

Article

# Educational Rationality: Measurement, Correlates, and Consequences

Maciej Karwowski \*  and Bogusław Milerski 

Department of Social Science, Christian Theological Academy in Warsaw, Władysława Broniewskiego 48, 01-771 Warszawa, Poland; b.milerski@chat.edu.pl

\* Correspondence: m.karwowski@chat.edu.pl

**Abstract:** This paper introduces and empirically tests the model of tetragonal educational rationality that consists of four interrelated categories: hermeneutic, emancipatory, praxeological, and negational rationalities. Based on a large longitudinal study on primary and middle school students (total  $N = 1990$ ), we investigated the psychometric properties of the Educational Rationalities Questionnaire (ERQ) and examined relevant correlates, antecedents and longitudinal consequences of the four rationalities. Confirmatory factor analysis corroborated the four-factor structure of the ERQ. Praxeological rationality was more prevalent than hermeneutic rationality, which was accepted more often than emancipatory and negational rationality. Structural equation modeling demonstrated that hermeneutic rationality was primarily driven by participants' academic self-concept in their native language, as well as extraversion, neuroticism, and valuing creativity. Emancipatory rationality was linked to academic self-concept, valuing creativity, and agreeableness, while praxeological rationality was predicted by extraversion, school achievement, and valuing creativity. Finally, negational rationality was inversely linked with several individual characteristics: academic self-concept, agreeableness, and school achievement. Longitudinal analyses demonstrated that negational rationality was associated with lower grades and more negative emotions during lessons, while hermeneutic rationality was associated with school grades improvement. Emancipatory rationality was related to positive emotions felt during classes, yet negatively with grades. We discuss potential reasons and consequences of these findings.

**Keywords:** tetragonal model of rationality; educational rationality; Educational Rationality Questionnaire; longitudinal studies



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## 1. Introduction

Contemporary education policy often focuses on measurable effects of schooling [1,2]. Such an approach usually favors analyzing the education process from the perspective of empirically operationalized skills or test results [3]. This article takes a different approach and discusses education with a focus on its internal logic—called rationality—assigned to education by students, parents, or teachers. Rationality enables identifying the meaning of education and the skills (both simple and complex) acquired in its course, concerning the ability to interpret existential, social or cultural reality. For this reason, studying the rationality of school education is an inquiry into its foundations and meaning.

We posit that identification of rationality is both interesting and important as it makes it possible to understand the way school education is legitimized by its different actors. It also allows one to understand how students (but also parents or teachers) perceive and give meaning to education, with its goals, curricula and processes. In a sense, rationality (or different *rationalities*) illustrates the mental context of school education processes and are therefore an important premise of educational theory and practice [4].

### 1.1. From Philosophical to Educational Theories of Rationality

When referring to the concept of rationality, its multi-faceted nature or even ambiguity must be emphasized. The issue of rationality is inscribed in the history of philosophical reflection. Rationality is related to the concept of “ratio” in a double sense. It refers to reason and rationality, the reason for the existence of being or the reason for cognition. Rationality as a concept then penetrated other fields of knowledge. In the post-Enlightenment period, it acquired various interpretations also in the field of social sciences.

One of the most significant ones was the concept of rationality developed by Weber [5–9] in the early twentieth century. The first subject of this concept was human actions, which should be meaningful and thus understandable for people to act in a community. Giving meaning to action is related, on the one hand, to discovering cause-effect relationships in action and, on the other hand, to uncovering the meaning of that action and its underlying values. Reading the rationality of action becomes a condition of social life.

Relatedly, in a manifesto of critical theory [10–12], Horkheimer showed two ways or two logics of practicing social science. More specifically, as Horkheimer explained, the traditional theory uses the rationality of traditional social science that believes in objective truth and the objectivity of scientific inquiry. It is based on the belief that there is an independent and neutral subject of cognition. Critical theory is a conscious theory, which means that it is aware that no theory in social sciences (including critical theory itself) is free from being marked by a particular interest of a specific social group, called an ideological interest. This means that a critical theory has the task of exposing the ideological dimension of other theories and developing its concept of society.

However, most importantly from the perspective of our current work, a category of rationality received a new status in philosophy and social sciences thanks to Habermas theorizing [13–17]. Habermas distinguished two leading interests of cognition: the first is technical and practical, the second—emancipatory. The cognitive, technical interest is characterized by natural and social sciences of an analytical and empirical nature, the theoretical basis of positivism or pragmatism. Their determinant is the priority of sensuality (sensual cognition) objectification of the cognized reality itself and knowledge as an effect of understanding. The goal is to control and manage reality. It is exactly this goal that reveals a fully technical and practical cognitive interest. Emancipatory interest is an alternative cognitive interest. It is related to a new type of human knowledge of a communicative nature oriented towards social action. Self-reflection and the importance of striving for maturity and autonomy are determinants of this knowledge. The emancipatory cognitive interest is also educational. It aims at shaping personal and social reality. In self-reflection, thanks to the interest directed towards maturity, it is possible to secure cognition. All this is for the sake of cognition itself; the work of reflection is understood as movement towards emancipation.

In the summary of the Frankfurt School’s achievements, Apel [18,19] distinguished three interests in cognition and action: technical, cognitive interest assumed in analytical and empirical sciences, hermeneutic cognitive interest considered in the humanities, and emancipatory cognitive interest assumed in critical theory. The above distinction has become a point of reference for the pedagogical reconstruction of the three types of educational rationality. An example is Mollenhauer’s “Erziehung und Emanzipation” [20], which analyzes this concept’s uses in education. Most often, rationality is synonymous with what is rational and based on logical, scientific principles. Rationality understood in this way aims at scientific objectivity of the world. From this perspective, Mollenhauer [20] diagnosed existence of irrational moments in the practice of education. At the same time, he argued that these two types of thinking in education and about education should be subordinated to critical rationality, which emphasizes autonomy, emancipation, and liberation from dogmatisms. Mollenhauer [20] proclaimed the importance of critical and emancipatory rationality. However, it is also important to emphasize that he distinguished not two but three different types of pedagogical thinking, which we could call rationalities: positivistic, hermeneutic, and critical. A similar typology of rationality was developed

by Giroux [21], who understood rationality as a specific set of assumptions and social practices that mediate how individuals or groups relate to broader society. At the core of any rationality is a set of interests that determine how the world is mirrored [21,22].

### 1.2. A Tetragonal Model of Educational Rationality

In this paper, we adapt and empirically operationalize a four-fold typology of educational rationalities. This theory, derived from critical theory and hermeneutics, was recently proposed by Milerski and Karwowski [4,23], who developed a tetragonal model of educational rationality. This model makes it possible to translate philosophical discourse into the language and questions of empirical educational science. The present paper forms a step in this direction.

The tetragonal theory distinguishes between four types of rationality: praxeological, hermeneutic, emancipatory, and negational. Praxeological rationality has a technological nature and is oriented at practical skills; it allows one to achieve measurable results. For praxeologically oriented individuals, a school should develop skills useful in solving future problems and adapt to job requirements. Hermeneutic rationality has an existential and interpretative nature and aims to understand oneself and the world. Therefore, it is conceptually closer to such categories as self-development, openness toward others, and tolerance, all being deeply embedded in culture. Emancipatory rationality has a critical nature and is oriented at empowerment and self-determination of an individual in a social context [24,25]. It expresses individuals' social responsibility, their subjective involvement in social communication processes, and activity for the sake of social change in the spirit of emancipatory interest (since social interests facilitate an individual's emancipation). Finally, negational rationality is connected to rejecting the sense of education *per se* or one that is known in its hitherto forms. It rejects *the status quo* yet does not propose much in return; rather, it illustrates a rebellious perspective of school-contesting [23].

While the tetragonal model of rationality brings some potentially interesting insights and predictions, their testability is limited due to the lack of broadly accessible, easy-to-administer yet rigorous instruments to measure educational rationalities. In the study we present below, we aim to fill this gap by proposing a parsimonious measure—Educational Rationality Questionnaire and testing its psychometric properties. Prior to this, however, we briefly introduce some potential antecedents and consequences of educational rationalities.

### 1.3. Antecedents and Consequences of Educational Rationality

There is a wide array of variables that are conceptually related to educational rationalities—be it social factors (e.g., socioeconomic status, social class [26,27]), school factors (e.g., school culture and school climate [28,29]), gender differences [30], and psychological traits of students, teachers, or parents [31]. We decided to include at least some of them to examine potential differences exploratorily.

The first candidate variable that might be associated with educational rationality is family socioeconomic status (SES). Indeed, thinking about education's goals and duties was found to be dependent on social class and SES [32,33]. Classic works in the sociology of education have found that the social position is related to educational values, behavior in school, as well as teachers' perception and attitudes toward students [34–37]. Therefore, it seems well justified to expect that SES will be inversely related to the negational rationality while being positively related to the remaining rationalities.

The second potential factor that might be associated with educational rationalities is students' gender. As previous research demonstrated, male students tend to present a higher intensity of dysfunctional behavior and are more often poorly adapted to school [38,39]. Therefore, there is a reason to expect that male students will be characterized by a higher level of negational rationality. Given the gendered perspective on education, there are also arguments to expect a higher level of praxeological rationality among male than female students, while the opposite could be expected in the case of hermeneutical

rationality [40–42]. There are no solid arguments to expect gender differences in the case of emancipatory rationality.

The third broad factor category denotes students' school functioning. Notably, there are reasons to see this general category as both a predictor and a consequence of educational rationalities. In other words, we posit that students who function more effectively in school settings are more likely to hold some rationalities (i.e., hermeneutical, praxeological) rather than others (i.e., negational), yet we also predict that certain rationalities should also help students to adapt to school expectations. By school functioning, we consider three distinct yet related groups of variables. The first is academic achievement, so cognitive effects of school learning, usually measured using standardized achievement tests or teacher-assigned grades [43]. The second group is academic self-concept, namely, students' convictions that they are able to effectively solve problems associated with learning specific school subjects, like math or science [44–47]. Thirdly and finally, we are interested in the possible effects of rationalities on students' well-being in school [48,49], particularly their positive and negative emotions felt during lessons [50–52].

The fourth factor that might be associated with educational rationality is students' personality. Given that personality is quite consistently associated with school functioning and school successes [53], we predict that certain personality factors, like openness, extraversion, or conscientiousness will reduce negational rationality, while neuroticism might be positively associated with it. Regarding praxeological rationality, we predict positive links with conscientiousness and extraversion [54,55] while expecting positive links between hermeneutic and emancipatory rationality and openness to experience.

The fifth and final factor we decided to include is creative self-concept, or more precisely—creative personal identity (CPI) [56]. CPI denotes the importance of being creative for an individual's identity and self-description—valuing being different and creative. Previous research demonstrated that CPI is positively related to a number of relevant effects: be it creative activity and achievement [57] or better adaptation to complex reality due to flexible strategies and more effective self-regulation [58]. Therefore, we predicted that CPI would be positively linked with hermeneutical and emancipatory rationality, while we did not have specific predictions regarding its links with the remaining two rationalities.

## 2. Materials and Methods

### 2.1. Participants

Our sample consisted of 1990 primary ( $n = 1002$ ) and middle-school ( $n = 988$ ) students, 1059 female and 931 male from 93 schools located across the entire Poland. Students participated in a longitudinal study, with two measurement waves conducted in October (Time 1) and April (Time 2). Primary school students were on average 14 years-old when the study started ( $M = 13.86$ ,  $SD = 0.49$ ), while middle school students were one year older ( $M = 14.89$ ,  $SD = 0.43$ ). Schools were selected randomly based on available registers, and one or two random classes in each school were invited to participate in the study.

### 2.2. Measures

**Educational Rationality Questionnaire.** To measure educational rationalities, we used a newly constructed ERQ—a modified and shortened version of an instrument presented elsewhere [4]. There were twenty items—five per each of the four scales. The responses were provided on a 7-point Likert scale, with 1 = definitely not and 7 = definitely yes. ERQ was used during T1. All items and descriptive statistics are presented in Table 1.

**School Achievement.** Participants' school achievement was measured by a standardized test that covered the curriculum base's material. The test consisted of 31 tasks, 14 tasks devoted to measuring school achievement in the Polish language ( $\alpha = 0.81$ ), and 17 tasks measuring school achievement in math ( $\alpha = 0.86$ ). The tasks were previously calibrated in other studies on late grades of primary and middle-schoolers (e.g., [59]). All tasks were scored as either 0 (incorrect) or 1 (correct), so reliability was estimated based on matrices of tetrachoric correlations. Additionally, we collected data on students' grade point average

(GPA) twice, during T1 (October) and T2 (April). GPA in Polish schools can range from 1 (the lowest possible grade) to 6 (the highest possible grade).

**Table 1.** ERQ Items' descriptive statistics and factors' loadings from CFA model.

Item	M	SD	Loading
<b>Hermeneutic</b>			
The school should teach how to interpret culture and traditions.	4.67	1.42	0.52
The school should develop the ability to reflect on itself and the world.	5.06	1.39	0.66
The school should teach a reflective approach to oneself and the world.	4.96	1.40	0.68
The school should relate the content of education to questions about understanding life's dilemmas.	4.63	1.32	0.65
The aim of school education should be to educate creative people.	4.64	1.50	0.57
<b>Negational</b>			
School is a waste of time nowadays.	3.55	1.76	0.73
It is not worth to learn because outside school, it's all about your cleverness and connections.	3.66	1.62	0.68
In today's world, the school doesn't make sense.	3.31	1.75	0.74
School kills students' interests and abilities.	3.79	1.73	0.74
Today, school is primarily a chore.	4.17	1.74	0.69
<b>Praxeological</b>			
The school should teach specific life skills.	5.57	1.40	0.63
There is too much theory and too little practice in school today.	5.19	1.49	0.67
Nowadays, specific skills count on the labor market, not book knowledge.	4.90	1.52	0.60
The problem of school education is that it is overloaded with theory.	4.90	1.57	0.70
It is essential to learn at school things that can be useful for something.	5.76	1.43	0.50
<b>Emancipatory</b>			
Education makes it easier for people to be themselves.	4.69	1.52	0.61
Studying at school allows you to develop passions and interests.	4.72	1.67	0.62
School education teaches you to understand others.	4.40	1.52	0.73
School education enables all students to express their views.	4.40	1.59	0.65
Education is a program to develop individuality.	4.46	1.46	0.54

**Academic Self-Concept.** Participants' academic self-concept in the Polish language was measured by ten items from the Self-Description Questionnaire [60], previously used in Polish [59]. Sample item: "I'm quite good at the Polish language." The reliability of this scale was excellent ( $\alpha = 0.92$ ). Academic self-concept in math was measured by a similar set of ten items (e.g., "I have always done well in mathematics") with the same reliability ( $\alpha = 0.92$ ). Participants answered using a 1–7-point Likert scale, with 1 = definitely not, 7 = definitely yes). ASC was measured during T1.

**Personality.** Students' personality was measured by the Ten-Item Personality Inventory (TIPI) [61,62]. There were two items per each of the five personality traits: openness, conscientiousness, extraversion, agreeableness, and neuroticism. Previous research confirmed the validity and reliability of the TIPI using the test-retest method [62,63]. The responses were provided on a 1–7 Likert scale, with 1 = doesn't fit to me at all, 7 = fits to me perfectly. Personality was measured during T1.

**Creative Personal Identity.** Valuing creativity, namely creative personal identity (CPI) was measured by six items from the Short Scale of Creative Self [64]. Sample item: "My creativity is important for who I am,"  $\alpha = 0.85$ ). The responses were provided on a 1–7 Likert scale, with 1 = definitely not, 7 = definitely yes. CPI was measured during T1.

**Academic Emotions.** To capture epistemic emotions felt during the Polish language and math classes, we used the Epistemically-Related Emotions Scales [52]. We separately asked about the intensity of each of the emotions felt during both classes. Participants declared whether these were rather positive (e.g., curious, interested) or negative (e.g., bored, worried) emotions. The scales were reliable: positive emotions Polish ( $\alpha = 0.87$ ), negative emotions Polish ( $\alpha = 0.88$ ), positive emotions math ( $\alpha = 0.84$ ), negative emotions math ( $\alpha = 0.90$ ). Responses were provided on a 1–7 Likert scale, with 1 = never and 7 = very often or always. Epistemic emotions were measured during T2.

Socioeconomic Status. Parents' education level was used as a proxy of socioeconomic status [65,66]. Education of both parents was robustly positively correlated ( $r = 0.59, p < 0.001$ ).

### 2.3. Procedure

The study was longitudinal. The first wave of data collection (T1) was conducted in October, the second wave (T2) in May. Participants attended 7th classes of primary schools reformed in Poland in 2017 and 2nd classes of middle schools. All participants, as well as their parents, provided informed written consent.

### 2.4. Data Analysis

We analyzed data in two steps. First, we conducted a confirmatory factor analysis to examine whether the four-factor structure assumed by the tetragonal educational rationalities model fits the data well. We also tested whether the measurement is invariant concerning participants' gender and cohort (primary school, middle school). To this end, we tested for configural, metric, and scalar invariance across gender groups and cohorts. In the next step, we moved to structural equation modeling (SEM) to examine each of the four rationalities' potential predictors, including academic self-concept, personality, school achievement, and valuing creativity. In the third and final step, again using SEM, we regressed positive and negative emotions during native language and math classes and participants' grade point average (GPA) while controlling for the grades six months earlier on the latent factors of four educational rationalities.

## 3. Results

### 3.1. Confirmatory Factor Analysis

CFA model testing the four-factor structure of the ERQ fitted the data well according to the usually applied fit indices [67], namely comparative fit index (CFI) and Tucker Lewis Index (TLI) above 0.90 and root mean square error of approximation (RMSEA) and standardized root mean residual (SRMR) below 0.08. The fit indices were, CFI = 0.95, TLI = 0.94, RMSEA = 0.054, 90% CI: 0.05, 0.06, SRMR = 0.06. Items' descriptive statistics and factor loadings are presented in Table 1.

Latent correlations among scales provided several interesting observations (see Figure 1). Consistently with what could be expected based on theory, there was a robust, statistically significant correlation between hermeneutic and emancipatory rationality (latent  $r = 0.50, p < 0.001$ ). However, contrary to what could be expected, we have also observed a strong, positive correlation between hermeneutic and praxeological rationality (latent  $r = 0.65, p < 0.001$ ), indicating that students tended to share the perception of school duties as based on understanding and hermeneutic values as well as on technical rationalization of its goals. Praxeological and negational rationalities were positively related (latent  $r = 0.49, p < 0.001$ ), which would suggest that students who were oriented toward measurable and useful goals were also dissatisfied with the current shape of school education. Emancipatory rationality was negatively linked with negational rationality ( $r = -0.26, p < 0.001$ ) and unrelated to praxeological rationality ( $r = 0.05, p = 0.37$ ). Finally, we did observe another interesting and unexpected relationship—hermeneutic rationality tended to be weakly, yet positively linked with negational rationality ( $r = 0.24, p < 0.001$ ) (Figure 1).

Given that the scales were characterized by good reliability as assessed by both Cronbach's alpha (lower bound of reliability) and composite reliability from the CFA: hermeneutic  $\alpha = 0.74$ , H = 0.76, negational,  $\alpha = 0.83$ , H = 0.84, emancipatory,  $\alpha = 0.76$ , H = 0.77, and praxeological  $\alpha = 0.75$ , H = 0.78, in the next steps we proceeded with repeated measures analysis of variance (RM ANOVA) to examine whether there were differences across rationalities. This indeed was the case: the overall effect was highly significant ( $F [3, 1684] = 712.68, p < 0.001$ ) with a robust effect size of the differences between rationalities ( $\eta^2 = 0.30$ ). Pairwise comparisons with Bonferroni correction demonstrated that all compared pairs differed significantly, with higher level of approval observed for

praxeological rationality ( $M = 5.29, SD = 1.06$ ), and lower for hermeneutical rationality ( $M = 4.79, SD = 0.98$ ) than emancipatory rationality ( $M = 4.53, SD = 1.10$ ), and finally negational rationality ( $M = 3.70, SD = 1.33$ ; all differences were statistically significant,  $p < 0.001$ ) (Figure 2).

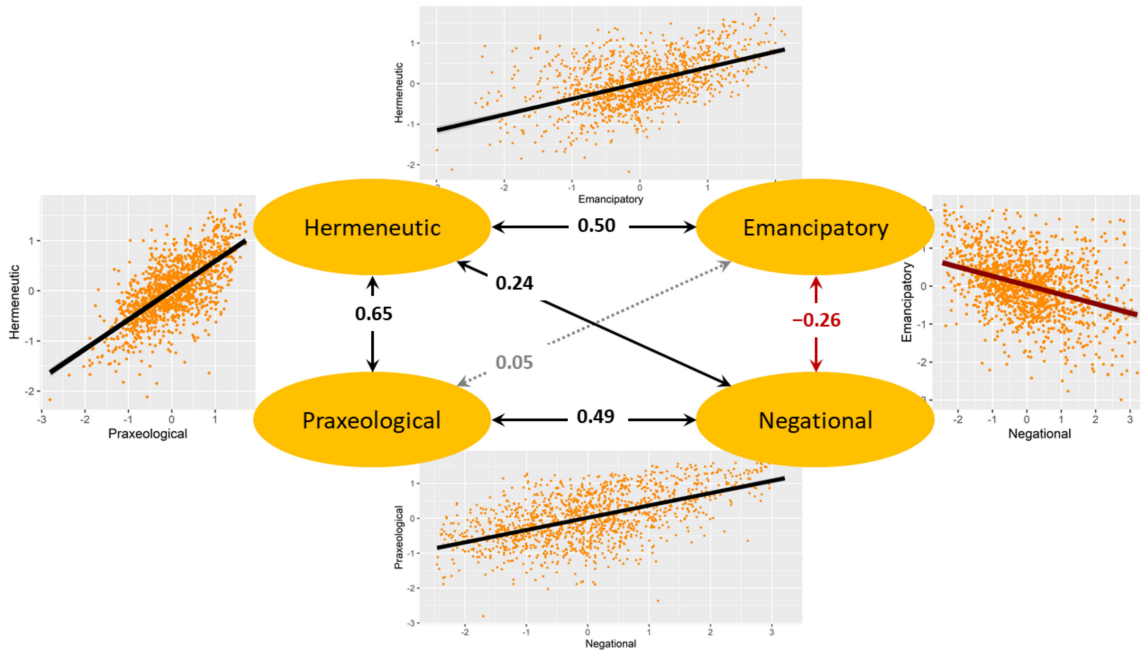


Figure 1. Latent Correlations between educational rationalities factors. The dotted line denotes non-significant latent correlation.

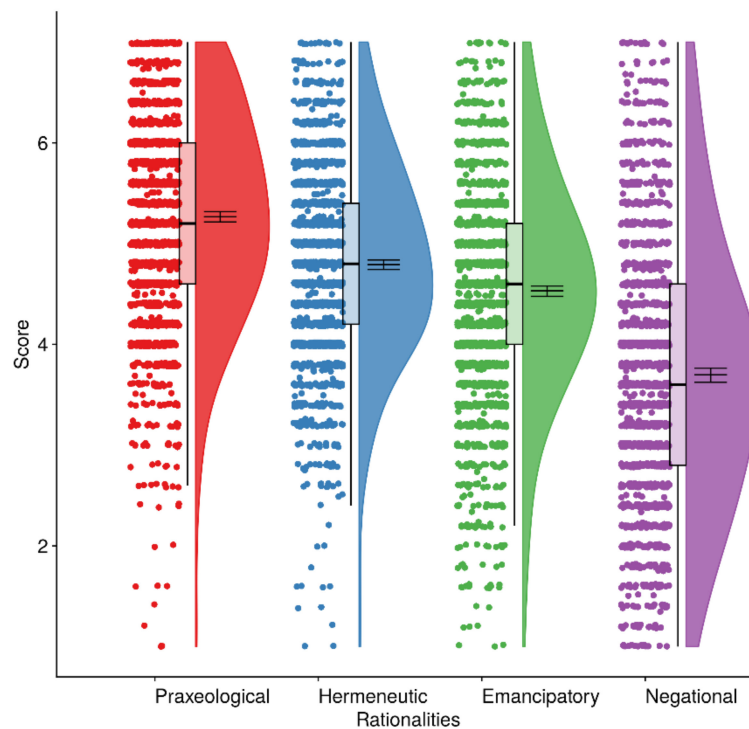


Figure 2. Distribution and differences between four educational rationalities. Means and 95% confidence intervals are placed in the middle of violin plots.

To ensure that the measurement with ERQ is equivalent across the different groups of participants, we tested for measurement invariance among male and female participants

and participants who attended primary and middle schools. As summarized in Table 2, the decrease in fit indices allows us to conclude that the measurement was equivalent across groups, and therefore, they can be safely compared [68,69].

Our comparisons demonstrated that while there were significant gender differences in rationalities, a cohort did not differentiate participants in this respect. More specifically, male and female participants did not differ in terms of their praxeological rationality,  $t(1594) = 0.56, p = 0.58$ , yet female participants scored higher in hermeneutic rationality than male students ( $M = 4.91, SD = 0.93$  and  $M = 4.65, SD = 1.02, t[1604] = 5.51, p < 0.001$ , Cohen's  $d = 0.27$ ) and held higher emancipatory rationality ( $M = 4.64, SD = 1.10$ , and  $M = 4.40, SD = 1.08, t[1665] = 4.60, p < 0.001, d = 0.22$ ). Male participants scored significantly higher in negational rationality ( $M = 3.97, SD = 1.37$  and  $M = 3.46, SD = 1.24, t[1608] = -7.90, p < 0.001, d = 0.39$ ). Comparison between two cohorts: primary school students and middle school students revealed only one statistically significant difference: middle school students scored higher in praxeological rationality than primary school students ( $M = 5.33, SD = 1.02$ , and  $M = 5.20, SD = 1.10, t[1664] = 2.48, d = 0.12$ ). All remaining comparisons did not reach the conventional threshold of statistical significance (all  $p > 0.05$ ).

**Table 2.** Measurement Invariance of ERQ concerning participants' gender and cohort (primary school-vs.-middle school).

Predictors	Gender	Cohort
Configural Invariance	CFI = 0.953, TLI = 0.945, RMSEA = 0.050, 90% CI: 0.046, 0.054, SRMR = 0.062	CFI = 0.950, TLI = 0.942, RMSEA = 0.052, 90% CI: 0.048, 0.056, SRMR = 0.064
Metric Invariance	CFI = 0.950, TLI = 0.945, RMSEA = 0.050, 90% CI: 0.047, 0.054, SRMR = 0.064	CFI = 0.949, TLI = 0.944, RMSEA = 0.051, 90% CI: 0.047, 0.055, SRMR = 0.065
Scalar Invariance	CFI = 0.948, TLI = 0.945, RMSEA = 0.050, 90% CI: 0.047, 0.054, SRMR = 0.065	CFI = 0.950, TLI = 0.947, RMSEA = 0.050, 90% CI: 0.046, 0.053, SRMR = 0.065
Metric vs. Configural	$\Delta$ CFI = 0.003, $\Delta$ RMSEA = 0.00	$\Delta$ CFI = 0.001, $\Delta$ RMSEA = 0.001
Scalar vs. Metric	$\Delta$ CFI = 0.002, $\Delta$ RMSEA = 0.00	$\Delta$ CFI = -0.001, $\Delta$ RMSEA = -0.001

### 3.2. Correlates and Antecedents of Educational Rationalities—SEM Results

Our second step involved SEM model, with latent variables of educational rationalities being regressed on participants' characteristics: their gender, SES, academic self-concept in Polish (native) language and math, personality factors measured according to the five-factor model, school achievement measured with the use of standardized tests and teacher-assigned grades, and CPI. The model fit was appropriate,  $CFI = 0.94, TLI = 0.93, RMSEA = 0.042, 90\% CI: 0.040, 0.045$ , and the included predictors were associated with 12% of the variability of praxeological rationality, 13% of the variance of emancipatory, 17% of negational and 19% of the variance of hermeneutical rationality (Table 3).

**Table 3.** Antecedents of Educational Rationalities—Standardized Coefficients from the SEM Model.

Predictors	Hermeneutic	Negational	Praxeological	Emancipatory
Gender <sup>a</sup>	-0.22 ***	0.35 ***	0.11	-0.20 ***
SES	0.02	-0.07 *	0.01	-0.02
Academic Self-Concept Polish Language	0.14 **	-0.14 ***	-0.02	0.15 ***
Academic Self-Concept Math	-0.07	-0.15 ***	-0.09*	0.17 ***
Openness to Experience	0.06	-0.05	0.03	-0.03
Conscientiousness	0.03	-0.09 **	0.05	0.07 *
Extraversion	0.09 **	0.02	0.14 **	0.05
Agreeableness	0.04	-0.12 **	0.00	0.08 *
Neuroticism	0.08 *	0.00	0.03	0.02
School Achievement Math	0.05	0.00	0.09 *	-0.02
School Achievement Polish Language	0.03	-0.12 ***	0.15 **	-0.06
Grade Point Average	-0.05	0.00	-0.07	-0.12*
Creative Personal Identity	0.28 ***	0.14 **	0.23 ***	0.11 *
R <sup>2</sup>	0.19	0.17	0.12	0.13

Note. The values are standardized coefficients from the Structural Equation Model. a = gender coded: 0 = female, 1 = male. In the case of gender values are standardized mean differences (Cohen's  $d$ ). \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .



As illustrated in Table 3, hermeneutical rationality was higher among female than male participants, yet unrelated to SES. It has also increased along with participants' academic self-concept in the native, Polish language, extraversion, and neuroticism. Yet, the strongest predictor ( $\beta = 0.28$ ) was creative personal identity: a feeling that a person is creative and creativity matters for their self-definition. Negational rationality was stronger among males than females and inversely related to students' SES, academic self-concept in the Polish language and math, their openness, conscientiousness, and agreeableness, and negatively linked with school achievement in Polish. Quite intriguingly, however, negational rationality was positively (albeit weakly,  $\beta = 0.14$ ) related to valuing creativity (CPI).

Praxeological rationality was only associated with extraversion and participants' school achievement measured by standardized tests—both in Polish ( $\beta = 0.15$ ) and math ( $\beta = 0.09$ ). Similarly as in previous cases, here too creative personal identity was positively linked with praxeological rationality. Emancipatory rationality was higher among females and positively linked with academic self-concept, agreeableness, and creative personal identity. It was also negatively linked to students' GPA.

### 3.3. Consequences of Educational Rationalities—SEM Results

To explore potential consequences and distal correlates of educational rationalities, we tested whether they can significantly predict the level of positive and negative emotions felt during Polish language and math classes and whether they contribute to the GPA change. To this end, our SEM model was longitudinal, with rationalities and GPA measured during Time 1 (T1), predicting positive and negative emotions and GPA during Time 2 (T2)—seven months apart. The model fit was appropriate: CFI = 0.93, TLI = 0.92, RMSEA = 0.052, 90% (0.047, 0.054), SRMR = 0.058, and the coefficients are presented in Table 4.

**Table 4.** Longitudinal Consequences of Educational Rationalities—Standardized Coefficients from the SEM Model.

Predictors	Positive Emotions Polish	Negative Emotions Polish	Positive Emotions Math	Negative Emotions Math	GPA
Hermeneutic	0.08	−0.09	−0.09	0.05	0.35 ***
Negational	−0.18 ***	0.17 ***	−0.12 *	0.09	−0.39 ***
Praxeological	0.04	0.09	0.09	0.05	0.04
Emancipatory	0.15 *	−0.08	0.19 **	−0.13 *	−0.19 ***
Grade Point Average	0.09 *	−0.12 ***	0.12 ***	−0.19 ***	0.68 ***
R <sup>2</sup>	0.09	0.07	0.06	0.07	0.60

Note. The values are standardized coefficients from the Structural Equation Model. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

During Polish language and math classes, positive emotions were found to be consistently predicted by emancipatory (positively) and negational (negatively) rationalities. Praxeological and hermeneutical rationalities were not related to either positive or negative emotions, while students with higher GPA declared more positive and less negative emotions during their lessons. Importantly though, educational rationalities were instrumental in predicting a robust portion of participants' GPA's change variance. Even when we controlled for initial school grades ( $\beta = 0.68$ ), there were still statistically significant and robust effects of three out of four rationalities. While hermeneutic rationality was positively related to the change in school grades ( $\beta = 0.35$ ) and negational rationality was related negatively to GPA ( $\beta = -0.39$ ), there was also an unexpected, negative relationship with emancipatory rationality ( $\beta = -0.19$ ).

## 4. Discussion

The goal of this paper was to empirically operationalize and develop an instrument to measure an abstract construct—educational rationality. Based on the tetragonal model of educational rationality that theorized four interrelated yet conceptually distinct rationalities: hermeneutic, praxeological, emancipatory, and negational [4], in a large longitudinal

study on adolescents, we obtained several findings that might inform future measurement and theorizing. In what follows, we discuss them in light of our predictions and broader inspiration drawn from the literature.

Educational Rationalities Questionnaire developed to capture the intensity of four rationalities was found to be both reliable and valid. Confirmatory factor analysis was characterized by good fit (supporting convergent validity), factor loadings of items were robust (all above the recommended threshold of 0.50). Therefore, the ERQ might be considered a valuable instrument for researchers interested in integrating educational rationalities into their research programs. It is short, with twenty statements overall, yet psychometrically sound. Importantly, as we have demonstrated, ERQ measurement is invariant with regard to different variables—in our case, gender and students' cohorts (late primary school versus early middle school)—hence allowing for a comparison of latent means across groups and ensuring that the measurement is not biased.

Our second important set of findings relates to correlations between rationalities and differences in their intensity. As we observed, primary and middle school students were mainly driven by praxeological rationality, with hermeneutic and (third) emancipatory rationality placed next in the hierarchy. Negational rationality was clearly least acceptable. Hence, school and education were perceived as (and expected to be) the sources of critical and useful skills and competencies, although we emphasize that high acceptance of hermeneutic and emancipatory rationalities (in both cases pooled means above 4 on 1-7 scale, so well above the mid-point of the scale) confirms their importance as well. Based on the observed hierarchy, it seems justified to speculate that for adolescents who are about to start high school, education's role is primarily to provide accountable competencies, while the goals associated with self-creation or developing conscious and critical citizens are more optional than necessary. Here, however, we should acknowledge that our measure's format, i.e., the questionnaire with responses provided on a Likert-type scale, may obscure some differences between rationalities. Given that all rationalities (except negational) are generally worthwhile, there could be a tendency to provide responses according to the satisfying strategy [70]. Indeed, when item-meaning activates thinking about something that is considered positive, participants often overuse "agree" or "strongly agree" categories. Consequently, the differences between rationalities might be underestimated. This limitation could be resolved by using rank scales, yet they are not without problems either. Nevertheless, while acknowledging this limitation, we can only emphasize that real differences between rationalities might be even more pronounced than our estimate suggest.

What seems particularly intriguing is a pattern of intercorrelations between rationalities we observed. Tetragonal theory [4,23] and its philosophical inspirations [12,18] lead to the expectation that while there will be positive links between hermeneutic and emancipatory rationalities, they both would be either unrelated or even negatively related to praxeological rationality. Given that praxeological rationality is based on a technical and pragmatic perception of school's responsibilities, while emancipatory and hermeneutic rationalities rather focus on interpretative and critical aspects of school education, such a prediction was indeed justified. Still, we found an unexpected, strong and positive relationship between hermeneutic and praxeological rationalities and—expected—lack of relationship between praxeological and emancipatory rationality. Thus, students who participated in our investigation strongly believed that education should be both practically oriented (e.g., providing training in critical skills to function effectively in the contemporary world) and providing opportunities to understand others, culture, and the world around. This finding, especially given the effect size of  $r = 0.65$ , calls for future studies and replication. It also seems important to examine to what extent this correlation might be driven by developmental reasons (e.g., being in their adolescent period, students might be somehow torn between different goals and values [71]). The last reason for this strong link may stem from the measurement issue we mentioned above—it is indeed possible that the response format led to somewhat stronger coefficients than we had expected.

Consistently with predictions, negational rationality—skepticism toward education—was negatively related to emancipatory rationality and was robustly positively related to praxeological rationality. This positive relationship seems consistent with the observations that people who perceive curricula as overtheorized also exhibit a generally negative attitude toward school. What is more intriguing is the positive (albeit weak,  $r = 0.24$ ) relationship between negational and hermeneutic rationality. This puzzling link calls for future studies on similar and differing populations (e.g., parents and teachers). What seems particularly useful to untangle these unexpected positive correlations are person-centered analyses, namely, testing whether there are certain clusters or types of students who hold both high hermeneutic and high negational rationalities and therefore quite artificially boost the overall correlation in the entire sample.

Are educational rationalities related to demographic (e.g., gender), social (SES), psychological (personality, epistemic emotions), or educational (academic self-concept, school achievement) factors? Our SEM models provide an affirmative answer to this question. However, that said, we acknowledge that the effect size we obtained in the majority of cases was moderate at best.

On the most general level, the praxeological rationality, so the one that was the most prevalent among our participants, was least strongly related to the factors we investigated and did not predict the outcomes we studied longitudinally. While the ceiling effect and restricted variance may cause this, Figure 1 does not suggest particularly restricted variability. Extraversion, school achievement (test results in math and Polish), valuing creativity (creative personal identity), and—negatively linked—academic self-concept in math were the only significant correlates of praxeological rationality. Thus, a somehow paradoxical pattern is observed: while better students (at least in terms of their test scores) are more practically oriented, these same students are not particularly convinced that they are able to solve math problems (academic self-concept). This suggests that praxeologically oriented students might underestimate their math skills: a finding worth exploring in future studies.

Hermeneutic rationality was more typical for female than male students, albeit the effect size of this difference was small according to usually applied criteria in social sciences [72] (Cohen's  $d = -0.22$ ). There were also positive links between hermeneutic rationality and academic self-concept (in the Polish language), extraversion, neuroticism, and creative personal identity. We particularly emphasize this last, robust ( $\beta = 0.28$ ) predictor, as it seems theoretically relevant for understanding how school and education are being perceived. In short, creative personal identity denotes the centrality of being creative for one's self-perception [56]. One of the recent models of creative behaviors [57] perceives creative personal identity as the main factor that allows for the fulfillment of creative potential and its translation into activity. People high in CPI are usually more curious and engaged [73], persistent and successful in solving problems requiring complex skills and imagination [64]. Consequently, the finding that people who value creativity more are also those who expect that education will be more related toward reflexive functioning makes theoretical sense. What is worth emphasizing is the longitudinal finding that demonstrated that hermeneutic rationality predicted the change in students' grades six months later, even when we included students' initial GPA as a covariate. Thus, hermeneutic rationality seems not only to be relevant on its own rights, but it also may be instrumental as one of the conditions of school achievement.

Emancipatory and hermeneutic rationalities shared some similarities in terms of correlates and consequences, yet we also noted substantial specificity. Emancipatory rationality was more typical for female than male students and tended to be stronger when academic self-concept (both in language and math), conscientiousness, and creative personal identity increased. Interestingly, while it was unrelated to standardized test results, it was negatively linked with teachers' assigned grades. What is more, although emancipatory rationality predicted positive emotions during Polish language and math lessons (and reduced negative emotions), it was also negatively related to GPA six months later (when previous GPA was controlled). This result is intriguing and might be of interest to researchers interested

in the condition of school achievement. It does suggest that individuality-oriented, critical, emancipatory rationality might be somehow dysfunctional, at least when teachers provide student assessments. This resembles findings that showed that teachers often reject students who are rebellious, disruptive, and overly independent [74–76]. Indeed, emancipatory rationality may be at odds with traditional school rules.

Finally, negational rationality was clearly the least adaptive among all rationalities theorized by the tetragonal model and measured by ERQ. We observed that it was more pronounced in male than female students, inversely linked with participants' family SES, and negatively associated with their academic self-concept, personality factors of conscientiousness and agreeableness, and school achievement. Surprisingly, negational rationality was positively yet weakly linked with creative personal identity—a result that could be interpreted as a sign that students who highly value creativity are dissatisfied with the contemporary school. After six months, negational rationality strengthened negative and reduced positive epistemic emotions during classes and was negatively linked to school grades. Therefore, a kind of self-fulfilling prophecy was observed: students (mostly male) who were worse in terms of their grades, tended to perceive school negatively, yet this negative perception and attitude served as a factor that further harmed their school functioning.

#### *4.1. Limitations and Future Directions*

Although the findings presented in this article were obtained in a large, representative, and longitudinal study, they should be interpreted in light of three limitations. First, as we have already mentioned, there is a risk that a response format used in the ERQ, so typical Likert-type scale, might be suboptimal for proper differentiation between rationalities. Future studies should consider using some more advanced methodological solutions, for example, those used in studies on values [55,77].

The second limitation of our study may be seen in participants' age and particularly in the lack of variability in age. Given that we researched two cohorts of participants (14 and 15 years old), we cannot say much about our estimates' generalizability beyond these groups. It seems necessary to replicate these results and extend them to other age groups and different actors on the educational stage: parents and teachers. It seems an especially worthwhile research endeavor to investigate the extent to which rationalities are shared within child-parent dyads or transmitted in teacher-class interactions.

Thirdly and finally, we acknowledge that operationalization and measurement of the complex theoretical construct of rationality, with its philosophical roots, is by no means an easy task and that it is always associated with some difficult decisions to make. Consequently, it is unavoidable that the items developed for the four rationalities are unable to cover their scope and complexity fully. Therefore, we invite fellow researchers interested in studying educational rationalities to triangulate, namely, to apply ERQ altogether with in-depth qualitative interviews and observations to untangle the complex nature of educational rationalities.

#### *4.2. Conclusions*

The tetragonal educational rationality model considers four interrelated rationalities: hermeneutic, emancipatory, praxeological, and negational rationalities robustly related to students' characteristics and predict their school functioning. Future research on educational rationalities, their predictors, and effects might benefit from ERQ—a parsimonious yet valid and reliable instrument—presented in this article.

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