a behavior, or when they personally value it and find it important. Finally, *integrated motivation* refers to the most internalized type of extrinsic motivation. This type requires the individual to have formed an identity such that s/he can identify with the importance of a behavior and assimilate that identification with other aspects of a coherent sense of self. Since the hierarchical organization of the self is developed only by the end of adolescence (Harter, 2003), we did not assess integrated motivation in the present study.

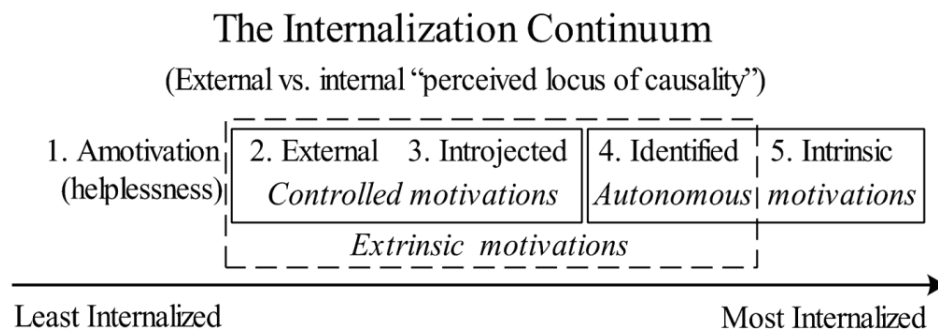


Figure 1. The Internalization Continuum (from Sheldon & Gordeeva, 2018)

In the educational domain, these types of motivation have been found to lead to a number of important cognitive, behavioral, and emotional outcomes. Students who express more autonomous types of motivation (intrinsic and identified types of motivation) are more persistent and cognitively involved in their tasks, display more positive coping styles and higher quality learning, whereas students who are motivated in a more controlled fashion (introjected and external types of motivation) expend less effort, are more easily distracted, experience more anxiety and other negative emotions, and have lower grades (Guay, Ratelle, & Chanal, 2008; Ryan & Connell, 1989; Ryan & Deci, 2017; Gordeeva, 2014).

Developmental Education and School Climate as External Factors of Academic Attainment

Both educational system and school climate are considered to have a significant impact on students’ achievement and persistence. Definitions of school climate usually include students’ perceptions about school, relationships with teachers and

classmates, and values and expectations that help feeling emotionally, socially, and physically safe (Cohen et al., 2009). Educational system is defined as a set of pedagogical principles and strategies that relate to the goals, content, methods, forms of education (teaching), as well as the grading system; its main goal is to improve instructional quality.

Developmental Education (DE). Based on L.S. Vygotsky's idea about "education that leads development" (Vygotsky, 1956/2017) and Davydov's theory of developmental education (Davydov, 1996), this practical approach to education was proposed by Russian psychologists V.V. Davydov, D.B. El'konin and V.V. Repkin in the late 1950s and was further developed by G.A. Zuckerman (2011, 2014). DE has received official state approval and is currently used in some Russian schools (Vorontsov, Zaslavsky, L'vovsky, Chudinova, & El'konin, 2013). Compared to the traditional educational system, DE involves changes in the goals and content of learning, as well as innovative methods, different forms of learning, and a different grading system.

The main goal of the Elkonin–Davydov "system of developmental education", as it is called, is to encourage students' learning initiative, independent critical thinking, and "the development of reflective abilities ... and learning potential that requires transcending the limits of one's knowledge and skills in search of new ways of acting" (Zuckerman, 2014, p. 198). In particular, this system implies a change in the content of education, which means the inclusion in such content of theoretical knowledge and the corresponding general methods of action. This change presumably leads to the formation of theoretical thinking. Theoretical knowledge is knowledge about the genesis of the concept being learned (Davydov, 2008). Theoretical knowledge allows children to understand not only how to do something, but also why to perform a task this way and not another.

DE criticizes traditional educational system for developing in children the ability to act deliberately in accordance with given rules and instructions, while in the DE system the teacher deliberately does not provide ready-made knowledge for the students, but makes an effort to help them search independently for new means and methods of action (Zuckerman, 2014). Within this educational system, continuing the ideas of J. Bruner's "discovery learning" (Bruner, 1960), different problem-based methods of teaching are used. In particular, various means of educating children about how to work with a contradiction found within a problem are utilized, while entertaining different points of view about the same phenomenon. As to the forms of teaching, DE emphasizes the students' collaboration toward the formation of learning cooperation. Zuckerman (2014) considers the "molecule" of developmental education to be the mutual (i.e., interactive) actions of the child (or group of children) and the adult, which intersect at the point of the socially designed tool, sign, or symbol that is to be mastered.

According to Zuckerman, the general principles of cultivating learning skills in DE are as follows. First, new concepts are introduced when schoolchildren come across a contradiction between their knowledge and a new fact. Second, the introduction and concretization of each concept take place in the form of a discussion specially "sharpened" by the teacher, so that different points of view existing in the classroom are presented in a contrasting way. Third, judgments made by a student, teacher, or textbook author are considered to be an hypothesis until evidence for it

is provided, and the methods for that are specifically taught (Zuckerman, 2005; see examples in Zuckerman, 2014).

Finally, the DE system differs from the traditional one in that the traditional (teacher-guided, public, and comparative) grading system does not apply. From the very beginning of the learning activity, children are taught to evaluate their own achievements based on a system of different criteria jointly discussed and selected with the teacher. Additionally, as the DE system suggests, if the child is working at the limit of his or her abilities, the teacher should proceed from the fact that the pupil deserves the highest evaluation, regardless of what the achievements of other children were.

A number of studies by Davydov, Zuckerman and their colleagues showed that DE facilitates better theoretical thinking, problem-solving skills, the ability to learn (Davydov, 2008; Zuckerman, 2005), and a higher level of readiness for school education (Nisskaya, 2018). However, the results were based on rather small samples and questionable measures. For example, Zuckerman (2005) has shown that high school students from DE classes compared to their peers in modern traditional classes demonstrate higher ability to learn, which means the ability to acquire knowledge independently and use intellectual tips. However, the sample of participants from DE classes was small and there were no differences in intellectual achievements measured by math PISA tests. Even more importantly, less is known about motivational and self-regulatory factors that stimulate the positive intellectual outcomes of DE students, and in particular the level of intrinsic and different types of extrinsic motivation that may support them. It is also unclear whether these results apply already to elementary school students studied in DE classes.

In Voronkova's study (2003) it was shown that 8th graders from DE classes had significantly higher learning motivation than their peers from high school lyceum classes with a pre-selection but standard educational program. Based both on this study and the theoretical principles of the theory of developmental education (see Selevko, 2005), we assumed that the level of intrinsic motivation of children from DE classes would be higher than that of children from classes with traditional education.

School climate. In the present study, we consider school climate as a relevant dimension of the learning environment which, together with the educational system, may shape student motivation related to academic achievement. Empirical evidence suggests that children's perception of a positive school climate is linked to better academic performance and learning outcomes (Jia et al., 2009; Niehaus, Rudasill, & Rakes, 2012; Reyes et al., 2012); to well-being, including greater life satisfaction and less likelihood of depression; and to fewer behavioral and emotional problems (Scrimin, Moscardino, Altoé, & Mason 2017). Differences in school climate have helped to explain why, despite large class sizes, students in China demonstrate higher academic achievement and less disruptive and aggressive behaviors than those at many schools in the United States (Yang et al., 2013).

Relationships with teachers are often considered to be the most salient and important components of school climate. In classrooms with a positive climate, teachers are responsive and caring in relation to their students' academic and emotional needs; they create a warm and harmonious atmosphere, respect and highly value

the students' perspectives. Relationships with teachers, when measured as positive teacher regard and perceptions of teacher support, have been found to correlate positively with student grades (Roeser & Eccles, 1998). Similarly, students' perceptions of a caring and supportive relationship (Battistich, Solomon, Kim, Watson, & Schaps, 1995) were found to positively relate to math, science, and writing performance for elementary and middle school students.

A recent large-sample study of high school students showed that intrinsic motivation mediates the link between perceived school climate (in particular, the teacher–student relationship) and achievement in reading and math (Fan & Williams, 2018). We hoped to replicate these findings using a sample of elementary school children, utilizing the SDT perspective on motivation. To the best of our knowledge, no attention has been given to the link between an innovative educational system and controlled types of motivation, and the role of these types of motivation in the link between the educational system and academic achievement. Furthermore, despite the fact that the system of developmental education has been found to be effective (Zuckerman, 2005), there is a lack of studies that show the psychological mechanisms that mediate its impact on students' educational attainments.

Three research questions guided the present study:

1. Do elementary school students in DE classes show higher intrinsic and identified (i.e., autonomous) motivations than students in traditional classes?
2. Do elementary school students in DE classes show lower introjected and external (i.e., controlled) motivations than students in traditional classes, and a higher relative autonomy index (RAI), which testifies to the dominance of autonomous over controlled forms of motivation?
3. Are autonomous and controlled motivations associated with the type of educational system, perceived school climate, and academic achievement of elementary school students?

Our hypotheses were the following:

1. On the basis of the literature suggesting that (a) DE increases problem-solving skills and academic achievement, and (b) DE by itself is an activity aimed to develop the child's potential and this goal should be the subject of reflection by the child (Zuckerman, 2005), we anticipated that students in DE would report higher autonomous and lower controlled motivations.
2. Building on our own research as well as the work by Fan and Williams (2018), we expected that the developmental education system would have an impact on student motivation, which in turn would be associated with higher grades.
3. Given that motivation has been found to be linked both to the school's emotional climate and to children's adjustment to school, sometimes mediating both variables (e.g., Reyes et al., 2012), we hypothesized that perceived school climate would be associated with autonomous motivation, which in turn would be associated with academic achievement.

Method

Participants and Procedure

Participants were 345 third and fourth graders drawn from four public schools in Moscow, with some ($N = 192$) educated in the traditional system and others ($N = 153$) in an innovative one (DE). The total sample comprised 186 boys and 158 girls (one child did not specify gender); age $M = 9.7$, $SD = 0.69$, age range 8–12 years. The questionnaires were administered to students in group settings during regular class hours. The research was introduced as “a study of children’s views on life and study”. Parental consent to participate was obtained for all students. At the end of the school year, we obtained information on the academic achievement of 259 pupils (final marks for four main subjects) from the school administrations.

Measures

Academic motivation. For the purposes of this study, we created Academic Motivation Questionnaire (AMQ) based on the Ryan and Connell (1989) SRQ measure. This questionnaire addresses the reasons that children do their schoolwork and homework, and try to answer questions in class; it measures intrinsic, identified, introjected, and external regulations (motivations) for these various school-related activities. Each subscale had 4 items. An expert committee of two professors and two doctoral students created a set of items, which included new items and several translated items previously used in SRQ. Partly following Vallerand’s ideas (Vallerand et al., 1993) and our own model of intrinsic motivation (Gordeeva, 2014), we developed two intrinsic motivation subscales, one to measure motivation to learn (a sample item is, “I do my homework because I like knowing new things”) and another for self-development motivation (a sample item is, “Because I like to improve myself”). Following previous research (Sheldon et al., 2017), we developed two introjected subscales, positive and negative. Sample items are, “Because I’ll be proud of myself if I do it” (positive introjection) and “Because I’ll feel ashamed of myself if I don’t” (negative introjection). Finally, to capture more precisely the variety of external pressures that induce children to learn, in addition to a general external motivation scale, scales were created to assess students’ perceptions of external pressures coming from parents and teachers. Example items are, “I have no choice, I have to work in class” (General), “Because my parents demand that I study well” (Parents), “Because my teacher will be glad if I study well” (Teachers). CFA for the questionnaire is $\chi^2 = 997.62$; $df = 436$; $p < 0.001$; CFI = 0.841; NNFI = 0.820; RMSEA = 0.061; 90% CI for RMSEA: 0.056–0.066; PCLOSE = 0.000; $N = 345$. Reliability coefficients (Cronbach’s α) for all scales are presented in table 1.

Educational system. The educational system (innovative vs. traditional) was coded as 1 and 0, respectively, for classes that used the El’konin–Davydov (DE) system (2 schools, 8 classes, $N = 153$) and the traditional educational system (2 schools, 9 classes, $N = 192$). The specificity of the DE educational system compared to the traditional one is described above.

School climate. We assessed school climate via the Perception of School subscale from the Multidimensional Students’ Life Satisfaction Scale (MSLSS) (Huebner, 1994, Russian adaptation — Sychev, Gordeeva, Osin, & Sidneva, 2019) and by creating a scale to measure relationships with teachers. Both Perception of School

and Relationships with Teachers subscales had six items, with items rated on 5-point Likert scales. Example items are “I do not really like my school” (School), “I like to listen to my teachers” (Teachers). Cronbach’s alphas were 0.87 and 0.89, respectively.

A nonverbal measure of general attitude towards school and study was also employed (Andrews & Withey, 1976). It depicts seven faces, ranging from most happy to least happy. The child was asked to decide which face best reflects his/her attitude towards school and study.

Academic achievement. The end of the year’s grades in four principal school subjects (math, native language [Russian], foreign language [English], and reading/literature) were collected from school records. We were able to compare academic achievement in two types of schools, because even a school that does not give the children grades in the traditional sense (DE) is obliged to submit grades to the school administration at the end of the year. The four grades were averaged to form an overall academic achievement indicator (pairwise correlations between four subjects ranged from 0.51 to 0.77). All schools except one used traditional scale of marks ranging from 2 to 5 and in one school 100-point scale was used. We transformed 100-point marks into traditional scale using the rules recommended by the school administration before statistical analysis (the system they actually use presenting students’ academic achievement at the end of the school year).

Results

First, we conducted a correlation analysis of the scales of the extended version of the AMQ. Correlations of scales, the mean values, and standard deviations are presented in Table 1. As we expected, the two intrinsic types of motivation and identified motivation were highly correlated ($r > 0.7$), which justifies combining them to represent the construct of autonomous motivation. The three subscales of external motivation (Teachers, Parents, and General) were also strongly correlated, although the values of coefficients were somewhat lower ($0.63 > r > 0.44$). In accordance with SDT, there was no positive association between intrinsic and external (as least autonomous form of extrinsic) motivation, while introjected motivations, which is middle of the self-determination continuum, showed positive correlations with both intrinsic and external types of motivation. On the whole, the correlation analysis demonstrated that in spite of the large number of scales, their correlations support well the simplex pattern postulated in SDT (Ryan & Connell, 1989). Accordingly, an unweighted relative autonomy index (RAI) was calculated following Sheldon et al. (2017), showing the relative dominance of autonomous motivation over controlled motivation. In particular, RAI index was calculated as sum of motivation to learn, self-development, identified and positive introjected motivation minus sum of negative introjected and three external types of motivation.

Given that the sample comprised students from four schools we started by comparing children from schools that used the same educational system by all the measured variables. Using Student’s *t*-test we discovered that students studying in different schools but using the DE innovative system were similar to each other (no statistically significant differences were found). Relationships with teachers (as a school climate indicator) was the only scale to show weak, but significant differ-

Table 1
Means, standard deviations and correlations by scales of academic motivation

	Number of items	Mean	SD	1	2	3	4	5	6	7	8
1. Intrinsic M.	4	2.81	0.85	(0.77)							
2. Self-developed M.	4	3.22	0.76	0.77***	(0.81)						
3. Identified M.	4	3.19	0.77	0.75***	0.79***	(0.78)					
4. Positive introjected M.	4	2.84	0.85	0.36***	0.40***	0.42***	(0.70)				
5. Negative introjected M.	4	2.89	0.90	0.36***	0.43***	0.43***	0.63***	(0.74)			
6. External M. (Parents)	4	2.89	0.79	0.02	0.10	0.08	0.38***	0.40***	(0.66)		
7. External M. (Teachers)	4	2.85	0.80	-0.12*	-0.03	-0.07	0.29***	0.29***	0.59***	(0.70)	
8. External M. (General)	4	2.78	0.92	-0.12*	-0.04	-0.08	0.16**	0.30***	0.44***	0.63***	(0.65)
9. RAI	32	0.67	3.22	0.68***	0.61***	0.63***	0.17**	-0.07	-0.48***	-0.63***	-0.65***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed, $N = 345$. On the diagonal in parentheses are values of Cronbach's α . M — motivation, RAI — relative autonomy index, numbers of variables in column names correspond to the numbers in row names.

ence at $p < .05$. For students studying in the two schools employing the traditional system we found two significant differences on positive introjected motivation and Perception of school scales. However, these differences were also rather weak and significant at $p < .05$. The small magnitude and low number of differences allowed us to merge the students into two groups, on the basis of the respective educational system, for convenience of further analysis.

T-tests conducted upon the academic motivation scales comparing innovative and traditional educational systems revealed that students in the DE system showed significantly lower external motivation for all three subscales (Parents, Teachers, General) and a higher relative autonomy index (see Table 2). The most significant difference between students educated in the two systems was in parental control. For this scale, the Cohen's d effect size equal to 0.60 demonstrated a medium effect of educational system, while the effect size for the two other extrinsic motivation scales (Teachers and General) was small. No differences were found for intrinsic, identified, and introjected motivation as well as for academic achievement.

T-tests conducted upon indicators of school climate comparing the DE and traditional educational systems revealed that students in the innovative system had better attitudes towards school and studies and a slightly more positive perception of school (marginally significant), which was demonstrated both via self-report and nonverbal measures (see Table 2).

Table 2

Differences in motivation, indicators of school climate and academic achievement between students in the system of developmental education (DE, innovative system) and the traditional system

Indicators	Means		Mann-Whitney U	Z	p -value	Cohen's d
	Innovative system (DE) ($N = 153$)	Traditional system ($N = 192$)				
Intrinsic learning M	2.81	2.82	14642.5	-0.05	n.s.	0
Intrinsic self-development M	3.16	3.28	13271	-1.56	n.s.	0.16
Identified M	3.12	3.25	13372.5	-1.44	n.s.	0.17
Introjected Positive M	2.77	2.90	13737.5	-1.04	n.s.	0.15
Introjected Negative M	2.77	2.99	13120	-1.72	n.s.	0.24
External M (Parents)	2.64	3.09	9891.5	-5.24	< 0.001	0.60
External M (Teachers)	2.73	2.94	12695	-2.17	< 0.05	0.26
External M (General)	2.66	2.87	12641.5	-2.26	< 0.05	0.23
Relative Autonomy Index	1.06	0.36	12580.5	2.29	< 0.05	0.22
Perception of school	3.45	3.24	12995.5	1.84	0.06	0.20
Relationships with teachers	3.69	3.83	13788.5	-0.98	n.s.	0.13
Attitude towards school	5.45	5.18	12685	2.23	< 0.05	0.19
Academic achievement	4.21	4.23	6154.5	-0.34	n.s.	0.02

Note. M — motivation.

The difference between motivational profiles of students in two educational systems is illustrated in Figure 2.

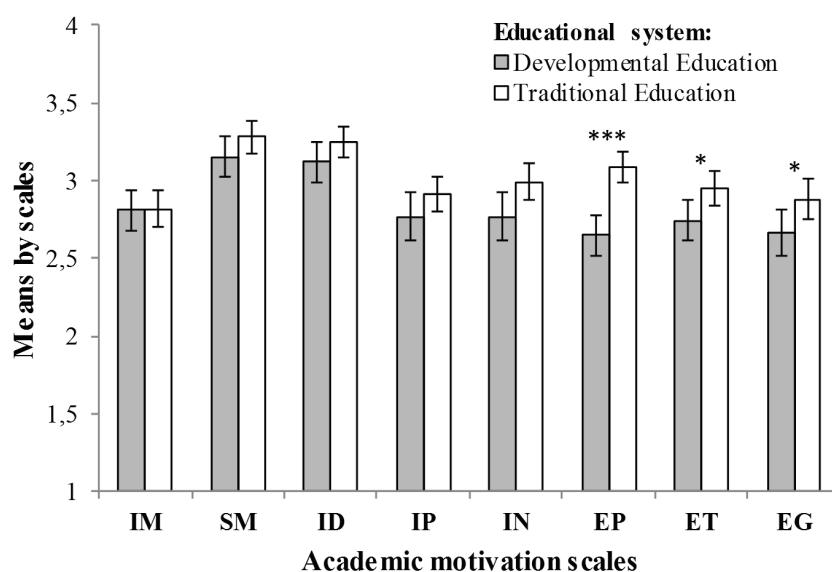


Figure 2. Profiles of academic motivation in the traditional system and the system of developmental education (vertical bars indicate limits of 95% CI, * $p < .05$, *** $p < .001$). IM — intrinsic learning motivation, SM — intrinsic self-development motivation, ID — identified motivation, IP — positive introjected motivation, IN — negative introjected motivation, EP — external motivation (Parents), ET — external motivation (Teachers), EG — external motivation (General).

Table 3

Correlations of academic motivation scales with school climate indicators and academic achievement

Indicators	School climate			Academic achievement
	Perception of school	Relationships with teachers	Attitude towards school	
Intrinsic learning M	0.70***	0.60***	0.67***	0.14*
Intrinsic self-development M	0.57***	0.56***	0.58***	0.13*
Identified M	0.57***	0.55***	0.55***	0.19**
Introjected Positive M	0.18***	0.26***	0.21***	-0.01
Introjected Negative M	0.20***	0.30***	0.21***	0.04
External M (Parents)	-0.08	0.15**	-0.05	-0.15*
External M (Teachers)	-0.21***	-0.06	-0.14**	-0.16**
External M (General)	-0.16**	-0.10	-0.11*	-0.13*
Relative Autonomy Index	0.56***	0.41***	0.52***	0.21**
N	345	345	345	259
α	0.87	0.89	—	0.87

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed, α — Cronbach's α .

Correlations between academic motivation scales, indicators of school climate, and academic achievement are presented in Table 3. At the zero-order level, school climate variables showed strong positive correlations ($r > 0.5$) with intrinsic and identified motivation; moderate positive correlations with both types of introjected motivations; and weak to moderate negative correlations with extrinsic types of motivation. Academic achievement showed positive significant correlations with both types of intrinsic motivation, identified motivation and relative autonomy index. Also weak but significant negative correlations with academic achievement were shown by all subscales of external motivation.

For deeper investigation of the relations among academic achievement, motivation, educational system, and school climate, we conducted structural equation modeling analyses using MPLUS 7.4 in the subsample of students that included data on academic achievement ($N = 259$). This sample included all students ($N = 192$) educated in the traditional system and 67 (44%) students in a developmental one. We did not succeed to get the student's grades from one DE school participated in the study. However, comparison of this subsample of DE students with the other DE students showed the absence of significant differences among the variables included in the model.

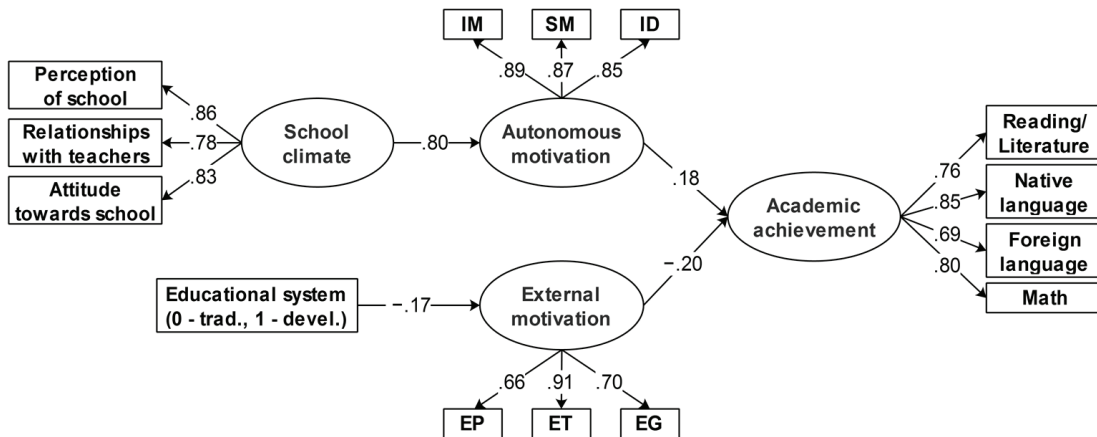


Figure 3. The structural model of relations between educational system, school climate, academic motivation, and academic achievement (all coefficients are standardized and significant at $p < 0.05$, $N = 259$). IM — intrinsic motivation (motivation to learn), SM — self-development intrinsic motivation, ID — identified motivation, EP — external motivation (parents), ET — external motivation (teachers), EG — external motivation (general).

Building the model, we specified two motivational factors of autonomous and external motivation that predicted the latent variable of academic achievement. Introjected motivations were excluded from this analysis to show two extreme types of motivational functioning. External motivation was predicted by the educational system, while autonomous motivation was predicted by school climate. To analyze this model, we used the robust maximum likelihood (MLR) estimator and the full-information maximum likelihood algorithm (Enders & Bandalos, 2001), which estimated parameters on the basis of the available complete data, as well as the implied values of the missing data given the observed data. Figure 2 presents the standardized coefficients that resulted in the model. The path coefficients from

autonomous motivation to academic achievement and from educational system to external motivation were significant at $p < .05$; all the other coefficients were significant at $p < .01$. This model yielded a good fit to the data ($\chi^2 = 137,657$; $df = 74$; $p < 0,001$; CFI = 0,961; NNFI = 0,952; RMSEA = 0,058; 90% CI for RMSEA: 0,043-0,073; PCLOSE = 0,190; $N = 259$).

The model demonstrates that autonomous motivation is positively associated with academic achievement, while external motivation shows a negative impact on academic achievement, as SDT predicts. The model also shows that educational system and school climate are independent factors, and each has its special motivational consequences. As the model suggests, autonomous motivation shows a strong association with school climate, but is not related to educational system. At the same time, studying in the innovative educational system makes a moderately negative impact on students' external (controlled) motivation (that is, for those in the DE system, external motivation tended to be lower than for those in the traditional system), which in turn is associated with lower academic achievement.

Discussion

The El'konin–Davydov system of developmental education is the most famous system of instruction in Russia. It is grounded in psychological theory, the ideas of scholars such as Vygotsky, Bruner, Davydov, El'konin, Repkin, and Zuckerman. Our results show that DE does have a certain potential for the development of children. In particular, the results indicate that students in DE classes had a more favorable attitude towards school and study and a more positive pattern of motivation, expressed in lower external motivation. Although previous research was focused on showing the role of intrinsic and autonomous motivation in the effective learning process (Garon-Carrier et al., 2016), we were able to show that an educational system might be effective by lowering the level of controlled (i.e. external) motivation in elementary school students. We found that all three types of external motivation were lower in DE classes than in traditional classes. We suggest that this might be due to the methods of collective discussion and mutually active interaction, which downplay the teacher's individual pressure and control imposed on, or at least perceived by, students. The low level of external regulation could also be due to the fact that in DE the teacher aims not to favor following rules and instructions, as well as favor obedience and submission, but gravitates to focusing on supporting the students' initiative and independent thinking (Zuckerman, 2014).

Perhaps even more importantly, the lack of traditional evaluation practices in DE classes may positively affect student motivation. The ways in which students are evaluated is one of the most salient classroom factors that can affect student motivation. Depending on how evaluation is structured and presented, students may experience different patterns of motivation and different learning goals (Ames, 1992). For example, SDT research argues for the negative impact of high-stakes testing (Ryan & Weinstein, 2009). Due to the innovative grading practices used in developmental education, students in DE classes may feel more secure about their own competence. As mentioned earlier, in DE classes the students are not given

traditional grades; instead, they learn to evaluate themselves first, using different criteria, then compare these evaluations with the teacher's assessments, which are usually private, so comparison with others is not emphasized. This pedagogical practice is also accompanied by lack of opportunity for parents to control the children by interrogating them about grades, which is a common practice in modern families. As research shows, Russian parents compared to British and American parents are especially prone to be critical regarding children's academic performance (Elliott et al., 2005).

We also found that DE students demonstrated a more positive attitude toward school and learning, i.e. school climate was more positive in DE classes than in traditional classes. This could be explained from an SDT perspective. Teachers can foster students' well-being and motivation to learn by supporting their psychological needs for autonomy, competence, and relatedness (Ryan & Deci, 2000, 2017). Collective problem-focused discussions practiced both in small groups and with the whole class may support children's competence and autonomy needs by having the teacher listen more, offer encouragement (making fewer "should/must" statements), and provide the children with the opportunity to think and act independently and perceive themselves as creators of knowledge, subjects, not objects of the learning process. The competence need could also be better satisfied in DE classes due to the grading practices considered above. Greater relatedness may be fostered by the team-based projects and collaborative learning in discussion sessions practiced in DE. A recent study (Trenshaw et al., 2016) showed that students' feelings of connectedness could be improved by transforming instructors from graders into mentors, and peers from competitors into valued partners in learning. These relationships motivate students to challenge themselves as it becomes safe to fail and try again.

Why were intrinsic and identified motivations not higher in DE classes than in classes with traditional system of education? It was an unexpected result which basically contradicts the core principles of DE (see Selevko, 2006), as well as the results obtained by Voronkova (2003) on adolescents from DE classes. Perhaps this is due to the age of our sample, which has not yet fully felt the results of developmental education. The main reasons we hypothesized that children in DE would feel greater intrinsic motivation are the innovative problem-based methods of teaching, which try to capture students' interest, and the theoretical content of education in DE. However, despite we did not find any differences in intrinsic motivation between DE and traditional classes, although it is worth mentioning that the relative autonomy index (RAI), which shows the dominance of autonomous motivation over controlled motivation, was higher in DE classes. We suggest that a decrease in the level of external (controlled) motivation may be the first step towards raising the level of intrinsic motivation in the future. The more positive school climate found in DE classes also supports this claim. On the other hand, recent studies in math achievements of elementary school children show that the role of intrinsic motivation might be overestimated (Garon-Carrier, Guay, Dionne et al., 2016) which means that our expectations regarding higher intrinsic motivation in DE classes were not justified.

In the present study, the correlations among school climate and autonomous motivation confirm previous findings (Guay et al., 2008). Even more importantly,

our results about school climate, intrinsic motivation, and academic achievement are in good agreement with the results of the study by Fan and Williams (2017) on high school students, which showed the role of intrinsic motivation as a mediator of school climate's influence on academic achievement. Using a sample of elementary students, we found that autonomous motivation (a general desire to know, to develop one's potential, and to value learning) is associated with both positive relationships with teachers and a positive attitude towards school, as well as with academic achievement. This finding is also in line with humanistic theories of learning (Maslow, 1954; Rogers, 1961) and the SDT perspective, which both assert that acceptance, relatedness, and respect from teachers is critical to students' desire to learn and develop their potential.

Limitations

The limitation of this study is the broad nature of the DE concept, which was not measured in detail. Future researchers might evaluate DE teachers' goals of education, to explore their understanding of the content, methods, forms of education and grading system they actually use while teaching. Also with this type of design we cannot be sure that the distribution of children in TE and DE classes was random, which could also affect our results (although we know from school administrations that no special selection was undertaken in either DE or TE classes). Clearly, to better understand how the DE approach affects student motivations to learn and make educational progress, more research is needed.

Another limitation of the study is its cross-sectional design; it is especially important for the claim that school climate makes an impact on academic motivation. In future studies a longitudinal design is needed, so that climate variables and motivational variables as dependent variables can be measured at least twice to test the causal nature of these relationships.

Conclusion

The results highlight that the children from developmental education classes compared to children from traditional system of education classes demonstrate more positive attitude towards school and study as well as more beneficial motivational profile including lower levels of external academic motivations, which means that they feel less controlled by parents, teachers and grades. No differences in intrinsic and identified motivations as well as the level of academic achievement were found. However, the pedagogical mechanisms that underlie these phenomena are not completely clear, and further research should show what needs to be changed in the system of traditional education in Russia, so that it becomes more consistent with modern psychological theories of learning and learning motivation.

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