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Basic psychological needs in the classroom: A literature review in elementary and middle school students

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ABSTRACT

Self-Determination Theory conceptualizes basic psychological needs (BPN) for autonomy, competence and relatedness as essentials for the learner to experience, maintain, and promote well-being, personal growth, and learning. However, the evidence of its influence in the classroom is still limited, especially in basic education (ages six to 14). The aim of the present study was to perform a systematic review of empirical evidence addressing the association of basic psychological needs on motivation, well-being, engagement, and academic achievement in elementary and middle school students. A comprehensive search of studies published in peer-review articles (2000–2021) was conducted on six electronic databases, and from 204 articles retrieved, 32 articles met the inclusion criteria. The studies showed that all psychological needs satisfaction were positively associated with intrinsic motivation and engagement. In contrast, due to the lack of studies that met methodological quality, the hypothesis that need satisfaction positively influences the well-being and academic achievement of elementary school students cannot be fully supported. The findings underscore the role of teachers in supporting pupils' psychological needs, not only for early adolescents, but also for children. However, the strength of the evidence is tempered by the lack of studies for each variable studied. Further experimental research on this topic should elucidate how educators can harness the benefits of need-supportive environment to improve the motivation, well-being, engagement and achievement of children in their communities.

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1. Introduction

1.1. Basic psychological need satisfaction in SDT

In recent years, within the area of psychology in so many different fields, there has been a rise in theoretical approaches, all of them with a common objective: the analysis of motivation and personal development, with the purpose of explaining some behaviors and optimizing the quality of personal processes. One theory that shows to have a significant impact in the educational context is self-determination theory (SDT), developed by Deci & Ryan (2008); Ryan & Deci (2000a, 2017).

This theory starts with the premise that all people have a natural propensity towards growth and healthy development, and that the fundamental motivational energy comes from a set of BPNs that are essential for students to experiment, sustain, and promote wellbeing, personal growth and learning. This micro-theory that emerges from the SDT framework is named basic psychological needs theory (BPNT; Deci & Ryan, 2008; Ryan & Deci, 2000a) and acts against age, culture, and gender differences, including in both childhood and adulthood (Chen et al., 2015; Deci & Vansteenkiste, 2004; Vansteenkiste et al., 2020).

The BPNs are competence, autonomy, and relatedness, which when satisfied or frustrated show a direct influence on student's motivation. Contexts such as the school, can be determinants for the satisfaction or frustration of these needs. (Niemiec & Ryan, 2009; Ryan & Deci, 2020; Vansteenkiste et al., 2020). The need for *autonomy* refers to the experience of showing will and self-direction within an activity or action, proving itself to be a key to understanding behavior regulation (Ryan & Deci, 2006). The need for *competence* is considered to be the experience of efficacy, in other words, the perception of an effectiveness in pupils when conducting their learning activities. This need manifests itself as the desire to extend pupils' own capacities and skills (Ryan & Deci, 2017; Vansteenkiste et al., 2020). The effort that people carry out, in order to establish a relationship with others—caring about others and at the same time being cared about—is defined as the need for *relatedness* (Ryan, 1991). This gets mitigated through the transmission of care and respect, the feeling of being understood and related to others. Relatedness is also making the effort to build safe and close relationships, caring about others (Reeve et al., 2004).

In the last three decades, this micro-theory, BPNT, has been strongly backed up by the literature research in the educational field. Many authors propose measuring the support of BPN as motivational antecedents required to determine their effects in the diverse cognitive, social or motivational aspects of students (Niemiec & Ryan, 2009; Zhang et al., 2011; Vansteenkiste et al., 2020).

One of the main hypotheses that supports SDT is that students with a greater fulfillment of BPN enjoy wider intrinsic motivation, hence it can be a determinant factor in the educational context. SDT proposes a multidimensional conceptualisation of motivation that postulates the existence of four forms of extrinsic motivation: external regulation, introjected regulation, identified regulation and intrinsic motivation (Ryan & Connell, 1989). *External regulation*, described as a form of controlled motivation in which actions are carried out due to external control and the presence of outputs such as reward or punishment avoidance (Ryan & Deci, 2002). *Introjected regulation* refers to a type of controlled motivation where the learner is driven to act by internal or self pressures based on contingent self-esteem, shame, anxiety or guilt about failure (Ryan, 1982). In recent years, several studies have suggested that students who are motivated in a more controlled way (such as external and/or introjected regulation) exert less effort in the classroom, are more easily distracted and have lower grades (Guay et al., 2008; Ryan & Connell, 1989; Taylor et al., 2014). *Identified regulation*, shown on the continuum as the most autonomous form of extrinsic motivation, occurs when students identify and judge the activity as valuable or important to themselves. For example, a student who studies at home and complete homework assignments because he/she wants to understand the subject or it is important for him/herself to do so. *Intrinsic motivation* refers to the more autonomous type of regulation based on the continuum of self-determination, where learners perform their actions for their inherent enjoyment and interest (Deci and Ryan, 2000a). The activities of play and curiosity exemplify intrinsically regulated behaviours as learners do not rely on external control or pressures, but rather seek to satisfy their own needs. At this stage of the continuum, we can find those students who enjoy

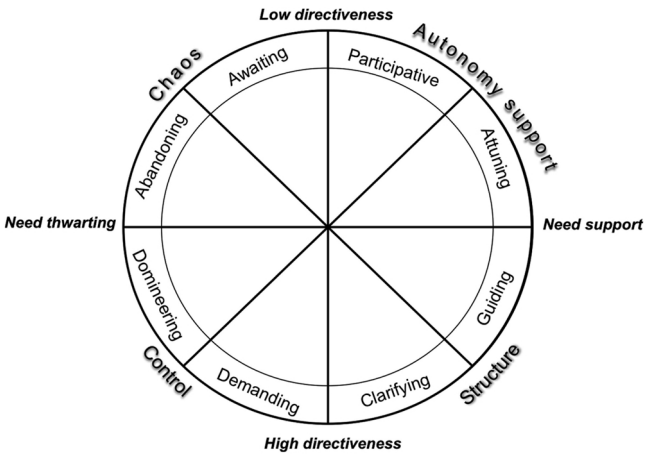

Fig. 1. Graphical representation of the circumplex model by Aelterman et al., (2019).

participating in class or find it fun. An intrinsically motivated learner feels competent and effective as he/she is interested in the task and self-fulfilled, and may even increase his/her interest at the end of the task. In recent years, several studies have suggested the positive influence of students' intrinsic motivation in the classroom, for example, on goals, effort or persistence in academic tasks (Albrecht & Karabenick, 2018; Vansteenkiste et al., 2009), engagement (Froiland & Worrell, 2016) or academic achievement (Taylor et al., 2014). In addition, several researchers found a systematic decline in academic intrinsic motivation from the age of 9–12 years (Gillet, Vallerand, & Lafreniere, 2012; Gottfried et al., 2001a). However, we find that at the elementary classroom there is a clear lack of literature that addresses understanding and mediators that can facilitate an enhancement of such motivation at this age. One of the possible mediators between age relations and academic intrinsic motivation may be the needs-supportive teaching style (Gillet, Vallerand, & Lafreniere, 2012; Reeve & Cheon, 2021).

1.2. Conceptualization of needs-supportive teaching

A needs-supportive motivational style is thus characterized by the provision of autonomy, structure and relatedness in order to fulfil learners' psychological needs for autonomy, structure and relatedness. (Reeve, 2009; Reeve & Cheon, 2021). Within SDT, and through the circumflex model recently proposed by Aelterman et al. (2019), four main motivational interpersonal styles in teachers are distinguished. They proposed a circular structure through two main axes, where the vertical axis shows the degree of directivity used and the horizontal axis ranges from least to greatest satisfaction of needs (see Fig. 1). In this model it is shown that those teachers who show attitudes relating to the support of autonomy, that is, where the teachers identify the interests, desires, and feelings of their students in order for them to participate more in class, promote greater satisfaction of needs in their pupils (Mouratidis et al., 2011; Cheon et al., 2012; Reeve & Cheon, 2021). A number of interventions have been conducted during the past years, which confirm that teachers can learn to support autonomy, and when they do, students benefit from it in many different ways (Cheon et al., 2012, 2018, 2020; Reeve & Cheon, 2021). Similarly, with autonomy support, a structure-based teaching style where the teacher provides strategies, help, and support also seems to be able to satisfy students' needs much more than a control-based motivational style (*pressure*) or chaos (laissez-faire) where there is possibly a less satisfaction and greater thwarting of these needs (Aelterman et al., 2019; Bartholomew et al., 2011, 2018; De Meyer et al., 2014; Jang et al., 2016).

1.3. Well-being, engagement, academic achievement and needs satisfaction at school

Another assumption of SDT is that situational contexts that diminish or frustrate the satisfaction of the needs diminish well-being (Ryan & Deci, 2000a). *Well-being* is characterized by an affective and cognitive-judgmental component (Diener et al., 2010). The affective component includes the balance between *positive affects* - the degree to which a student feels emotional states such as interest, joy and confidence - and *negative affect* - the degree to which a student feels emotional states such as depression, anxiety, fear or shame- (Snyder & Lopez, 2002). The cognitive component of well-being, namely *school satisfaction*, represents a student's self-evaluation of satisfaction with his or her life in general (Pavot & Diener, 1993). However, well-being is considered flourishing or fully functioning, and not only the presence of positive emotions and the absence of negative emotions (Niemiec & Ryan, 2013; Ryan & Deci, 2017). The full functioning of students is determined by several factors, such as development (e.g. temperament, intellectual abilities, etc.) or social situation (motivational style of teachers, parenting styles, etc.). Recent literature has revealed that need satisfaction is related to states such as feelings of vitality (Müller et al., 2021; Vansteenkiste & Ryan, 2013a), general life satisfaction, hope, and internal locus of control (Huebner & Gilman, 2007), gratitude and positive mood (Sheldon & Bettencourt, 2002; Tian, Pi, et al., 2016), lower stress (Li et al., 2019) or general well-being (Chen et al., 2015a; Orkibi & Ronen, 2017).

Another aspect that is closely associated with the satisfaction of psychological needs in the classroom, is *academic engagement*. This multidimensional concept refers to students' active participation in a learning task, whether or not they engage in the learning opportunities provided by the teacher (Christenson et al., 2012). Predominantly, researchers had distinguished four types of engagement at school and in the classroom: *behavioural engagement* (conduct, involvement in learning tasks, and participation in extracurricular activities; Fredricks et al., 2004), *emotional engagement* (positive and negative reactions to people and activities at school; Fredricks et al., 2004), *cognitive engagement* (the extent to which students' are willing and able to take on the learning task at hand; Fredricks et al., 2004) and *agentic engagement* (ability to be proactive in improving their own learning conditions, making suggestions or offering and communicating preferences; Patall et al., 2019; Reeve, 2013). Several research studies have associated engagement in school with the satisfaction of students' needs (Jang et al., 2012a; Van Ryzin, 2011).

However, the contribution of each need to student engagement is unclear as the results of various studies are contradictory. Some researchers showed that academic engagement was predicted by the need for competence and relatedness (Liu & Flick, 2019; Molinari & Mameli, 2018) (Liu & Flick; 2019; Molinari & Mameli, 2018; Olivier et al., 2020) and other researchers, found that satisfaction of the need for autonomy and competence is associated with higher academic engagement and achievement (Jang et al., 2009). And finally, several studies showed that the satisfaction of the three basic psychological needs not only influences academic engagement, but also affects academic achievement (Liu & Flick, 2019; Olivier et al., 2020; Wang et al., 2019; Wang et al., 2019; Zhou et al., 2020).

Therefore, following the SDT postulate, a student with greater need satisfaction in the classroom may have a greater sense of autonomous motivation, engagement, and academic achievement (Reeve & Cheon, 2021; Ryan & Deci, 2017). Motivation, well-being, engagement, or academic achievement during the elementary school period is crucial to students' success in their later educational experiences. Despite this, only a handful of studies have included elementary school students (e.g (Hajovsky et al., 2017; Marshik et al., 2017; Milyavskaya & Koestner, 2011; Y. Wang et al., 2019). This aspect makes us need to be somewhat careful in analyzing the influence of need satisfaction at these ages. In order to analyze more conclusive results, this literature review is conducted.

1.4. Purpose of this study

To date, all systematic reviews that have explored the influence of BPN took place in diverse dominions or other age ranges, for example, exercise or physical activity (Teixeira et al., 2018; Teixeira et al., 2012), physical education (Salazar-Ayala & Gastélum-Cuadras, 2020; Saugy et al., 2020), later life (Tang et al., 2020), adolescents with chronic pain (Riggenbach et al., 2019), health interventions (Gillison et al., 2019) or at work (Van den Broeck et al., 2016). In all these reviews, the direct influence of psychological needs on the individual, with a greater or lesser effect size, is apparent. However, what influence do psychological needs have on such an important educational stage as the 6–14 years of age?

Notwithstanding, no exhaustive reviews related to early stages of learning, such as childhood (ages six to 14) have been found. According to SDT, the satisfaction of basic psychological needs facilitates more autonomous forms of motivation, which in turn leads to greater well-being and engagement, and, subsequently, higher academic achievement. In line with SDT, we hypothesise that the satisfaction of basic psychological needs would show positive association with indicators of autonomous motivation, well-being, engagement and academic achievement in students aged 6–14.

Therefore, the main objective of this review is to examine the research literature of the last 20 years on the correlates found between BPNs and autonomous motivation, well-being, engagement and academic achievement in elementary and middle students, from six to 14 years old.

2. Method

The method of this systematic review was developed in accordance with the preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) criteria (Moher et al., 2009). The PICO model (population, intervention, comparison, and outcomes) (Booth & Fry-Smith, 2004) was used in the development of the eligibility criteria for the inclusion of studies.

Population. Studies must have been conducted with children aged six to 14 years. This represents the age span of children attending mainstream elementary and middle schools in Spain. This population is of interest due to the important developmental changes that

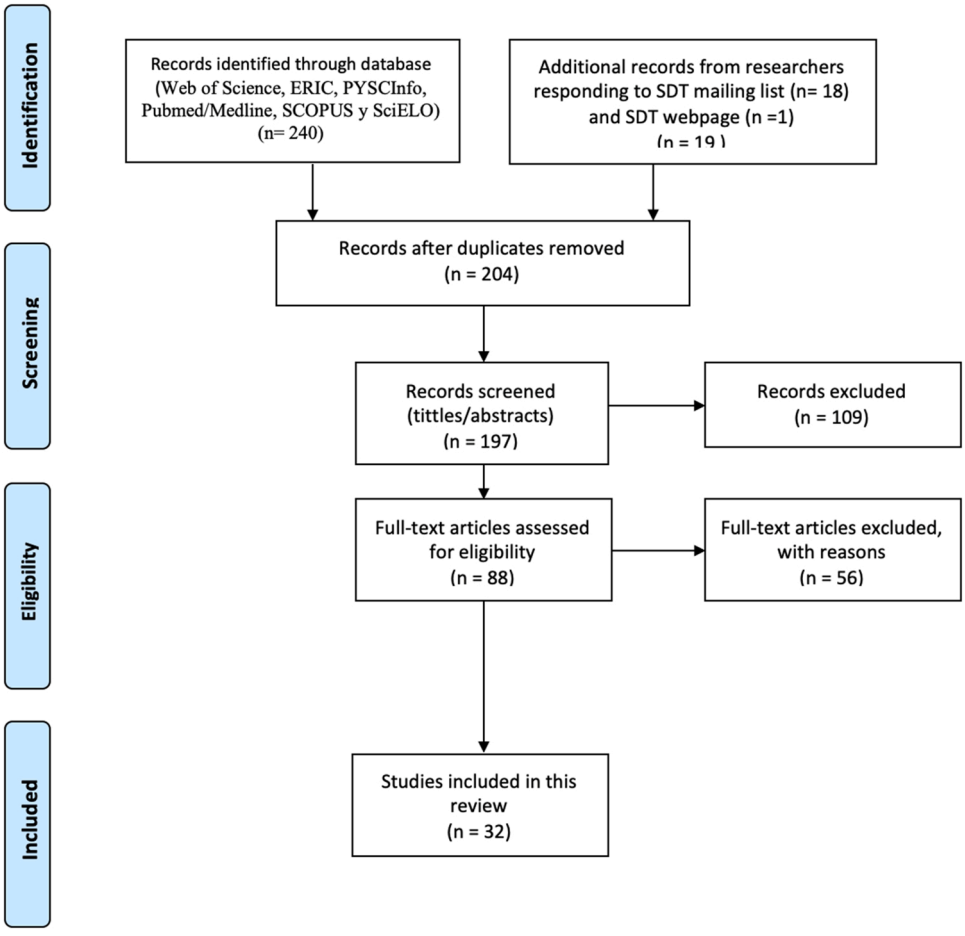

Fig. 2. PRISMA flow diagram for the systematic review.

occur in middle childhood and early adolescence where the child increases autonomy and develops a need for relationships and trust with the environment (Eccles, 1999). Moreover, in line with previous research, it was in this age range that a linear decrease in motivation was found (Gillet, Vallerand, & Lafrenière, 2012; Gottfried et al., 2001b, 2009; Lepper et al., 2005; Otis et al., 2005).

Intervention. Studies may have implemented any analysis aimed at the satisfaction or frustration of basic psychological needs of the student applied within the educational context. Any quantitative or qualitative investigation, peer-reviewed, with its respective introduction, correctly formulated, data analysis and specified measures of these variables within the SDT framework was included. Studies conducted in Physical Education context were excluded from the current review as these have been rigorously reviewed and debated previously (Owen et al., 2014; Vasconcellos et al., 2020). Additionally, it should be kept in mind that PE strategies and contexts differ from those associated with many other academic subjects. For example, in many physical education sessions, demonstrations and assessments of competence are often public, whereas, in other academic sessions at school, an individual's performance may be relatively more covert (Vasconcellos et al., 2020). In addition, many of the learning goals of PE are qualitatively different from those of other academic subjects, and healthy behaviors (e.g., levels of physical activity or exercise) have been shown to be a possible predictor of satisfaction of basic psychological needs in students in PE contexts (Teixeira et al., 2012), while transferability to other subjects is yet to be established. Thus, the physical education context may represent a different arena for the satisfaction of basic psychological needs, which greatly differs from other classroom settings.

Comparison. The review compares any cross-sectional or experimental studies using measurements of the outcomes. There were no special considerations or restrictions on who delivered the studies. For example, the researcher, teachers or staff. Nevertheless, the interventions had to take place in the classroom. Studies related to BPN support and parenting were excluded.

Outcomes.The studies had to include at least one measure related to satisfaction/frustration or support for autonomy, competence or relatedness. Any study that considered the above-mentioned BPNs with other variables as relevant in the educational setting, either constructs outlined in SDT (e.g., any type of motivation on the self-determination continuum) or cognitive, emotional, or behavioral outcome related to learning in the classroom (e.g., achievement].

2.1. Data sources and search strategy

Three complementary strategies were employed in the search for articles and for their consequent inclusion in the study. Firstly, a search in six international databases: (Web of Science, ERIC, PYSCInfo, Pubmed/Medline, SCOPUS y SciELO) through a search of the following keywords both Spanish and English: (self-determination theory OR SDT) AND (basic psychological need OR autonomy OR competence OR relatedness OR autonomous motivation OR self-determinated motivation OR need support) AND (elementary school OR middle school OR secondary school) NOT physical education NOT physical activity". A total of 240 published studies were found.

Secondly, the SDT website: (https://selfdeterminationtheory.org/publications/) was used. Lastly, related references and studies were requested from various authors through the SDT email listserv. For these last two strategies, there was a match of 19 articles, and almost all of them were included in the final research (14) —showing the importance of communication and feedback between the researchers. In Fig. 2a detailed scheme of the literature search and results can be seen.

Articles published between 2000 and 2021 were selected. The selected period started in 2000 as it is considered that this is where the authors formally identified the construct of basic psychological needs (Deci & Ryan, 2000; Vansteenkiste et al., 2020). Due to resource constraints, searches were restricted to studies written in English and Spanish.

Lastly, the references of all selected studies were analyzed for the possibility of including new studies. The articles resulting from the bibliographic search, organized according to the steps previously described, were analyzed by same reviewer. First, the titles and abstracts of studies that could possibly be eligible for the literature review were evaluated, followed by the analysis of the full article.

During the first step, the titles and abstracts of all the papers found were read, excluding those duplicated on the database. Sequentially, 109 articles were excluded. In the last step, the articles were thoroughly examined, taking into consideration the inclusion and exclusion criteria, with a result of 32 remaining articles revised. The impact factor of these papers was revised through the Journal Citation Reports of Web of Science.

After careful consideration, it was decided that a meta-analysis was not appropriate for this review. This decision was based on the heterogeneity of the elementary and middle school outcomes found. The low number of studies in each analysis category would also result in very low power for any sub-group meta-analyses so it would be difficult to make generalisations from the results (Borenstein, 2009).

3. Method

The total number of articles initially found was 259, being 120 WoK, 43 PsycINFO, 22 Medline, 11 SCOPUS, 3 SciELO, 41 Pubmed, 18 SDT Lists and 1 SDT website. After deleting the 55 duplicates from the different databases, we had a remaining number of 204 articles to be revised and then, 109 were excluded. Qualitative studies were not found. Finally, a total of 32 full articles were selected for the analysis of this research, 8 of them are cross-sectional, 18 longitudinals and six experimental.

In this section, the findings of the 32 empirical studies are categorized into five outcome analyses: an analysis of the instruments employed; representative studies illustrating the relationship between need satisfaction and motivation, well-being, engagement and, consequently, achievement.

Table 1
Representative studies illustrating the relationship between need satisfaction and motivation.

Authors, year	Participants	Design	Need Satisfaction measures	Motivation indicators	Representative findings
Baten et al., (2020	479 Belgian elementary school students, age range: 9–11, Mage = 9.41	E	BPNSF with the BPNSFS-child version (Chen et al., 2015a)	Autonomous and controlled motivation in mathematics	- AS and CS were positively related to autonomous motivation, especially competence. - AF and CF were positively related to controlled motivation, especially autonomy.
Carreira et al., (2013)	239 Japanese elementary school students, age range: 8–12, M_{age} = n/f	CS	Students' BPNS (Wu, 2003) Perceived teachers' autonomy support with Learning Climate Questionnaire (Black & Deci, 2000)	Intrinsic motivation	- CS were not associated with students' RS. - Perceived teachers' autonomy support significantly predicted students' AS, CS, and RS. - Although all three psychological needs had effects on intrinsic motivation, AS had the strongest effect and RS had the least effect.
Carreira, (2012)	505 Japanese elementary school students, age range: 10–12 years, M_{age} = n/f	CS	Students' BPNS (Wu, 2003)	Intrinsic motivation, identified regulation, introjected regulation and external regulation.	- BPNS showed a stronger relation with the intrinsic motivation than with less self-determined forms of motivation (i.e., identified regulation and external regulation).
Domen et al., (2020)	506 Dutch elementary school students, age range: 8–10 years, M_{age} = 9.55	L	Student perceptions of autonomy support and competence Teacher perceptions of autonomy support and competence. Both measures were carried out using the Teachers as Social Context Questionnaire (TASC; Belmont et al., 2018)	Intrinsic motivation, identified regulation, introjected regulation and external regulation.	- Teachers' autonomy support was positively related to student' need support. - Autonomy support were positively related to students' autonomous motivation. - Competence support was negatively related to students' autonomous motivation and positively to students'-controlled motivation. - Teacher perceptions of need support were not congruent with student perceptions of need support.
Gnambs & Hanfstingl, (2016)	600 Austrians middle school students, age range: 11–15 M_{age} = n/f	L	Students' BPNS at school (Prenzel et al., 2001)	Intrinsic motivation, identified regulation, introjected regulation and external regulation	- Satisfaction of the needs for autonomy, competence, and relatedness concordantly buffered the decline of youths' intrinsic motivations.
Gorissen et al., 2015)	69 Dutch elementary school students, age range: 9–11 M_{age} = 10.60	E	BPNS with the Basic Psychological Needs Scale (Ilardi et al., 1993)	Controlled regulation and Autonomous regulation	- No association was found between need satisfaction and levels of motivation in the hypermedia-based intervention.
Guay et al., (2016)	277 Canadian elementary school students, age range: n/f, M_{age} = 7.23	E	Competence in writing using the Academic Self-Description Questionnaire (Marsh, 1990) Relatedness to teachers using the Interpersonal Relationships Quality Scale (IRQ;Senécal et al., 1992) Teachers' support of students' needs: involvement, structure, autonomy support and control (seeGuay et al., 2016)	Intrinsic motivation, identified regulation and control regulation	- No significant effects of the experimental group (professional development teacher-based program on support of students'needs) on perceived competence and perceived relatedness to teachers were observed.
Katz et al., (2009)	179 Israeli elementary and secondary school students, age range: n/f, M_{age} = n/f	L	Students' BPNS in the context of homework (n/f) Teachers' support of students' needs	Autonomous and controlled motivation for doing homework	- BPNS was weakly correlated with controlled motivation, positively correlated with autonomous motivation and with perceived teachers' support of students' needs.
Martinek et al., (2016)	413 Austrian elementary and secondary school students, age range: 6–20, M_{age} = 12.31	CS	Students' perceived autonomy support was assessed with Learning Climate Questionnaire (Black & Deci, 2000)	Intrinsic motivation, identified regulation, introjected regulation and external regulation.	- AS was positively associated with self-determined styles.

(*continued on next page*)

Table 1 (*continued*)

Authors, year	Participants	Design	Need Satisfaction measures	Motivation indicators	Representative findings
Quint Oga-Baldwin et al., (2017)	555 Japanese elementary school students, age range: 10–11 M_{age} = n/f	L	Students' BPNS were measured using the Activity Feeling Scale (AFS;Reeve & Sickenius, 1994)	Autonomous regulation, introjected regulation and external regulation	- Students' prior autonomous motivation predicted their sense of need satisfaction.
Shih, (2008)	343 Taiwanese elementary and middle school students, age range: 13–15, M_{age} = n/f	CS	Autonomy support with Learning Climate Questionnaire (Black & Deci, 2000)	Intrinsic motivation, identified regulation, introjected regulation and external regulation	- Autonomy support was related to identified regulation and students' intrinsic motivation.
Van Loon et al., (2012)	320 Dutch elementary school students, age range: 10–13 years, M_{age} = 11.70	E	Autonomy and CS using the Intrinsic Motivation Inventory (IMI;McAuley et al., 1989)	Intrinsic motivation (interest/ enjoyment)	- Autonomy increases when a digital learning task supported autonomy by offering choices, a rational for a task, and non-directive language. - A digital learning task that provides structure through clear expectations, guidance, and procedures contributed to greater competence. - The results showed that even a single dimension (autonomy support or structure) was sufficient to foster intrinsic motivation. When both autonomy support and structure are present they are mutually supportive and result in high intrinsic motivation. If both are absent, however, low intrinsic motivation results.
Wang et al., (2019)	1459 Singaporean middle school students, age range: n/f, M_{age} = 14.16	CS	Students' BPNS using the student version of the Teacher as Social Context Questionnaire (TASC; Belmont et al., 2018)	Intrinsic motivation, identified regulation, introjected regulation and external regulation.	- BPNS were positively related to autonomous motivation. - BPNS were negatively related to controlled motivation.
Waterschoot et al., (2019)	126 Dutch elementary school students, age range: 9–12 years, M_{age} = 10.80	E	Autonomy and CS using the Intrinsic Motivation Inventory (IMI;McAuley et al., 1989) Child-teacher relatedness using the 14-item People in My Life questionnaire (PIML;Ridenour et al., 2006)	Intrinsic motivation (pleasure, interest, intended persistence and vitality)	- AS and CS were positively correlated with one another and with all three indicators of intrinsic motivation. - During the intervention, children in the choice provision condition, reported enhanced intrinsic motivation and vitality because they experienced more autonomy and competence need satisfaction. Relatedness with the teacher did not play a moderating role.

*Note: CS = cross-sectional; L = longitudinal; E = experimental; BNPS = basic psychological needs satisfaction; AS = autonomy satisfaction; CS = competence satisfaction; RS = relatedness satisfaction; AF = Autonomy frustration; CF = Competence frustration

3.1. Measuring the basic psychological needs in elementary and middle school students

In a general context, and to measure both the satisfaction and the frustration components, the main scale is the *Basic psychological need satisfaction and frustration scale* (BPNSFS; Chen et al., 2015) which includes a balanced combination of satisfaction and frustration items. In the paper conducted by Vansteenkiste et al. (2020), there is an overview of different translations and adaptations of the BPNSFS in general, domain-specific or/and daily measures. This scale was originally used in an adult population. However, for this study's age range, the instrument choice may vary considerably according to the orientation and objectives of the respective studies. Generally speaking, the reviewed studies have revealed that the most common instruments are the adapted version of BPNSS (such as, (F. Gillison et al., 2008; Rodríguez-Meirinhos et al., 2020; C. K. J. Wang et al., 2019) or *The adolescent students' basic psychological needs at school* scale (ASBPNSS). This instrument—used in seven studies (i.e., (Tian et al., 2018; Tian, Tian, et al., 2016; Zhong et al., 2020; Zhou et al., 2020)—is a 15-item self-report scale that measures the satisfaction levels of autonomy, competence and relatedness at the school.

Further to this, an instrument that measured the perceptions of BPN in a situation-specific (solving the SOMA puzzle) and short-term experiential state was found. This is called the *activity-feeling scale* (Reeve & Sickenius, 1994) and it was used in several studies (Jang et al., 2012b; Oga-Baldwin & Nakata, 2015). Another scale found is the *Children's intrinsic needs satisfaction* (Véronneau et al., 2005).

On a more specific level, it is perceived that the investigators used a large number of instruments in order to evaluate the autonomy, competence, and relatedness of the students. So as to measure the autonomy levels, several scales such as *Adaptation of the patterns of adaptive learning scale* (Kurdi et al., 2018), *The autonomy scale* (Skinner et al., 2008) or the *Subscale of intrinsic motivation inventory* (e.g., van Loon et al., 2012; Waterschoot et al., 2019) were found. To measure competence, other instruments such as the *Multidimensional scale of motivation for school learning* (e.g., Skinner et al., 2008) or the adapted version from the *Academic self-description questionnaire* (Guay et al., 2017). Furthermore, one of the most used instruments to measure support in the two variables of this research is the *Learning climate questionnaire* (see Caleon et al., 2016; Carreira et al., 2013; Martinek et al., 2016; Shih, 2008; Wei et al., 2019). Finally, the instruments to measure the levels of perceived relatedness were, *Peer scale of the self-description questionnaire* (Kurdi & Archambault, 2020; Marshik et al., 2017) or *Basic need satisfaction in relationships* scale (Simões & Alarcão, 2014).

To sum up, it is necessary to highlight that the only three studies which measured the frustration levels in elementary or middle school children were used (Baten et al., 2020; Rodríguez-Meirinhos et al., 2020; Schmidt et al., 2020). In one of them in particular, children reported on their perceived RS and frustration at school every evening for two–four weeks (Schmidt et al., 2020). Although this study appears to show the observed differences between the intensity of feelings of frustration and satisfaction, it seems to have found some proof of the differences and asymmetry. That is, it shows that low satisfaction does not involve a higher level of frustration, however, high frustration levels seems to incur low satisfaction levels (Vansteenkiste & Ryan, 2013b; Warburton et al., 2020).

There could be different reasons for this situation. One of them being the challenge of pupils in this age range to distinguish between frustration and satisfaction. This could be due to the students' one-dimensional perspective on the world, which is in full swing at the age of eight to nine (Griffin, 1991), as well as the integration of these two feelings (Harter et al., 1992). Another reason why it is difficult to apply the right instrument to measure such complex questions is the lack of literature about the matter.

3.2. Basic psychological needs and motivation

Among the 32 empirical studies included in this literature review, 14 studies focus on the relationship between basic psychological need satisfaction and motivation, as shown in Table 1. Of these 14 studies, four studies were from Netherlands, three were from the Japan, and the remaining seven were from other countries, including Austria (n = 2), Belgium (n = 1), Canada (n = 1), Israel (n = 1), Taiwan (n = 1) and Singapore (n = 1). Regarding sample sizes, we found 5 studies with samples of 1–300 participants, 7 studies with 300–600 participants, one study with 600–900 participants and one study with samples greater than 900. Concerning the type of study design used, 5 studies used a cross-sectional design, 5 studies used an experimental design and the remaining four used a longitudinal design.

As expected, autonomy, competence and relatedness needs were correlated with each other in most studies (e.g., see Carreira, 2012; Oga-Baldwin et al., 2017; Wang et al., 2019). In contrast, in one study, student perceptions of competence satisfaction were not related to student perceptions of relatedness (Carreira et al., 2013). Among the 14 studies that investigated the satisfaction of needs in the motivation of elementary school students, all studies addressed autonomy need satisfaction, 12 studies approached competence satisfaction, and 10 studies targeted relatedness satisfaction.

Regarding autonomous motivation, most studies significantlyn associated need satisfaction with more self-determined regulatory styles, such as intrinsic motivation or identified regulation (Baten et al., 2020; Carreira et al., 2013; Katz et al., 2009; Oga-Baldwin et al., 2017; van Loon et al., 2012; C. K. J. Wang et al., 2019; Waterschoot et al., 2019). However, it was less clear which need satisfaction had the greatest effect. In some studies, it showed that autonomy satisfaction had the greatest effect (Carreira et al., 2013; Domen et al., 2020; Martinek et al., 2016), and in other studies, it was competence satisfaction (e.g., see Baten et al., 2020). Also, in several studies, it was observed that relatedness satisfaction had the smallest effect on the positive association with autonomous motivation (Carreira et al., 2013; Waterschoot et al., 2019). Additionnally, it should be noted that there were two experimental studies based on supporting needs that had no effect on students' autonomous motivation (Gorissen et al., 2015; Guay et al., 2016).

In terms of controlled motivation, there were inconsistent results. The only study that measured frustration of students' needs, autonomy frustration and competence frustration were positively related to controlled motivation, especially autonomy (Baten et al., 2020). Regarding need satisfaction, there were studies that positively and slightly associated need satisfaction and less self-determined

Table 2
Representative studies illustrating the relationship between need satisfaction and well-being.

Authors, year	Participants	Design	Need Satisfaction measures	Well-being indicators	Representative findings
Gillison et al.; (2008)	63 UK year 7 students age range: 11–12 M_{age} = n/f	L	BPNS using an adapted version of the need satisfaction in the workplace questionnaire (Deci et al., 2001)	Well-being	- Improvements in well-being were predicted by improvements in perceived relatedness and perceived autonomy, but not by competence.
Kurdi & Archambault (2020)	170 Canadian elementary school students from disadvantagemultiethnic schools, age range: 7–10 M_{age} = 10.34	L	Perceptions of BPNS. Each need was measured on a different scale.	Anxiety	- Immigrant students with elevated anxiety, in particular, displayed stronger behavioral and affective engagement when they had high self-perceptions of autonomy.
Rodríguez-Meirinhos et al., (2020)	1047 Spanish middle school students, age range: 12–17 M_{age} = 14.68	CS	BPNSF with the BPNSFS-child version (Chen et al., 2015)	Life satisfaction, positive affect and psychological maladjustment (internalizing problems, externalizing problems and other problems)	- BPNS was solely related to well-being (life satisfaction and positive affect) but not to maladjustment, - BPNF was uniquely associated with maladjustment (i.e., externalizing, internalizing, and other problems) but not well-being
Schmidt et al., (2020) Study 1, 2 and 3	317 German elementary school students, age range: 9–12 M_{age} = 10.12	L	Students' RS and frustration (Schmidt et al., 2019)	Positive affect and negative affect (Schmidt et al., 2019)	- RS was significantly associated with PA, and relatedness frustration was significantly associated only with NA.
Simões & Alarcão, (2014)	317 Portuguese elementary school students, age range: 9–16 years, M_{age} = 12.40	E	Students' BPNS using the Basic Need Satisfaction in Relationships Scale (BNSRS;Simões & Alarcão, 2013)	Physical well-being, psychological well-being, parent relations and autonomy, social support and peers, school environment, hopeful	- The experimental group (school-based mentoring program) that increased their need satisfaction was the most effective in promoting school environment and perceived competence in learning. - The experimental group based on increased support of BPNS was not significantly more effective in improving the personal well-being (physical and psychological well-being, as well as hope) or the social well-being (parent relations and autonomy and social support and peers).
Tian et al., (2018)	801 Chinese elementary school students, age range: 7–12 M_{age} = 9.46	L	Students' BPNS at school with the Adolescent Students' Basic Psychological Needs at School Scale (Tian, Han, et al., 2014)	Prosocial behavior, antisocial behavior and school satisfaction	- Satisfaction of relatedness and competence needs at school both displayed statistically significant direct effects on prosocial behavior, but not AS. - Satisfaction of relatedness needs, but not competence or autonomy

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Table 2 (*continued*)

Authors, year	Participants	Design	Need Satisfaction measures	Well-being indicators	Representative findings
					needs at school, significantly predicted antisocial behavior - School satisfaction mediated the relation between relatedness and CS at school on prosocial and antisocial behavior, but not autonomy.
Tian, Pi, et al., (2016)	881 Chinese middle school students, age range: 11–15 M_{age} = 12.97	CS	Students' BPNS at school with the Adolescent Students' Basic Psychological Needs at School Scale (Tian, Han, et al., 2014)	Gratitude, subjective wellbeing in school	- Relatedness and CS at school served as significant mediators of the relation between gratitude and SWB in school.
Véronneau et al., (2005)	331 Canadian elementary school students, age range: 8–13 M_{age} = n/f	L	Students' BPNS with Children's Intrinsic Needs Satisfaction Scale (Orpana et al., 2019)	Depression, positive affect and negative affect	- Satisfaction of the need for competence was a significant predictor of depressive symptoms. - Autonomy and CS were significantly negatively related to negative affect. - All three needs were significantly positively associated with positive affect.
Zhong et al., (2020)	692 Chinese elementary school students, age range: 7–10 M_{age} = 8.96	L	BPNS at school (ASBPNSS;Tian, Chen, & Huebner 2014)	Depressive Symptoms and anxiety	- After controlling for anxiety, low RS predicted a higher trajectory of depressive symptoms in girls. For boys, it was lower CS that predicted greater depressive symptoms.
Zhou et al., (2020)	712 Chinese early adolescents students, age range: 12–14 M_{age} = 12.92	L	Students' BPNS at school with the Adolescent Students' Basic Psychological Needs at School Scale (Tian, Han, et al., 2014)	Positivity	- Students' BPNS and positivity reciprocally enhanced each other. - Reciprocal relations between BPNS and academic achievement.

**Note*: CS = cross-sectional; L = longitudinal; E = experimental; BNPS = basic psychological needs satisfaction; AS = autonomy satisfaction; CS = competence satisfaction; RS = relatedness satisfaction; PA = positive affect; NA = negative affect

motivations (Carreira, 2012; Katz et al., 2009). In contrast, other studies need satisfaction were negatively related to controlled motivation (van Loon et al., 2012; C. K. J. Wang et al., 2019).

BPN satisfaction also seems to be play an important role, when considering age. Gnambs & Hanfstingl, (2016) explained the reason for a decrease in intrinsic motivation in students between 11 and 16 as seen through its relationship with BPN. Although they could not show that intrinsic motivation does not decline considerably when these needs are satisfied, they do claim that they play a stabilizing role in this decline. Therefore, the study concludes that satisfying the needs of autonomy, competence, and relatedness softened the decrease in the intrinsic motivation of these students.

3.3. Basic psychological needs and well-being

Within the 32 empirical studies included in this literature review, 10 studies focused on the relationship between basic psychological need satisfaction and well-being, as shown in Table 2. Of these 10 studies, four studies were from China, two were from the Canada, and the remaining four were from other countries, including UK (n = 1), Spain (n = 1), Germany (n = 1) and Portugal (n = 1). Regarding sample sizes, we found two studies with samples of 1–300 participants, 3 studies with 300–600 participants, 4 studies with 600–900 participants and one study with samples greater than 900. Concerning the type of study design used, two studies used a cross-sectional design, two studies used an experimental design and the remaining six used a longitudinal design. In this subsection, it is complex to unite different concepts of well-being in the same construct due to the variety of terminology used by the

Table 3
Representative studies illustrating the relationship between need satisfaction and engagement.

Authors, year	Participants	Design	Need Satisfaction measures	Engagement indicators	Representative findings
Baten et al., (2020	479 Belgian elementary school students, age range: 9–11, Mage = 9.41	E	BPNSF with the BPNSFS-child version (Chen et al., 2015a)	Dis-engagement	- Cognitive disengagement was predicted by both autonomy and competence frustration (positively) and CS (negatively).
Jang et al., (2012)	500 Korean middle school students, age range: 13–14 M_{age} = n/f	L	Autonomy need satisfaction using the Activity Feeling Scale (AFS;Reeve & Sickenius, 1994) Autonomy support with Learning Climate Questionnaire (Black & Deci, 2000)	Cognitive, emotional, behavioral and agentic engagement	- The associations between the variables were not stable during measurements - Students' engagement predicted their AS
Kurdi & Archambault (2020)	170 Canadian elementary school students from disadvantagemultiethnic schools, age range: 7–10 M_{age} = 10.34	L	Perceptions of BPNS. Each need was measured on a different scale.	Behavioral engagement, emotional engagement and cognitive engagement	- The relations between students' engagement and their self-perceptions of needs in mathematics varied according to their immigration status and level of anxiety. - Self-perceptions of autonomy, relatedness and competence are associated with all types of engagement, especially autonomy and relatedness. - Immigrant students with elevated anxiety, in particular, displayed stronger behavioral and affective engagement when they had high self-perceptions of autonomy.
Pitzer & Skinner, (2017)	1020 USA elementary school students, age range: 8–11 M_{age} = n/f	L	Perceptions of BPNS. Each need was measured on a different scale. Teacher support of their BPNS: warmth versus rejection, structure versus chaos and autonomy support versus coercion (Skinner & Belmont, 1993)	Behavioral engagement, behavioral disaffection, emotional engagement and emotional disaffection	- Students who reported high engagement in fall showed small improvements in their achievement as the year progressed along with increasing feelings of relatedness, autonomy, and especially, competence. They also reported experiencing increases in warmth, structure, and especially autonomy support from their teachers.
Quint Oga-Baldwin et al., (2017)	555 Japanese elementary school students, age range: 10–11 M_{age} = n/f	L	Students' BPNS were measured using the Activity Feeling Scale (AFS; (Reeve & Sickenius, 1994)	Single construct using items representing cognitive, emotional, and behavioral engagement	- Both supportive teaching and need satisfaction predicted positive engagement.
Shih, (2008)	343 Taiwanese elementary and middle school students, age range: 13–15, M_{age} = n/f	CS	Autonomy support with Learning Climate Questionnaire (Black & Deci, 2000)	Behavioral engagement, emotional engagement	- Students with higher levels of emotional engagement report higher perceptions of autonomy support from teachers.
Skinner et al., (2008)	805 USA elementary school students, age range: 9–13, M_{age} = n/f	L	Perceptions of students' BPN. Each need was measured on a different scale. Teachers' support of students' needs	Behavioral engagement and emotional engagement	- Students' self-perceptions (especially autonomy) predicted increases in engagement and decreases in disaffection.

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Table 3 (*continued*)

Authors, year	Participants	Design	Need Satisfaction measures	Engagement indicators	Representative findings
Wang et al., (2019)	627 Chinese elementary school students, age range: 8–11 M_{age} = 9.01	L	Students' BPNS at school with the Adolescent Students' Basic Psychological Needs at School Scale (Tian, Han, et al., 2014)	Behavioral engagement	- BPNS at school, behavioral engagement, and academic achievement reciprocally enhanced each other directly. - BPNSS displayed an indirect positive effect on academic achievement via behavioral engagement, and academic achievement also displayed an indirect positive effect on BPNS via behavioral engagement.
Wei et al., (2019)	1624 Chinese elementary school students, age range: 9–11 M_{age} = n/f	L	Autonomy need satisfaction using Basic Psychological Needs Satisfaction Scale (Gagné, 2003) Autonomy support	Cognitive, emotional and behavioral engagement	- The three facets of classroom engagement distinguished effects with respect to the prediction of mathematics achievement growth factors when controlling for perceived autonomy support
Williams et al., (2018)	113 USA elementary school students, age range: 11–13 M_{age} = n/f	L	BPNS (Skinner et al., 2012)	Emotional engagement and behavioral engagement	- Students experienced higher levels of competence, relatedness and autonomy they tended to be more engaged with learning activities

*Note: CS = cross-sectional; L = longitudinal; E = experimental; BNPS = basic psychological needs satisfaction; AS = autonomy satisfaction; CS = competence satisfaction; RS = relatedness satisfaction,

authors. The following is a description of the studies analyzed.

A study by Gillison et al., (2008) observed that in the transition from elementary to secondary education, when children adapt their position in life, both the context and the value system, and describe it as having been tough. This difficulty in transition was predicted from scores on relatedness and perceived autonomy, although not so much from the perspective of competence. In a recent study conducted with a Chinese population, after controlling for anxiety, low relatedness and competence satisfaction predicted a higher depressive symptoms (Zhong et al., 2020). In a Canadian sample, the satisfaction competence was a significant predictor of the concurrent levels of depression symptoms. In all studies that addressed students' positive and negative affect, need satisfaction was assertively associated with levels of positive affect and negatively associated with levels of negative affect (Rodríguez-Meirinhos et al., 2020; Schmidt et al., 2019; Véronneau et al., 2005).

In terms of school satisfaction, it has been observed that there are bi-directional significant relations between BPN and satisfaction in school (Rodríguez-Meirinhos et al., 2020; Tian, Chen, et al., 2014; Tian, Pi, et al., 2016). Alongside scholar satisfaction as a mediator, it was observed that when the need of relatedness and competence were satisfied, both a direct and indirect change in antisocial and prosocial behavior was shown (Tian et al., 2018).

Finally, feelings of hopeful, gratitude and positivity were also positively associated with need satisfaction in elementary school students (Simões & Alarcão, 2013; Tian, Pi, et al., 2016; Zhou et al., 2020).

3.4. Basic psychological needs and engagement

Among the 32 empirical studies included in this literature review, 10 studies focused on the association between basic psychological need satisfaction and engagement, as shown in Table 3. Of these 10 studies, three studies were from the United States, two were from the China, and the remaining five were from other countries, including Taiwan (n = 1), Japan (n = 1), Canada (n = 1), South Korea (n = 1) and Belgium (n = 1). Regarding sample sizes, we found two studies with samples of 1–300 participants, four studies with 300–600 participants, 2 studies with 600–900 participants and other two studies with samples greater than 900. Concerning the type of study design used, two studies used a cross-sectional design, eight studies used an experimental design and the remaining one used a experimental design. Among the 10 studies that investigated the satisfaction of needs and engagement in elementary school students, 9 studies addressed behavioral engagement, 8 studies approached emotional engagement, 4 studies focused on cognitive engament, and one study on agentic engagement.

Regarding behavioral school engagement, all the studies that measured this variable were associated with the students' needs satisfaction, where especially, it was autonomy satisfaction that seems to have had the greatest effects (Jang et al., 2012; Oga-Baldwin et al., 2017; Pitzer & Skinner, 2017; Skinner et al., 2008; Wang et al., 2019). However, in other studies it was observed that relatedness or competence satisfaction could also have greater effects (Jang et al., 2012; Kurdi & Archambault, 2020; Oga-Baldwin et al., 2017; Pitzer & Skinner, 2017; Shih, 2008; Skinner et al., 2008; Williams et al., 2018). In terms of emotional engagement, a positive association was also observed between students' need satisfaction and emotional engagement (Jang et al., 2012; Kurdi & Archambault, 2020; Oga-Baldwin et al., 2017; Pitzer & Skinner, 2017; Shih, 2008; Skinner et al., 2008; Williams et al., 2018). Regarding cognitive engagement, all the studies that measured this variable associated cognitive engagement and satisfaction of student needs (Jang et al., 2012a; Kurdi & Archambault, 2020; Oga-Baldwin et al., 2017; Wei et al., 2019). The study that included agentic engagement as a engagement outcome variable also associated autonomy satisfaction and agentic engagement.

3.5. Basic psychological needs and achievement

Among the 32 empirical studies included in this literature review, 8 studies focused on the association between basic psychological need satisfaction and achievement, as shown in Table 4. Of these 8 studies, three studies were from the United States, three were from the China, and the remaining two were from other countries, such as Netherlands (n = 1) and Canada (n = 1). Regarding sample sizes, we found three studies with samples of 1–300 participants, 2 studies with 600–900 participants and other five studies with samples greater than 900. Concerning the type of study design used, only one study used a cross-sectional design, five studies used an experimental design and the remaining two used an experimental design.

In research with 627 elementary school students, the satisfaction of their BPN predicted their later academic performance, which also had an effect on their subsequent satisfaction levels (Wang et al., 2019). Furthermore, as can be seen indirectly in the aforementioned research by Wang et al., (2019) improvement in behavioral engagement through greater satisfaction of students' BPNs school, promotes higher academic performance, just as suggested by the authors, this relation is reciprocal. Similar findings have been identified in the research by Zhou et al. (2020), conclusions drawn in this article suggest a mutual satisfaction relation between BPNs at school and achievement. In a long-term research carried out with 1624 elementary school students, it was discerned that the initially registered level of satisfaction of the autonomy need has been found to be the most significant in terms of academic achievement (Wei et al., 2019). This means that those students with a greater satisfaction of their BPNs experienced a speedy improvement in their goals. A sample in North America, sighted the statistical significant relation between BPNs and reading achievement (Marshik et al., 2017). However, in the only two experimental studies, no significant effects were found between need satisfaction and achievement (Gorissen et al., 2015; Guay et al., 2016).

Table 4
Representative studies illustrating the relationship between need satisfaction and achievement.

Authors, year	Participants	Design	Need Satisfaction measures	Achievement indicators	Representative findings
Gorissen et al., (2015)	69 Dutch elementary school students, age range: 9–11 $M_{age} = 10.60$	E	BPNS with the Basic Psychological Needs Scale (Ilardi et al., 1993)	Factual Knowledge Test	- No association was found between need satisfaction and levels of achievement in the hypermedia-based intervention.
Guay et al., (2016)	277 Canadian elementary school students, age range: n/f, $M_{age} = 7.23$	E	Competence in writing using the Academic Self-Description Questionnaire (Marsh, 1990) Relatedness to teachers using the Interpersonal Relationships Quality Scale (IRQ;Senécal et al., 1992) Teachers' support of students' needs: involvement, structure, autonomy support and control (seeGuay et al., 2016)	*Writing Achievement*	- No significant effects of the experimental group (professional development teacher-based program on support of students 'needs) on writing achievement
Marshik et al., (2017)	1039 USA elementary school students, age range: 9–11, $M_{age} = n/f$	CS	Perceptions of students' BPN satisfaction. Each need was measured on a different scale.	The Item-Response Theory (IRT) scale scores for the reading assessment	- Students' BPN satisfaction are significantly related to their reading achievement. - Teachers' support of students' autonomy is not significantly related to students' reading achievement in fifth grade.
Pitzer & Skinner, (2017)	1020 USA elementary school students, age range: 8–11 $M_{age} = n/f$	L	Perceptions of BPNS. Each need was measured on a different scale. Teacher support of their BPNS: warmth versus rejection, structure versus chaos and autonomy support versus coercion (Skinner & Belmont, 1993)	Students' grades for reading, language arts, spelling, and math	- Students who reported high engagement in fall showed small improvements in their achievement as the year progressed along with increasing feelings of relatedness, autonomy, and especially, competence.
Wang et al., (2019)	627 Chinese elementary school students, age range: 8–11 $M_{age} = 9.01$	L	Students' BPNS at school with the Adolescent Students' Basic Psychological Needs at School Scale (Tian, Han, et al., 2014)	*Academic achievement*	- BPNS at school, behavioral engagement, and academic achievement reciprocally enhanced each other directly. - BPNSS displayed an indirect positive effect on academic achievement via behavioral engagement, and academic achievement also displayed an indirect positive effect on BPNS via behavioral engagement.
Wei et al., (2019)	1624 Chinese elementary school students, age range: 9–11 $M_{age} = n/f$	L	Autonomy need satisfaction using Basic Psychological Needs Satisfaction Scale (Gagné, 2003) Autonomy support	*Mathematics Achievement*	- The three facets of classroom engagement distinguished effects with respect to the prediction of mathematics achievement growth factors when controlling for perceived autonomy support - Students' AS positively predicted the rate of growth of their achievement.
Williams et al., (2018)	113 USA elementary school students, age range: 11–13 $M_{age} = n/f$	L	BPNS (Skinner et al., 2012)	*S*tudents' grades for science	- Students experienced higher levels of competence, relatedness and autonomy they reported better grades in science class.
Zhou et al., (2020)	712 Chinese early adolescents students, age range: 12–14 $M_{age} = 12.92$	L	Students' BPNS at school with the Adolescent Students' Basic Psychological Needs at School Scale (Tian, Han, et al., 2014)	Students' grades for Chinese, mathematics, and English course	- Reciprocal relations between BPNS and academic achievement.

**Note*: CS = cross-sectional; L = longitudinal; E = experimental; BNPS = basic psychological needs satisfaction; AS = autonomy satisfaction; CS = competence satisfaction; RS = relatedness satisfaction; PA = positive affect; NA = negative affect

4. Discussion

The main objective of this review is to examine the research literature from the past 20 years on the subject of the relation between BPNs and motivation, well-being, engagement and academic achievement in elementary and middle students, from six to 14 years old. This review also shows the recent growth in the application of this theory in educational contexts, with 17 of the 32 papers having been published in the last five years.

The latest review shows once again the importance of satisfying BPNs in human beings, as suggested by the original SDT in other populations (Chen et al., 2015; Ryan & Deci, 2000b; Vansteenkiste et al., 2020). In this study, six electronic databases were used to identify empirical studies that were published in English and Spanish. Despite the differences amongst the diversity of questionnaires used, the terminological complexity of the constructs used (e.g., well-being), the various study designs (longitudinal, experimental or cross-sectional), the different in ages (elementary or middle school), and other factors, including the results from these publications, four main conclusions can be drawn.

First, we hypothesized that the satisfaction of basic psychological needs could have an association with motivation in elementary school students. This hypothesis is supported in the literature review through the analysis of the results as need satisfaction was associated with the most self-determined motivational regulatory styles of the students (e.g., see Baten et al., 2020; Carreira et al., 2013; Katz et al., 2009; Wang et al., 2019). Also, lower need satisfaction was associated with students'-controlled motivation (e.g., see Baten et al., 2020; Wang et al., 2019). This findings generally confirmed the hypothesis of SDT, which points out the increase in intrinsic motivation when their needs are satisfied (Ryan & Deci, 2002, 2020). What is more, needs satisfaction, can be the key to softening the downturn in intrinsic motivation, which takes place at different school stages, such as secondary (Gillet et al., 2012; Gottfried et al., 2001, 2009; Otis et al., 2005; Gnambs & Hanfstingl, 2016). A group of students with higher reported levels of needs satisfaction will tend to have greater autonomic motivation, value, and joy about what goes on in the classroom. Whereas, those students showing lower satisfaction levels will tend to have higher controlled regulation, for example, feeling pressured to perform a behavior or pursue a goal (Ryan & Deci, 2000b).

With regards to which of the three needs is the strongest one when predicting higher intrinsic motivation, an agreement cannot be reached as inconsistent results have been observed (Baten et al., 2020; Martinek et al., 2016). Therefore, more research is needed in this area. A supportive learning environment addressing those needs and provides "need-supportive instructional behaviours" by teachers will help students feel more autonomous, competent, and connected to all components of the educational community (Cheon et al., 2019, 2020; Reeve & Cheon, 2021). They will feel more motivated and interested in their learning (Cerasoli et al., 2014; Taylor et al., 2014).

Second, we hypothesized that the satisfaction of basic psychological needs could have an association with well-being in elementary school students. In this case, the diversity of terms and constructs prevents us from solidly supporting the hypothesis given that the number of quality studies was quite limited. Nevertheless, and despite such diversity, significant correlations were observed between the satisfaction of needs and different terms related to students' well-being (e.g., see Rodríguez-Meirinhos et al., 2020; Tian et al., 2016, p. 20; Véronneau et al., 2005). The satisfaction of these needs is directly related to positive affect levels, as well as perceptions of competence and autonomy or frustration of relatedness are negatively related with the negative affect (Véronneau et al., 2005; Schmidt et al., 2020). Other findings seem to confirm the hypothesis that the satisfaction of BPNs in school is key in avoiding depressive symptoms in pupils, taking into account the first stages of education and focusing especially on girls (Zhong et al., 2020). These studies suggest, for example, that in order to satisfy the competence need in schools, teachers should try to provide appropriate information, specifically adapted to the students' needs and interests, in order to get tasks successfully completed.

These results match with several studies conducted with other age ranges or in other realms, where this effect has been quite influential on different aspects related to mental health of participants (Jang et al., 2009; Ng et al., 2012; Van den Broeck et al., 2016). We cannot forget, as stated by Baker et al., (2003), that schools work as healthy psychological environments, as long as they please their students' needs. These observations are especially consistent within the hierarchical model of motivation, as suggested by Vallerand (1997), which describes the satisfaction of these needs as a mediator between the social context and motivation at three main different levels: situation (state), contextual (domains of life) and global (traits of personality). Vallerand determines that through the influence in our cognition, information is adjusted from top to bottom and bottom-up. In other words, even with only one improvement in the variables in general (such as quality of life or wellbeing) students can improve their ability to interpret different contextual situations in their school environment. Even in times of extraordinary circumstances such as a pandemic, by suggesting that the satisfaction and frustration of basic psychological needs could play a key role in the attainment of optimal well-being (Šakan et al., 2020).

Third, we hypothesized that the satisfaction of basic psychological needs could have a positive correlation with engagement in elementary school students. The issue is covered for the relevant age ranges (e.g., see Jang et al., 2012; Kurdi & Archambault, 2020; Oga-Baldwin et al., 2017; Skinner et al., 2008; Wei et al., 2019). The satisfaction of these needs is related is related to all the types of engagement analyzed, not only unidirectionally but also reciprocally (Wang et al., 2019). Therefore, those teachers who encourage their students to take an active part in school activities, explaining the importance of this to them, being interesting and appropriate, will be not only promote student engagement and participation in the classroom, but also fulfil their BPNs. Some researchers suggest that in order to promote those needs and establish a confident climate, there are several significant strategies recommended: (a) take into account the perspectives of the students in order to satisfy autonomy needs and offer them a setting where they can take certain decisions; (b) in order to satisfy the relatedness need, express feelings towards the students and provide them with certain dynamics and situations where they can keep an active relationship with classmates and teachers; (c) addressing competence needs, adapt classroom tasks according to students' level of interest or skills (Bear et al., 2018; Duchesne et al., 2017). All these questions also match

the well-known meta-analysis conducted by Hattie (2009), describing the causes of students' performance.

These results also support the idea that the teacher can cause changes in the levels of students' engagement (Reeve & Cheon, 2021). Teachers' autonomy support could affect students' emotional behavior, cognition, agency, curiosity and boredom levels, and the teachers' competence support was related to behavioral engagement and anxiety, especially in those students at high risk of academic failure (Caleon et al., 2016; Shih, 2008). It has also been observed that a higher level of competence satisfaction, points towards a wider self-sufficiency in students, creating an increase in their persistence and, with that, academic achievement. (Skinner et al., 2008).

Fourth, we hypothesized that we hypothesized that the satisfaction of basic psychological needs could have a positive association with achievement in elementary school students. Due to the lack of quality/quantity studies on this issue, we cannot fully support this hypothesis. Different studies have been observed where the satisfaction of needs has had a great influence on the academic achievement of students (e.g., see Marshik et al., 2017; Wang et al., 2019; Wei et al., 2019; Williams et al., 2018), but other studies have also been found - the only two that are experimental - where no effects have been observed (Gorissen et al., 2015; Guay et al., 2016). A number of studies conducted in the last years back up the importance of teachers putting into practice a need-supportive environment (Reeve, 2006; Reeve & Cheon, 2021). We need different policies which help teachers develop the skills to provide autonomy support and provide structure in an autonomy-supportive way (Aelterman et al., 2019; Cheon et al., 2020). It also suggests that students with a reported high level of participation in the classroom, are more likely to concentrate, learn, and ask and answer questions, being also more connected to the classroom dynamic and therefore enjoying higher academic achievement (Wang & Holcombe, 2010). Different studies have suggested that interventions such as helping students to determine their goals, providing appropriate feedback or making links between classroom material and pupils' experiences, improves motivation, and academic achievement significatively (Lazowski & Hulleman, 2016). This could be of vital relevance asit has been observed that in the aforementioned age range, an increase in students' independent decision taking, and therefore a higher need to take decisions on their own, was observed (Wray-Lake et al., 2010).

Therefore, these results, as suggested by Wang and his colleagues (2019), seem to be consistent with the person-environment fit theory applied in education (Edwards et al., 1998; Gilbreath et al., 2011). This theory proposes that the interaction between the person and the environment, as well as the consistency of the person's characteristics (e.g. knowledge or beliefs about his abilities) and the environmental characteristics (the values of the classroom) promote an adjustment, whether it be wellbeing or achievement. It is not uncommon to see how in certain countries such as Singapore, high levels of satisfaction of BPNs were reported from the very beginning (Wang et al., 2019, 2019; Wang et al., 2016), since Singapore is one of the countries with a higher rate of success in the international evaluation Programme for International Students Assessments (PISA; OECD, 2020).

4.1. Limitations and future research

Numerous limitations must be presented in this research, since further study is needed. On the one hand, it is important to mention that these conclusions should be treated with great caution due to the small number of publications found that discuss the different variables. The conclusions are shown as an approximation towards further research, although ideally more studies were needed in order to be able to draw clear conclusions about particular relations between some of these needs and the aforementioned educational variables. More studies on elementary and secondary school students measuring the level of satisfaction with autonomy, competence and the relatedness to these mentioned variables are needed in order to draw more solid conclusions. Meanwhile, this study can be considered a step towards the horizon, as observed through these articles, which seems quite encouraging.

At a methodological level, it is possible that certain articles where BPNs were not the main variables measured, or were not exposed explicitly from the SDT framework, were lost in the selection process. However, at the same time, they are similar constructs and/or have an incidential finding. Another obstacle found is the limitation in the experimental studies, where the effect of an intervention found in BPN in the educational contexts for elementary and middle students is observed. Nevertheless, nowadays many different researchers approach the area through the promotion of autonomy support and providing structure in an autonomy-supportive teaching style, although they focus mainly on physical education (Cheon et al., 2018, 2019, 2020; Reeve & Cheon, 2021). More experimental research is needed, with a higher level of teacher involvement in the classroom, especially in subjects such as maths, literacy or sciences.

Additionally, given the huge relavance and usage that it has nowadays, another research line, is to test the relation and effect in educational environments, known as *"online or blended learning"* with the satisfaction or frustration in the needs of students from six to 14. The only quasi-experimental study found with similar characteristics (hypermedia environments) has not shown any significant effect (Gorissen et al., 2015).

A similar situation is observed when it comes to the measurement of frustration in those age groups, since barely any scientific literature can be found. The lack of literature is clear. The theory of the satisfaction and frustration of needs with separated constructs, coexistent but different, is increasingly supported (Vansteenkiste et al., 2020). Therefore, frustration should be investigated thoroughly in the future, to be able to examine its comprehension and influence in different academic variables in students of the aforementioned age ranges.

Another significant limitation is that the reviewed studies exclusively relied on self-report measures (or teacher reporting) which may lead to possible variance bias, even though it has been shown that from seven-eight the use of self-report assessment gains force and provides legitimacy in different research (Beitchman & Corradini, 1988; Varni et al., 2007; Sturgess et al., 2016). Despite the heterogeneity of the tools employed, some of them are not sufficiently interpretable or are inappropriate for the age group. An approach for future research that addresses these limitations, as suggested by Reeve & Lee, (2019), could be through the use of neuroscientific methods and data, which could offer a new opportunity to measure these constructs, widening the educational

community knowledge and comprehension.

It is necessary to develop a larger investigation, especially experimental-based ones offering different strategies and resources to the school community (administration and education policies, teachers, families and students) for the support of those needs. This is extremely important for children's development, especially in this age ranges, where their intrinsic motivation has been shown to drop considerably and where many educational systems demand many hours with the same teacher, compared with other higher educational stages.

The importance of teachers in this process is to be highlighted, since through their use of many different tools and resources they promote a higher level of satisfaction of these needs in the classroom. The satisfaction and support of BPNs seems to show that it has significant positive effects on students. This finding can be generalized to all cultural contexts. The influence of teachers in the classroom is a universal question, being a determinant for the teaching-learning process and affecting, in many cases, students' future experiences. Therefore, a well-founded, practical and evidence-based educational intervention that considers the initial characteristics of such a community (e.g. personality and culture of its teachers) is required.

5. Conclusion

The aim of this research was to review the literature in relation to the role of autonomy, competence and relatedness needs in the motivation, well-being, engagement and achievement of elementary school students. The analysis shows positive relationships of the satisfaction of student needs with their intrinsic motivation and engagement. Also, it seems that the needs satisfaction could influence students' well-being and their academic achievement. However, the strength of the evidence is tempered by the lack of studies for each variable studied that contain rigorous methodology. Further well-designed and controlled studies with sound theoretical underpinnings and comprehensive outcome measurement, comparing carefully considered results, are needed to expand and improve the evidence base. In summary, this literature review suggests that need satisfaction, motivation, engagement, and academic achievement constitute a dynamic system, operating in students as early as elementary school. The consequent challenge is to give elementary students the opportunity to choose for themselves and make decisions (autonomy satisfaction), to promote students' inherent desire to feel effective in interacting with their learning (competence satisfaction), and to maintain a close relationship with their peers and teachers (relationship satisfaction).

CRediT authorship contribution statement

PJC conceived this manuscript and led the writing team. IO, JAD and MAM revised the entire manuscript and made important contributions in various sections. All authors read and approved the final version of the manuscript.

Declaration of Competing Interest

The authors declare that they have no known conflict of interest to disclose.

Data Availability

Data sharing is not applicable to this review as no new data were created or analyzed in this study.

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Code availability

Not applicable.

Ethics approval

Ethics approval was not required for this systematic review.

Consent to participate

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Consent for publication

Authors are responsible for correctness of the statements provided in the manuscript.

References

Aelterman, N., Vansteenkiste, M., Haerens, L., Soenens, B., Fontaine, J. R. J., & Reeve, J. (2019). Toward an integrative and fine-grained insight in motivating and demotivating teaching styles: The merits of a circumplex approach. *Journal of Educational Psychology, 111*(3), 497–521. https://doi.org/10.1037/edu0000293

Albrecht, J. R., & Karabenick, S. A. (2018). Relevance for Learning and Motivation in Education. *The Journal of Experimental Education, 86*(1), 1–10. https://doi.org/10.1080/00220973.2017.1380593

Baker, J. A., Dilly, L. J., Aupperlee, J. L., & Patil, S. A. (2003). The developmental context of school satisfaction: Schools as psychologically healthy environments. *School Psychology Quarterly, 18*(2), 206–221. https://doi.org/10.1521/scpq.18.2.206.21861

Bartholomew, K. J., Ntoumanis, N., Mouratidis, A., Katartzi, E., Thøgersen-Ntoumani, C., & Vlachopoulos, S. (2018). Beware of your teaching style: A school-year long investigation of controlling teaching and student motivational experiences. *Learning and Instruction, 53*, 50–63. https://doi.org/10.1016/j.learninstruc.2017.07.006

Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011). Self-Determination Theory and Diminished Functioning: The Role of Interpersonal Control and Psychological Need Thwarting. *Personality and Social Psychology Bulletin, 37*(11), 1459–1473. https://doi.org/10.1177/0146167211413125

Baten, E., Vansteenkiste, M., De Muynck, G.-J., De Poortere, E., & Desoete, A. (2020). How can the blow of math difficulty on elementary school children's motivational, cognitive, and affective experiences be dampened? The critical role of autonomy-supportive instructions. *Journal of Educational Psychology, 112*(8), 1490–1505. https://doi.org/10.1037/edu0000444

Bear, G. G., Yang, C., Chen, D., He, X., Xie, J.-S., & Huang, X. (2018). Differences in school climate and student engagement in China and the United States. *School Psychology Quarterly, 33*(2), 323–335. https://doi.org/10.1037/spq0000247

Beitchman, J. H., & Corradini, A. (1988). Self-report measures for use with children: A review and comment. *Journal of Clinical Psychology, 44*(4), 477–490. https://doi.org/10.1002/1097-4679(198807)44:4<477::AID-JCLP2270440402>3.0.CO;2-K

Belmont, M., Skinner, E. A., Wellborn, J., & Connell, J. (2018). *Teacher as Social Context Questionnaire [Data set]*. American Psychological Association. https://doi.org/10.1037/t10488-000

Black, A. E., & Deci, E. L. (2000). The effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry: A self-determination theory perspective. *Science Education, 84*(6), 740–756. https://doi.org/10.1002/1098-237X(200011)84:6<740::AID-SCE4>3.0.CO;2-3.

Borenstein, M. (2009). *Introduction to meta-analysis*. John Wiley & Sons. ⟨http://public.ebookcentral.proquest.com/choice/publicfullrecord.aspx?p=427912⟩.

Caleon, I. S., Tan, J. P.-L., Wui, Ma. G. L., Leen, C. C., & King, R. B. (2016). Academically At-risk Adolescents in Singapore: The Importance of Teacher Support in Promoting Academic Engagement. In R. B. King, & A. B. I. Bernardo (Eds.), *The Psychology of Asian Learners: A Festschrift in Honor of David Watkins* (pp. 519–539). Springer. https://doi.org/10.1007/978-981-287-576-1_32.

Carreira, J. M. (2012). Motivational orienations and psychological needs in EFL learning among elementary school students in Japan. *System, 40*(2), 191–202. https://doi.org/10.1016/j.system.2012.02.001

Carreira, J. M., Ozaki, K., & Maeda, T. (2013). Motivational model of English learning among elementary school students in Japan. *System, 41*(3), 706–719. https://doi.org/10.1016/j.system.2013.07.017

Cerasoli, C. P., Nicklin, J. M., & Ford, M. T. (2014). Intrinsic motivation and extrinsic incentives jointly predict performance: A 40-year meta-analysis. *Psychological Bulletin, 140*(4), 980–1008. https://doi.org/10.1037/a0035661

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., Duriez, B., Lens, W., Matos, L., Mouratidis, A., Ryan, R. M., Sheldon, K. M., Soenens, B., Van Petegem, S., & Verstuyf, J. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion, 39*(2), 216–236. https://doi.org/10.1007/s11031-014-9450-1

Cheon, S. H., Reeve, J., Lee, Y., & Lee, J. (2018). Why autonomy-supportive interventions work: Explaining the professional development of teachers' motivating style. *Teaching and Teacher Education, 69*, 43–51. https://doi.org/10.1016/j.tate.2017.09.022

Cheon, S. H., Reeve, J., & Moon, I. S. (2012). Experimentally Based, Longitudinally Designed, Teacher-Focused Intervention to Help Physical Education Teachers Be More Autonomy Supportive Toward Their Students. *Journal of Sport and Exercise Psychology, 34*(3), 365–396. https://doi.org/10.1123/jsep.34.3.365

Cheon, S. H., Reeve, J., & Song, Y.-G. (2019). Recommending goals and supporting needs: An intervention to help physical education teachers communicate their expectations while supporting students' psychological needs. *Psychology of Sport and Exercise, 41*, 107–118. https://doi.org/10.1016/j.psychsport.2018.12.008

Cheon, S. H., Reeve, J., & Vansteenkiste, M. (2020). When teachers learn how to provide classroom structure in an autonomy-supportive way: Benefits to teachers and their students. *Teaching and Teacher Education, 90*, Article 103004. https://doi.org/10.1016/j.tate.2019.103004

Christenson, S., Wylie, C., & Reschly, A. L. (2012). *Handbook of research on student engagement*. Springer.

De Meyer, J., Tallir, I. B., Soenens, B., Vansteenkiste, M., Aelterman, N., Van den Berghe, L., Speleers, L., & Haerens, L. (2014). Does observed controlling teaching behavior relate to students' motivation in physical education? *Journal of Educational Psychology, 106*(2), 541–554. https://doi.org/10.1037/a0034399

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01

Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology/Psychologie Canadienne, 49*(3), 182–185. https://doi.org/10.1037/a0012801

Deci, E. L., Ryan, R. M., Gagné, M., Leone, D. R., Usunov, J., & Kornazheva, B. P. (2001). Need satisfaction, motivation, and well-being in the work organizations of a former eastern bloc country: A cross-cultural study of self-determination. *Personality and Social Psychology Bulletin, 27*(8), 930–942. https://doi.org/10.1177/0146167201278002

Deci, E. L., & Vansteenkiste, M. (2004). Self-determination theory and basic need satisfaction: Understanding human development in positive psychology. *Ricerche di Psicologia, 27*(1), 23–40.

Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D., Oishi, S., & Biswas-Diener, R. (2010). New well-being measures: Short scales to assess flourishing and positive and negative feelings. *Social Indicators Research, 97*(2), 143–156. https://doi.org/10.1007/s11205-009-9493-y

Domen, J., Hornstra, L., Weijers, D., Veen, I. van der, & Peetsma, T. (2020). Differentiated need support by teachers: Student-specific provision of autonomy and structure and relations with student motivation. *British Journal of Educational Psychology, 90*(2), 403–423. https://doi.org/10.1111/bjep.12302

Duchesne, S., Ratelle, C. F., & Feng, B. (2017). Psychological need satisfaction and achievement goals: Exploring indirect effects of academic and social adaptation following the transition to secondary school. *The Journal of Early Adolescence, 37*(9), 1280–1308. https://doi.org/10.1177/0272431616659561

Eccles, J. S. (1999). The development of children ages 6 to 14. *The Future of Children, 9*(2), 30–44. https://doi.org/10.2307/1602703

Edwards, J., Caplan, R., & Harrison, V. (1998). Person-environment fit theory: Conceptual foundations, empirical evidence, and directions for future research. *Theories of Organizational Stress*, 28–67.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59–109. https://doi.org/10.3102/00346543074001059

Froiland, J. M., & Worrell, F. C. (2016). Intrinsic motivation, learning goals, engagement, and achievement in a diverse high school: Motivation and achievement in high school. *Psychology in the Schools, 53*(3), 321–336. https://doi.org/10.1002/pits.21901

Gagne, M. (2003). The role of autonomy support and autonomy orientation in prosocial behavior engagement. *Motivation and Emotion*, 26.

Gilbreath, B., Kim, T.-Y., & Nichols, B. (2011). Person-environment fit and its effects on university students: A response surface methodology study. *Research in Higher Education, 52*(1), 47–62. https://doi.org/10.1007/s11162-010-9182-3

Gillet, N., Vallerand, R. J., & Lafreniere, M.-A. K. (2012). Intrinsic and extrinsic school motivation as a function of age: The mediating role of autonomy support. *Social Psychology of Education: An International Journal, 15*(1), 77–95. https://doi.org/10.1007/s11218-011-9170-2

Gillet, N., Vallerand, R. J., & Lafrenière, M.-A. K. (2012). Intrinsic and extrinsic school motivation as a function of age: The mediating role of autonomy support (Scopus) *Social Psychology of Education, 15*(1), 77–95. https://doi.org/10.1007/s11218-011-9170-2.

OECD. (2020). *Education at a Glance 2020: OECD Indicators*. OECD. https://doi.org/10.1787/69096873-en

Gillison, F., Standage, M., & Skevington, S. (2008). Changes in quality of life and psychological need satisfaction following the transition to secondary school. *The British Journal of Educational Psychology, 78*(Pt 1), 149–162. https://doi.org/10.1348/000709907×209863
Gillison, F. B., Rouse, P., Standage, M., Sebire, S. J., & Ryan, R. M. (2019). A meta-analysis of techniques to promote motivation for health behaviour change from a self-determination theory perspective. *Health Psychology Review, 13*(1), 110–130. https://doi.org/10.1080/17437199.2018.1534071
Gnambs, T., & Hanfstingl, B. (2016). The decline of academic motivation during adolescence: An accelerated longitudinal cohort analysis on the effect of psychological need satisfaction. *Educational Psychology, 36*(9), 1691–1705. https://doi.org/10.1080/01443410.2015.1113236
Gorissen, C. J. J., Kester, L., Brand-Gruwel, S., & Martens, R. (2015). Autonomy supported, learner-controlled or system-controlled learning in hypermedia environments and the influence of academic self-regulation style. *Interactive Learning Environments, 23*(6), 655–669. https://doi.org/10.1080/10494820.2013.788038
Gottfried, A. E., Fleming, J. S., & Gottfried, A. W. (2001a). Continuity of academic intrinsic motivation from childhood through late adolescence: A longitudinal study. *Journal of Educational Psychology, 93*(1), 3–13. https://doi.org/10.1037/0022-0663.93.1.3
Gottfried, A. E., Fleming, J. S., & Gottfried, A. W. (2001b). Continuity of academic intrinsic motivation from childhood through late adolescence: A longitudinal study. *Journal of Educational Psychology, 93*(1), 3–13. https://doi.org/10.1037/0022-0663.93.1.3
Gottfried, A. E., Marcoulides, G. A., Gottfried, A. W., & Oliver, P. H. (2009). A latent curve model of parental motivational practices and developmental decline in math and science academic intrinsic motivation. *Journal of Educational Psychology, 101*(3), 729–739. https://doi.org/10.1037/a0015084
Griffin, S. (1991). Young children's awareness of their inner world: A neo-structural analysis of the development of intrapersonal intelligence. En. *The mind's staircase: Exploring the conceptual underpinnings of children's thought and knowledge* (pp. 189–206). Lawrence Erlbaum Associates, Inc.
Guay, F., Ratelle, C. F., & Chanal, J. (2008). Optimal learning in optimal contexts: The role of self-determination in education. *Canadian Psychology/Psychologie Canadienne, 49*(3), 233–240. https://doi.org/10.1037/a0012758
Guay, F., Roy, A., & Valois, P. (2017). Teacher structure as a predictor of students' perceived competence and autonomous motivation: The moderating role of differentiated instruction. *British Journal of Educational Psychology, 87*(2), 224–240. https://doi.org/10.1111/bjep.12146
Guay, F., Valois, P., Falardeau, É., & Lessard, V. (2016). Examining the effects of a professional development program on teachers' pedagogical practices and students' motivational resources and achievement in written French. *Learning and Individual Differences, 45*, 291–298. https://doi.org/10.1016/j.lindif.2015.11.014
Hajovsky, D. B., Mason, B. A., & McCune, L. A. (2017). Teacher-student relationship quality and academic achievement in elementary school: A longitudinal examination of gender differences. *Journal of School Psychology, 63*, 119–133. https://doi.org/10.1016/j.jsp.2017.04.001
Harter, S., Whitesell, N.R., & Kowalski, P. (1992). Individual Differences in the Effects of Educational Transitions on Young Adolescent's Perceptions of Competence and Motivational Orientation: American Educational Research Journal. https://doi.org/10.3102/00028312029004777.
Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement.* Routledge.
Huebner, E. S., & Gilman, R. (2007). Students who like and dislike school. *Applied Research in Quality of Life, 1*(2), 139–150. https://doi.org/10.1007/s11482-006-9001-3
Ilardi, B. C., Leone, D., Kasser, T., & Ryan, R. M. (1993). Employee and supervisor ratings of motivation: main effects and discrepancies associated with job satisfaction and adjustment in a factory setting1. *Journal of Applied Social Psychology, 23*(21), 1789–1805. https://doi.org/10.1111/j.1559-1816.1993.tb01066.x
Jang, H., Kim, E. J., & Reeve, J. (2012a). Longitudinal test of self-determination theory's motivation mediation model in a naturally occurring classroom context. *Journal of Educational Psychology, 104*(4), 1175–1188. https://doi.org/10.1037/a0028089
Jang, H., Kim, E. J., & Reeve, J. (2012b). Longitudinal test of self-determination theory's motivation mediation model in a naturally occurring classroom context. *Journal of Educational Psychology, 104*(4), 1175–1188. https://doi.org/10.1037/a0028089
Jang, H., Kim, E. J., & Reeve, J. (2016). Why students become more engaged or more disengaged during the semester: A self-determination theory dual-process model. *Learning and Instruction, 43*, 27–38. https://doi.org/10.1016/j.learninstruc.2016.01.002
Jang, H., Reeve, J., Ryan, R. M., & Kim, A. (2009). Can self-determination theory explain what underlies the productive, satisfying learning experiences of collectivistically oriented Korean students? *Journal of Educational Psychology, 101*(3), 644–661. https://doi.org/10.1037/a0014241
Katz, I., Kaplan, A., & Gueta, G. (2009). Students' needs, teachers' support, and motivation for doing homework: A cross-sectional study. *The Journal of Experimental Education, 78*(2), 246–267. https://doi.org/10.1080/00220970903292868
Kurdi, V., & Archambault, I. (2020). Self-perceptions and engagement in low-socioeconomic elementary school students: The moderating effects of immigration status and anxiety. *School Mental Health, 12*(2), 400–416. https://doi.org/10.1007/s12310-020-09360-3
Kurdi, V., Archambault, I., Brière, F. N., & Turgeon, L. (2018). Need-supportive teaching practices and student-perceived need fulfillment in low socioeconomic status elementary schools: The moderating effect of anxiety and academic achievement. *Learning and Individual Differences, 65*, 218–229. https://doi.org/10.1016/j.lindif.2018.06.002
Lazowski, R. A., & Hulleman, C. S. (2016). Motivation interventions in education: A meta-analytic review. *Review of Educational Research, 86*(2), 602–640. https://doi.org/10.3102/0034654315617832
Lepper, M. R., Corpus, J. H., & Iyengar, S. S. (2005). Intrinsic and extrinsic motivational orientations in the classroom: Age differences and academic correlates. *Journal of Educational Psychology, 97*(2), 184–196. https://doi.org/10.1037/0022-0663.97.2.184
Li, C., Ivarsson, A., Lam, L. T., & Sun, J. (2019). Basic psychological needs satisfaction and frustration, stress, and sports injury among university athletes: A four-wave prospective survey. *Frontiers in Psychology, 10*. ⟨https://www.frontiersin.org/article/10.3389/fpsyg.2019.00665⟩.
Liu, X., & Flick, R. (2019). The relationship among psychological need satisfaction, class engagement, and academic performance: Evidence from China. *Journal of Education for Business, 94*(6), 408–417. https://doi.org/10.1080/08832323.2018.1541855
Marsh, H. W. (1990). Confirmatory factor analysis of multitrait-multimethod data: The construct validation of multidimensional self-concept responses. *Journal of Personality, 58*(4), 661–692. https://doi.org/10.1111/j.1467-6494.1990.tb00249.x
Marshik, T., Ashton, P. T., & Algina, J. (2017). Teachers' and students' needs for autonomy, competence, and relatedness as predictors of students' achievement. *Social Psychology of Education, 20*(1), 39–67. https://doi.org/10.1007/s11218-016-9360-z
Martinek, D., Hofmann, F., & Kipman, U. (2016). Academic self-regulation as a function of age: The mediating role of autonomy support and differentiation in school. *Social Psychology of Education, 19*(4), 729–748. https://doi.org/10.1007/s11218-016-9347-9
McAuley, E., Duncan, T., & Tammen, V. V. (1989). Psychometric properties of the Intrinsic Motivation Inventory in a competitive sport setting: A confirmatory factor analysis. *Research Quarterly for Exercise and Sport, 60*(1), 48–58. https://doi.org/10.1080/02701367.1989.10607413
Milyavskaya, M., & Koestner, R. (2011). Psychological needs, motivation, and well-being: A test of self-determination theory across multiple domains. *Personality and Individual Differences, 50*(3), 387–391. https://doi.org/10.1016/j.paid.2010.10.029
Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & for the PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. b2535-b2535 *BMJ, 339*(jul21 1). https://doi.org/10.1136/bmj.b2535.
Molinari, L., & Mameli, C. (2018). Basic psychological needs and school engagement: A focus on justice and agency. *Social Psychology of Education, 21*(1), 157–172. https://doi.org/10.1007/s11218-017-9410-1
Mouratidis, A. A., Vansteenkiste, M., Sideridis, G., & Lens, W. (2011). Vitality and interest–enjoyment as a function of class-to-class variation in need-supportive teaching and pupils' autonomous motivation. *Journal of Educational Psychology, 103*(2), 353–366. https://doi.org/10.1037/a0022773
Müller, F. H., Thomas, A. E., Carmignola, M., Dittrich, A.-K., Eckes, A., Großmann, N., Martinek, D., Wilde, M., & Bieg, S. (2021). University Students' Basic Psychological Needs, Motivation, and Vitality Before and During COVID-19: A Self-Determination Theory Approach. *Frontiers in Psychology, 12*. ⟨https://www.frontiersin.org/article/10.3389/fpsyg.2021.775804⟩.
Ng, J. Y. Y., Ntoumanis, N., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-determination theory applied to health contexts: A meta-analysis. *Perspectives on Psychological Science, 7*(4), 325–340. https://doi.org/10.1177/1745691612447309
Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice. *Theory and Research in Education, 7*(2), 133–144. https://doi.org/10.1177/1477878509104318

Niemiec, C. P., & Ryan, R. M. (2013). What makes for a life well lived?. *Autonomy and its Relation to Full Functioning and Organismic Wellness*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199557257.013.0016
Oga-Baldwin, W. L. Q., & Nakata, Y. (2015). Structure also supports autonomy: Measuring and defining autonomy-supportive teaching in Japanese elementary foreign language classes: Structure also supports autonomy. *Japanese Psychological Research, 57*(3), 167–179. https://doi.org/10.1111/jpr.12077
Oga-Baldwin, W. L. Q., Nakata, Y., Parker, P., & Ryan, R. M. (2017). Motivating young language learners: A longitudinal model of self-determined motivation in elementary school foreign language classes. *Contemporary Educational Psychology, 49*, 140–150. https://doi.org/10.1016/j.cedpsych.2017.01.010
Olivier, E., Archambault, I., & Dupéré, V. (2020). Do needs for competence and relatedness mediate the risk of low engagement of students with behavior and social problem profiles? *Learning and Individual Differences, 78*, Article 101842. https://doi.org/10.1016/j.lindif.2020.101842
Orkibi, H., & Ronen, T. (2017). Basic psychological needs satisfaction mediates the association between self-control skills and subjective well-being. *Frontiers in Psychology, 8*. ⟨https://www.frontiersin.org/article/10.3389/fpsyg.2017.00936⟩.
Orpana, H., Pearson, C., Dopko, R. L., & Kocum, L. (2019). Validation of the children's intrinsic needs satisfaction scale among Canadian youth: Psychometric properties,criterion-related validity and multitrait multimethodconfirmatory factor analysis. *Health Promotion and Chronic Disease Prevention in Canada, 39*(1), 25–32. https://doi.org/10.24095/hpcdp.39.1.03
Otis, N., Grouzet, F. M. E., & Pelletier, L. G. (2005). Latent motivational change in an academic setting: A 3-year longitudinal study. *Journal of Educational Psychology, 97*(2), 170–183. https://doi.org/10.1037/0022-0663.97.2.170
Owen, B., Smith, K., Lubans, J., Ng, D. R., Y. Y, J., & Lonsdale, C. (2014). Self-determined motivation and physical activity in children and adolescents: A systematic review and meta-analysis. *Preventive Medicine, 67*, 270–279. https://doi.org/10.1016/j.ypmed.2014.07.033
Patall, E. A., Pituch, K. A., Steingut, R. R., Vasquez, A. C., Yates, N., & Kennedy, A. A. U. (2019). Agency and high school science students' motivation, engagement, and classroom support experiences. *Journal of Applied Developmental Psychology, 62*, 77–92. https://doi.org/10.1016/j.appdev.2019.01.004
Pavot, W., & Diener, E. (1993). Review of the satisfaction with life scale. *Psychological Assessment, 5*(2), 164–172. https://doi.org/10.1037/1040-3590.5.2.164
Pitzer, J., & Skinner, E. (2017). Predictors of changes in students' motivational resilience over the school year: The roles of teacher support, self-appraisals, and emotional reactivity. *International Journal of Behavioral Development, 41*(1), 15–29.
Prenzel, M., Kramer, K., & Drechsel, B. (2001). Selbstbestimmt motiviertes und interessiertes Lernen in der kaufmännischen Erstausbildung—Ergebnisse eines Forschungsprojekts. En. In K. Beck, & V. Krumm (Eds.), *Lehren und Lernen in der beruflichen Erstausbildung* (pp. 37–61). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-663-10645-6_2.
Reeve, J. (2006). Teachers as facilitators: What autonomy-supportive teachers do and why their students benefit. *The Elementary School Journal, 106*(3), 225–236. https://doi.org/10.1086/501484
Reeve, J. (2009). Why teachers adopt a controlling motivating style toward students and how they can become more autonomy supportive. *Educational Psychologist, 44*(3), 159–175. https://doi.org/10.1080/00461520903028990
Reeve, J. (2013). How students create motivationally supportive learning environments for themselves: The concept of agentic engagement. *Journal of Educational Psychology, 105*(3), 579–595. https://doi.org/10.1037/a0032690
Reeve, J., & Cheon, S. H. (2021). Autonomy-supportive teaching: Its malleability, benefits, and potential to improve educational practice. *Educational Psychologist, 56*(1), 54–77. https://doi.org/10.1080/00461520.2020.1862657
Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004). Enhancing students' engagement by increasing teachers' autonomy support. *Motivation and Emotion, 28*(2), 147–169. https://doi.org/10.1023/B:MOEM.0000032312.95499.6f
Reeve, J., & Lee, W. (2019). A neuroscientific perspective on basic psychological needs. *Journal of Personality, 87*(1), 102–114. https://doi.org/10.1111/jopy.12390
Reeve, J., & Sickenius, B. (1994). Development and validation of a brief measure of the three psychological needs underlying intrinsic motivation: The Afs scales. *Educational and Psychological Measurement, 54*(2), 506–515. https://doi.org/10.1177/0013164494054002025
Ridenour, T. A., Greenberg, M. T., & Cook, E. T. (2006). Structure and validity of people in my life: A self-report measure of attachment in late childhood. *Journal of Youth and Adolescence, 35*(6), 1037–1053. https://doi.org/10.1007/s10964-006-9070-5
Riggenbach, A., Goubert, L., Van Petegem, S., & Amouroux, R. (2019, enero 6). Topical Review: Basic Psychological Needs in Adolescents with Chronic Pain—A Self-Determination Perspective [Review Article]. Pain Research and Management; Hindawi. ⟨https://doi.org/10.1155/2019/8629581⟩.
Rodríguez-Meirinhos, A., Antolín-Suárez, L., Brenning, K., Vansteenkiste, M., & Oliva, A. (2020). A Bright and a Dark Path to Adolescents' Functioning: The Role of Need Satisfaction and Need Frustration Across Gender, Age, and Socioeconomic Status. *Journal of Happiness Studies, 21*(1), 95–116. https://doi.org/10.1007/s10902-018-00072-9
Ryan, R. M. (1991). The Nature Of The Self In Autonomy And Relatedness. In J. Strauss, & G. R. Goethals (Eds.), *The Self: Interdisciplinary Approaches* (pp. 208–238). Springer. https://doi.org/10.1007/978-1-4684-8264-5_11.
Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*(5), 749–761. https://doi.org/10.1037/0022-3514.57.5.749
Ryan, R. M., & Deci, E. L. (2000a). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68
Ryan, R. M., & Deci, E. L. (2000b). Intrinsic aNd Extrinsic Motivations: ClasSic Definitions And New Directions. *Contemporary Educational Psychology, 25*(1), 54–67. https://doi.org/10.1006/ceps.1999.1020
Ryan, R. M., & Deci, E. L. (2002). Overview of self-determination theory: An organismic-dialectical perspective. *En Handbook of self-determination research* (pp. 3–33). University of Rochester Press.
Ryan, R. M., & Deci, E. L. (2006). Self-regulation and the problem of human autonomy: Does psychology need choice, self-determination, and will? *Journal of Personality, 74*(6), 1557–1586. https://doi.org/10.1111/j.1467-6494.2006.00420.x
Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Press.
Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*. , Article 101860. https://doi.org/10.1016/j.cedpsych.2020.101860
Šakan, D., Žuljević, D., & Rokvić, N. (2020). The role of basic psychological needs in well-being during the COVID-19 outbreak: A self-determination theory perspective. *Frontiers in Public Health, 8*. ⟨https://www.frontiersin.org/article/10.3389/fpubh.2020.583181⟩.
Salazar-Ayala, C. M., & Gastélum-Cuadras, G. (2020). Teoría de la autodeterminación en el contexto de educación física: Una revisión sistemática (Self-determination Theory in the Physical Education context: A systematic review). *Retos, 38*, 838–844. https://doi.org/10.47197/retos.v38i38.72729
Saugy, J. J., Drouet, O., Millet, G. P., & Lentillon-Kaestner, V. (2020). A systematic review on self-determination theory in physical education. *Translational Sports Medicine, 3*(2), 134–147. https://doi.org/10.1002/tsm2.121
Schmidt, A., Dirk, J., & Schmiedek, F. (2019). The importance of peer relatedness at school for affective well-being in children: Between- and within-person associations. *Social Development, 28*(4), 873–892. https://doi.org/10.1111/sode.12379
Schmidt, A., Neubauer, A. B., Dirk, J., & Schmiedek, F. (2020). The bright and the dark side of peer relationships: Differential effects of relatedness satisfaction and frustration at school on affective well-being in children's daily lives. *Developmental Psychology, 56*(8), 1532–1546. https://doi.org/10.1037/dev0000997
Senécal, C. B., Vallerand, R. J., & Vallières, E. F. (1992). Construction et validation de l'échelle de la qualité des relations interpersonnelles (ÉQRI). *Revue Européenne de Psychologie Appliquée, 42*(4), 315–322 (Scopus).
Sheldon, K. M., & Bettencourt, B. A. (2002). Psychological need-satisfaction and subjective well-being within social groups. *British Journal of Social Psychology, 41*(1), 25–38. https://doi.org/10.1348/014466602165036

Shih, S.-S. (2008). The relation of self- determination and achievement goals to Taiwanese eighth graders' behavioral and emotional engagement in schoolwork. *The Elementary School Journal, 108*(4), 313–334. https://doi.org/10.1086/528974

Simões, F., & Alarcão, M. (2013). Satisfação de necessidades psicológicas básicas em crianças e adolescentes: Adaptação e validação da ESNPBR. *Psicologia: Reflexão e Crítica, 26*(2), 261–269. https://doi.org/10.1590/S0102-79722013000200006

Simões, F., & Alarcão, M. (2014). Promoting well-being in school-based mentoring through basic psychological needs support: Does it really count? *Journal of Happiness Studies, 15*(2), 407–424. https://doi.org/10.1007/s10902-013-9428-9

Skinner, E., Furrer, C., Marchand, G., & Kindermann, T. (2008). Engagement and disaffection in the classroom: Part of a larger motivational dynamic? *Journal of Educational Psychology, 100*(4), 765–781. https://doi.org/10.1037/a0012840

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology, 85*(4), 571–581. https://doi.org/10.1037/0022-0663.85.4.571

Skinner, E. A., Chi, U., & The Learning-Gardens Educational As. (2012). Intrinsic motivation and engagement as "active ingredients" in garden-based education: Examining models and measures derived from self-determination theory. *The Journal of Environmental Education, 43*(1), 16–36. https://doi.org/10.1080/00958964.2011.596856

Snyder, C. R., & Lopez, S. J. (Eds.). (2002). *Handbook of positive psychology*. Oxford University Press.

Sturgess, J., Rodger, S., & Ozanne, A. (2016). A Review of the Use of Self-Report Assessment with Young Children: British Journal of Occupational Therapy. https://doi.org/10.1177/030802260206500302.

Tang, M., Wang, D., & Guerrien, A. (2020). A systematic review and meta-analysis on basic psychological need satisfaction, motivation, and well-being in later life: Contributions of self-determination theory. *PsyCh Journal, 9*(1), 5–33. https://doi.org/10.1002/pchj.293

Taylor, G., Jungert, T., Mageau, G. A., Schattke, K., Dedic, H., Rosenfield, S., & Koestner, R. (2014). A self-determination theory approach to predicting school achievement over time: The unique role of intrinsic motivation. *Contemporary Educational Psychology, 39*(4), 342–358. https://doi.org/10.1016/j.cedpsych.2014.08.002

Teixeira, D. S., Marques, M., & Palmeira, A. L. (2018). Associations between affect, basic psychological needs and motivation in physical activity contexts: Systematic review and meta-analysis. *Revista Iberoamericana de Psicología Del Ejercicio y El Deporte, 13*(2), 225–233.

Teixeira, P. J., Carraça, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity, 9*(1), 78. https://doi.org/10.1186/1479-5868-9-78

Tian, L., Chen, H., & Huebner, E. S. (2014). The longitudinal relationships between basic psychological needs satisfaction at school and school-related subjective well-being in adolescents. *Social Indicators Research, 119*(1), 353–372. https://doi.org/10.1007/s11205-013-0495-4

Tian, L., Han, M., & Huebner, E. S. (2014). Preliminary development of the Adolescent Students' Basic Psychological Needs at School Scale. *Journal of Adolescence, 37*(3), 257–267. https://doi.org/10.1016/j.adolescence.2014.01.005

Tian, L., Pi, L., Huebner, E. S., & Du, M. (2016). Gratitude and adolescents' subjective well-being in school: The multiple mediating roles of basic psychological needs satisfaction at school. *Frontiers in Psychology*, 7. https://doi.org/10.3389/fpsyg.2016.01409

Tian, L., Tian, Q., & Huebner, E. S. (2016). School-related social support and adolescents' school-related subjective well-being: The mediating role of basic psychological needs satisfaction at school. *Social Indicators Research, 128*(1), 105–129. https://doi.org/10.1007/s11205-015-1021-7

Tian, L., Zhang, X., & Huebner, E. S. (2018). The effects of satisfaction of basic psychological needs at school on children's prosocial behavior and antisocial behavior: The mediating role of school satisfaction. *Frontiers in Psychology, 9*, 548. https://doi.org/10.3389/fpsyg.2018.00548

Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In *Advances in Experimental Social Psychology* (Vol. 29, pp. 271–360). Elsevier. https://doi.org/10.1016/S0065-2601(08)60019-2

Van den Broeck, A., Ferris, D. L., Chang, C.-H., & Rosen, C. C. (2016). A review of self-determination theory's basic psychological needs at work. *Journal of Management, 42*(5), 1195–1229. https://doi.org/10.1177/0149206316632058

van Loon, A.-M., Ros, A., & Martens, R. (2012). Motivated learning with digital learning tasks: What about autonomy and structure? *Educational Technology Research and Development, 60*(6), 1015–1032. https://doi.org/10.1007/s11423-012-9267-0

Van Ryzin, M. J. (2011). Protective factors at school: reciprocal effects among adolescents' perceptions of the school environment, engagement in learning, and hope. *Journal of Youth and Adolescence, 40*(12), 1568–1580. https://doi.org/10.1007/s10964-011-9637-7

Vansteenkiste, M., & Ryan, R. M. (2013a). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration, 23*(3), 263–280. https://doi.org/10.1037/a0032359

Vansteenkiste, M., & Ryan, R. M. (2013b). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration, 23*(3), 263–280. https://doi.org/10.1037/a0032359

Vansteenkiste, M., Ryan, R. M., & Soenens, B. (2020). Basic psychological need theory: Advancements, critical themes, and future directions. *Motivation and Emotion, 44*(1), 1–31. https://doi.org/10.1007/s11031-019-09818-1

Vansteenkiste, M., Soenens, B., Verstuyf, J., & Lens, W. (2009). `What is the usefulness of your schoolwork?': The differential effects of intrinsic and extrinsic goal framing on optimal learning. *Theory and Research in Education, 7*(2), 155–163. https://doi.org/10.1177/1477878509104320

Varni, J. W., Limbers, C. A., & Burwinkle, T. M. (2007). How young can children reliably and validly self-report their health-related quality of life?: An analysis of 8,591 children across age subgroups with the PedsQLTM 4.0 Generic Core Scales. *Health and Quality of Life Outcomes, 5*(1), 1. https://doi.org/10.1186/1477-7525-5-1

Vasconcellos, D., Parker, P. D., Hilland, T., Cinelli, R., Owen, K. B., Kapsal, N., Lee, J., Antczak, D., Ntoumanis, N., Ryan, R. M., & Lonsdale, C. (2020). Self-determination theory applied to physical education: A systematic review and meta-analysis. *Journal of Educational Psychology, 112*(7), 1444–1469. https://doi.org/10.1037/edu0000420

Véronneau, M., Koestner, R. F., & Abela, J. R. Z. (2005). Intrinsic need satisfaction and well–being in children and adolescents: An application of the self–determination theory. *Journal of Social and Clinical Psychology, 24*(2), 280–292. https://doi.org/10.1521/jscp.24.2.280.62277

Wang, C. K. J., Liu, W. C., Kee, Y. H., & Chian, L. K. (2019). Competence, autonomy, and relatedness in the classroom: Understanding students' motivational processes using the self-determination theory. *Heliyon, 5*(7), Article e01983. https://doi.org/10.1016/j.heliyon.2019.e01983

Wang, J. C. K., Ng, B. L. L., Liu, W. C., & Ryan, R. M. (2016). Can Being Autonomy-Supportive in Teaching Improve Students' Self-Regulation and Performance. In W. C. Liu, J. C. K. Wang, & R. M. Ryan (Eds.), *Building Autonomous Learners* (pp. 227–243). Singapore: Springer. https://doi.org/10.1007/978-981-287-630-0_12.

Wang, M.-T., & Holcombe, R. (2010). Adolescents' perceptions of school environment, engagement, and academic achievement in middle school. *American Educational Research Journal, 47*(3), 633–662. https://doi.org/10.3102/0002831209361209

Wang, Y., Tian, L., & Scott Huebner, E. (2019). Basic psychological needs satisfaction at school, behavioral school engagement, and academic achievement: Longitudinal reciprocal relations among elementary school students. *Contemporary Educational Psychology, 56*, 130–139. https://doi.org/10.1016/j.cedpsych.2019.01.003

Warburton, V. E., Wang, J. C. K., Bartholomew, K. J., Tuff, R. L., & Bishop, K. C. M. (2020). Need satisfaction and need frustration as distinct and potentially co-occurring constructs: Need profiles examined in physical education and sport. *Motivation and Emotion, 44*(1), 54–66. https://doi.org/10.1007/s11031-019-09798-2

Waterschoot, J., Vansteenkiste, M., & Soenens, B. (2019). The effects of experimentally induced choice on elementary school children's intrinsic motivation: The moderating role of indecisiveness and teacher–student relatedness. *Journal of Experimental Child Psychology, 188*, Article 104692. https://doi.org/10.1016/j.jecp.2019.104692

Wei, D., Zhang, D., He, J., & Bobis, J. (2019). The impact of perceived teachers' autonomy support on students' mathematics achievement: Evidences based on latent growth curve modelling (No Pagination Specified-No Pagination Specified) *European Journal of Psychology of Education*. https://doi.org/10.1007/s10212-019-00437-5.

Williams, D. R., Brule, H., Kelley, S. S., & Skinner, E. A. (2018). Science in the Learning Gardens (SciLG): A study of students' motivation, achievement, and science identity in low-income middle schools. *International Journal of STEM Education, 5*(1), 8. https://doi.org/10.1186/s40594-018-0104-9

Wray-Lake, L., Crouter, A. C., & McHale, S. M. (2010). Developmental patterns in decision-making autonomy across middle childhood and adolescence: European American parents' perspectives. *Child Development, 81*(2), 636–651. https://doi.org/10.1111/j.1467-8624.2009.01420.x

Wu, X. (2003). Intrinsic motivation and young language learners: The impact of the classroom environment. *System, 31*(4), 501–517. https://doi.org/10.1016/j.system.2003.04.001

Zhang, T., Solmon, M. A., Kosma, M., Carson, R. L., & Gu, X. (2011). Need Support, Need Satisfaction, Intrinsic Motivation, and Physical Activity Participation among Middle School Students. *Journal of Teaching in Physical Education, 30*(1), 51–68. https://doi.org/10.1123/jtpe.30.1.51

Zhong, M., Huebner, E. S., & Tian, L. (2020). Gender-specific trajectories of depressive symptoms in chinese children: Relations with basic psychological needs satisfaction at school. *Journal of Abnormal Child Psychology, 48*(10), 1367–1378. https://doi.org/10.1007/s10802-020-00674-z

Zhou, J., Huebner, E. S., & Tian, L. (2020). The reciprocal relations among basic psychological need satisfaction at school, positivity and academic achievement in Chinese early adolescents. *Learning and Instruction, 71*, Article 101370. https://doi.org/10.1016/j.learninstruc.2020.101370