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CURIOSITY AND PHD STUDIES: DISCREPANCIES OF CURIOSITY MANIFESTATION OF PHD AND UNSUCCESSFUL DOCTORAL CANDIDATES

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ABSTRACT

Aim/Purpose	The research is aimed at understanding the role of curiosity in obtaining a PhD degree. The differences in the expression of curiosity between PhD and unsuccessful doctoral candidates are studied.
Background	Differences in the expression of curiosity predict differences in behavior and achievement of results. The role of curiosity in research activities and progress has been recognized in the literature review. However, the influence of curiosity on the success of researchers has received little attention as a subject of empirical research.
Methodology	Quantitative methods were used to examine differences in curiosity among PhD candidates and unsuccessful doctoral candidates. The study involved PhD (n=181) and unsuccessful doctoral candidates (n=194) aged 29 to 49 years. A questionnaire of socio-demographic characteristics, the tests "Curiosity" and the "Test for assessing research potential" were used to collect data. Independent groups were compared using the Mann-Whitney U test, and relationships between variables were studied using the partial correlation matrix and Network

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	Plots, to determine statistically significant differences between the strength of the relationship between two pairs of variables. Partial correlations were compared.
Contribution	The study initiates a new line of questioning and contributes to the study of factors influencing the successful completion of doctoral studies. The focus of the study is on a group of respondents who have previously received insufficient attention.
Findings	The comparison analysis of partial correlations lets us establish the differences in all components of curiosity (target, motivational, cognitive, productive, dynamic, emotional, regulatory, reflective-evaluative) and research potential. The differences relate to the desire for research, the importance of scientific knowledge, priorities, ways of expressing curiosity, emotional experiences, comparison of intentions, and achieved results. The profiles of curiosity in research activities are described based on the identified differences.
Recommendations for Practitioners	From a practical point of view, the research results can help organize and plan the research activities of doctoral students.
Recommendations for Researchers	The authors recommend researchers study in more detail the nature of the connections between the components of curiosity and their impact on research success. Future research could focus on a detailed analysis of curiosity profiles, including in the context of various personality traits. It is also recommended that a longitudinal or experimental study be conducted that involves diagnosing curiosity in doctoral students at different stages of training and with different research productivity.
Impact on Society	Doctoral studies are considered as an important strategic resource of the modern economy. The development of curiosity can help increase the research productivity of doctoral students and competitiveness in the globalizing scientific world.
Future Research	Following research on curiosity as it relates to research activities could contribute to the development of a conceptual framework.
Keywords	curiosity, research potential, PhD, unsuccessful doctoral candidates, doctoral studies, Kazakhstan

INTRODUCTION

The past two decades have seen a steady increase in the number of PhD students (OECD, 2016; Shin et al., 2018). This tendency is caused by the official recognition of the value of highly educated PhD graduates for the development of a knowledge economy and competitiveness (Cyranoski et al., 2011; Duke & Denicolo, 2017; Pearson et al., 2011; Solli & Nygaard, 2023). However, the problem of high dropout of doctoral students is relevant for many countries (Sverdlik et al., 2018; Yudkevich et al., 2020). To address this issue, research has paid considerable attention to institutional factors of research success (Sevim & Sarikaya, 2020; Smith et al., 2008; Spaulding & Rockinson-Szapkiw, 2012). However, the psychological aspect remains the least represented in the scientific literature (Djupe et al., 2020). This study seeks to fill existing gaps in scientific knowledge by examining an under-researched context – the role of curiosity in successfully obtaining a PhD degree.

Based on previous research, this article suggests that curiosity can potentially motivate doctoral students to deeply explore a topic and seek new knowledge, maintain passion for the research subject,

and contribute to successful dissertation completion. Individual differences in curiosity predict discrepancies in behavior and achievement (McDougall, 2001). The role of curiosity in research activities and scientific progress has been recognized in the research literature (Galli et al., 2018; Grüning & Lechner, 2023). However, the influence of curiosity on the success of researchers has received little attention as a subject of empirical research. Curiosity has generally been studied most extensively in relation to cognitive traits (Brooks et al., 2021; Fang et al., 2016; Gottlieb et al., 2016; Gruber et al., 2014; Kidd & Hayden, 2015; Trudewind, 2000; Vogl et al., 2020); academic achievement (Kashdan & Yuen, 2007; von Stumm et al., 2011); labor productivity (Pratt et al., 2016; Reio & Wiswell, 2000); personal and professional development (Kashdan et al., 2004; Mussel et al., 2012), and so forth. Moreover, as far as we know, there is less scientific literature on the profiles that differentiate researchers in the manifestation of curiosity.

The purpose of the study is to identify differences in the expression of curiosity between PhD and unsuccessful doctoral candidates. Based on the findings, an attempt is made to describe profiles of curiosity in the context of research activities.

The following research questions are addressed:

RQ1: Are there any differences in the expression of curiosity components between PhDs and unsuccessful doctoral candidates?

RQ2: Are there any differences in the structure of connections between the components of curiosity in PhDs and unsuccessful doctoral candidates?

Thus, the study initiates a new line of questioning and contributes to the study of factors influencing the successful completion of doctoral studies. The focus of the study is on a group of respondents that has previously received insufficient attention.

The presented article includes a literature review on the study of curiosity; a system-functional approach is considered. The research methodology, including methods, sampling, and ethical considerations, and the results of statistical data processing are presented, including a comparison of partial correlations between components of curiosity. The discussion summarizes the findings regarding the differences in curiosity between PhDs and unsuccessful doctoral candidates and outlines the limitations of the present study and directions for future research. The appendix provides a calculation for comparing partial correlations.

LITERATURE REVIEW

CURIOSITY AND RESEARCH

Curiosity is a component of human nature whose presence goes largely unnoticed in everyday life (Kidd & Hayden, 2015). At the same time, it is curiosity that contributes to the rapid arousal and long-term preservation of the desire for exploratory search (Wilson et al., 2005), the subtle attitude toward upcoming discoveries (Kashdan & Steger, 2007), and the enjoyment of the research process. Curiosity initiates the basic steps for scientific discoveries, such as collecting and analyzing information and posing a problem (Sun et al., 2022). Curiosity focuses on the research task (Pratt et al., 2016), ignores background information (Kashdan et al., 2004), and encourages greater persistence in achieving goals (Ainley et al., 2002), which is an important indicator of an individual's willingness to explore for the sake of exploring. Curiosity serves as a remedy for burnout (Kashdan & Steger, 2007; Wang & Li, 2015), which can result from putting in too much effort (Flake et al., 2015; Jensen & Deemer, 2019) to achieve research goals. Curiosity also contributes to building social interactions (Burpee & Langer, 2005; Kashdan et al., 2009; Renner, 2006), which is essential for strengthening research communication and integration into the scientific community.

Curiosity: Concept, Components, Conceptualization as a State and Personality Traits

This literature reviews the most significant studies of curiosity in chronological order. One of the first conceptualizations of curiosity, which became the basis for much modern research and the development of measurement scales, belongs to Berlyne (1954, 1960). Berlyne (1954) defined curiosity as "the desire for knowledge" (p. 187) and considered it as a motivational state (Berlyne, 1975). Berlyne (1954) compared epistemic and perceptual curiosity through the lens of activating stimuli. Epistemological curiosity is characterized by thoughtful ideas that encourage learning new things. In contrast, perceptual curiosity stimulates the search for experience and information through the senses (Berlyne, 1954). Berlyne (1960) later distinguished between specific and diversive curiosity, considering specific curiosity as the desire to reduce uncertainty by obtaining missing information and diversionary curiosity as a general desire for cognitive or perceptual stimulation to reduce boredom (Berlyne, 1960).

A recent study summarizes Berlyne's conceptual ideas and proposes an adapted definition of curiosity: "a motivational drive or need for knowledge that is driven by collative variables and expressed through various types of exploratory behavior to obtain information" (McNary, 2024, p. 575).

It should be noted that in the 60s-70s, quite a lot of research appeared on curiosity, not only as a motivational state but also as a trait (Boyle, 1983). For example, James (1970) identified a specific "scientific curiosity," i.e., curiosity, as a stable personality trait (Kashdan & Silvia, 2009), which determines the inclination and desire for new knowledge and experience, openness and receptivity to objects of attention, interest, surprise, and willingness to overcome uncertainty (Kashdan et al., 2004; Kashdan & Silvia, 2009).

Boyle (1983), commenting on the focus of Berlyne's (1975) theory on curiosity as a state, ruled out the author's possible ignorance of the trait aspect. He supported the assumption that Berlyne did not consider this aspect due to the many problems that accompany trait measurement (Boyle, 1983). Later, summarizing previous studies of curiosity as a state and trait, he revealed the methodological limitations of the presented approaches. The criticism also concerned the construction of measurement scales and shortcomings in factor analysis, taking into account the identified shortcomings that Boyle (1989) proposed in the state-trait curiosity model.

In the 90s and to the present day, scientific debate continues regarding the nature of curiosity. For example, according to Loewenstein's (1994) information gap theory, based on the theoretical principles of Berlyne (1954, 1960), state curiosity appears in the form of a desire to close the information gap by obtaining the missing information. The first implication of the theory is that the intensity of curiosity directed toward specific information should be positively related to the ability to close an information gap. In other words, curiosity will be stronger if there is confidence that the information gap can be closed. The second implication is that curiosity should be positively related to domain knowledge. Therefore, if a person has a sufficiently large amount of information in a particular area, there is a possibility that the person will focus on what is not known rather than on what is known. Two reasons have been identified why curiosity may not increase with an increase in information. First, is a situation where the person has mastered a sufficient amount of knowledge. Second, is a situation where all information is not known, but the value of a certain part of it has decreased (Loewenstein, 1994).

Berlyne's (1954, 1960) ideas were expanded in the works of Litman and Spielberger (2003), whose research focused on conceptualizing epistemological curiosity as a multifaceted personality trait. The researchers have developed a scale for measuring epistemological curiosity that diagnoses specific and divertive curiosit.

In further research, Litman and Jimerson (2004) noted that the motivation to seek new knowledge is driven more by an unpleasant state of uncertainty due to a lack of information compared to a pleasant state of interest. The research in this direction has made it possible to divide epistemological curiosity into two types. Type I curiosity is based on a feeling of pleasure, activated by the awareness of the prospect of discovering completely new knowledge, and is associated with the desire to develop intellectual potential. D-type curiosity involves an unsatisfied need, is stimulated in conditions of a lack of information necessary for complete knowledge, and is aimed at solving specific problems and achieving short-term goals (Litman, 2008; Litman et al., 2010; Litman & Jimerson, 2004). The individual differences in personality determine the extent to which Type I and Type D curiosity are activated (Litman & Jimerson, 2004; Litman & Spielberger, 2003). Thus, in the studies of Litman and colleagues, epistemological curiosity is represented as "the desire to acquire new knowledge that will stimulate positive feelings of intellectual interest (I-type) or reduce undesirable states of information deprivation (D-type)" (Litman et al., 2010, p. 531).

The significant contributions to the study of curiosity were made by Kashdan et al. (2004), who presented a new theoretical framework for studying the nature of curiosity. The early research conceptualized curiosity as a "positive emotional-motivational system" (p. 291). The authors proposed a scale that measures two components of curiosity: the desire for new experience (exploration) and absolute involvement in a certain activity (absorption) (Kashdan et al., 2004). As a result of further research to expand the construct of curiosity, the Curiosity and Exploration Inventory-II was developed. This scale also included two dimensions of curiosity: motivation to seek new knowledge and experience (Stretching) and a general willingness to accept the new, uncertain, and unpredictable nature of everyday life (Embracing) (Kashdan et al., 2009, p. 995).

Continuing their research on curiosity, Kashdan et al. (2018) combined previously developed methodologies into a single framework: the Five-Dimensional Curiosity Scale (5DC) (Joyous Exploration, Deprivation Sensitivity, Stress Tolerance, Thrill Seeking, Social Curiosity). The first two dimensions differ in the emotional manifestation of curiosity. In particular, Joyful Exploration is characterized by a passion for learning, an enthusiastic attitude towards the activity being performed, and a high level of well-being. Conversely, Deprivation Sensitivity occurs in conditions of lack of information, is accompanied by discomfort and irritation, and is designated as "aversive avoidance motivation" (Kashdan et al., 2018, 2020). Stress Tolerance is represented by a dispositional tendency to overcome the anxiety that arises in a situation of novelty. Thrill Seeking is defined as the excitement that makes an event special. Social Curiosity is expressed as an interest in other people (Kashdan et al., 2018, 2020). More recently, this scale has been improved (Five-Dimensional Curiosity Scale Revised (5DCR). In particular, the aspect of social curiosity is divided into two components: Overt Social Curiosity (motivation to understand other people) and Covert Social Curiosity (searching for details about other people in hidden ways) (Kashdan et al., 2020). Thus, more recent work conceptualizes curiosity as "recognition, pursuit, and desire to explore novel, uncertain, complex, and ambiguous events (Kashdan et al., 2018, p. 130).

5DC and 5DCR have been tested by many independent researchers and have also been adapted into other languages (Birenbaum et al., 2019; Grüning & Lechner, 2023; Keshavarz, 2020; Schutte & Malouff, 2020). However, along with positive reviews, there are also critical comments regarding the methodology and dimensionality of the scale (McNary, 2024).

The literature reviews that the construct of curiosity needs further research due to several limitations. First, the generalized approach to defining curiosity is not presented in the scientific literature, which creates serious obstacles for the theoretical justification of the concept and for the development of measurement tools. However, most researchers, when justifying the content of the concept of curiosity, single out motivational and emotional components as defining categories. This indicates a positive trend in the possible operationalization of the concept of curiosity. Second, contemporary research criticizes conceptualizations that are limited to one or two components of curiosity and emphasizes the multidimensionality of this phenomenon (Birenbaum et al., 2019; Grossnickle, 2016;

Kashdan et al., 2018, 2020; Kidd & Hayden, 2015; Renner, 2006; Roth & Hammelstein, 2012). At the same time, the structural components of curiosity and their quantity are still not clearly defined. Third, scientific literature remains unclear on whether curiosity is a state or a trait (Grossnickle, 2016; McNary, 2024; Wagstaff et al., 2020).

Theoretical Underpinnings

In addition to the existing research, an alternative possibility for studying curiosity is presented within the framework of the system-functional approach of Krupnov (2006). This approach allows us to view curiosity as a system consisting of interconnected components, each of which performs specific functions to ensure integrity. Studying the interactions between the components provides an opportunity to understand their influence on the curiosity of PhDs and unsuccessful doctoral candidates. Another argument in favor of the system-functional approach is the recognized multidimensionality of the concept of curiosity (Birenbaum et al., 2019; Grossnickle, 2016; Kashdan et al., 2018, 2020; Kidd & Hayden, 2015). The previous studies have conceptualized curiosity as two or three components (Collins et al., 2004; Kashdan et al., 2009; Litman & Jimerson, 2004), with the exception of recent work by Kashdan et al. (2018, 2020). In this context, the system-functional approach offers a perspective for studying the eight components of curiosity. Within the framework of the system-functional approach, curiosity integrates some components presented in other models: cognitive (Berlyne, 1954, 1960), motivational (Berlyne, 1954, 1960; Kashdan et al., 2018, 2020), and emotional (Kashdan et al., 2018, 2020; Litman et al., 2010). Thus, the use of a system-functional approach will provide a comprehensive and in-depth analysis of curiosity in the context of research activities. This approach is poorly represented in the English-language literature. We believe that this study will complement and expand scientific knowledge in the field under study, synchronizing local discussions with international research on curiosity.

System-Functional Approach to the Study of Curiosity

The methodological basis of this approach is the most important theoretical provisions of psychology about the inextricable relationship between the content, dynamic, and productive aspects of mental activity (Krupnov, 2006).

Krupnov (2006) divided personality traits into two basic classes: actual personality traits and character traits. Personality traits determine the general orientation of the personality, reveal the meaningful side of the subject's behavior, perform a strategic function, constitute the core of the personality's orientation, and are formed in the later stages of ontogenesis. This class is divided into two groups. The first is socio-psychological (or positional-role) traits, including a fixed and definite attitude towards the political system, the struggle of the masses, power, war, peace, and attitude towards other ethnic groups. The second is moral and psychological traits that express an attitude towards other people (kindness, attentiveness, sensitivity, responsiveness, etc.), an attitude towards activity (hard work, diligence, discipline, conscientiousness, etc.), an attitude towards oneself (modesty, self-criticism, self-sufficiency, etc.), attitude towards nature (thrift, caring, etc.), etc.

By character traits, Krupnov understands specific objective relationships of a person to knowledge, communication, difficulties, emotional experiences, and dynamic characteristics that are formed in the early stages of ontogenesis and determine the content-style characteristics of actions and actions (Krupnov & Novikova, 2014). The author identified cognitive traits (curiosity, observation, ingenuity, thoughtfulness, etc.), volitional traits (decisiveness, perseverance, courage, organization, etc.), emotional traits (enthusiasm, cheerfulness, anxiety, optimism, etc.), communicative traits (sociability, openness, reticence, shyness, etc.), psychomotor and speech-motor characteristics (speed, clumsiness, slowness, etc.) (Krupnov, 2006).

The psychological nature of any trait is a complex functional system. The first version of the trait structure included four components, then it was expanded to six (Krupnov, 1988). The modern

structure of traits consists of eight components (Krupnov, 1999), which are divided into two subsystems – *motivational-semantic* and *regulatory-dynamic* – which determine a person's readiness and constancy of intentions to implement various relationships (Table 1) (Krupnov et al., 2017).

Table 1. Organization of the trait of curiosity within the framework of the system-functional approach (Krupnov et al., 2013)

Components	Variables
Motivational-semantic subsystem	
Target	Socially significant goals
	Personally significant goals
Motivative	Sociocentricity
	Egocentricity
Cognitive	Meaningfulness
	Awareness
Productive	Objectivity
	Subjectivity
Regulatory-dynamic subsystem	
Dynamic	Energy
	Aenergy
Emotional	Sthenia
	Asthenia
Regulatory	Internality
	Externality
Reflective-evaluative	Operational difficulties
	Personal difficulties

The *motivational-semantic subsystem* of curiosity includes attitudinal-target, motivational, cognitive, and productive components. The starting point in this subsystem is the attitudinal-target component, through which the selection and priority of meanings, goals, subject relations, and motivations is carried out. The motivational component ensures the choice of dominant motives focused on other people or oneself. The cognitive component is responsible for the depth and accuracy of cognitive meanings and their role in the subject's behavior. The productive component determines the area of application of the trait in accordance with the goal and the expected result. The leading strategy for the functioning of the motivational-semantic subsystem is the subject's choice of dominant meanings, orientation, and motivations according to the principle "both, but something to a greater extent" (Krupnov et al., 2017).

The *regulatory-dynamic subsystem* of curiosity is represented by dynamic, emotional, regulatory, and reflexive-evaluative components. The dynamic component reveals a system of techniques and methods for implementing a trait, a measure of intensity and variability in manifestations. The emotional component determines the range of experiences that accompany the manifestation of a trait. The regulatory component shows the degree of activity or passivity of self-regulation of a trait. The reflexive-evaluative component compares initial intentions, real results, and difficulties during the execution of the instrumental-semantic program for trait implementation. The components of the regulatory-dynamic subsystem are closely related to the innate, biologically determined aspects of human individuality (Krupnov et al., 2017). Each component of the subsystem contains two variables – "harmonic" and "aharmonic" (Krupnov, 2006). Between two subsystems there are connections and relationships that determine the specific structure of each feature and ensure the performance of an active or adaptive function of the subject's life activity (Krupnov, 2006).

In this study, curiosity in the context of the systemic-functional approach includes eight components and is defined as a system of motivational-semantic and regulatory-dynamic characteristics that ensure a state of readiness and constancy of aspirations to search for new scientific knowledge and implement research activities.

METHODS

HYPOTHESES

The present study aimed to investigate the differences between the relationships between the components of curiosity and research potential in PhD and unsuccessful doctoral candidates. Based on the results of previous studies, hypotheses were presented.

For PhDs:

(H_1) The target component of curiosity will be positively related to the motivational component.

(H_2) The motivational component of curiosity will be positively related to the dynamic component.

(H_3) The cognitive component of curiosity will be positively related to the dynamic component.

(H_4) The productive component of curiosity will be positively related to research potential.

For unsuccessful doctoral candidates:

(H_5) The goal component will be positively related to the dynamic component.

(H_6) The productive component will be positively related to the reflective-evaluative component.

(H_7) The variable aenergy of the dynamic component will be negatively related to research potential.

DOCTORAL EDUCATION IN KAZAKHSTAN

Kazakhstan, like other former republics of the Soviet Union, implemented a two-stage model for obtaining a doctorate: postgraduate studies (PhD) and doctoral studies (Doctor of Sciences). To achieve greater compatibility and comparability of scientific degrees in the international educational and research space, in 2005, along with "postgraduate – doctoral studies," the training of scientific personnel within the framework of PhD doctoral educational programs began. In 2010, the Soviet two-stage model completely ended its existence.

Today, doctoral education in Kazakhstan is regulated by state regulations. The duration of training is three years. During the first year, as a rule, theoretical training is carried out in 45 ECTS. A one-month foreign research internship is provided. The scientific supervision of doctoral students is carried out by two consultants, local and foreign supervisors. The research can be issued either in the form of a doctoral dissertation, as well as at least one publication in an international peer-reviewed scientific journal indexed in the Web of Science or Scopus database and three publications in Kazakhstan peer-reviewed journals, or in the form of a series of scientific articles (minimum 3), published in publications included in the first/second quartile according to Journal Citation Reports. Basically, doctoral students prefer the first option for presenting research results. The dissertation is pre-checked by two external reviewers, followed by a public defense.

ETHICAL APPROVAL

The study was approved by the ethics committee of the Faculty of Social Sciences of the L.N. Gumilyov Eurasian National University (Protocol #1 from 26 September 2022). Participation in the study was free, voluntary, and confidential, and the respondents were informed about the purpose of the survey and agreed to the processing of the data received.

PARTICIPANTS/SAMPLES

The study involved 375 people (122 men, 253 women), of whom 181 had a PhD, and 194 were unsuccessful doctoral candidates. The age of the respondents ranged from 29 to 49 years (M = 32.2; SD = 3.4) (Table 2). The data from the National Science Report (2017, 2020, 2021, 2022) show that between 2008 and 2021, 14,773 people were enrolled in PhD programs, of whom 2,797 received a PhD degree. Based on these data, a calculation was made using the sample size calculator, according to which the confidence level for the presented number of respondents is 95% and the error is ± 5%.

Table 2. Demographic characteristics of the sample (n=375)

Respondents	Frequency	Percent
Gender		
Male	122	32.5
Female	253	67.5
Degree		
PhD	181	48.3
Unsuccessful doctoral candidates	194	51.7
Gender and degree		
Male PhD	60	16
Male unsuccessful doctoral candidates	62	16.5
Female PhD	121	32.3
Female unsuccessful doctoral candidates	132	35.2
Research field		
Social	24	6.4
Humanitarian	161	42.9
Natural science	107	28.5
Technical	70	18.7
Education	13	3.5

The sample reflects the heterogeneity of the Kazakhstani academic environment in terms of age, sex, and scientific areas. In particular, the age of PhD and unsuccessful doctoral candidates varies from 27 to over 40 years. Women significantly predominate both in the number of doctoral students and scientists (National Science Report, 2022). The sample includes respondents in the social, humanitarian, pedagogical, technical, and natural science areas of 12 Kazakhstani universities. Thus, the sample is a good representation of the entire population, which provides a rich contextual background.

The respondents were selected purposefully according to the following criteria: (1) PhD; (2) unsuccessful doctoral candidates who studied doctoral studies in the period from 2008 to 2017, i.e., for whom at least five years have passed since completing their doctoral studies. The choice of the designated time period is due to certain reasons. First, Kazakh doctoral studies have a very short history, which at the time of the study (2022) was 14 years. Second, the official statistics on the average period for preparing a dissertation and obtaining an academic degree are not publicly available. However, the National Science Report (2022) notes that, in 2021, not a single doctoral student who completed a three-year educational program received a PhD diploma. The authors' personal observations allow us to conclude that doctoral students who have not completed their dissertation within five years after completing their doctoral studies have a lower likelihood of receiving a PhD diploma. Previous studies have found that the average dissertation research process takes about seven years (Council of Graduate Schools, 2008; Kim & Otts, 2016). Thus, the presented selection criterion allows us to focus on the specific group of respondents of interest - unsuccessful doctoral candidates.

It should be noted that PhD candidates were more willing to participate, while unsuccessful doctoral candidates were more wary of the study. The tendency to participate in PhD research can be explained by confidence and pride in one's achievements and the opportunity to share positive experiences. In contrast, the failure to obtain a doctoral degree can be extremely disruptive to the doctoral student (Lovitts, 2001), as well as have serious consequences for the doctoral student's well-being (Bourke et al., 2004). In this context, the wariness of unsuccessful doctoral candidates may be explained by frustration, vulnerability, anxiety, or fear of facing negative perceptions or judgment due to failure in the doctoral program.

PROCEDURE

This research is part of a larger project that studies institutional and personal predictors of successful PhD completion. The data were collected from September to December 2022. The contacts of PhD graduates were obtained from postgraduate education departments of several Kazakh universities. Then, reminder emails were sent every two weeks.

After providing informed consent, the participants were asked to complete a response form that included a demographic questionnaire and psychological tests. The survey took an average of 25 minutes.

MEASURES

Socio-demographic characteristics of respondents

The socio-demographic characteristics were measured using a six-item questionnaire: gender, age, university, scientific direction, presence/absence of a scientific degree, and PhD study period.

Curiosity

The study used the Curiosity test developed by Krupnov on the basis of the system-functional approach (Krupnov, 2008; Krupnov et al., 2017). The total number of questions was 112. The respondents were required to indicate the degree of their agreement on a 7-point scale from absolute disagreement (1) to absolute agreement (7). Thus, eight scales were measured, including 16 variables.

Attitudinal-goal component of curiosity

Socially significant goals characterize the strength of the focus of curiosity on achieving recognition in the research environment, scientific collaboration, successful implementation of scientific research, and everything that is of high significance for the scientific community. Personally significant goals determine the subject's desire to show curiosity in order to realize intentions and interests of a personal nature.

The motivational component of curiosity

Sociocentricity is determined by motivations related to preparation for scientific research and the desire to establish a position in the research team. Egocentricity demonstrates the focus of curiosity on determining one's own point of view on the issue being studied, awareness of individual capabilities and limitations, and self-realization through obtaining and demonstrating new knowledge.

Cognitive component of curiosity

Meaningfulness is based on the subject's deep and holistic understanding of curiosity and its role in scientific research. Awareness is based on general information about the functions of curiosity and its manifestation in research activities.

Productive Component of Curiosity

Subjectivity expresses the desire to achieve success in research activities, obtaining a large amount of knowledge and research experience through curiosity. Subjectivity is aimed at personal self-development achievements, increasing self-esteem, confidence, well-being, etc.

Dynamic Component of Curiosity

Energy is a stable orientation towards overcoming difficulties that arise in the process of research activity and the use of various methods and techniques for the implementation of scientific research. Aenergy is characterized by the inconstancy of the manifestation of curiosity in scientific research, which causes the inability to find new relevant research ideas and a decrease in performance.

Emotional component of curiosity

Sthenia is supported by feelings of joy and optimism when receiving new scientific information or research data. Asthenia is characterized by the predominance of negative emotions, which gives rise to uncertainty due to a lack of scientific information, loss of strength in a situation where it is necessary to process a large volume of research results, and the expectation of failure.

Regulatory component of curiosity

Internality corresponds to the constant manifestation of curiosity, independent of external factors. Externality determines the situational manifestation of curiosity, limited by the conviction that obtaining new scientific information and experience is an accident beyond personal control.

Reflective-evaluative component of curiosity

Operational difficulties arise when the skills of analyzing and summarizing scientific information are insufficiently developed, intellectual habits, and research skills are limited and unformed. Personal difficulties are associated with increased self-criticism, uncertainty, and anxiety.

This method was chosen for several reasons. First, there is a small number of instruments adapted to the Kazakh context that measure curiosity. Second, the Curiosity Test provides a deep and detailed understanding of the opinions and experiences of research participants. Third, this instrument provides the ability to measure curiosity within a system-functional approach, which is a limitation of shorter scales. The potential fatigue among the target groups is mitigated by (1) clear, simple, and easy-to-understand question wording, (2) dividing questions into several subsections, (3) informing about the approximate time required to complete the survey, and (4) an explanation of the importance and value of participation in the study.

Research potential

The essence of research potential lies in the range, spectrum, and magnitude of the manifestation of research capabilities. Research potential is represented by a set of psychological characteristics that are necessary and sufficient to carry out research activities and achieve a certain level of productivity (Bordovskya et al., 2016). Research potential and curiosity overlap, including a general focus on active learning, the desire to expand knowledge, and openness to new ideas. A high level of research potential is associated with developed analytical skills, which favors the manifestation of curiosity.

The research potential was studied using the "Test for assessing research potential" (Bordovskya et al., 2017). The respondent was asked to assess how each of the judgments was typical for him or her on a 10-point scale (1 – does not fully correspond; 10 – fully corresponds). The test contains four scales: research potential (it is a qualitative characteristic of a psychological resource in the context of research activities); motivational component (assesses the motivating forces that determine the desire for research, research initiative, attitude towards knowledge as a value); cognitive component (assesses the ability to research, generate new ideas, analyze research situations); and behavioral component (assesses readiness for self-realization in research activities, self-organization, development of volitional qualities).

DATA ANALYSES

Data processing was performed in the software environment R version 4.1.1 software for statistical computing and graphics. In the first stage, descriptive statistics were analyzed on all scales of the two

methods, which made it possible to identify the mean, standard deviation, skewness, kurtosis, standard error of skewness and kurtosis, Shapiro–Wilk test, minimum, and maximum.

To study the display of curiosity among PhD and unsuccessful doctoral candidates, a number of methods were used. In particular, the assessment of differences between respondents on the variables of psychological tests was carried out by comparing independent groups according to the Mann–Whitney U test.

The relationships between variables were determined using Network Analysis. To avoid false edges and increase the number of nodes, partial correlations were used to create relationships between the variables' scores. A potentially useful compromise value of 0.25 was used (Hevey, 2018). This method allows one to increase the accuracy of estimates of the relationship between variables, excluding the influence of other variables. Consequently, it is possible to obtain more reliable results and draw more informed conclusions.

To determine statistically significant differences between the strength of the connection between two pairs of variables, partial correlations were compared. For each two compared variables, all other variables acted as controls. The calculation helped to understand the structure of relationships more accurately between variables and their influence on the manifestation of curiosity of PhDs and unsuccessful doctoral candidates.

RESULTS

DESCRIPTIVE STATISTICS

The descriptive statistics of the variables of the diagnostic tests are presented in Table 3. According to the presented data, the skewness and kurtosis values are within acceptable levels from -2 to 2, which do not require additional transformations (George & Mallery, 2016; Lewis-Beck et al., 2003). The Shapiro-Wilk test was used to check the normality of the data distribution. As a result, a deviation of the data distribution from normal was revealed, which may have an impact on the information content of average values and standard deviations, as well as on the strength and direction of connections between nodes in the network. In these circumstances, it will be necessary to interpret the results more carefully.

Table 3. Descriptive statistics for curiosity and exploratory potential variables (n = 375)

Variable	M	(SD)	Skewness	(SE)	Kurtosis	(SE)	W	(p*)	Min	Max
Curiosity										
Socially significant goals	34.10	(8.814)	-0.59	(0.12)	0.11	(0.25)	0.967	<0.001	4	49
Personally significant goals	37.99	(8.67)	-0.99	(0.12)	0.53	(0.25)	0.909	<0.001	5	49
Sociocentricity	36.57	(7.97)	-0.80	(0.12)	0.75	(0.25)	0.956	<0.001	8	49
Egocentricity	38.34	(8.03)	-1.10	(0.12)	1.16	(0.25)	0.916	<0.001	5	49
Meaningfulness	36.64	(8.03)	-0.81	(0.12)	0.68	(0.25)	0.954	<0.001	6	49
Awareness	24.92	(11.44)	-0.20	(0.12)	-0.60	(0.25)	0.984	<0.001	0	49
Objectivity	37.68	(7.95)	-0.88	(0.12)	0.63	(0.25)	0.942	<0.001	8	49
Subjectivity	37.16	(7.63)	-0.87	(0.12)	1.08	(0.25)	0.949	<0.001	8	4
Energy	33.31	(8.15)	-0.59	(0.12)	0.37	(0.25)	0.975	<0.001	7	49
Aenergy	17.29	(11.30)	0.37	(0.12)	-0.90	(0.25)	0.953	<0.001	0	43
Sthenia	33.81	(8.87)	-0.70	(0.12)	0.63	(0.25)	0.965	<0.001	0	49
Asthenia	22.61	(10.56)	-0.11	(0.12)	-0.65	(0.25)	0.986	0.001	0	46
Internality	34.30	(8.18)	-0.84	(0.12)	1.02	(0.25)	0.957	<0.001	0	49
Externality	17.93	(11.73)	0.27	(0.12)	-0.77	(0.25)	0.967	<0.001	0	49

Variable	M	(SD)	Skew-ness	(SE)	Kurt-osis	(SE)	W	(p*)	Min	Max
Operational difficulties	14.33	(10.65)	0.63	(0.12)	-0.20	(0.25)	0.948	<0.001	0	47
Personal difficulties	13.22	(11.36)	0.60	(0.12)	-0.62	(0.25)	0.919	<0.001	0	44
Research potential										
Research potential	5.78	(2.08)	-0.347	(0.12)	-0.61	(0.25)	0.948	<0.001	1	9
Motivational component	5.52	(2.05)	-0.197	(0.12)	-0.63	(0.25)	0.960	<0.001	1	9
Cognitive component	6.41	(1.97)	-0.474	(0.12)	-0.71	(0.25)	0.927	<0.001	1	9
Behavioral component	5.04	(2.09)	0.036	(0.12)	-0.68	(0.25)	0.964	<0.001	1	9

Note: M = mean, SD = standard deviation, SE = standard error, W = Shapiro Wilk test.
**p = Shapiro Wilk Test.*

Curiosity Expression and Research Potential Variables in PhD and Unsuccessful Doctoral Candidates

The results of a pairwise comparison of curiosity variables in PhD and unsuccessful doctoral candidates are presented in Table 4. According to the data obtained, when curiosity is represented in PhDs, harmonic variables of the target, cognitive, productive, dynamic and regulatory components, as well as variables of research potential, dominate. The aharmonic variables of the dynamic, emotional, regulatory, and reflexive-evaluative components of curiosity predominate among unsuccessful doctoral candidates There were no differences found in the motivational component of curiosity.

Table 4. Significant results comparing the curiosity expression between PhD and Unsuccessful doctoral candidates

Variables	PhD (n = 181)				Unsuccessful doctoral candidates (n = 194)				W	p*
	M	*(SD)*	SE	CV	*M*	*SD*	SE	CV		
Socially significant goals	35.17	(9.08)	0.67	0.25	33.09	(8.45)	0.60	0.25	20150.0	0.013
Meaningfulness	37.50	(8.06)	0.59	0.21	35.83	(7.93)	0.57	0.22	19882.5	0.026
Objectivity	38.93	(7.48)	0.55	0.19	36.52	(8.20)	0.58	0.22	20625.0	0.003
Energy	34.53	(8.34)	0.62	0.24	32.18	(7.83)	0.62	0.24	20424.5	0.006
Aenergy	14.32	(10.47)	0.77	0.73	20.06	(11.37)	0.81	0.56	12334.0	<0.001
Asthenia	21.13	(10.19)	0.75	0.48	24.00	(10.74)	0.77	0.44	14661.0	0.006
Internality	35.50	(8.14)	0.60	0.22	33.18	(8.08)	0.58	0.24	20627.0	0.003
Externality	15.74	(11.51)	0.85	0.73	19.97	(11.60)	0.83	0.58	13884.0	<0.001
Operational difficulties	10.97	(8.89)	0.66	0.81	17.47	(11.20)	0.80	0.64	11673.0	<0.001
Personal difficulties	10.42	(9.80)	0.72	0.94	15.83	(12.10)	0.86	0.76	12966.0	<0.001
Research potential	6.724	(1.75)	0.13	0.26	4.91	(1.99)	0.14	0.41	26482.5	<0.001
Motivational compo-nent	6.39	(1.79)	0.13	0.28	4.72	(1.95)	0.14	0.41	25835.0	<0.001

Variables	PhD (n = 181)				Unsuccessful doctoral candidates (n = 194)				W	p*
	M	*(SD)*	SE	CV	*M*	*SD*	SE	CV		
Cognitive component	7.23	(1.64)	0.12	0.23	5.64	(1.95)	0.14	0.35	25722.0	<0.001
Behavioral component	5.91	(1.83)	0.14	0.31	4.23	(2.00)	0.14	0.47	25756.5	<0.001

*Note. *Mann–Whitney U test.*
M = Mean, SD = Standard Deviation, SE = Standard Error, CV – Coefficient of variation.

The Specifics of Relationships Between Curiosity and Research Potential of PhD and Unsuccessful Doctoral Candidates

Partial correlations with results greater than 0.25 and their graphical representation are shown in Figure 1. Network plots visually illustrate positive and negative correlations, as well as isolated nodes. The size and color density of the edges show varying degrees of relationship between the studied variables. The edges are not directed (undirected edge) because the data are presented in the form of two-dimensional partial correlations.

As expected, PhD – specific relationships are between the variables of motivational and regulatory components, as well as cognitive and dynamic ones. For unsuccessful doctoral candidates, the motivational component is associated with the productive component. The dynamic component is associated with the emotional component, which, in turn, is negatively related to the regulatory component. At the same time, the cognitive component has no links with other variables.

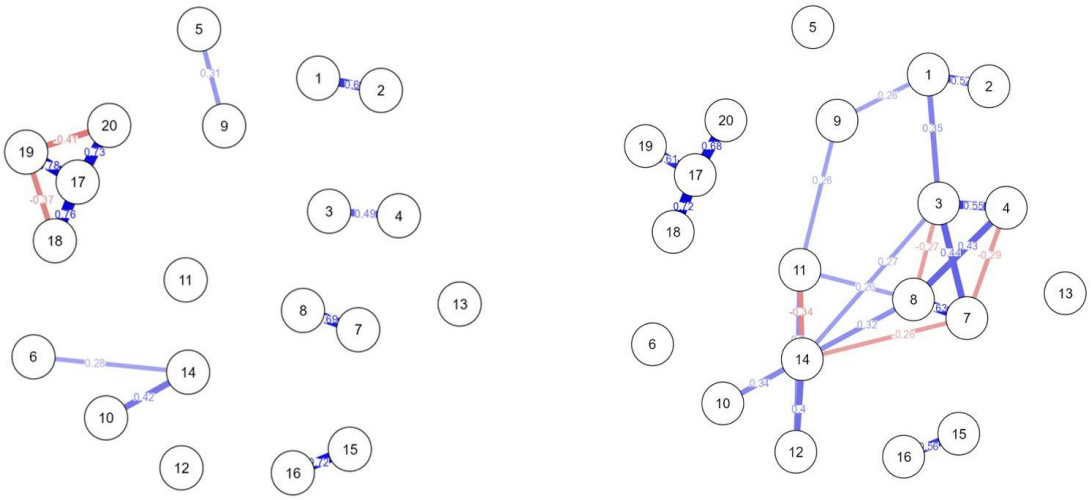

Figure 1. Graphical representation of correlations between study variables in a sample of PhD and unsuccessful doctoral candidates

Note. a) PhD; b) unsuccessful doctoral candidates

Blue lines are positive correlations; red lines are negative correlations. To interpret the colored lines, the reader should refer to the web version of this article.

1: Socially significant goals; 2: Personally significant goals; 3: Sociocentricity; 4: Egocentricity; 5: Meaningfulness; 6: Awareness; 7: Objectivity; 8: Subjectivity; 9: Energy; 10: Aenergy; 11: Sthenia; 12: Asthenia; 13: Internality; 14: Externality; 15: Operational difficulties; 16: Personal difficulties; 17: Research potential; 18: Motivational component; 19: Cognitive component; 20 Behavioral component.

In the PhD, the strongest relationship is between the variables of the reflective-evaluative component of curiosity (0.72). Also, a strong relationship is observed between the variables of the productive component of curiosity (0.69). There is a fairly strong relationship between the variables of the target component (0.60). There is a relationship between the variables of the motivational component (0.49). A node is fixed that includes variables of regulatory and dynamic (variable - energy (0.42)), cognitive (variable - awareness (0.28)) components. There is also a relationship between the bipolar variables of cognitive (meaningfulness) and dynamic (energy) components (0.31). It must be emphasized that the relationship between the cognitive and dynamic components is specific to PhD.

Among unsuccessful doctoral candidates, the strongest relationship was recorded between the variables of productive (0.63), reflective-evaluative (0.56), motivational (0.55), and goal-oriented (0.52) components. There are also quite strong negative and positive relationships between the motivational and productive components (0.44; -0.29), emotional and regulatory (0.4; -0.34), dynamic (0.34), and motivational (0.32) components. In both samples, there are strong relationships between the research potential variables.

Comparison of partial correlations (see the Appendix) made it possible to establish differences in all components of curiosity (target, motivational, cognitive, productive, dynamic, emotional, reflective-evaluative), as well as in scales of research potential. Of 190 pairs of partial correlations, differences were identified in 20 pairs for PhDs and 19 pairs for unsuccessful doctoral candidates. It should be noted that unsuccessful doctor candidates lack a relationship with the cognitive component of curiosity.

DISCUSSION

The purpose of this study was to identify differences in the manifestation of curiosity between PhD and unsuccessful doctoral candidates. The authors of this work sought to generate new knowledge about curiosity and its role in research activities. It is important to note that the obtained results develop and expand the scientific field under study in a few directions. The data analysis suggests that there are certain differences in the manifestation of curiosity between PhD and unsuccessful doctoral candidates. A comparison of independent groups according to the Mann–Whitney U test showed that PhDs are significantly more focused on the successful implementation of research (socially significant goals); understand that research productivity is due to the expression of willpower and personal desire for new scientific knowledge (meaningfulness); more fruitful application of the obtained scientific results (objectivity); demonstrate a higher openness to new scientific experience (energy); and are more convinced that successes and failures are determined by their own aspirations and the manifestation of curiosity (internality). The differences in research potential variables indicate a more developed internal resource that determines the readiness and ability for scientific research, a more pronounced desire for knowledge, a higher level of conceptual thinking, and developed self-organization. In turn, unsuccessful doctoral candidates' theses demonstrate inconsistency in the manifestation of curiosity (energy), dominance of negative emotions and confusion during scientific research (asthenicity), self-doubt, the need for enhanced external control (externality), and more pronounced operational and personal difficulties.

The results of the network analysis and comparison of partial correlations indicate differences in the curiosity displayed by PhDs and unsuccessful doctoral candidates. The specific relationships between variables of a number of components were discovered. The target component ensures the selection and priority of meanings, goals, and attitudes towards research (Krupnov et al., 2017), which also corresponds to the findings of Kashdan et al. (2020). In PhD, the goal component variable, personally significant goals, is positively related to sociocentricity (motivational component) and aenergy (dynamic component). The indicated connection indicates that the realization of personal intentions is associated with the desire to establish a position in the research team and a weak expression of curiosity. For unsuccessful doctoral candidates, socially significant goals are associated with the energy

and anergy of the dynamic component. Personal significant goals are associated with the subjectivity of the productive component. This relationship may indicate that the pursuit of research goals is correlated with variability in the intensity of curiosity. At the same time, personal goals are related to the results of solving personal problems, self-development, and increasing self-esteem.

The motivational component ensures the choice of dominant motives (Krupnov et al., 2017). The importance of the motivational aspect of curiosity is also highlighted by Sher et al. (2019) and Silvia (2012). PhDs revealed a positive relationship between the sociocentricity of the motivational component and energy (dynamic component), as well as research potential. On the other hand, egocentricity (motivational component) is positively correlated with the cognitive component of research potential but is negatively related to objectivity (productive component). These results indicate that among PhDs, the predominance of motivation to acquire and demonstrate new knowledge is associated with the desire for recognition in the scientific community, independence from external factors, and high activity. For unsuccessful doctoral candidates, relationships were found between sociocentricity and objectivity (productive component), externality (regulatory component), and the cognitive component of research potential. In addition, egocentricity has a connection with subjectivity (productive component), energy (dynamic component), sthenia (emotional component), and research potential. The indicated relationship indicates that the dominance of personal motives is associated with the determination of priorities for the manifestation of curiosity.

The *cognitive component* of curiosity regulates the depth and accuracy of cognitive meanings and their role in behavior (Krupnov et al., 2017). Unique to PhD is the relationship between the cognitive component variable meaningfulness and vigor (dynamic component) and externality (regulatory component). The relationship can be interpreted as an awareness of the role of curiosity in research activity that correlates with the manifestation of activity that contributes to the achievement of scientific results.

The *productive component* defines the priority area for the application of curiosity is determined in accordance with the set goal and expected result in research activities (Krupnov et al., 2017). In a PhD, there is a connection between the variable of the productive component objectivity and sthenia (emotional component), personal difficulties (reflective-evaluative component), and the behavioral component of research potential. For unsuccessful doctoral candidates, the subject matter is associated with operational difficulties (reflective-evaluative component) and research potential. Subjectivity is associated with sthenia (emotional component), externality (regulatory component), and behavioral component of research potential. The discovered differences confirm that emotional and reflective-evaluative manifestations of PhD curiosity are associated with research productivity. In unsuccessful doctoral candidates, research productivity is associated with undeveloped research skills, emotionality, situational manifestation of curiosity, and insufficient research potential.

The dynamic component defines a system of techniques and methods for implementing curiosity, a measure of intensity and variability in its manifestations (Krupnov et al., 2017). In PhD, the variable of the dynamic component, energy, is associated with the internality of the regulatory component. Variable aenergy is associated with asthenicity of the emotional component and the cognitive component of research potential. Among unsuccessful doctor candidates, a positive relationship was found between the dynamic component variables vigor and aenergy. There is also a negative relationship between energy and research potential. According to the presented results, PhD students use a variety of techniques and ways to implement curiosity in research activities. In turn, unsuccessful doctor candidates have weakly expressed curiosity and research potential.

The emotional component provides color to the experiences that accompany the manifestation of curiosity (Krupnov et al., 2017). PhDs revealed a negative relationship between the sthenia of the emotional component and the externality of the regulatory component, as well as a positive relationship between asthenia and internality. This relationship highlights the possibility that PhDs lack emotional

satisfaction when experiencing situational curiosity. This result is partly consistent with previous research (Litman, 2008; Litman & Jimerson, 2004; Whitecross & Smithson, 2023).

The *regulatory component* reflects the degree of activity or passivity in the manifestation of curiosity (Krupnov et al., 2017). In unsuccessful doctoral candidates, the relationship between changes in the internality of the regulatory component and personal difficulties (reflective-evaluative component) may indicate that low self-esteem correlates with their modest activity in the manifestation of curiosity.

The reflective-evaluative component compares initial intentions, actual results, and difficulties in the course of displaying curiosity in research activities (Krupnov et al., 2017). For PhDs, operational difficulties are related to research potential. The relationship indicates that poor research skills are correlated with limited expression of curiosity and research potential.

The differences in the relationships between the research potential variables indicate a discrepancy in the qualitative characteristics of the psychological resource, including the motivating forces that determine interest in research, cognitive abilities, and readiness for a productive search (Bordovskya et al., 2017).

The identified differences in the manifestation of curiosity in PhD and unsuccessful doctoral candidates confirmed the hypotheses and provided a basis for describing the two profiles of curiosity in the context of research activity.

Effective and efficient profile is distinguished by a representation of curiosity, expressed by a steady desire for scientific research, internal locus control, high productivity, emotional interest in the study, energy and focus on research activities, and understanding the significance of the efforts made for future scientific and personal achievements. In addition, this style is characterized by a developed internal resource that determines the readiness and ability for scientific research, the achievement of significant results, the desire for knowledge, a high level of conceptual thinking, the ability to generate scientific ideas, the development of self-organization, and volitional qualities. Intense research activity, which does not lead to quick results, may be accompanied by an expression of passivity, negative emotions, decreased performance, and a need for outside support. However, the previous research successes and the support of experienced colleagues made it possible to overcome various difficulties.

Passive-effective profile is characterized by an insufficient level of curiosity when conducting research, instability of research aspirations and activity, and research goals that are not paramount. In addition, this style is characterized by a moderately developed internal resource, which determines the ability to organize one's activity in accordance with research goals and objectives. The difficulties in the implementation of the study are due to insufficient desire to implement the intended, anxiety, passivity, reflection in situations where it is necessary to act, and self-doubt, which is accompanied by negative emotions and indicates a poor command of the methods of implementing research activities.

The identified differences in curiosity between PhDs and unsuccessful doctoral candidates and the profiles described on their basis are generally consistent with the conclusion of Schutte & Malouff that higher levels of curiosity are associated with greater performance (Schutte & Malouff, 2023). This suggests that systematic work to increase the curiosity of doctoral students will help increase their research productivity. As another key point, this is the first study in Kazakhstan that compares the psychological specifics of PhD graduates and unsuccessful doctoral candidates' curiosity.

Limitations and Directions for Future Research

The present study has some limitations that require further study. While the sample is relatively well-represented in terms of the age range and field of study of participants, the sample size is still smaller compared to some other quantitative studies of curiosity. In addition, the sample is represented predominantly by the female gender, which may cause certain distortions in generalizing the results

to the male gender. The "Test for assessing research potential" has not previously been tested on such a sample. This study was conducted only in Kazakhstan and, therefore, does not reflect the cross-cultural aspect of curiosity representation in research activities.

This limitation is due, first, to the educational context, including the characteristics of doctoral programs, approaches to dissertation research, requirements for completing training, etc., as well as very modest experience in implementing doctoral programs. Second, linguistic and cultural characteristics may influence the understanding and interpretation of questions on the tests used. Third, differences in the social and economic environment affect the availability of resources for the implementation of research. Thus, individually or in combination, the listed factors can influence the display of the components of curiosity in research activities among doctoral students from different countries. It is also necessary to take into account that the study design limits the ability to interpret the results obtained in terms of cause-and-effect relationships. These limitations potentially raise questions regarding the generalizability of the findings presented.

An interesting topic for future research to replicate these findings would be to further explore the specific relationships between components of curiosity in PhDs and unsuccessful doctoral candidates, including a more detailed study of the nature of the relationship and identifying cause-and-effect relationships. It is advisable to study the factors influencing the formation of the structure of curiosity within doctoral studies, for example, the educational environment, mentoring, personal characteristics, etc. Future research may focus on a detailed analysis of curiosity profiles, including in the context of various personal characteristics. It is also interesting to study the dynamics of changes in curiosity profiles over time to identify support strategies that facilitate the transition from a passive-effective to an effective-effective profile. Cross-national comparisons performed on larger samples seem promising. In addition, the development and testing of a program for psychological support of research activities and the development of curiosity among doctoral students deserve attention. In order to increase the research productivity of doctoral students, it is interesting to conduct a longitudinal or experimental study that involves diagnosing curiosity among doctoral students at different stages of training and with different research productivity. It also seems very useful to adapt the 5DCR to the Kazakh context, which will allow cross-cultural expansion of the study of the concept of curiosity.

CONCLUSION

Regardless of limitations and the need for future research, the findings complement existing research and provide a greater understanding of the nature of curiosity in the context of research activities. The authors made an attempt, based on a system-functional approach, to present the differences in the manifestation of curiosity between PhDs and unsuccessful doctoral candidates. The identified connections in the structure of curiosity in PhD and unsuccessful doctoral candidates indicate unique patterns in the goal, motivational, cognitive, productive, dynamic, emotional, regulatory, reflective-evaluative components. In particular, the differences relate to the desire for research, the cognitive significance of scientific knowledge, priorities and ways of expressing curiosity, accompanying emotional experiences, comparison of intentions and results. Profiles of curiosity and knowledge in the context of research activities are highlighted. An effective profile is characterized by a stable desire for scientific research, high motivation and productivity, and an emotional interest in research. The passive-effective profile is characterized by unstable research aspirations and low activity in scientific research. The internal resources in this profile are less developed, which affects the ability to organize one's activity in accordance with research goals. Thus, the study contributes to the identification of key aspects that may determine success in research activities.

From a practical point of view, understanding the differences in the structure of curiosity can help improve the selection process of doctoral students and improve the organization and planning of doctoral students' research activities.

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No potential conflict of interest was reported by the author(s).

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, Y.T., upon reasonable request.

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Conceptualization: YT, AS
Methodology: YT
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REFERENCES

Ainley, M., Hidi, S., & Berndorff, D. (2002). Interest, learning and the psychological processes that mediate their relationship. *Journal of Educational Psychology, 94*(3), 545–561. https://doi.org/10.1037/0022-0663.94.3.545

Berlyne, D. E. (1954). A theory of human curiosity. *British Journal of Psychology, 45*(3), 180–191. https://doi.org/10.1111/j.2044-8295.1954.tb01243.x

Berlyne, D. E. (1960). *Conflict, arousal, and curiosity*. New York, NY: McGraw-Hill. https://doi.org/10.1037/11164-000

Berlyne, D. E. (1975). Behaviourism? Cognitive theory? Humanistic psychology? To Hull with them all. *Canadian Psychological Review, 16*(2), 69-80. https://doi.org/10.1037/h0081798

Birenbaum, M., Nasser-Abu Alhija, F., Shilton, H., Kimron, H., Rosanski, R., & Shahor, N. (2019). A further look at the five-dimensional curiosity construct. *Personality and Individual Differences, 149,* 57–65. https://doi.org/10.1016/j.paid.2019.05.038

Bordovskya, N. V., Kostromina, S. N., Rosum, S. I., & Moskvicheva, N. L. (2017). Student's research potential: Constructs content and method for its assessment. *Psychological Journal, 38*(1), 52–66. https://www.researchgate.net/profile/Svetlana-Kostromina/publication/319092930_Student%27s_research_potential_Constructs_content_and_method_for_its_assessment/links/5a71d9490f7e9ba2e1ccffd2/Students-research-potential-Constructs-content-and-method-for-its-assessment.pdf

Bordovskya, N. V., Kostromina, S. N., Rosum, S. I., Moskvicheva, N. L., Darinskaya, L. A., & Iskra, N. N. (2016). *Student research potential*. Ru-science.

Bourke, S., Holbrook, A., Lovat, T., & Farley, P. (2004, November). *Attrition, completion and completion times of PhD candidates*. Paper presented at the AARE Annual Conference, Melbourne, Australia.

Boyle, G. J. (1983). Critical review of state-trait curiosity test development. *Motivation and Emotion*, *7*(4), 377–397. https://doi.org/10.1007/BF00991647

Boyle, G. J. (1989). Breadth-depth or state-trait curiosity? A factor analysis of state-trait curiosity and state anxiety scales. *Personality and Individual Differences*, *10*(2), 175–183. https://doi.org/10.1016/0191-8869(89)90201-8

Brooks, G., Yang, H., & Köhler, S. (2021). Feeling-of-knowing experiences breed curiosity. *Memory, 29*(2), 153–167. https://doi.org/10.1080/09658211.2020.1867746

Burpee, L. C., & Langer, E. J. (2005). Mindfulness and marital satisfaction. *Journal of Adult Development, 12,* 43–51. https://doi.org/10.1007/s10804-005-1281-6

Collins, R. P., Litman, J. A., & Spielberger, C. D. (2004). The measurement of perceptual curiosity. *Personality and Individual Differences*, *36*, 1127–1141. https://doi.org/10.1016/S0191-8869(03)00205-8

Council of Graduate Schools. (2008). *Ph.D. completion and attrition: Analysis of baseline demographic data from the Ph.D. completion project*. https://cgsnet.org/wp-content/uploads/2022/01/phd_completion_and_attrition_analysis_of_baseline_demographic_data-2.pdf

Cyranoski, D., Gilbert, N., Ledford, H., Nayar, A., & Yahia, M. (2011). Education: The PhD factory. *Nature, 472*, 276–279. https://doi.org/10.1038/472276a

Djupe, P. A., Hill, K. Q., Smith, A. E., & Sokhey, A. E. (2020). Putting personality in context: determinants of research productivity and impact in political science. *Scientometrics, 124*, 2279–2300. https://doi.org/10.1007/s11192-020-03592-5

Duke, D. C., & Denicolo, P. M. (2017). What supervisors and universities can do to enhance doctoral student experience (and how they can help themselves). *FEMS Microbiology Letters, 364*(9). https://doi.org/10.1093/femsle/fnx090

Fang, Y.-H., Tang, K., Li, C.-Y., & Wu, C.-C. (2016). *O*n electronic word-of-mouth diffusion in social networks: curiosity and influence. *International Journal of Advertising, 37*(3), 360–384. https://doi.org/10.1080/02650487.2016.1256014

Flake, J. K., Barron, K. E., Hulleman, C., McCoach, B. D., & Welsh, M. E. (2015). Measuring cost: The forgotten component of expectancy-value theory. *Contemporary Educational Psychology, 41*, 232–244. https://doi.org/10.1016/j.cedpsych.2015.03.002

Galli, G., Sirota, M., Gruber, M. J., Ivanof, B. E., Ganesh, J., Materassi, M., & Craik, F. I. M. (2018). Learning facts during aging: The benefits of curiosity. *Experimental Aging Research, 44*(4), 311–328. https://doi.org/10.1080/0361073X.2018.1477355

George, D., & Mallery, P. (2016). *IBM SPSS statistics 23 step by step: A simple guide and reference*. Routledge. https://doi.org/10.4324/9781315545899

Gottlieb, J., Lopes, M., & Oudeyer, P.-Y. (2016). Motivated cognition: Neural and computational mechanisms of curiosity, attention and intrinsic motivation. In S. Kim, J. Reeve, & M. Bong (Eds.), *Recent developments in neuroscience research on human motivation (advances in motivation and achievement)* (pp. 149–172). Emerald Group Publishing Limited. https://doi.org/10.1108/S0749-742320160000019017

Grossnickle, E. M. (2016). Disentangling curiosity: Dimensionality, definitions, and distinctions from interest in educational contexts. *Educational Psychology Review*, *28,* 23–60. https://doi.org/10.1007/s10648-014-9294-y

Gruber, M. J., Gelman, B. D., & Ranganath, C. (2014). States of curiosity modulate hippocampus-dependent learning via the dopaminergic circuit. *Neuron, 84*(2), 486–496. https://doi.org/10.1016/j.neuron.2014.08.060

Grüning, D. J., & Lechner, C. M. (2023). Measuring six facets of curiosity in Germany and the UK: A German-language adaptation of the 5DCR and its comparability with the English-language source version. *Journal of Personality Assessment, 105*(2), 283-295. https://doi.org/10.1080/00223891.2022.2057318

Hevey, D. (2018). Network analysis: A brief overview and tutorial. *Health Psychology and Behavioral Medicine, 6*(1), 301-328. https://doi.org/10.1080/21642850.2018.1521283

James, W. (1970). *Principles of psychology*. Holt.

Jensen, L. E., & Deemer, E. D. (2019). Identity, campus climate, and burnout among undergraduate women in STEM fields. *The Career Development Quarterly, 67*(2), 96–109. https://doi.org/10.1002/cdq.12174

Kashdan, T. B., Disabato, D. J., Goodman, F. R., & McKnight, P. E. (2020). The Five-Dimensional Curiosity Scale Revised (5DCR): Briefer subscales while separating overt and covert social curiosity. *Personality and Individual Differences, 157,* 109836. https://doi.org/10.1016/j.paid.2020.109836

Kashdan, T. B., Gallagher, M., Silvia, P., Winterstein, B., Breen, W., Terhar, D., & Steger, M. (2009). The curiosity and exploration inventory-II: Development, factor structure, and psychometrics. *Journal of Research in Personality*, *43(6)*, 987–998. https://doi.org/10.1016/j.jrp.2009.04.011

Kashdan, T. B., Rose, P., & Fincham, F. D. (2004). Curiosity and exploration: Facilitating positive subjective experiences and personal growth opportunities. *Journal of Personality Assessment, 82*(3), 291–305. https://doi.org/10.1207/s15327752jpa8203_05

Kashdan, T. B., & Silvia, P. J. (2009). Curiosity and interest: The benefits of thriving on novelty and challenge. In S. J. Lopez & C. R. Snyder (Eds.), *Oxford handbook of positive psychology* (pp. 367–374). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780195187243.013.0034

Kashdan, T. B., & Steger, M. F. (2007). Curiosity and pathways to well-being and meaning in life: Traits, states, and everyday behaviors. *Motivation and Emotion*, *31*, 159–173. https://doi.org/10.1007/s11031-007-9068-7

Kashdan, T. B., Stiksma, M. C., Disabato, D. J., McKnight, P. E., Bekier, J., Kaji, J., & Lazarus, R. S. (2018). The five-dimensional curiosity scale: Capturing the bandwidth of curiosity and identifying four unique subgroups of curious people. *Journal of Research in Personality*, *73*, 130–149. https://doi.org/10.1016/j.jrp.2017.11.011

Kashdan, T. B., & Yuen, M. (2007). Whether highly curious students thrive academically depends on perceptions about the school learning environment: A study of Hong Kong adolescents. *Motivation and Emotion, 31,* 260-270. https://doi.org/10.1007/s11031-007-9074-9

Keshavarz, H. (2020). Evaluating trustworthiness and expertise of information on websites among the undergraduate students: The role of curiosity. *The International Information & Library Review, 53*(3), 199–213. https://doi.org/10.1080/10572317.2020.1827216

Kidd, C., & Hayden, B. Y. (2015). The psychology and neuroscience of curiosity. *Neuron, 88*(3), 449–460. https://doi.org/10.1016/j.neuron.2015.09.010

Kim, D., & Otts, C. (2016). The effect of loans on time to doctorate degree: Differences by race/ethnicity, field of study, and institutional characteristics. *The Journal of Higher Education*, *81*(1), 1–32. https://doi.org/10.1080/00221546.2010.11778968

Krupnov, A. I. (1988). Psychological problems of a holistic analysis of personality and its basic properties. In N. I. Reinwald (Ed.), *Psychological and pedagogical problems of personality formation in educational activities* (pp. 28–39). Publishing House of Peoples' Friendship University.

Krupnov, A. I. (1999). Character trait as a functional system. In *Educational Psychology*. Publishing House Biysk State Pedagogical Institute.

Krupnov, A. I. (2006). System-dispositional approach to the study of personality and its properties. *Bulletin of RUDN University. Series: Psychology and Pedagogy, 1*(3), 63–73. https://scholar.google.ru/scholar?hl=ru&as_sdt=0%2C5&q=%D0%A1%D0%B8%D1%81%D1%82%D0%B5%D0%BC%D0%BD%D0%BE-%D0%B4%D0%B8%D1%81%D0%BF%D0%BE%D0%B7%D0%B8%D1%86%D0%B8%D0%BE%D0%BD%D0%BD%D1%8B%D0%B9+%D0%BF%D0%BE%D0%B4%D1%85%D0%BE%D0%B4+%D0%BA+%D0%B8%D0%B7%D1%83%D1%87%D0%B5%D0%BD%D0%B8%D1%8E+%D0%B

B%D0%B8%D1%87%D0%BD%D0%BE%D1%81%D1%82%D0%B8+%D0%B8+%D0%B5%D0%B5+%D1%81%D0%B2%D0%BE%D0%B9%D1%81%D1%82%D0%B2&btnG=

Krupnov, A. I. (2008). *Psychodiagnostics of personality traits and temperament.* Moscow State University of Design and Technology.

Krupnov, A. I., & Novikova, I. A. (2014). History and conceptual foundations of the systemic-functional approach to the personality traits study. In A. I. Krupnov, S. I. Kudinov, I. A. Novikova (Eds.), *Systemic studies of personality traits for the 30th anniversary of the Scientific School of A.I. Krupnov at RUDN.* RUDN University.

Krupnov, A. I., Novikova, I. A., & Kozhukhova, Y. V. (2013). System-functional model of personality traits. *Academic Journal of Interdisciplinary Studies, 2*(9), 407–413. https://doi.org/10.5901/ajis.2013.v2n9p407

Krupnov, A. I., Novikova, I. A., & Shlyakhta, D. A. (2017). *Complex studies of personality traits: Theory and practice.* RUDN.

Lewis-Beck, M., Bryman, A. E., & Liao, T. F. (2003). *The Sage encyclopedia of social science research methods.* Sage. https://doi.org/10.4135/9781412950589

Litman, J. A. (2008). Interest and deprivation factors of epistemic curiosity. *Personality and Individual Differences, 44*(7), 1585–1595. https://doi.org/10.1016/j.paid.2008.01.014

Litman, J. A., Crowson, H. M., & Kolinski, K. (2010). Validity of the interest- and deprivation-type epistemic curiosity distinction in non-students. *Personality and Individual Differences, 49*(5), 531–536. https://doi.org/10.1016/j.paid.2010.05.021

Litman, J. A., & Jimerson, T. L. (2004). The measurement of curiosity as a feeling of deprivation. *Journal of Personality Assessment, 82:2*, 147-157. https://doi.org/10.1207/s15327752jpa8202_3

Litman, J. A., & Spielberger, C. D. (2003). Measuring epistemic curiosity and its diversive and specific components. *Journal of Personality Assessment*, *80*, 75–86. https://doi.org/10.1207/S15327752JPA8001_16

Loewenstein, G. (1994). The psychology of curiosity: A review and reinterpretation. *Psychological Bulletin*, *116*(1), 75-98. https://doi.org/10.1037/0033-2909.116.1.75

Lovitts, B. E. (2001). *Leaving the ivory tower: The causes and consequences of departure from doctoral study*. Rowman & Littlefield.

McDougall, W. (2001). *An introduction to social psychology*. Batoche Books.

McNary, L. (2024). Curiosity: A conceptual re-analysis for improved measurement. *Current Psychology*, *43*, 575–586. https://doi.org/10.1007/s12144-022-04170-z

Mussel, P., Spengler, M., Litman, J. A., & Schuler, H. (2012). Development and validation of the German Work-Related Curiosity Scale. *European Journal of Psychological Assessment, 28*(2), 109–117. https://doi.org/10.1027/1015-5759/a000098

National Science Report. (2017). https://nauka-nanrk.kz/assets/assets/%D0%9D%D0%B0%D1%86%20%D0%B4%D0%BE%D0%BA%D0%BB%D0%B0%D0%B4%D1%8B/2017.pdf

National Science Report. (2020). https://nauka-nanrk.kz/assets/assets/%D0%94%D0%BE%D0%BA%D0%BB%D0%B0%D0%B4/%D0%9F%D0%BE%D1%81%D0%BB.%20%D0%9D%D0%B0%D1%86%D0%B4%D0%BE%D0%BA%D0%BB%D0%B0%D0%B4%20%D0%BF%D0%BE%20%D0%BD%D0%B0%D1%83%D0%BA%D0%B5%20%202020%20%D0%B0%D0%BD%D0%B3.pdf

National Science Report. (2021). https://nauka-nanrk.kz/assets/2021/%D0%B4%D0%BE%D0%BA%D0%BB%D0%B0%D0%B4%20%D0%B3%D0%BE%D1%82/%D0%9D%D0%B0%D1%86-%D0%B4%D0%BE%D0%BA%D0%BB%D0%B0%D0%B4%D1%8B%20ang.pdf

National Science Report. (2022). https://nauka-nanrk.kz/assets/Doklad%20eng.pdf

OECD. (2016). *Education at a Glance 2016: OECD indicators.* OECD Publishing. https://www.oecdilibrary.org/education/education-at-a-glance-2016_eag-2016-en

Pearson, M., Cumming, J., Evans, T., Macauley, P., & Ryland, K. (2011). How shall we know them? Capturing the diversity of differences in Australian doctoral candidates and their experiences. *Studies in Higher Education, 36*(5), 527–542. https://doi.org/10.1080/03075079.2011.594591

Pratt, J. A., Chen, L., & Cole, C. (2016). The influence of goal clarity, curiosity, and enjoyment on intention to code. *Behaviour & Information Technology, 35*(12), 1091–1101. https://doi.org/10.1080/0144929X.2016.1171399

Reio, T. G., & Wiswell, A. (2000). Field investigation of the relationship among adult curiosity, workplace learning, and job performance. *Human Resource Development Quarterly*, *11*(1), 5–30. https://doi.org/10.1002/1532-1096(200021)11:1<5::AID-HRDQ2>3.0.CO;2-A

Renner, B. (2006). Curiosity about people: The development of a social curiosity measure in adults. *Journal of Personality Assessment, 87*(3), 305–316. https://doi.org/10.1207/s15327752jpa8703_11

Roth, M., & Hammelstein, P. (2012). The Need Inventory of Sensation Seeking (NISS). *European Journal of Psychological Assessment, 28*(1), 11–18. https://doi.org/10.1027/1015-5759/a000085

Schutte, N. S., & Malouff, J. M. (2020). Connections between curiosity, flow and creativity. *Personality and Individual Differences, 152*, 109555. https://doi.org/10.1016/j.paid.2019.109555

Schutte, N. S., & Malouff, J. M. (2023). A meta-analytic investigation of the impact of curiosity-enhancing interventions. *Current Psychology, 42*, 20374–20384. https://doi.org/10.1007/s12144-022-03107-w

Sevim, Ö. M., & Sarikaya, E. E. (2020). How to be productive in PhD level: A needs assessment study for doctoral students' research productivity. *International Journal of Curriculum and Instruction*, *12*(2), 75–94.

Sher, K. B.-T., Levi-Keren, M., & Gordon, G. (2019). Priming, enabling and assessment of curiosity. *Educational Technology Research and Development, 67*(4), 931–952. https://doi.org/10.1007/s11423-019-09665-4

Shin, J. C., Kehm, B. M., & Jones, G. A. (Eds.). (2018). The increasing importance, growth, and evolution of doctoral education. In J. C. Shin, B. M. Kehm, & G. A. Jones (Eds.), *Doctoral education for the knowledge society: Convergence or divergence in national approaches?* (pp. 1–10). Springer. https://doi.org/10.1007/978-3-319-89713-4_1

Silvia, P. J. (2012). Curiosity and motivation. In R. M. Ryan (Ed.), *The Oxford handbook of human motivation* (pp. 157–166). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780195399820.013.0010

Smith, J. S., Fox, G. L., Park, S.-H., & Lee, L. (2008). Institutional antecedents to research productivity in operations: the US perspective. *International Journal of Operations & Production Management, 28*(1), 7–26. https://doi.org/10.1108/01443570810841086

Solli, K., & Nygaard, L. P. (2023). The doctorate in pieces: A scoping review of research on the PhD thesis by publication. *Higher Education Research & Development, 42*(4), 984-999. https://doi.org/10.1080/07294360.2022.2110575

Spaulding, L. S., & Rockinson-Szapkiw, A. J. (2012). Hearing their voices: Factors doctoral candidates attribute to their persistence. *International Journal of Doctoral Studies, 7*, 199-219. https://doi.org/10.28945/1589

Sun, C., Qian, H., & Miao, C. (2022). *From psychological curiosity to artificial curiosity: Curiosity-driven learning in artificial intelligence tasks.* arXiv:2201.08300.

Sverdlik, A., Hall, N. C., McAlpine, L., & Hubbard, K. (2018). The PhD experience: A review of the factors influencing doctoral students' completion, achievement, and well-being. *International Journal of Doctoral Studies*, *13*, 361–388. https://doi.org/10.28945/4113

Trudewind, C. (2000). Curiosity and anxiety as motivational determinants of cognitive development. In J. Heckhausen (Ed.), *Motivational psychology of human development: Developing motivation and motivating development* (pp. 15–38). Elsevier Science. https://doi.org/10.1016/S0166-4115(00)80004-7

Vogl, E., Pekrun, R., Murayama, K., & Loderer, K. (2020). Surprised–curious–confused: Epistemic emotions and knowledge exploration. *Emotion, 20*(4), 625–641. https://doi.org/10.1037/emo0000578

von Stumm, S., Hell, B., & Chamorro-Premuzic, T. (2011). The hungry mind: Intellectual curiosity is the third pillar of academic performance. *Perspectives on Psychological Science*, *6*(6), 574-588. https://doi.org/10.1177/1745691611421204

Wagstaff, M. F., Flores, G. L., Ahmed, R., & Villanueva, S. (2020). Measures of curiosity: A literature review. *Human Resource Development Quarterly, 32*(3), 363–389. https://doi.org/10.1002/hrdq.21417

Wang, H., & Li, J. (2015). How trait curiosity influences psychological well-being and emotional exhaustion: The mediating role of personal initiative. *Personality and Individual Differences, 75,* 135–140. https://doi.org/10.1016/j.paid.2014.11.020

Whitecross, W. M., & Smithson, M. (2023). Open or opposed to unknowns: How do curious people think and feel about uncertainty? *Personality and Individual Differences, 209,* 112210. https://doi.org/10.1016/j.paid.2023.112210

Wilson, T. D., Centerbar, D. B., Kermer, D. A., & Gilbert, D. T. (2005). The pleasures of uncertainty: Prolonging positive moods in ways people do not anticipate. *Journal of Personality and Social Psychology, 88*, 5–21. https://doi.org/10.1037/0022-3514.88.1.5

Yudkevich, M., Altbach, P., & Wit, H. (Eds.). (2020). *Trends and issues in doctoral education*. Sage. https://doi.org/10.4135/9789353885991

APPENDIX

Comparison of partial correlations

Variables		Partial correlation		z.stat	p.val
		PhD	Unsuccessful doctoral candidates		
Socially significant goals	Energy	-0.059	0.261	2.929413	0.003396
Socially significant goals	Aenergy	-0.217	0.024	2.19547	0.02813
Personally significant goals	Sociocentricity	0.11	-0.117	2.04709	0.040649
Personally significant goals	Subjectivity	-0.095	0.168	2.378507	0.017383
Personally significant goals	Aenergy	0.151	-0.124	2.485446	0.012939
Sociocentricity	Objectivity	0.158	0.438	2.787263	0.005316
Sociocentricity	Energy	0.172	-0.199	3.370896	0.000749
Sociocentricity	Externality	-0.068	0.271	3.107181	0.001889
Sociocentricity	Research potential	0.115	-0.155	2.440241	0.014677
Sociocentricity	Cognitive component	-0.154	0.146	2.71424	0.006643
Egocentricity	Objectivity	-0.023	-0.286	2.435122	0.014887
Egocentricity	Subjectivity	0.217	0.43	2.149503	0.031595
Egocentricity	Energy	-0.05	0.238	2.62812	0.008586
Egocentricity	Asthenia	-0.067	0.171	2.15315	0.031307
Egocentricity	Research potential	-0.01	0.249	2.373582	0.017616
Egocentricity	Cognitive component	0.105	-0.14	2.211665	0.02699
Meaningfulness	Energy	0.313	0.078	2.206233	0.027368
Meaningfulness	Externality	0.14	-0.124	2.384539	0.017101
Objectivity	Sthenia	0.212	-0.225	3.988323	6.65E-05
Objectivity	Operational difficulties	-0.184	0.081	2.400078	0.016392
Objectivity	Personal difficulties	0.173	-0.085	2.334222	0.019584
Objectivity	Research potential	-0.119	0.214	3.025276	0.002484
Objectivity	Behavioral component	0.122	-0.175	2.688603	0.007175
Subjectivity	Sthenia	-0.078	0.257	3.062325	0.002196

Variables		Partial correlation		z.stat	p.val
		PhD	Unsuccessful doctoral candidates		
Subjectivity	Externality	-0.015	0.319	3.102571	0.001918
Subjectivity	Research potential	0.184	-0.077	2.363936	0.018082
Subjectivity	Behavioral component	-0.221	0.1	2.918573	0.003516
Energy	Aenergy	-0.2	0.034	2.125751	0.033524
Energy	Internality	0.175	-0.065	2.172138	0.029845
Aenergy	Asthenia	0.224	-0.039	2.396358	0.016559
Aenergy	Research potential	-0.233	-0.014	2.005546	0.044905
Aenergy	Cognitive component	0.208	-0.031	2.173737	0.029725
Sthenia	Externality	-0.003	-0.336	3.111928	0.001859
Asthenia	Internality	0.186	-0.049	2.130099	0.033163
Asthenia	Externality	0.18	0.4	2.169933	0.030012
Internality	Personal difficulties	-0.138	0.107	2.211516	0.027
Operational difficulties	Personal difficulties	0.718	0.555	2.495513	0.012578
Operational difficulties	Research potential	0.144	-0.096	2.166684	0.030259
Research potential	Cognitive component	0.78	0.611	3.006679	0.002641
Cognitive component	Behavioral component	-0.407	-0.189	2.16135	0.030668

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