

1 Understanding the Need for Novelty from the Perspective of Self-Determination Theory

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1 Abstract

2 A fundamental tenet of self-determination theory is that the satisfaction of three basic,
3 innate psychological needs for autonomy, competence, and relatedness is necessary for
4 optimal functioning. The aim of this research was to propose novelty as a basic
5 psychological need in self-determination theory and develop a new measure to assess
6 novelty need satisfaction, the Novelty Need Satisfaction Scale (NNSS). Two studies
7 were performed, one at the global lifestyle level (Study 1: general adults, $N = 399$, M_{age}
8 $= 31.30$ years) and the other at a contextual level in physical education (Study 2: first-
9 year post-compulsory secondary school students, $N = 1035$, $M_{\text{age}} = 16.20$ years).
10 Participants completed the NNSS alongside measures of psychological needs and
11 regulation styles from self-determination theory and psychological well-being. The six-
12 item NNSS showed adequate psychometric properties and discriminant validity with
13 other psychological needs in both studies. Novelty need satisfaction predicted life
14 satisfaction (Study 1) and intrinsic motivation in physical education (Study 2)
15 independent of the other three psychological needs. Results provide preliminary
16 evidence that need for novelty is a unique candidate need alongside existing needs from
17 self-determination theory, but further confirmatory and experimental research is
18 required.

19 *Keywords:* basic psychological needs, motivation, well-being, curiosity

Understanding the Need for Novelty from the Perspective of Self-Determination Theory

1. Introduction

Self-determination theory (Deci & Ryan, 1991, 2000) is currently one of the most important motivational theories in social psychology given considerable evidence of its capacity to predict human behavior in multiple behavioral contexts. Although the theory postulates have been widely tested and applied, it is a ‘living’ theory that has been modified and advanced as new applications and processes are discovered (e.g., Vansteenkiste, Niemiec, & Soens, 2010). A key driver of motivation set out in self-determination theory is satisfaction of three basic, psychological needs for autonomy, competence, and relatedness. Since its formulation, these three needs considered ‘basic’ and fundamental to the development of effective motivational orientations and optimal functioning, despite other proposals (Ryan & Deci, 2000a; Sheldon, Elliot, Kim, & Kasser, 2001). The aim of this article is to suggest the need for novelty, defined as the need to experience something not previously experienced or deviates from everyday routine, as an additional basic need alongside the needs proposed in self-determination theory. The focus is to provide the conceptual basis of the need for novelty and its role in the theory, why its satisfaction is important for optimal functioning, develop a measure of satisfaction of the need, and provide and empirical test of its construct, discriminant, convergent, and predictive validity alongside existing needs in the theory. Consistent with measures based on the conceptualization of the existing candidate needs within self-determination theory, our proposed new measure focuses on the satisfaction of the need for novelty rather than its intensity. While previous studies have developed instruments to measure people’s tendency to seek novelty, our study is the first that conceptualizes novelty as a need within self-determination theory and analyzes the relations of novelty need satisfaction with different positive outcomes.

1.1 Basic Psychological Needs in Self-Determination Theory

1 The conceptualization of needs in self-determination theory is based on two classic
2 traditions in the study of motivation, the Hull (1943) and Murray (1938) traditions. On the
3 one hand, Hull specified a set of innate physiological needs (e.g., food, water, sex) whose
4 deficit activates drive states, and that must be met for the organism to remain physically
5 healthy. On the other hand, Murray referred to psychological instead of physiological needs
6 and he considered needs as acquired instead of innate. Murray defined needs as anything that
7 moves an individual to action, and, therefore, most needs established in his list (e.g.,
8 abasement, acquisitiveness, dominance) are not necessary to achieve a healthy development
9 and optimal functioning (Deci & Ryan, 2000). Self-determination theory proposes a set of
10 innate needs consistent with the Hullian tradition, but it focus at the psychological level
11 according Murray's approach. However, the function of the needs is quite different based on
12 their organismic-dialectical approach.

13 According to self-determination theory, basic psychological needs are defined as innate
14 psychological nutriments, the satisfaction of which is essential for the process of continuous
15 psychological growth, integrity, well-being, and optimal functioning (Deci & Ryan, 2000).
16 These needs are organismic and present in all individuals, therefore, they do not represent
17 acquired or learned orientations. The needs are qualitatively different from deficits or
18 defensive motives. The needs are conceptualized as essential for optimal functioning—the
19 means to promote human potential— whereas defensive motives are derived from threats and
20 the thwarting of needs (Ryan & Deci, 2000a).

21 In addition, the needs are considered universal and present in all cultures and settings
22 (Deci & Ryan, 2000; Sheldon et al., 2001). Need satisfaction is essential for healthy
23 development and well-being and can be achieved by means of a great variety of behaviors
24 that can differ among individuals and cultures. This means that individuals cannot prosper
25 unless they satisfy their needs. Needs persist over the entire lifespan, although their relative

1 importance, their forms of expression, and the pathways to achieve their satisfaction vary
2 throughout lifetime and across cultures (Ryan & Deci, 2000b).

3 Deci and Ryan (1991, 2000; Ryan & Deci, 2000b) in their basic postulates of self-
4 determination theory, establish three basic psychological needs that meet the above-
5 mentioned criteria: autonomy, competence, and relatedness. The need for autonomy refers to
6 the desire for choice and volition over one's activities and goals, without externally-
7 referenced pressures and threats, actively engaging in the process of decision-making and
8 attaining a sense of agency in one's environment. The need for competence reflects the desire
9 to experience efficacy, to feel that one is doing things well, and achieving one's goals. The
10 need for relatedness reflects the desire to experience a sense of connectedness with
11 significant others and to maintain good social relations and feel accepted. It is the satisfaction
12 of these three needs that is hypothesized to be related to adaptive motivational orientations
13 toward behaviors, that is, autonomous motivation, and to maintain a sense of optimal
14 functioning. Furthermore, it is the satisfaction of all three needs that is required for optimal
15 functioning and measures of the satisfaction of the needs have indicated a higher-order need
16 satisfaction construct consistent with this complementarity hypothesis (Hagger, Harris, &
17 Chatzisarantis, 2006).

18 **1.2 Internalization, Intrinsic Motivation, and Novelty**

19 The concept of basic psychological needs specifies the content of motivation and
20 provides a basis for energizing and directing action. Needs are considered essential to
21 understand what (content) and why (process) one seeks goals, and they are a key concept to
22 interpret the processes of internalization and intrinsic motivation in self-determination theory
23 (Deci & Ryan, 2000). According to the theory, satisfaction of basic psychological needs is
24 related to more autonomous forms of motivation with respect to activities and behaviors.
25 Autonomous actions are those that are experienced as self-endorsed and reflect of an

1 individual's genuine sense of self. If psychological needs are satisfied, people value the
2 importance of the activity they are performing, integrate it into their lifestyle, feel that they
3 are the origin of their actions, and experience adaptive outcomes including behavioral
4 persistence, enjoyment, and psychological well-being. However, for the interpretation of this
5 process to be effective, it is necessary to establish a fundamental set of needs that explain a
6 large number of phenomena. As the number of needs increases, the utility of this approach
7 decreases. In fact, one of the reasons why the classic theories of needs were not accepted was
8 that their list of needs was too long and weighty (Ryan & Deci, 2000a). It is extremely
9 important for each candidate need to reflect a basic, fundamental need that extends to the
10 explanation of a large number of behavioral phenomena (Ryan & Deci, 2000a).

11 Taking this into account, we propose novelty as a candidate basic psychological need
12 within self-determination theory. Drawing from the tenets of the theory, we aim to identify
13 the conceptual basis for the need for novelty, explaining its relation with the process of
14 internalization, intrinsic motivation, and well-being. In fact, in the classic studies of Deci and
15 Ryan, novelty is frequently mentioned as an important element of human motivation. Deci
16 and Ryan (2000) define intrinsic motivation as “active engagement with tasks that people
17 find interesting and that, in turn, promote growth. Such activities are characterized by
18 novelty, or what Berlyne (1971) called ‘collative stimulus properties’, and by optimal
19 challenge” (p. 233). Ryan and Deci (2000b) consider that intrinsic motivation is “the inherent
20 tendency to seek out novelty and challenges, to extend and exercise one's capacities, to
21 explore, and to learn” (p. 70), and Deci and Ryan (1991) state that intrinsic motivation “leads
22 people to encounter new challenges that are optimal for their self-development and that can
23 be integrated as development proceeds naturally” (p. 244). Novelty and perceived
24 competence, therefore, represent two essential aspects of intrinsic motivation derived from
25 original conceptualizations of the construct in self-determination theory. It is therefore

1 surprising that competence has been conceived as a basic psychological need, the object of
2 study of many studies, while novelty has not received comparable attention.

3 The conceptual case for novelty seeking as an innate and universal need is based on the
4 original operationalization of self-determination theory. Deci and Ryan (1985) contend that
5 children are active, inquisitive, and curious from birth and are constantly in need of
6 stimulation. The key motivational state of intrinsic motivation characterizes the natural
7 inclination toward spontaneous interest and exploration, assimilation, and mastery as an
8 essential experience necessary for cognitive and social development and optimal functioning
9 (Ryan, 1995; Ryan & Deci, 2000b). Moreover, self-determination theory suggests that
10 humans have innate propensities to commit to interesting activities (novelty), practice
11 capacities (competence), pursue relations with others in social groups (relatedness), and
12 integrate personal and intrapsychic experiences in relative unity (autonomy) (Deci & Ryan,
13 2000). Individuals are therefore compelled to seek out new experiences, a need that
14 complements the desire to experience effectance and choice, mastery, and connectedness
15 with others (Deci & Ryan, 1991).

16 The integration of new experiences is related to a tendency toward negentropy, a term
17 that represents a more elaborated organization of the system which is central to the
18 development of a sense of self (Deci & Ryan, 1991). Systems that are not renewed tend to
19 deplete, disappear and become extinct, and, therefore, for humans to survive they need
20 continuous innovation and evolution in their developmental process. Since prehistory,
21 humans have developed new objects, inventions, activities, ideas, and projects as a part of
22 their natural evolution. Life without the pursuit of novelty would mean individuals would not
23 engage in exploratory pursuits to understand the self and their environment, to search for
24 meaning, and for personal growth (Kashdan & Silvia, 2009). Although this need to innovate
25 is related to the needs for competence and autonomy, it seems a source of motivation in its

1 own. In this line, novelty would have an adaptive function being important for the
2 development of phylogenetic and ontogenetic adaptive strategies. Children seek new
3 experiences to stimulate their developing brains; adolescents seek novelty to extend their
4 horizons and to develop their social identities; and in adults novelty is related to the
5 development of the self-actualized individual, cognitive flexibility and better social
6 relationships, fundamental aspects for this longest stage of psychosocial growth (see Reio &
7 Choi, 2004).

8 Novelty is needed in all the life contexts, such as education, work, leisure, physical
9 activity or interpersonal relationships. For example, students and exercisers need to alternate
10 familiar and new activities in an optimal challenge (balance between competence and
11 novelty) to improve their motivation, satisfaction, well-being and performance
12 (Csikszentmihalyi, 1990; Sylvester et al., 2016). Furthermore, if people do not seek novel
13 activities within the tasks they do in the workplace or in leisure time, they will likely
14 experience boredom and maladaptive outcomes like low self-worth, negative affect, low life
15 satisfaction and psychological well-being. Research has shown that even individuals engaged
16 in the most mundane and routine of tasks in the workplace seek novel strategies to maintain
17 interest (Sansone, Weir, Harpster, & Morgan, 1992). The need for novelty is also related to
18 experience more adaptive social outcomes. When individuals experience novel activities,
19 people seek to share it with others and this process increases their intrinsic motivation and
20 relatedness (Kashdan & Silvia, 2009). This suggests that novelty may co-exist and
21 complement the existing needs within self-determination theory and that satisfaction of the
22 need for novelty in parallel with satisfaction of other needs will lead to adaptive outcomes
23 and optimal functioning.

24 **1.3 Contemporary Approaches to the Study of Novelty**

1 Other approaches to the study of novelty and intrinsic motivation exist in the literature
2 that share certain aspects with the conceptualization of novelty within self-determination
3 theory, although from different viewpoints and foci.

4 **Interest.** Silvia (2005, 2006, 2008) suggests that intrinsic motivation proceeds from
5 two assessments: (a) an individual's assessment of the novelty-complexity of an event,
6 referring to assessing it as new, unexpected, complex, difficult to process, surprising,
7 mysterious, or obscure; and (b) his or her assessment of the comprehensibility of the event,
8 implying that people value it if they have the skills, knowledge, and resources to deal with it.
9 If people rate an event as new and comprehensible, they will consider it motivating,
10 regardless of their age and culture. This approach seems to conceive novelty and competence
11 as the drivers of intrinsic motivation, drawing from classic approaches to novelty and
12 curiosity like that of Berlyne (1960, 1971) and, more recently, self-determination theory
13 itself. In fact, Silvia (2006) explicitly equates his view of novelty with self-determination
14 theory, considering it an important aspect of intrinsic motivation. In this sense, Silvia (2006),
15 drawing from the classic experiments of Reeve (1989) with anagrams and puzzles, suggests
16 that interest and enjoyment, two defining features of intrinsic motivation, have different
17 origins. Novelty and complexity would activate feelings of interest, whereas perceived
18 competence would increase feelings of enjoyment, which is consistent with self-
19 determination theory principles.

20 **Curiosity.** Curiosity is defined as the predisposition to recognize and seek new
21 knowledge and experiences (Kashdan, Sherman, Yarbro, & Funder, 2013). Kashdan (2004)
22 assumes that curiosity emerges from a person's self-development, and is therefore related to
23 the nature of the organismic needs established in self-determination theory (Silvia, 2006).
24 This approach to curiosity also has its origins in the studies of Berlyne. In fact, Berlyne
25 (1954) differentiated between two types of curiosity, perceptual and epistemic. The former

1 refers to the impulse that is activated by new stimuli and reduced by continuous exposure to
2 them, whereas the latter refers to the desire for knowledge. Berlyne also distinguished
3 between specific curiosity (desire for particular information) and diversive curiosity (a more
4 general search for stimulation). With the introduction of the concepts of perceptual and
5 diversive curiosity, Berlyne classified the desire for change and novelty as curiosity.

6 In development of self-determination theory, Deci (1975) also mentioned curiosity,
7 including it in “the more general realm of all intrinsically motivated behaviors” (p. 53). From
8 this perspective, competence and curiosity are related, establishing that people are curious
9 about their own skills, and curiosity is considered as a mild motivational state that is easily
10 overcome by any weak physiological drive (Loewenstein, 1994). This perspective has been
11 criticized by Loewenstein (1994), supported by two arguments. On the one hand, competence
12 and curiosity are not synonymous. For example, the effort to learn a certain motor skill is
13 probably motivated by the need for competence rather than curiosity. However, the desire to
14 explore a new site while hiking would reflect curiosity but not the need to achieve
15 competence. Furthermore, curiosity cannot be considered to be overcome by other
16 physiological drives because many people can remember moments in their lives when
17 curiosity was very intense, even interfering with basic needs such as hunger and thirst
18 (Loewenstein, 1994).

19 **Sensation seeking.** Sensation seeking was developed by Zuckerman (1979, 1984) and
20 it was initially described as “the need for varied, novel, and complex sensations and
21 experiences, and the willingness to take physical and social risks for the sake of such
22 experiences” (Zuckerman 1979, p. 10). Arnett (1994), in a new conceptualization, defines
23 sensation seeking as the need for novelty and intensity of stimulation, giving a greater
24 emphasis to the role of socialization, and not viewing sensation seeking as a potential for
25 taking risks but as a more general experience presents in multiples areas of people’s life.

1 Sensation seeking is akin to a need, because an exclusively behavioral definition for the
2 construct without a motivational component would only lead to a descriptive
3 conceptualization without explanatory function (Hammelstein, 2004). Similarly, studies
4 indicate that it is reasonable to conceive of sensation seeking as a basic need for stimulation
5 (Roth & Hammelstein, 2012; Roth, Hammelstein, & Brähler, 2007). In fact, these authors
6 directly link the concept of novelty as a need to that established by other comprehensive
7 psychological theories like self-determination theory. Sensation seeking has also been shown
8 to be related to interest, so that people with a high need of sensation seeking are more
9 interested in new, unfamiliar and complex things (Zuckerman, 1994).

10 **Perceived variety.** The hedonic adaptation prevention model (Sheldon &
11 Lyubomirsky, 2012) establishes that experiencing varied, unexpected, or surprising behaviors
12 serve to continually stimulate and promote well-being. Sylvester et al. (2014) define
13 perceived variety as a psychological experience that includes novel experiences (stimulating
14 interest) and alternating familiar experiences (reinforcing learning and development).
15 Although Sylvester et al. do not propose perceived variety as a basic psychological need, the
16 results of their study show that it directly predicts well-being and is empirically distinct from
17 competence, autonomy, and relatedness. It is a complementary experience with the
18 satisfaction of the three basic psychological needs that explains an important amount of the
19 variance of positive affect and subjective vitality.

20 **1.4 The Present Research**

21 The purpose of this research is to introduce novelty as basic psychological need parallel
22 with the three existing needs for autonomy, competence, and relatedness proposed in self-
23 determination theory. Based on our review of the literature, novelty seems to be an innate
24 need which is present in all cultures and stages of development, the satisfaction of which
25 contributes to increased intrinsic motivation and well-being, and is related to adaptive

1 behavioral outcomes and optimal functioning. Although the exploratory behavior may vary in
2 intensity throughout the life span, it is omnipresent in daily human experience (Kashdan,
3 Rose, & Finchman, 2004). It seems, therefore, to meet the criteria established by Deci and
4 Ryan (2000) of a basic psychological need. In fact, original studies on intrinsic motivation on
5 which self-determination theory is based make reference to novelty as an essential element of
6 intrinsic motivation (Deci, 1975; Deci & Ryan, 1985, 1991, 2000; Ryan & Deci, 2000b).
7 Deci and Ryan (1985) seem to consider that novelty is implicit in existing need sets. For
8 example, novelty considered subsumed by autonomy in that autonomous activities tend also
9 to have a sensational or unique component and by competence in that experiencing challenge
10 requires one to extend one's skills by trying something new. From this perspective, people
11 seek to practice newly acquired skills, but when the skills cease to be novel, their satisfaction
12 decreases. This view would limit novelty to being a construct intimately linked to autonomy
13 and competence. It is important, therefore, to identify whether novelty can function in its own
14 right largely independent of autonomy and competence.

15 Recent approaches to the study of novelty from other perspectives, using different
16 terminology (interest, curiosity, sensation seeking, perceived variety), also allude to the
17 importance of novelty for human motivation. These approaches clearly consider novelty as
18 different to competence. Novelty would be more linked to interest, reflecting a perceptual and
19 diversive level (general search for new stimuli), whereas competence would be more linked
20 to enjoyment and a more epistemic and specific view (attempting to acquire some particular
21 knowledge) (Loewenstein, 1994; Silvia, 2006). Although these constructs and their
22 underpinning approaches are different to that proposed by self-determination theory, their
23 conceptualization of novelty is entirely consistent with the basic principles of self-
24 determination theory. In this sense, the study of novelty is topical and timely; however, the
25 different approaches have quantified the intensity with which people seek novelty instead of

1 the people's level of satisfaction of this need. Only the study of Sylvester et al. (2014) on
2 perceived variety has measured level of satisfaction, but it should also be taken into account
3 that their construct includes alternating familiar experiences, in addition to novel experiences.
4 Despite of the widespread acknowledgment of the importance of novelty in numerous life
5 domains including education, work, and interpersonal relations, there has been a relative
6 dearth in research examining the contribution of novelty in these domains and the role of the
7 need for novelty in predicting motivation and behavior in these domains is in need of further
8 investigation (Loewenstein, 1994).

9 Theoretical and empirical accounts of self-determination theory focused exclusively on
10 three needs for competence, autonomy, and relatedness as the basic and fundamental needs
11 driving human motivation and have not tended to consider alternatives (Sheldon, 2011).
12 Sheldon et al. (2001) carried out three studies to test the construct and cross-cultural validity
13 of 10 candidate psychological needs. The results showed that the three basic psychological
14 needs proposed in self-determination theory with self-esteem were associated to event-related
15 affect and, therefore, sat at the apex of a 'basic' needs hierarchy. However, this research did
16 not consider novelty as a candidate need. We plan to continue advancement in the
17 identification of basic psychological needs within self-determination theory by proposing
18 novelty as a candidate basic psychological need. In order to provide empirical support for this
19 proposal, we plan to develop a measure of the satisfaction of the need for novelty from first
20 principles. In addition, we aim to explore relations of our measure of novelty need
21 satisfaction with the existing needs from self-determination theory and like constructs in tests
22 of construct, discriminant, convergent, and predictive validity.

23 We also planned to test the validity of the satisfaction of the need for novelty with
24 constructs operating at the global and contextual levels of generality, consistent with
25 Vallerand's (1997) hierarchical model of intrinsic and extrinsic motivation. According to

1 Vallerand's model, global level represents a general state of motivation towards life while the
2 contextual level refers to the motivation developed in specific spheres of the human activity
3 (contexts). Research has shown that education, work, leisure (of which physical activity is a
4 significant part), and interpersonal relationships are the most important contexts for humans
5 (Biddle, Hagger, Chatzisarantis, & Lippke, 2007; Vallerand, 1997). The Study 1 was
6 conducted at a global level of generality while the Study 2 was carried out at a physical
7 education (PE) context. We decided to analyze this context because it represents an education
8 context with high transference to the leisure context of physical activity (Hagger &
9 Chatzisarantis, 2016) and, therefore, was highly representative of this level of the hierarchy.

10 In Study 1 we explored the psychometric properties of the measure of satisfaction of
11 the need for novelty and its discriminant and convergent validity with measures of satisfaction
12 of the other three basic psychological needs from self-determination theory. In addition, we
13 tested the predictive validity of the satisfaction of need for novelty in predicting life
14 satisfaction as an indicator of well-being independent of satisfaction of the other three needs.
15 Study 2 provided a replication of the construct validity of the novelty need satisfaction
16 measure at the contextual level with adolescents in PE classes. Relations between satisfaction
17 of the need for novelty and the other three needs and the different forms of motivation from
18 self-determination theory were tested.

19 We expected that satisfaction of the need for novelty would be positively related to the
20 satisfaction of other needs from self-determination theory with medium effect sizes. We also
21 predicted positive, medium-sized effects of the novelty measure on life satisfaction and
22 autonomous forms of motivation. We expected our findings to provide preliminary evidence
23 for the validity of the satisfaction of the need for novelty importance as a predictor of well-
24 being and adaptive forms of motivation from self-determination theory.

25 **2. Study 1**

1 2.1 Method

2 2.1.1 Participants

3 Participants were 399 adults (202 males, 197 females) aged 18 to 65 years ($M_{age} =$
4 31.30, $SD = 11.31$) from two provinces in southeast Spain. Participants were recruited from
5 university, sports centers, social and leisure centers, with the majority Caucasian and of a
6 middle-income socio-economic status.

7 2.1.2 Measures

8 **Basic psychological needs.** We used the validated Spanish version (González-Cutre et
9 al., 2015) of the Basic Needs Satisfaction in General Scale (BNSG-S, Gagné, 2003). The
10 Spanish version was comprised 16 items, in contrast to the 21 items of the original version,
11 and a negative-worded method effect following the model proposed by Johnston and Finney
12 (2010). The scale measures satisfaction of the needs for competence (6 items, e.g., “People I
13 know tell me I am good at what I do”), autonomy (3 items, e.g., “I generally feel free to
14 express my ideas and opinions”), and relatedness (7 items, e.g., “People in my life care about
15 me”). Participants were requested to consider their own life when responding and to indicate
16 the extent to which an item was true for them on 7-point Likert-type scale ranging from 1
17 (*not at all true*) to 7 (*very true*). We removed the competence item “I have been able to learn
18 interesting new skills recently” due to overlap with the need for novelty.

19 **Need for novelty.** We developed a set of nineteen candidate items for our initial
20 version of the satisfaction of the need for novelty measure. First, three university researchers
21 each with a doctoral degree in psychology from a psychology of motivation research group
22 developed a definition of the construct novelty, supported by an extensive review of the
23 scientific literature. The need for novelty was defined as the need to experience something
24 not previously experienced or deviates from everyday routine. Next, based on contemporary
25 definitions in studies of novelty and existing questionnaires measuring the intensity of the

1 experience of novelty (e.g., Curiosity and Exploration Inventory II; Kashdan et al., 2009), a
2 broad battery of items was developed to assess the satisfaction of the need for novelty, in
3 order to finally select the items with the best psychometric properties. The items were written
4 to be used referring to the people's perception about the presence of novelty both in their
5 lives in general (global level, Study 1) and in a specific context (e.g., PE, Study 2). The items
6 were drafted to avoid redundancy and to include different facets of novelty: activities, skills,
7 situations, emotions, knowledge. We tried to develop the same number of items for each
8 facet. The candidate items are provided in the Supplementary materials numbered 1 to 19.

9 To assess their content and face validity and ensure that they matched the semantic
10 definition, the items were reviewed by three experts who were not members of the research
11 group; they assessed the representativeness, uniqueness (not overlapping with the other three
12 basic psychological needs), and clarity of the items, giving their qualitative opinion and
13 suggested modifications. Next, taking into account the experts' opinions, and after a
14 theoretical debate within the research group, we eliminated items 3 ("I develop new skills"),
15 17 ("I frequently acquire new knowledge"), 18 ("I think I frequently know new things"), and
16 19 ("I think I learn something new every day") because we considered that, as they referred
17 to acquiring new knowledge and learning, they might be overlapping with the concept of the
18 need for competence. Lastly, we observed that, on the one hand, items 2 ("I perform activities
19 that seem novel to me") and 4 ("I feel I do novel things"), and, on the other hand, items 11 ("I
20 have the opportunity to discover new things") and 16 ("I think I discover new things
21 frequently") were redundant, so we decided to retain only items 4 and 16, which had better
22 clarity and brevity, following the recommendations of the expert group. The remaining 13
23 items were inserted in the BNSG-S to be administered concurrently in order to prevent an
24 acquiescence effect in the responses and all items were, therefore, rated on 7-point Likert-
25 type scales, ranging from 1 (*not at all true*) to 7 (*very true*).

1 **Life satisfaction.** We used the validated Spanish version (Atienza, Pons, Balaguer, &
2 García-Merita, 2000) of the Satisfaction with Life Scale (SWLS) of Diener, Emmons, Larsen,
3 and Griffin (1985). The scale comprises 5 items (e.g., “In most ways, my life is close to my
4 ideal”) measuring general life satisfaction on 5-point Likert-type scales ranging from 1
5 (*strongly disagree*) to 5 (*strongly agree*).

6 **2.1.3 Procedure**

7 The ethical board of the first author’s university approved this study. Three researchers
8 with expertise in administering psychological tests and wearing official accreditation passes,
9 approached center attendees as they were entering or leaving the facility asking them to
10 complete the questionnaires. Participants were informed that they would be participating in a
11 survey on life motivation and were asked to provide verbal and written consent to participate.
12 They then completed the questionnaires in a quiet waiting area of the center without
13 disruption under the supervision of the researcher.

14 **2.1.4 Data Analysis**

15 First, we performed a one-factor CFA of the novelty items. Second, to analyze the
16 convergent and discriminant validity of novelty items with items measuring satisfaction of
17 the three basic psychological needs from self-determination theory, a model with four
18 correlated latent factors (novelty, competence, autonomy and relatedness) was tested.
19 Composite reliability (ρ) and Average Variance Extracted (AVE) of novelty were calculated.
20 Composite reliability should be higher than .60 (Bagozzi & Yi, 1988) and AVE should be
21 higher than .50 (Hair, Black, Babin, & Anderson, 2009). AVE measures the amount of
22 variance captured by a construct in relation to variance due to random measurement error.
23 Pending acceptable fit of the four-correlated-factor model, we analyzed invariance of this
24 model across gender and age to observe possible group differences.

1 For the CFAs, we used the covariance matrix and the maximum likelihood estimation
2 method with bootstrapped parameter estimates and standard errors. This procedure is
3 effective in generating stable estimates robust to any departures in multivariate normality
4 (Byrne, 2001). To analyze the goodness of fit of the model, we used the following indices:
5 the comparative fit index (CFI), the incremental fit index (IFI), the root mean square error of
6 approximation (RMSEA), and its 90% confidence interval (CI), and the standardized root
7 mean square residual (SRMR). According to the main guidelines of structural equation
8 modeling (Hu & Bentler, 1999), the following cut-points were established as indicative of
9 good fit: CFI and IFI values equal to or higher than .95, and RMSEA values equal to or lower
10 than .06, and SRMR values equal to or lower than .08. There is a general consensus to
11 consider values over .90 as acceptable for CFI and IFI, in view of the difficulty of obtaining a
12 good fit when analyzing models with multiple variables and using real data instead of
13 simulated data (Marsh, Hau, & Wen, 2004)

14 Convergent and discriminant validity of the satisfaction of the need for novelty measure
15 as a basic psychological need alongside the needs established in self-determination theory
16 was tested using the latent factor correlations (ϕ) between the novelty measure and the
17 satisfaction of the needs for autonomy, competence, and relatedness. Convergent validity was
18 assumed if statistically significant and positive relations were found among the need
19 satisfaction measures. Discriminant validity was supported if correlations of the novelty
20 measure with the other needs measures were different from unity (1.00) by a value 1.96 times
21 the standard error of the correlation (Bagozzi & Kimmel, 1995). Predictive validity was
22 established using regression testing whether the novelty measure predicted life satisfaction
23 independent of the other need satisfaction variables. All the analyses were carried out with
24 the SPSS 22 and AMOS 22 statistical packages.

25 **2.2 Results and Discussion**

1 **2.2.1 Confirmatory Factor Analysis**

2 First, we eliminated item 13 (“I feel that I frequently do different activities”) because
3 the bootstrapping analysis indicated a large fluctuation in the value of the factor loading,
4 showing a CI value of $p > .05$. The single factor CFA of the 12 novelty items obtained the
5 following fit indices: $\chi^2(54, N = 399) = 148.69, p < .001$; CFI = .96; IFI = .96; RMSEA =
6 .066 (90% CI = .054-.079); SRMR = .036. Although the fit indices could be considered
7 acceptable, in a final analysis, in order to improve the quality of the measure and obtain
8 excellent values, we decided to eliminate the items with the largest standardized covariance
9 residuals (ranging from 2.02 to -1.48) and the factor loadings lower than .70 (Comrey & Lee,
10 1992): items 1, 5, 6, 7, 10, and 12. We examined the content of the items that were identified
11 in the examination of the analysis of the residuals. Items 1 (“I frequently feel I do different
12 things”) and 5 (“What I do is usually different for me”) appeared to have redundant content
13 with both reflecting perceptions of doing different things in life. Item 6 (“I feel new
14 emotions”) also shared some redundancy with item 9 (“I feel new sensations”) regarding
15 experiencing new sensations or emotions. Item 7 (“I think that the activities I carry out are
16 varied”) and 12 (“I think I manage to develop my originality”) likely reflected constructs
17 rather than novelty. For example, item 7 relates more to the construct of perceived variety
18 that includes novel and alternating familiar experiences than novelty per se (Sylvester et al,
19 2014), and item 12 refers to the concept of originality that covers creativity and even
20 autonomy (Sheldon, 1995). Finally, item 10 (“I do not usually slip into routines”) was
21 negatively worded that may have presented some difficulties in understanding. Removing
22 these items resulted in the final six-item version of the scale which captures the novelty need
23 satisfaction construct (see Appendix). A CFA of the six-item version exhibited good fit with
24 the data ($\chi^2(9, N = 399) = 24.86, p = .003$; CFI = .99; IFI = .99; RMSEA = .067 (90% CI =

1 .036-.098); SRMR = .024). The descriptive statistics and the factor loadings of the items are
2 provided in Table 1.

3 [Insert Table 1 here]

4 Second, the CFA with four correlated latent variable comprising the novelty need
5 satisfaction scale and the need satisfaction scales for autonomy, competence, and relatedness
6 exhibited acceptable fit indices ($\chi^2(178, N = 399) = 376.38, p < .001$; CFI = .92; IFI = .92;
7 RMSEA = .053 (90% CI = .045-.060); SRMR = .054). Latent factor correlations between
8 novelty need satisfaction and the competence ($\phi = .64$; 90% CI = .52-.79) and autonomy ($\phi =$
9 .55; 90% CI = .45-.67) need satisfaction scales were medium in effect size, and the
10 correlation between novelty and relatedness ($\phi = .30$; 90% CI = .16-.40) was smaller by
11 comparison and differed significantly from the other two correlations. These correlations
12 support the convergent validity of the novelty factor because they form a theoretically-
13 predictable pattern of relations with conceptually-related constructs. Discriminant validity
14 was also supported because the factor correlations were less than unity by 1.96 times the
15 standard error of the correlation. Factor loadings and error variances of the four-correlated-
16 factor model are shown in Figure 1. Composite reliability ($\rho = .89$) and AVE (.57) values
17 were acceptable for the novelty factor.

18 [Insert Figure 1 here]

19 **2.2.2 Invariance Analysis across Gender and Age**

20 We used multi-group analysis to examine invariance of the four-correlated-factor
21 model across gender and age given the broad age range of the participants: 18-65 years
22 (Table 2). We compared the unconstrained model with models in which sets of key model
23 parameters were progressively constrained to be invariant across groups consistent with
24 Byrne, Shavelson, and Muthén's (1989) recommendations. With regard to the analysis across
25 gender, no significant differences were found in the model χ^2 between the unconstrained

1 model and the model in which the factor loadings were set as invariant, which is a minimum
2 criterion for invariance (Byrne et al., 1989; Milfont, & Fischer, 2010). In addition, the
3 difference in CFI between the unconstrained model and the models in the invariance routine
4 was lower than .01, thus meeting the criterion established by Cheung and Rensvold (2002) to
5 support model invariance.

6 [Insert Table 2 here]

7 In the analysis across age, we divided the sample into three age groups: 18 and 24 years
8 ($n = 155$; $M = 21.86$, $SD = 1.69$); 25 and 32 years ($n = 111$; $M = 28.04$, $SD = 2.45$); older than
9 32 years ($n = 133$; $M = 45.03$, $SD = 8.60$). This decision was made taking into account that
10 there were not enough people between ages 45 and 65 to enable us to adequately compare the
11 different life stages. The multi-group analysis revealed no significant differences in the model
12 χ^2 between the unconstrained model and the model in which the factor loadings were set as
13 invariant, thus supporting factorial invariance. Moreover, the CFI differences between these
14 models were less than .01.

15 **2.2.3 Predictive Validity Analysis**

16 Factor correlations (Table 3) indicated that satisfaction of the need for novelty was
17 positively correlated with life satisfaction with medium effect size as predicted. Predictive
18 validity was tested using linear multiple regression analysis using manifest variables rather
19 than a latent variable analysis due to restrictions in parameter: sample size ratio which should
20 be at least 10:1; our model had 399 participants and over 100 parameters. This had the
21 limitation of not controlling for measurement error. However, as factors were well specified
22 with good composite reliabilities, it is unlikely that the findings in analyses using manifest
23 variables were substantially affected.

24 [Insert Table 3 here]

1 The students participated in two weekly 55-minute sessions of compulsory PE. Most
2 participants were Caucasian and belonged to middle-income socioeconomic class.

3 **3.1.2 Measures**

4 **Basic psychological needs in PE.** The adapted Spanish version (Moreno, González-
5 Cutre, Chillón, & Parra, 2008) of the Basic Psychological Needs in Exercise Scale (BPNES,
6 Vlachopoulos & Michailidou, 2006) was used. The scale was preceded by the common
7 statement “In my PE classes...” and comprised four items per factor to measure satisfaction
8 of the need for competence (e.g., “...I can perform the exercises effectively”), autonomy
9 (e.g., “...the exercises that I perform fit my interests”) and relatedness (e.g., “...I feel very
10 comfortable with my classmates”). Responses were made using 5-point Likert-type scales
11 ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

12 **Need for novelty.** The final six-item version of the Novelty Need Satisfaction Scale
13 (NNSS) developed in Study 1 was used to measure satisfaction of the need for novelty in PE.
14 The items were integrated into the BPNES to be administered and, therefore, rated on 5-point
15 Likert-type scales, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

16 **Motivation in PE.** The Spanish version (Ferriz, González-Cutre, & Sicilia, 2015) of
17 the Perceived Locus of Causality Scale (PLOC, Goudas, Biddle, & Fox, 1994), including
18 items to measure integrated regulation, was used to measure the different motivational styles
19 proposed in self-determination theory. Each of the 24 items was preceded by the common
20 stem “I participate in PE classes...” with four items each tapping the six motivation types:
21 intrinsic motivation refers to a participation in the activity for the enjoyment derived from it
22 (e.g., “...because PE is fun”), integrated regulation represents the integration of the activity
23 into sets of behaviors that reflect an individual’s true sense of self (e.g., “...because I
24 consider that PE is part of me”), identified regulation reflects actions that produce outcomes
25 that are personally valued and internalized (e.g., “...because it is important for me to do well

1 in PE”), introjected regulation reflects performing actions to avoid externally-referenced
2 negative (guilt and shame) and positive (e.g., non-contingent self-esteem) outcomes (e.g.,
3 “...because I would feel bad about myself if I didn’t”), external regulation refers to acting to
4 receive an external incentive or to avoid punishment (e.g., “...so that the teacher won’t yell at
5 me”), and amotivation reflects the absence of motivation or interest in doing an activity (e.g.,
6 “...but I can’t see what I’m getting out of PE”). Intrinsic, integrated and identified regulations
7 represent autonomous forms of motivation while introjected and external regulation represent
8 controlled forms. Responses were provided on Likert-type scales ranging from 1 (*strongly*
9 *disagree*) to 7 (*strongly agree*).

10 **3.1.3 Procedure**

11 Informed consent was requested from the adult participants and the families of the
12 underage participants. The participants were informed that they would participate in a survey
13 on their motivation in PE. The questionnaires were completed anonymously in a classroom
14 setting under the supervision of the researcher. The study was conducted with prior
15 permission from the school administrators and received approval from the research ethics
16 board of the second author’s university prior to data collection.

17 **3.1.4 Data Analysis**

18 First, in order to assess the validity of the Novelty Need Satisfaction Scale in PE, a one-
19 factor CFA was carried out on six-item version of the scale developed in Study 1. Second, in
20 order to examine in this study the extent to which the need for novelty is empirically distinct
21 from measures of competence, autonomy, and relatedness need satisfaction, we tested a four-
22 correlated-factor CFA model in which all of the need satisfaction variables indicated a latent
23 factor and the factors set to freely correlate. Model fit was evaluated using the same
24 goodness-of-fit indices adopted in Study 1 along with composite reliability and AVE
25 statistics.

1 Third, we examined the latent variable correlations of the novelty need satisfaction
2 measure with the measures of need satisfaction of the other three needs and the different
3 forms of motivation from self-determination theory in a PE context. In addition, as the
4 literature has shown that satisfaction of the three basic psychological needs and the need for
5 novelty are strongly related to intrinsic motivation, we tested the predictive validity of the
6 construct using a structural equation model in which novelty and need satisfaction variables
7 predicted intrinsic motivation as a dependent variable. All the analyses were carried out with
8 the AMOS 22 statistical package.

9 **3.2 Results and Discussion**

10 **3.2.1 Confirmatory Factor Analysis**

11 The one-factor CFA of the six-item version of the novelty need satisfaction measure
12 exhibited acceptable goodness-of-fit indices ($\chi^2 (9, N = 1035) = 65.03, p < .001; CFI = .98;$
13 $IFI = .98; RMSEA = .078 (90\% CI = .061-.096); SRMR = .021$). Descriptive statistics and
14 factor loadings of the items are provided in Table 4. The four-correlated-factor CFA yielded
15 acceptable fit indices with the data ($\chi^2 (129, N = 1035) = 748.15, p < .001; CFI = .93; IFI =$
16 $.93; RMSEA = .068 (90\% CI = .063-.073); SRMR = .075$). Latent factor correlations between
17 novelty need satisfaction and the competence ($\phi = .46; 90\% CI = .36-.53$), autonomy ($\phi = .79;$
18 $90\% CI = .74-.83$) and relatedness ($\phi = .29; 90\% CI = .22-.35$) need satisfaction scales
19 support the convergent validity of the novelty need satisfaction factor. Discriminant validity
20 was supported because the factor correlations were less than unity by 1.96 times the standard
21 error of the correlation. Composite reliability ($\rho = .90$) and AVE (.61) values were
22 acceptable.

23 [Insert Table 4 here]

24 **3.2.2 Predictive Validity Analysis**

1 Latent factor correlations among the other need satisfaction measures and forms of
2 motivation from self-determination theory are provided in Table 5. The satisfaction of the
3 need for novelty was positively correlated with the most autonomous forms of motivation in
4 PE and with introjected regulation. It did not correlate with external regulation, and it was
5 negatively correlated with amotivation. The pattern of correlations for the need for novelty
6 with the types of motivation in PE was very similar to those obtained with the other three
7 basic psychological needs.

8 [Insert Table 5 here]

9 The results of the structural equation model with intrinsic motivation as the dependent
10 variable and the three basic psychological needs as independent variables showed that
11 intrinsic motivation was predicted by satisfaction of the needs for competence ($\beta = .67, p <$
12 $.001$) and autonomy ($\beta = .16, p = .005$), explaining 58.6% of the variance. Satisfaction of the
13 need for relatedness did not significantly predict intrinsic motivation ($\beta = -.05, p = .189$). The
14 model exhibited acceptable fit according to multiple criteria: $\chi^2(98, N = 1035) = 595.60, p <$
15 $.001$; CFI = .92; IFI = .92; RMSEA = .070 (90% CI = .065-.076); SRMR = .066. In the
16 second analysis, including novelty as another independent variable (Figure 2), intrinsic
17 motivation was predicted by satisfaction of the need for competence ($\beta = .71, p < .001$), and,
18 in addition, by satisfaction of the need for novelty ($\beta = .22, p < .001$), with 60% of explained
19 variance. Satisfaction of the needs for autonomy ($\beta = -.04, p = .688$) and relatedness ($\beta = -$
20 $.06, p = .127$) did not significantly predict intrinsic motivation. The model also exhibited
21 acceptable fit with the data ($\chi^2(199, N = 1035) = 962.32, p < .001$; CFI = .93; IFI = .93;
22 RMSEA = .061 (90% CI = .057-.065); SRMR = .069).

23 [Insert Figure 2 here]

1 The present study provides further support for the findings of Study 1, this time at the
2 contextual level in PE classes. Satisfaction of the need for novelty exhibited adequate validity
3 and was an independent predictor of intrinsic motivation when accounting for the effects of
4 the other three basic psychological needs from self-determination theory.

5 **4. General Discussion**

6 The study of novelty as a potential psychological need and potential antecedent of
7 motivation in multiple domains has received relatively little attention but is receiving
8 increased attention given its importance for human development and growth. Furthermore,
9 the need for variety and variability in methods and approaches in psychology is recognized as
10 a means to promote better theories and explanations (Ogden, 2016). The aim of the current
11 research was to propose novelty as a basic psychological need alongside the set of existing
12 needs in self-determination theory and provide empirical support for its validity at the global
13 and contextual levels.

14 Drawing from self-determination theory principles, there are indications in the literature
15 that novelty could be considered a basic psychological need. It is not our intention in the
16 present research to question self-determination theory, quite the contrary. Self-determination
17 theory is currently one of the most prominent motivational theories, and this research is an
18 attempt to contribute to refining it to explain more variance of motivation and associated
19 behaviors (Sheldon, 2011). We therefore reviewed theoretical and empirical contributions on
20 the importance of novelty to human motivation, beginning with a review of classic studies on
21 self-determination theory (Deci, 1975; Deci & Ryan, 1985, 1991, 2000; Ryan & Deci,
22 2000b). We also drew from other contemporary approaches to novelty (Kashdan, 2004; Roth
23 & Hammelstein, 2012; Silvia, 2005; Sylvester et al., 2014) in which novelty has also been
24 conceptualized as a need and linked to self-determination theory. Our review revealed that

1 novelty has been characterized as a need and that novelty is an important defining component
2 of intrinsic motivation.

3 However, there has been no proposal to date considering novelty as a basic
4 psychological need. In addition, empirical studies on novelty have focused on the effects of a
5 greater or lesser tendency to seek novelty instead of measuring its level of satisfaction.
6 Developing a measure of the satisfaction of the need for novelty and examining its
7 convergent and predictive validity alongside other psychological need satisfaction measures
8 and types of motivation from self-determination theory as well as life satisfaction could be a
9 first step to consider novelty as a basic psychological need and its potential role in
10 determining well-being and optimal functioning.

11 The results of the present research provide preliminary support to the validity and
12 reliability of our measure of the satisfaction of the need for novelty, the Novelty Need
13 Satisfaction Scale (NNSS). Developing the scale from an expert-determined pool of
14 candidate items, two studies on demographically different samples revealed that our final six-
15 item novelty need satisfaction measure exhibited construct, discriminant, and convergent
16 validity alongside measures of psychological need satisfaction and forms of motivation from
17 self-determination theory. The pattern of correlations found between satisfaction of the need
18 for novelty and the forms of motivation is very similar to that found for the other three basic
19 psychological needs in prior studies (Ntoumanis, 2012), and consistent with theory
20 postulates. We also demonstrated invariance of the measure across gender and age. Tests of
21 predictive validity were consistent with the predictions of self-determination theory, with
22 unique effects of our satisfaction of the need for novelty measure on life satisfaction and
23 intrinsic motivation independent of other need satisfaction constructs. In addition, our results
24 were tested in a generalized life domain and a specific life context, PE. The application of our
25 findings at two levels of Vallerand's (1997) hierarchy should be highlighted as a strength of

1 the current data because it shows the potential generalizability of novelty need satisfaction
2 across life domains.

3 The present research is a first approach to the study of novelty as a basic psychological
4 need from the perspective of self-determination theory. Although the results obtained were in
5 line with our expectations, there are reasons to exercise caution when interpreting the
6 findings. First, with regard to the conceptualization of novelty as a basic psychological need,
7 we acknowledge that this proposal may be controversial. It is a difficult issue for which to
8 provide unequivocal empirical support and to suggest modifications or extensions to the
9 existing tenets of the theory. In this article, we attempted to show the characteristics that
10 allow novelty to be considered a basic psychological need, drawing on self-determination
11 theory principles established in original theoretical and empirical studies, and attempting to
12 provide empirical support to our proposal. Nevertheless, we understand the scientific
13 community may hold other view and perspectives and we encourage further conceptual
14 debate and research on this issue. It is clear that self-determination theory has had
15 considerable success in explaining human motivation based on three basic psychological
16 needs for over three decades. This research offers a contribution to this conceptualization in
17 order to continue to further our understanding of human motivation. Regardless of whether or
18 not novelty is accepted as a basic psychological need within the theory, we hope that it
19 stimulates debate on the role novelty may play in human motivation within the theory.

20 Second, this research was carried out exclusively in a Spanish context. It would be
21 interesting to analyze satisfaction of the need for novelty in other countries, cultures and
22 contexts, using the Novelty Need Satisfaction Scale. The items were developed to be context
23 and domain neutral but could be adapted to settings like education, work, or physical
24 exercise. We issue a call to researchers in the field to conduct large-scale, highly-powered
25 replications of our current findings in multiple samples from different cultural, socio-

1 economic, and demographic backgrounds consistent with current trends toward replication
2 and confirmation in psychology (e.g., Hagger et al., 2016). This will lend converging
3 evidence for our proposal for novelty as a separate psychological need within the confines of
4 self-determination theory. This process can also help to refine the scale and to eliminate items
5 that could be identified as problematic in future studies.

6 Third, the correlational design with self-report measures did not allow us to infer causal
7 effects and to determine unequivocally that novelty is a basic psychological need. Our results
8 showed that satisfaction of the need for novelty is separable from autonomy, competence and
9 relatedness needs satisfaction measures, and that it has unique effects on life satisfaction and
10 intrinsic motivation consistent with theory. Further studies are necessary to analyze
11 longitudinally the importance of the satisfaction of the need for novelty in different stages of
12 life, and its effects on people's well-being and quality of life over time. Experimental designs
13 are also required to test the effect of novelty support in various contexts on adaptive
14 outcomes including autonomous motivation, life satisfaction, and psychological well-being
15 with novelty need satisfaction as a mediator.

16 Fourth, future studies should analyze the convergent and divergent validity of the
17 novelty need satisfaction construct with other constructs such as interest, curiosity, sensation
18 seeking, and perceived variety. It should also be possible to establish parallels between the
19 causality orientations proposed in self-determination theory and an orientation toward
20 novelty, which would reflect individuals with a tendency to seek novelty. The interaction
21 between personal orientation towards novelty and novelty support from the environment
22 could influence the satisfaction level of this need and its consequences.

23 Fifth, predictive validity of the satisfaction of the need for novelty was only related to
24 life satisfaction and motivation in PE and did not show very high predictive power. Future
25 research should test models introducing novelty in the motivational sequence of self-

1 determination theory. Such a sequence would outline the processes by which environmental
2 and normative support for needs lead to outcomes through need satisfaction and motivation
3 (e.g., social factors → satisfaction of basic psychological needs including need for novelty →
4 motivation → consequences) and it would be important to highlight this in different
5 consequences and other indicators of well-being (hedonic: positive and negative affect;
6 eudaimonic: self-actualization, vitality). Satisfaction of the need for novelty might have more
7 weight in the explanation of some constructs than others. Accordingly, satisfaction of the
8 need for novelty may be more closely linked to intrinsic motivation to experience stimulation,
9 whereas satisfaction of competence may be more closely linked to intrinsic motivation to
10 know and toward accomplishments. Likewise, satisfaction of the need for novelty could
11 explain more variance in other variables such as vitality, self-actualization, and flow state. It
12 would also be interesting to design items to assess thwarting of the need for novelty and its
13 effects, in line with recent approaches to the study of basic psychological needs (e.g.,
14 Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011).

15 Finally, we suggest analyzing the interaction of the different basic psychological needs.
16 It may be that novelty is positive for human development as long as it is not combined with
17 the thwarting of the other three basic psychological needs. People want to engage in novel
18 activities and pursuits, but only if they are adaptive and do not conflict with other life goals or
19 if they feel the novel activities or pursuits are being imposed on them. It would be interesting
20 to establish motivational profiles according to the satisfaction of these fourth needs to analyze
21 how the variation in needs satisfaction is related to different consequences.

22 The present research offers a new proposal that novelty can be considered as a basic
23 psychological need, and it provides an instrument to measure its satisfaction that exhibits
24 good psychometric properties and predictive validity. Future studies should analyze the
25 viability of this proposal with a view to improving understanding of human motivation.

5. References

- 1
- 2 Arnett, J. (1994). Sensation seeking: A new conceptualization and a new scale. *Personality*
- 3 *and Individual Differences*, 16, 289-296.
- 4 Atienza, F. L., Pons, D., Balaguer, I., & García-Merita, M. (2000). Propiedades psicométricas
- 5 de la Escala de Satisfacción con la Vida en adolescentes [Psychometric properties of
- 6 the satisfaction with life scale in adolescents]. *Psicothema*, 12, 314-319.
- 7 Bagozzi, R. P., & Kimmel, S. K. (1995). A comparison of leading theories for the prediction
- 8 of goal directed behaviours. *British Journal of Social Psychology*, 34, 437-461.
- 9 Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of*
- 10 *the Academy of Marketing Science*, 16, 74-94.
- 11 Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C.
- 12 (2011). Self-determination theory and diminished functioning: The role of interpersonal
- 13 control and psychological need thwarting. *Personality and Social Psychology Bulletin*,
- 14 37, 1459-1473.
- 15 Berlyne, D. E. (1954). A theory of human curiosity. *British Journal of Psychology*, 45, 180-
- 16 191.
- 17 Berlyne, D. E. (1960). *Conflict, arousal, and curiosity*. New York: Mc-Graw-Hill.
- 18 Berlyne, D. E. (1971). *Aesthetics and psychobiology*. New York: Appleton-Century-Crofts.
- 19 Biddle, S. J. H., Hagger, M. S., Chatzisarantis, N. L. D., & Lippke, S. (2007). Theoretical
- 20 frameworks in exercise psychology. In G. Tenenbaum & R. C. Eklund (Eds.),
- 21 *Handbook of sport psychology* (3rd ed., pp. 537-559). New York, NY: Wiley.
- 22 Byrne, B. M. (2001). *Structural equation modeling with Amos: Basic concepts, applications,*
- 23 *and programming*. Mahwah, NJ: Erlbaum.

- 1 Byrne, B. M., Shavelson, R. J., & Muthén, B. (1989). Testing for the equivalence of factor
2 covariance and means structures: The issue of partial measurement invariance.
3 *Psychological Bulletin, 105*, 456-466.
- 4 Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing
5 measurement invariance. *Structural Equation Modeling, 9*, 233-255.
- 6 Cicchetti, D. V. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and
7 standardized assessment instruments in psychology. *Psychological Assessment, 6*, 284-
8 290.
- 9 Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis* (2nd ed.). Hillsdale, NJ:
10 Lawrence Erlbaum Associates.
- 11 Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York:
12 Harper & Row.
- 13 Deci, E. L. (1975). *Intrinsic motivation*. New York: Plenum.
- 14 Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human*
15 *behavior*. New York: Plenum.
- 16 Deci, E. L., & Ryan, R. M. (1991). A motivational approach to self: Integration in
17 personality. In R. Dienstbier (Ed.), *Nebraska symposium on motivation: Vol. 38.*
18 *Perspectives on motivation* (pp. 237-288). Lincoln, NE: University of Nebraska Press.
- 19 Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and
20 the self-determination of behaviour. *Psychological Inquiry, 11*, 227-268.
- 21 Diener, E., Emmons, R., Larsen, R. J., & Griffin, S. (1985). The Satisfaction With Life Scale.
22 *Journal of Personality Assessment, 49*, 71-75.
- 23 Ferriz, R., González-Cutre, D., & Sicilia, A. (2015). Revisión de la Escala del Locus
24 Percibido de Causalidad (PLOC) para la inclusión de la medida de la regulación
25 integrada en educación física [Revision of the Perceived Locus of Causality Scale

- 1 (PLOC) to include the measure of integrated regulation in physical education]. *Revista*
2 *de Psicología del Deporte*, 24, 329-338.
- 3 Gagné, M. (2003). The role of autonomy support and autonomy orientation in prosocial
4 behavior engagement. *Motivation and Emotion*, 27, 199-223.
- 5 González-Cutre, D., Sierra, A. C., Montero-Carretero, C., Cervelló, E., Esteve-Salar, J., &
6 Alonso-Álvarez, J. (2015). Evaluación de las propiedades psicométricas de la Escala de
7 Satisfacción de las Necesidades Psicológicas Básicas en General con adultos españoles
8 [Evaluation of the psychometric properties of the Scale of Satisfaction of Basic
9 Psychological Needs in General with Spanish adults]. *Terapia Psicológica*, 33, 81-92.
- 10 Goudas, M., Biddle, S. J. H., & Fox, K. (1994). Perceived locus of causality, goal
11 orientations, and perceived competence in school physical education classes. *British*
12 *Journal of Educational Psychology*, 64, 453-463.
- 13 Hagger, M. S., & Chatzisarantis, N. L. D. (2016). The trans-contextual model of autonomous
14 motivation in education: Conceptual and empirical issues and meta-analysis. *Review of*
15 *Educational Research*, 86, 360-407.
- 16 Hagger, M. S., Chatzisarantis, N. L. D., Alberts, H., Anggono, C. O., Batailler, C., Birt, A., . .
17 . Zwieneberg, M. (2016). A multi-lab pre-registered replication of the ego-depletion
18 effect. *Perspectives on Psychological Science*. Advance online publication.
- 19 Hagger, M. S., Chatzisarantis, N. L. D., & Harris, J. (2006). From psychological need
20 satisfaction to intentional behavior: Testing a motivational sequence in two behavioral
21 contexts. *Personality and Social Psychology Bulletin*, 32, 131-148.
- 22 Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2009). *Multivariate data analysis*
23 (7th ed.). Upper Saddle River, NJ: Prentice Hall.
- 24 Hammelstein, P. (2004). Faites vos jeux! Another look at sensation seeking and pathological
25 gambling. *Personality and Individual Differences*, 37, 917-931.

- 1 Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure
2 analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*,
3 6, 1-55.
- 4 Hull, C. L. (1943). *Principles of behavior: An introduction to behavior theory*. New York:
5 Appleton-Century-Crofts.
- 6 Johnston, M. M., & Finney, S. J. (2010). Measuring basic needs satisfaction: Evaluating
7 previous research and conducting new psychometric evaluations of the Basic Needs
8 Satisfaction in General Scale. *Contemporary Educational Psychology*, 35, 280-296.
- 9 Kashdan, T. B. (2004). Curiosity. In C. Peterson & M. E. P. Seligman (Eds.), *Character*
10 *strengths and virtues: A handbook and classification* (pp. 125-141). New York: Oxford
11 University Press.
- 12 Kashdan, T. B., Gallagher, M. W., Silvia, P. J., Winterstein, B. P., Breen, W. E., Terhar, D.,
13 & Steger, M. F. (2009). The Curiosity and Exploration Inventory-II: Development,
14 factor structure, and psychometrics. *Journal of Research in Personality*, 43, 987-998.
- 15 Kashdan, T. B., Rose, P., & Fincham, F. D. (2004). Curiosity and exploration: Facilitating
16 positive subjective experiences and personal growth opportunities. *Journal of*
17 *Personality Assessment*, 82, 291-305.
- 18 Kashdam, T. B., Sherman, R. A., Yarbro, J., & Funder, D. C. (2013). How are curious people
19 viewed and how do they behave in social situations? From the perspectives of self,
20 friends, parents, and unacquainted observers. *Journal of Personality*, 81, 142-154.
- 21 Kashdam, T. B., & Silvia, P. J. (2009). Curiosity and interest: The benefits of thriving on
22 novelty and challenge. In S. J. Lopez (Ed.), *Handbook of positive psychology* (2nd ed.,
23 pp.367-375). Oxford, UK: Oxford University Press.
- 24 Loewenstein, G. (1994). The psychology of curiosity: A review and reinterpretation.
25 *Psychological Bulletin*, 116, 75-98.

- 1 Marsh, H. W., Hau, K-T., & Wen, Z. (2004). In search of golden rules: Comment on
2 hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in
3 overgeneralizing Hu and Bentler's (1999) findings. *Structural Equation Modeling 11*,
4 320-341.
- 5 Milfont, T. L., & Fischer, R. (2010). Testing measurement invariance across groups:
6 Applications in cross-cultural research. *International Journal of Psychological*
7 *Research, 3*, 111-121.
- 8 Moreno, J. A., González-Cutre, D., & Chillón, M. (2009). Preliminary validation in Spanish
9 of a scale designed to measure motivation in physical education classes: The Perceived
10 Locus of Causality (PLOC) Scale. *Spanish Journal of Psychology, 12*, 327-337.
- 11 Moreno, J. A., González-Cutre, D., Chillón, M., & Parra, N. (2008). Adaptación a la
12 educación física de la escala de las necesidades psicológicas básicas en el ejercicio
13 [Adaptation of the basic psychological needs in exercise scale to physical education].
14 *Revista Mexicana de Psicología, 25*, 295-303.
- 15 Murray, H. A. (1938). *Explorations in personality*. New York: Oxford University Press.
- 16 Ntoumanis, N. (2012). A self-determination theory perspective on motivation in sport and
17 physical education: Current trends and possible future research directions. In G. C.
18 Roberts & D. C. Treasure (Eds.), *Advances in motivation in sport and exercise* (pp. 91-
19 128). Champaign, IL: Human Kinetics.
- 20 Ogden, J. (2016). Celebrating variability and a call to limit systematisation: the example of
21 the Behaviour Change Technique Taxonomy and the Behaviour Change Wheel. *Health*
22 *Psychology Review*. Advance online publication. doi: 10.1080/17437199.2016.1190291
- 23 Reeve, J. (1989). The interest-enjoyment distinction in intrinsic motivation. *Motivation and*
24 *Emotion, 13*, 83-103.

- 1 Reio, T. G. Jr., & Choi, N. (2004). Novelty seeking in adulthood: Increases accompany
2 decline. *The Journal of Genetic Psychology, 165*, 119-133.
- 3 Roth, M., & Hammelstein, P. (2012). The Need Inventory of Sensation Seeking (NISS).
4 *European Journal of Psychological Assessment, 28*, 11-18.
- 5 Roth, M., Hammelstein, P., & Brähler, E. (2007). Beyond a youthful behavior style – Age
6 and sex differences in sensation seeking based on need theory. *Personality and*
7 *Individual Differences, 43*, 1839-1850.
- 8 Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal*
9 *of Personality, 63*, 397-427.
- 10 Ryan, R. M., & Deci, E. L. (2000a). The darker and brighter sides of human existence: Basic
11 psychological needs as unifying concept. *Psychology Inquiry, 11*, 319-338.
- 12 Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and the facilitation of intrinsic
13 motivation, social development, and well-being. *American Psychologist, 55*, 68-78.
- 14 Sansone, C., Weir, C., Harpster, L., & Morgan, C. (1992). Once a boring task always a boring
15 task? Interest as a self-regulatory mechanism. *Journal of Personality and Social*
16 *Psychology, 63*, 379-390.
- 17 Sheldon, K. M. (1995). Creativity and self-determination in personality. *Creativity Research*
18 *Journal, 8*, 25-36.
- 19 Sheldon, K. M. (2011). Integrating behavioral-motive and experiential requirement
20 perspectives on psychological needs: A two process model. *Psychological Review, 118*,
21 552-569.
- 22 Sheldon, K. M., Elliot, A. J., Kim, Y., & Kasser, T. (2001). What is satisfying about
23 satisfying events? Testing 10 candidate psychological needs. *Journal of Personality*
24 *and Social Psychology, 80*, 325-339.

- 1 Sheldon, K. M., & Hilpert, J. C. (2012). The balanced measure of psychological needs
2 (BMPN) scale: An alternative domain general measure of need satisfaction. *Motivation
3 and Emotion, 36*, 439-451.
- 4 Sheldon, K. M., & Lyubomirsky, S. (2012). The challenge of staying happier: Testing the
5 hedonic adaptation prevention model. *Personality and Social Psychology Bulletin, 38*,
6 670-680.
- 7 Silvia, P. J. (2005). What is interesting? Exploring the appraisal structure of interest.
8 *Emotion, 5*, 89-102.
- 9 Silvia, P. J. (2006). *Exploring the psychology of interest*. New York: Oxford University
10 Press.
- 11 Silvia, P. J. (2008). Interest-The curious emotion. *Current Directions in Psychology Science*,
12 *17*, 57-60.
- 13 Sylvester, B. D., Lubans, D. R., Eather, N., Standage, M., Wolf, S. A., McEwan, D., ...
14 Beauchamp, M. R. (2016). Effects of variety support on exercise-related well-being.
15 *Applied Psychology: Health and Well-Being*. Advance online publication. doi:
16 10.1111/aphw.12069
- 17 Sylvester, B. D., Standage, M., Dowd, A. J., Martin, L. J., Sweet, S. N., & Beauchamp, M. R.
18 (2014). Perceived variety, psychological needs satisfaction and exercise-related well-
19 being. *Psychology & Health, 29*, 1044-1061.
- 20 Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In
21 M. P. Zanna (Ed.), *Advances in experimental social psychology* (pp. 271-360). New
22 York: Academic Press.
- 23 Vansteenkiste, M., Niemiec, C. P., & Soens, B. (2010). The development of the five mini-
24 theories of self-determination theory: An historical overview, emerging trends, and
25 future directions. In T. C. Urdan & S. A. Karabenick (Eds.), *Advances in motivation*

- 1 *and achievement, Volume 16A. The decade ahead: Theoretical perspectives on*
2 *motivation and achievement* (pp. 105-165). Bingley, UK: Emerald Publishing.
- 3 Vlachopoulos, S. P., & Michailidou, S. (2006). Development and initial validation of a
4 measure of autonomy, competence, and relatedness in exercise: the basic psychological
5 needs in exercise scale. *Measurement in Physical Education and Exercise Science, 10,*
6 179-201.
- 7 Zuckerman, M. (1979). *Sensation seeking: Beyond the optimal level of arousal*. Hillsdale, NJ:
8 Lawrence Erlbaum.
- 9 Zuckerman, M. (1984). Sensation seeking: A comparative approach to a human trait.
10 *Behavioral and Brain Sciences, 7,* 413-471.
- 11 Zuckerman, M. (1994). *Behavioural expressions and biosocial bases of sensation seeking*.
12 Cambridge: Cambridge University Press.

Appendix

Novelty Need Satisfaction Scale (NNSS)

4. I feel I do novel things

8. I frequently feel there are novelties for me

9. I feel new sensations

14. I think that new situations come up for me

15. I have the opportunity to innovate

16. I think I discover new things frequently

Table 1

Descriptive Statistics and Factor Loadings for the Final Items of the Novelty Need Satisfaction Scale in Study 1

Items	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Factor loadings
Item 4	4.49	1.51	-.35	-.32	.73
Item 8	4.38	1.42	-.31	-.21	.77
Item 9	4.54	1.44	-.24	-.26	.76
Item 14	4.29	1.40	-.23	-.30	.78
Item 15	4.54	1.53	-.27	-.50	.73
Item 16	4.50	1.51	-.30	-.48	.75

Table 2

*Multi-Group Invariance Analysis across Gender and Age of the Four-Correlated-Factor**Model*

Invariance analysis across gender								
Models	χ^2	<i>df</i>	$\Delta\chi^2$	Δdf	CFI	IFI	SRMR	RMSEA (CI 90%)
Model 1	740.36	366	-	-	.849	.852	.075	.051 (.045-.056)
Model 2	757.99	383	17.63	17	.849	.851	.078	.050 (.044-.055)
Model 3	777.08	393	36.71	27	.845	.847	.081	.050 (.044-.055)
Model 4	809.04	414	68.68*	48	.841	.841	.084	.049 (.044-.054)
Invariance analysis across age								
Models	χ^2	<i>df</i>	$\Delta\chi^2$	Δdf	CFI	IFI	SRMR	RMSEA (CI 90%)
Model 1	980.68	549	-	-	.828	.833	.078	.045 (.040-.049)
Model 2	1011.16	583	30.47	34	.829	.832	.081	.043 (.039-.047)
Model 3	1048.07	603	67.38	54	.822	.824	.085	.043 (.039-.048)
Model 4	1175.51	645	194.82*	96	.788	.787	.088	.046 (.041-.050)

Note. Model 1 = unconstrained; Model 2 = invariant factor loadings; Model 3 = invariant structural covariances; Model 4 = invariant measurement residuals.

* $p < .05$.

Table 3

Latent Factor Correlations among Variables in Study 1

Variables	ρ	1	2	3	4	5
1. Novelty	.89		.65**	.30**	.56**	.45**
2. Competence	.73			.69**	.74**	.71**
3. Relatedness	.82				.66**	.41**
4. Autonomy	.64					.56**
5. Life satisfaction	.85					

** $p < .001$.

Table 4

Descriptive Statistics and Factor Loadings for the Final Items of the Novelty Need Satisfaction Scale in Study 2

Items	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Factor loadings
Item 4	2.88	1.14	.08	-.70	.80
Item 8	2.84	1.13	.12	-.71	.79
Item 9	2.92	1.15	.02	-.78	.78
Item 14	2.74	1.13	.18	-.68	.82
Item 15	2.85	1.12	.13	-.67	.70
Item 16	2.84	1.12	.17	-.67	.79

Table 5

Latent Factor Correlations among Variables in Study 2

Variables	ρ	1	2	3	4	5	6	7	8	9	10
1. Novelty	.90		.46**	.29**	.79**	.50**	.36**	.47**	.35**	-.03	-.19**
2. Competence	.72			.54**	.71**	.75**	.73**	.72**	.47**	-.29**	-.44**
3. Relatedness	.81				.39**	.37**	.26*	.35**	.26**	.03	-.18**
4. Autonomy	.77					.62**	.55**	.60**	.46**	-.06	-.27**
5. Intrinsic	.84						.86**	.98**	.67**	-.24**	-.50**
6. Integrated	.91							.88**	.62**	-.32**	-.47**
7. Identified	.84								.76**	-.19**	-.50**
8. Introjected	.69									.36**	-.15**
9. External	.65										.64**
10. Amotivation	.79										

** $p < .001$.

Figure 1. Four-correlated factor model CFA. The ellipses represent the factors and the rectangles represent the diverse items. The error variances are in the small circles. All the parameters are standardized and significant at $p < .001$. Novelty items numbering is based on the original NNSS of 19 items, whereas BNSG-S has an independent numbering from 1 to 15.

Figure 2. Structural equation modeling showing associations between basic psychological needs (including novelty need satisfaction) and intrinsic motivation. Dashed arrows represent non-significant relations.