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Research Article

A Meta-Analytic Investigation of the Relationship between Basic Psychological Need Satisfaction and Affect

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Abstract

Self Determination Theory proposes that psychological needs satisfaction is associated with high positive affect and low negative affect. The present study consolidated effect sizes from previous research on the relationship of satisfaction of autonomy, competence and relatedness needs with positive affect and negative affect, and identified moderators of the relationships. The basic need satisfaction and positive affect meta-analyses included 16 samples for autonomy, 16 for competence, and 16 for relatedness, with 7335, 6832, and 6710 participants, respectively. Across studies, higher positive affect was significantly associated with greater autonomy satisfaction (r=.39), competence satisfaction (r=.45), and relatedness satisfaction (r=.39). The basic need satisfaction and negative affect meta-analyses included 11 samples for autonomy, 13 for competence, and 11 for relatedness, with 5114 participants, 5481 participants, and 5114 participants, respectively. Across studies, lower negative affect was significantly associated with greater autonomy satisfaction (r=-.30), competence satisfaction (r=-.33), and relatedness satisfaction (r=-.30). Moderator analyses found that gender composition, sample type, and basic need satisfaction measure were related to the strength of associations.

Keywords: Affect, self-determination theory, autonomy, competence, relatedness

Self-determination is a theory of human motivation which posits three universal basic psychological needs (Deci & Ryan, 2000). These are the need for autonomy, the need for competence, and the need for relatedness. Some theorists and researchers have proposed that fulfilling the basic psychological needs leads to well-being and growth, and by extension increased positive emotional states and decreased negative emotional states (Chang, Huang, & Lin, 2015; Ryan & Deci, 2000). Although much research has examined the theory, no previous study has evaluated this fundamental premise by consolidating and quantifying observed relationships between basic psychological needs and affect.

Self-Determination Theory and Basic Needs Satisfaction

Self-determination Theory conceptualises human motivation as being driven by external or internal factors (Ryan & Deci, 2002; Deci & Ryan, 1985). Intrinsic motivation is an important type of internal motivation. Central to intrinsic motivation is satisfaction of the three innate basic psychological needs of autonomy, competence, and relatedness (Ryan & Deci, 2002; Deci & Vansteenkiste, 2004). Autonomy involves having a sense of volition in determining one's behaviour (Ryan & Deci, 2008). Competence consists of the experience of feeling capable and effective when interacting with one's environment (Church, et al.,

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2013; Ryan & Deci, 2000). Relatedness involves feeling a sense of support and connection with others (Ryan & Deci, 2002).

Satisfaction of the basic needs of autonomy, competence, and relatedness has been associated with a variety of beneficial characteristics (Johnston & Finney, 2010). These characteristics include self-esteem (e.g. Thøgersen-Ntoumani & Ntoumanis, 2007), authentic self (Heppner et al., 2008), aspirations (e.g. Niemiec, Ryan, & Deci, 2009), satisfaction with life (e.g. Meyer, Enstrom, Harstveit, Bowles, & Beevers, 2007), reduced anxiety (e.g. Deci et al., 2001), reduced burnout (Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011), and decreases in depressive symptomology (e.g. Wei, Philip, Shaffer, Young, & Zakalik, 2005). In addition, degree of satisfaction of the basic needs on a daily basis has been associated with fluctuations in emotional well-being outcomes (Deci et al., 2001; Reis, Sheldon, Gable, Roscoe, & Ryan 2000). A composite basic needs satisfaction score has also been found to be associated with increased positive affect (Demir & Davidson, 2013; Pope and Hall, 2015), and decreased negative affect (Demir & Davidson, 2013). In the education/schooling context, a large body of research (e.g., Reeve, 2009; Ryan & Deci, 2000; Wang, Liu, Kee, & Chian, 2019), has established a relationship between student self-determination or basic need fulfilment and positive learning outcomes. Finally, satisfaction of the basic needs has been used to predict motivation for positive behaviours, such as exercise (Kirkland, Karlin, Stellino, & Pulos, 2011), task effort (Deci et al., 2001), and athlete engagement (De Francisco, Arce, Sanchez-Romero, & Vilchez, 2018).

Positive and Negative Affect

Positive affect is the subjective experience of positive sentiments, sensations, and emotions (Sidi, Ackerman & Erez, 2017). Positive affect is also characterised by positive mood states such as joy, interest, confidence, energy, enthusiasm, and alertness (Sin, Moskowitz, & Whooley, 2015). Negative affect is also a subjective experience; it encompasses negative sentiments, sensations, and emotions. Negative mood states which are components of negative affect are disgust, anger, distress, guilt, shame, fear, and contempt (Koch, Forgas & Matovic, 2013). Positive and negative affect do not lie on opposite ends of a single continuum. The constructs are relatively independent (Larsen, Hershfield, Stastny, & Hester, 2017; Schmukle, Egloff & Burns, 2002).

When a basic psychological need is met, positive emotional states may increase, and negative emotional states may decrease. For example, when the need for autonomy is met, the demands or pressure to act in a certain way decrease. This may lead to increased feelings of contentment and joy, and decreased feelings of fear and contempt (Deci & Ryan, 1995; Patall, Cooper, & Robinson, 2008; Sheldon, Ryan, & Reis 1996). When the need for competency is met, a feeling of mastery pervades interactions with one's environment. This mastery may lead to positive experiences such as confidence, self-efficacy and energy, and the reduction of negative emotional states such as distress, shame, or guilt (Bandura, Pastorelli, Barbaranelli, & Caprara, 1999). When the need for relatedness is met, individuals may feel that they have a secure interpersonal base (Chang, Huang, & Lin, 2015). This may lead to an increase in positive experiences and emotions such as joy and pride, and a reduction in negative feelings of loneliness and anger (Chang, Huang, & Lin, 2015; Mikulincer, & Shaver, 2007).

Satisfaction of the basic needs (autonomy, competence, relatedness) may facilitate the development of positive affect and the reduction of negative affect. A number of studies have examined this association between basic needs satisfaction and positive affect and negative affect. These studies examined the association across differing populations, such as employees (e.g., Vandercammen, Hofmans, & Theuns, 2013), athletes (e.g., Podlog, Lochbaum, & Stevens, 2010), students (e.g., Tian, Chen, & Huebner 2014; Martela & Ryan, 2016), in samples with high percentages of men (e.g., Kim, 2016) or women (e.g., Kashdan, Mishra, Breen, & Froh 2009), and in samples with young (e.g., Tian, Chen, & Huebner, 2014) or older (e.g., Sylvester et al., 2014) mean ages. When assessing basic needs satisfaction, these studies have used varied measures such as the Basic Psychological Needs Scale (Gagne, 2003) or the Balanced Measure of Psychological Needs (Sheldon & Hilpert, 2012) and in the assessment of affect through measures such as Positive Affect Negative Affect Scale (Watson, Clark, & Tellegen, 1998) and the Questionnaire on the Experience and Evaluation of Work (Van Veldhoven & Meijman, 1994). Studies assessing the association of satisfaction of each of the basic needs (autonomy, competence, relatedness) and affect have found varying effect sizes. Therefore, the overall sizes of the effect between the basic needs and affect are unknown. A meta-analysis can provide these overall effect sizes. Affect was chosen as a construct to focus upon due to

the number of studies available and the potential for this variable to underlay the development positive attributes. According to the Broaden and Build Theory, positive affect may lead individuals to increase engagement with their environment and pursue wider social, familial, and educational involvement, possibly underlying or leading to the development of some of the aforementioned beneficial characteristics.

Purpose of the Investigation

The purpose of the current meta-analytic investigation was to consolidate the results of studies investigating the association between satisfaction of basic psychological needs (autonomy, competence, relatedness) with positive affect; and satisfaction of basic psychological needs with negative affect. The results of this investigation could serve as the foundation for the development of future positive psychology research. This research is correlational in nature and cannot establish causality, however, future research may use this study as the foundation for research to establish causality; which could lead to subsequent interventions aimed at utilising basic needs satisfaction to increase positive affect and decrease negative affect. The meta-analysis examined the hypotheses that across studies a high level of basic psychological needs satisfaction would be associated with high levels of positive affect and high levels of basic psychological needs satisfaction would be associated with low levels of negative affect. Exploratory meta-analytic moderator analyses investigated aspects of the studies that might relate to the strength of the association, and thus, conditions that might relate to future interventions, between basic psychological needs satisfaction and positive affect; and basic psychological needs satisfaction and negative affect.

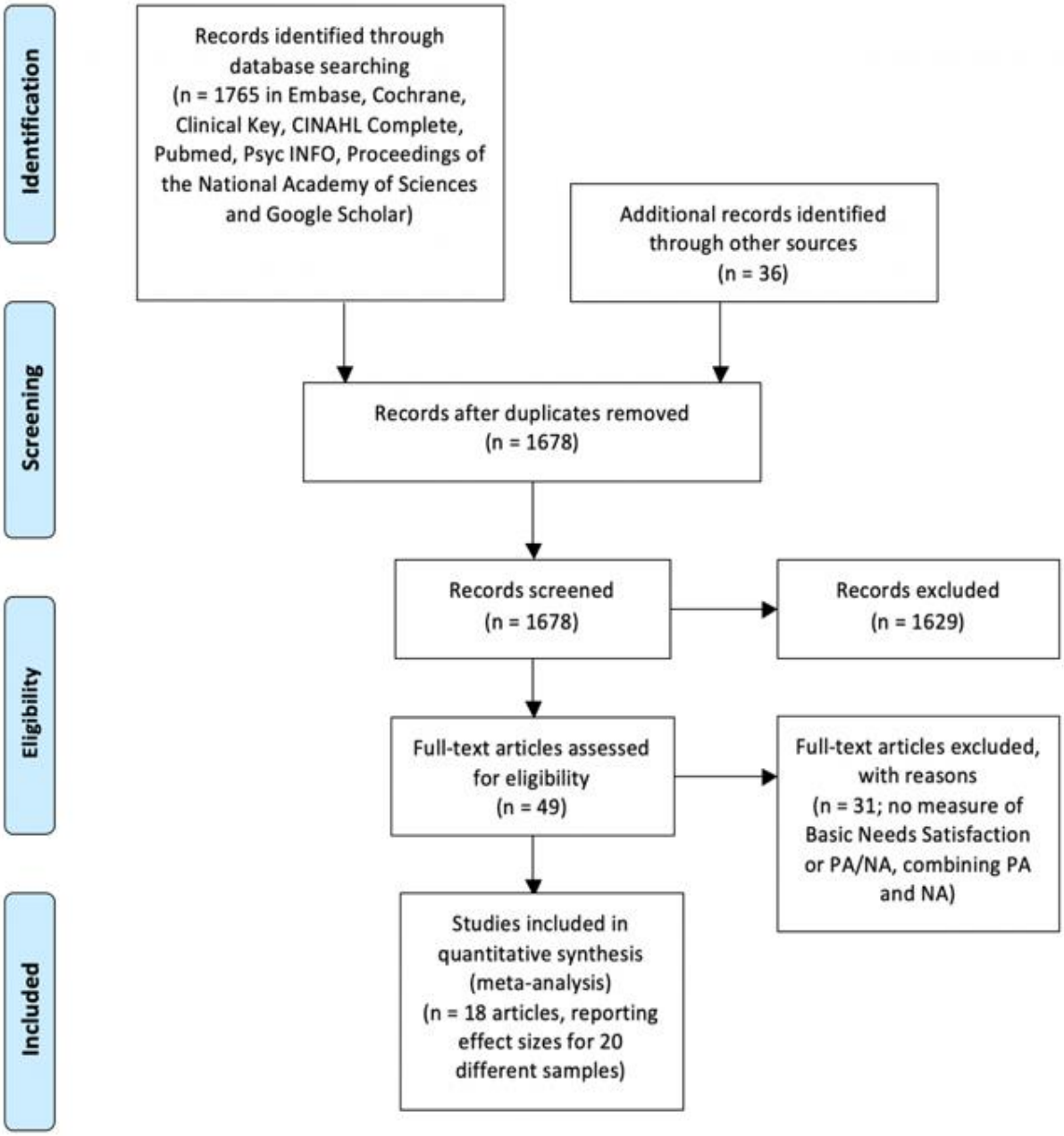

Figure 1. PRISMA flow chart detailing the process of identification, screening, excluding and including for the meta-analysis

Specifically, mean age was assessed as a moderator because it may be that older individuals have had more opportunities to experience the reciprocal effects of basic need satisfaction and positive affect. Type of scale used was also assessed as a moderator as it was thought that some basic need satisfaction scales may be particularly sensitive basic need and affect relationship. Furthermore, previous research (Ayub, 2010) suggests that females have higher self-determination, which may lead to a stronger relationship between basic need satisfaction and positive affect, thus percent female was also assessed as a moderator.

Method

Studies met inclusion criteria when they (a) measured satisfaction of at least one of the three basic needs and positive affect or negative affect, and (b) provided sufficient statistical results, power and sample size across studies, to allow the calculation of an association effect size suitable for meta-analysis. The databases that we searched for studies reporting this information, in March and April of 2019, were Embase, Cochrane, Clinical Key, CINAHL Complete, Pubmed, Psyc INFO, Proceedings of the National Academy of Sciences and Google Scholar. Due to the volume of results, searches were conducted using the "in the title" or "subject" function. The search terms employed were basic psychological needs or basic psychological needs satisfaction or autonomy or competence or relatedness or cognitive evaluation theory or needs satisfaction or basic needs and affect or positive affect or negative affect or PANAS or subjective well-being or emotion. Reference lists of the articles which related to basic psychological needs satisfaction and affect were also searched to find additional studies. Authors of published articles included in the current meta-analysis were contacted in a search for grey literature that would be suitable for the current study. No suitable grey literature was found using this method. The reasons for excluding studies were that an article mentioned basic needs satisfaction or any of the individual needs of autonomy, competence, relatedness and positive and/or negative affect; however, there was no measurement of the variables; or there was a combining of the positive and negative affect variables. Figure 1 details a flowchart of the search process and the number of resulting samples in the current meta-analysis.

The studies that were included in the meta-analyses were coded on (1) the effect size for the association between autonomy, competence, relatedness and positive affect and/or negative affect, (2) *N*, (3) sample mean age, (4) percentage of females included in each sample, (5) whether the effect size was related to autonomy, competence, or relatedness, (6) name of basic needs satisfaction scale, (7) name of affect scale, (8) defining characteristic of sample population (athlete, employee, student, or mixed), (9) if the effect was associated with positive or negative affect, and (10) if the research had been published in a peer reviewed journal. Mean age, percent female, scale utilised and sample characteristics were assessed as moderators to identify aspects of studies that may influence the relationships between satisfaction of basic needs and affect.

Effect sizes for all studies were based on cross-sectional designs, convenience samples, and for the most part established measures of basic psychological needs satisfaction and positive or negative affect which had proved reliable in prior testing. For example, the Basic Psychological Needs Scale has demonstrated reliability (autonomy, α = .81, competence α = .86, relatedness α = .90; Kashdan et al., 2009), Basic Psychological Needs at School Scale (autonomy, α = .85, competence, α = .80, relatedness, α = .77; Tian, Chen, & Huebner, 2014), need for competence satisfaction (α = .88; Schuler et al., 2011), and the PANAS (α_{PA} = .89 and α_{NA} = .85; Watson et al., 1988). Thus, study quality was similar for all studies and was not coded. Some meta-analyses adjust effect sizes for the reliability of measures (Kohler, Cortina, Kurtessis, & Golz, 2015), which tends to inflate effect sizes and the decision was made not to make this adjustment for the present meta-analysis.

Independent coding of a third of the studies included in the meta-analysis was conducted by two researchers. Inter-rater agreement for coding was 98%. The ratings on which there was not initial agreement, were discussed and consensus reached on the final coding.

Table 1. Characteristics of studies.

Study Sample	*N*	Mean age	% female	Population	BNS Scale	Affect Scale	Auto & PA Effect	Comp & PA Effect	Relate & PA Effect	Auto & NA Effect	Comp & PA Effect	Relate & PA Effect
Chang et al. (2015)	194	21	50	Student	GNSS	PANAS	0.32	0.25	0.27	-0.36	-0.22	-0.22
Church et al. (2013)	1384	21	57	Student	Other	PANAS	0.20	0.31	0.33	-0.14	-0.14	-0.23
Hammond et al (2015)	411	38	50	Employee	DMLS	PANAS	0.25					
Hicks and King (2009) sample one	150	20	70	Student	BSNS	Other	0.58					
Hicks and King (2009) sample two	95	20	75	Student	BSNS	Other	0.43					
Kashdan et al. (2009)	191	23	77	Student	BPNS	PANAS	0.50	0.58	0.44	-0.42	-0.46	-0.40
Kim (2016)	459	33	13	Employee	Other	Other	0.36					
Martela and Ryan (2016)	89	20	66	Student	BMPN	mDES	0.67	0.59	0.66			
Martela et al. (2018)	332	38	63	Mixed	BPNSPS	PANAS	0.52	0.55	0.43			
Podlog et al. (2010)	204	22	48	Athlete	NSS	PANAS	0.28	0.25	0.08	0.05	-0.10	-0.17
Reis et al. (2000)	67	NR	57	Student	Other	Other	0.28	0.52	0.53	-0.23	-0.37	-0.13
Schuler et al. (2013) sample one	165	37	53	Employee	NCS	PANAS		0.54			-0.44	
Schuler et al. (2013) sample two	202	22	86	Student	NCS	PANAS		0.47			-0.39	
Sheldon and Schüler (2011)	939	NR	55	Students	Other	Other	0.31	0.29	0.40			
Simsek and Koydemir (2012)	721	29	66	Mixed	BPNS	PANAS	0.18	0.32	0.23	-0.38	-0.39	-0.35
Sylvester et al. (2014)	498	34	66	Mixed	PNSE	SPANE	0.55	0.43	0.40	-0.29	-0.23	-0.32
Tian et al. (2014)	576	16	58	Student	BPNSS	ASWBSS	0.42	0.54	0.47	-0.29	-0.40	-0.32
Toth-Kiraly et al. (2018)	1094	26	68	Internet	BPNSFS	PANAS	0.53	0.61	0.37	-0.41	-0.49	-0.40
Vandercammen, et al. (2013)	72	37	48	Employee	BNSGS	QEEW	0.41	0.43	0.24	-0.36	-0.32	-0.22
Yang et al. (2018)	131	NR	56	Students	BMPN	PANAS	0.42	0.40	0.39	-0.47	-0.39	-0.38

Note: NR = Not Reported; GNSS = General Needs Satisfaction Scale; PANAS = Positive and Negative Affect Scale; DMLS = Decision Making Latitude Scale; BPNS = Basic Psychological Needs Scale; BMPN = Balanced Measure of Psychological Needs; BPNSFS = Basic Psychological Needs Satisfaction and Frustration Scale; mDES = Modified Differential Emotions Scale; NSS = Needs Satisfaction Scale. NCS = Need for Competence Scale. PNSE = Psychological Needs Satisfaction in Exercise. SPANE = Scale of Positive and Negative Experience. ASWBSS = Adolescents' Subjective Well-Being in School Scale. BPNSS = Basic Psychological Needs at School Scale. BNSGS = Basic Need Satisfaction in General Scale. Dutch Questionnaire on the Experience and Evaluation of Work.

The quantitative meta-analyses used *r* as the effect size. When a study reported more than one effect size for the association between autonomy, competence, and relatedness, and positive or negative affect, the effect sizes were averaged. Comprehensive Meta-Analysis Version 3.3 (CMA; Borenstein Hedges, Higgins, & Rothstein, 2014) was used to compute the overall weighted effect size for the association between autonomy, competence, and relatedness, and positive and negative affect. CMA software was also used to compute meta-regressions and moderator analyses. Because it was anticipated that effect sizes would vary and sample populations differed, it could not be expected that the effect would remain stable across studies. Consequently, in accordance with Borenstein, Hedges, Higgins, and Rothstein (2009), a random effects model was used.

Results

The Relationship Between Need Satisfaction and Positive Affect

To test the hypothesis that across studies a high level of basic needs satisfaction (for autonomy, competence, and relatedness respectively) would be associated with a high level of positive affect, three mean weighted effect sizes were calculated for each of the basic needs samples included in the meta-analysis (autonomy *k = 16*, competence *k = 16*, relatedness *k = 16*). These samples consisted of 7335 individuals for autonomy, 6832 individuals for competence, and 6710 individuals for relatedness.

The mean weighted effect size for autonomy was *r* =.39, 95% CI [0.32, 0.46], *p* <.001, for competence *r* =.45, 95% CI [0.37, 0.52], *p* <.001, and for relatedness *r* =.39, 95% CI [0.33, 0.44], *p* <.001. These results indicate that across samples greater basic needs satisfaction was associated with high levels of positive affect. Table 1 shows the effect sizes for each individual study, broken down into autonomy, competence, and relatedness. Figures 2 - 4 show a forest plot of weighted effect sizes for the relationship between each type of need satisfaction and positive affect.

The Relationship Between Need Satisfaction and Negative Affect

To test the hypothesis that across studies a high level of basic needs satisfaction (for autonomy, competence, and relatedness respectively) would be associated with a low level of negative affect, three mean weighted effect sizes were calculated for each of the basic needs samples included in the meta-analysis (autonomy *k = 11*, competence *k = 13*, relatedness *k = 11*). These samples consisted of 5114 individuals for autonomy, 5481 individuals for competence, and 5114 individuals for relatedness.

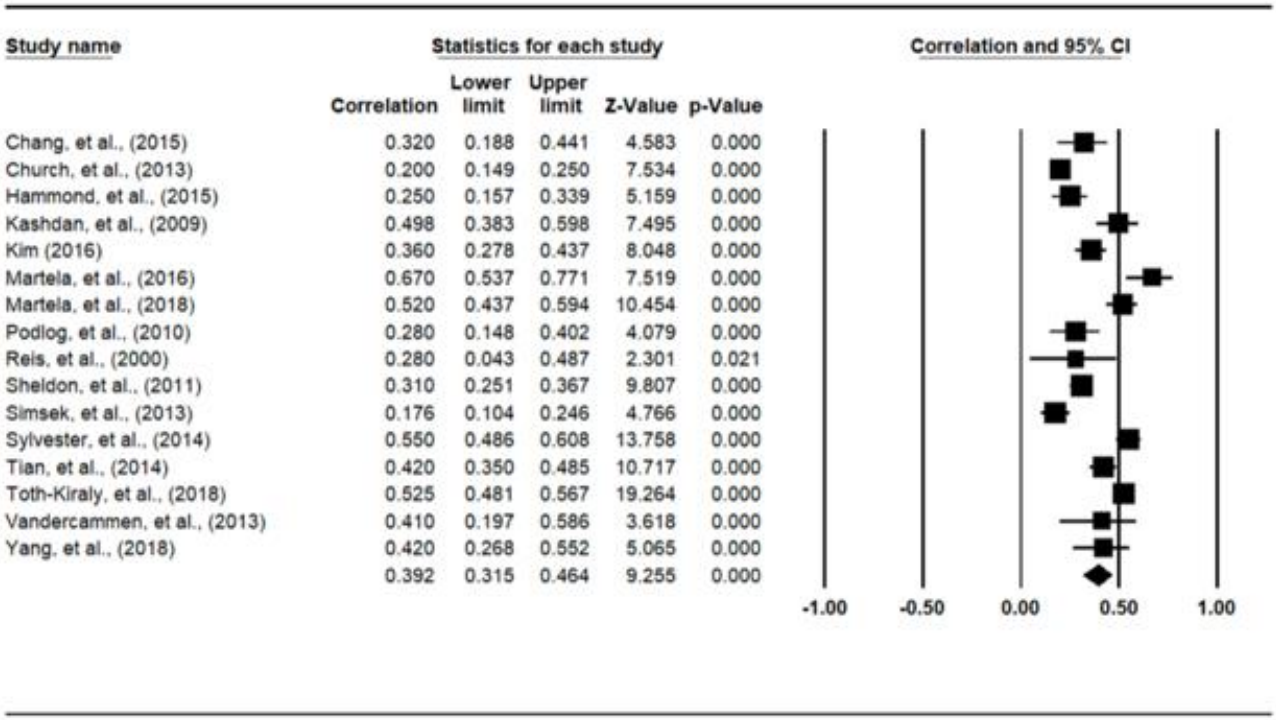

Figure 2. Random-effects model forest plot showing relative weights for effects of the association between autonomy and positive affect

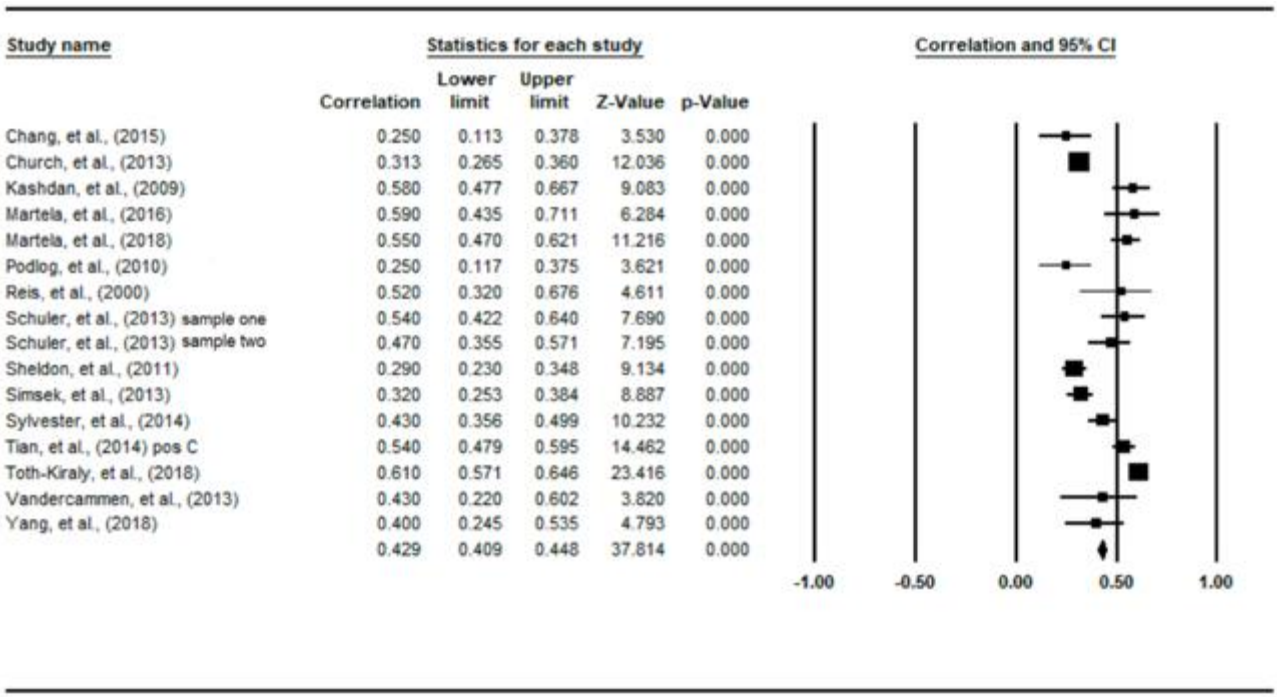

Figure 3. Random-effects model forest plot showing relative weights for effects of the association between competence and positive affect

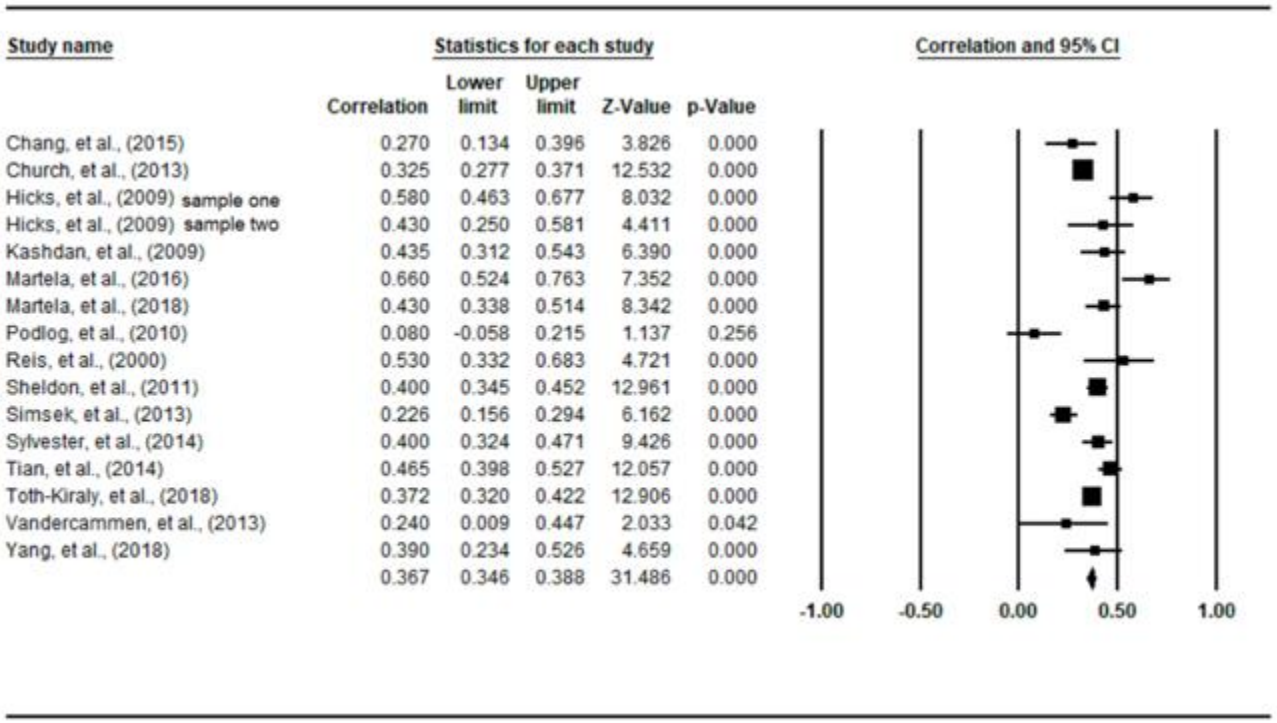

Figure 4. Random-effects model forest plot showing relative weights for effects of the association between relatedness and positive affect

The mean weighted effect size for autonomy was r = -.30, 95% CI [-.22, -.39], p <.001, for competence r = -.33, 95% CI [-.25, -.41], p <.001, and for relatedness r = -.30, 95% CI [-.25, -.35], p <.001. These results indicate that across samples greater basic needs satisfaction was associated with low negative affect. Table 1 shows the effect sizes for each individual study, broken down for autonomy, competence, and relatedness. Figures 5 - 7 show a forest plot of weighted effect sizes for basic needs satisfaction and negative affect.

The absolute confidence intervals only slightly overlapped for the associations between satisfaction of each of the three basic needs with positive affect with the confidence intervals between the three basic needs with negative affect. This suggests that the associations between basic need satisfaction and positive affect were

greater than the associations between basic need satisfaction and negative affect.

Publication Bias

A classic fail-safe N test (Rosenthal, 1979), Orwin's fail-safe (Orwin, 1983) and Duval and Tweedie's (2000) trim and fill procedure with funnel plot tested the six meta-analyses for publication bias. A fail-safe N indicates the number of studies needed, which find no association between the two variables, for the two-tailed *p*-value to exceed .05. For the analyses examining the relationship of need satisfaction with positive affect, 3998 studies focusing on autonomy and finding no association, 5087 studies focusing on competence and finding no association, and 3545 studies focusing on relatedness and finding no association would be needed to bring the *p*-values to >.05. For the analyses examining the relationship of need satisfaction with negative affect, 1104 studies focusing on autonomy and finding no association, 1705 studies focusing on competence and finding no association, and 1132 studies focusing on relatedness and finding no association would be needed to bring the *p*-values to >.05.

Orwin's fail-safe indicates the number of studies finding no significant relationship needed to bring each meta-analysis *r* to a small correlation of 0.10. For the analyses examining the relationship of need satisfaction with positive affect, the respective number of studies that would be needed to bring the meta-analytic *r* to 0.10 was 45 for autonomy, 58 for competence, and 46 for relatedness. For the analyses examining the relationship of need satisfaction with negative affect, the respective number of studies that would be needed to bring the meta-analytic *r* to -0.10 was 22 for autonomy, 30 for competence and 24 for relatedness. For all six analyses the funnel plots were symmetrical, and Duval and Tweedie's trim and fill found no missing studies, which suggested that there was no evidence of publication bias.

Heterogeneity Analyses and Moderators of the Effect Sizes of the Relationship Between Satisfaction of Each of the Three Needs and Affect

Q-tests were utilised to assess heterogeneity. The meta-analyses of the relationship between basic needs satisfaction and positive affect showed a significant Q-statistic, $Q(15) = 195.5$, $p < .001$ and an I^2 index of 92 for autonomy need satisfaction, a $Q(15) = 182.6$, $p < .001$, with an I^2 index of 92 for competence, and a $Q(15) = 84.9$, $p < .001$ and an I^2 index of 82 for relatedness. Similarly, the meta-analyses of the relationship between basic needs satisfaction and negative affect showed a significant Q-statistic, $Q(10) = 95.9$, $p < .001$ and an I^2 index of 82 for autonomy, a $Q(12) = 112.2$, $p < .001$ and an I^2 index of 89 for competence, and a $Q(10) = 34.7$, $p < .001$ and an I^2 index of 71 for relatedness. These results indicated that effect sizes varied significantly across studies. The I^2 index indicates that dispersion is not due to sampling error, but due to true effects. Therefore, the effect sizes were varied enough to warrant moderator analyses.

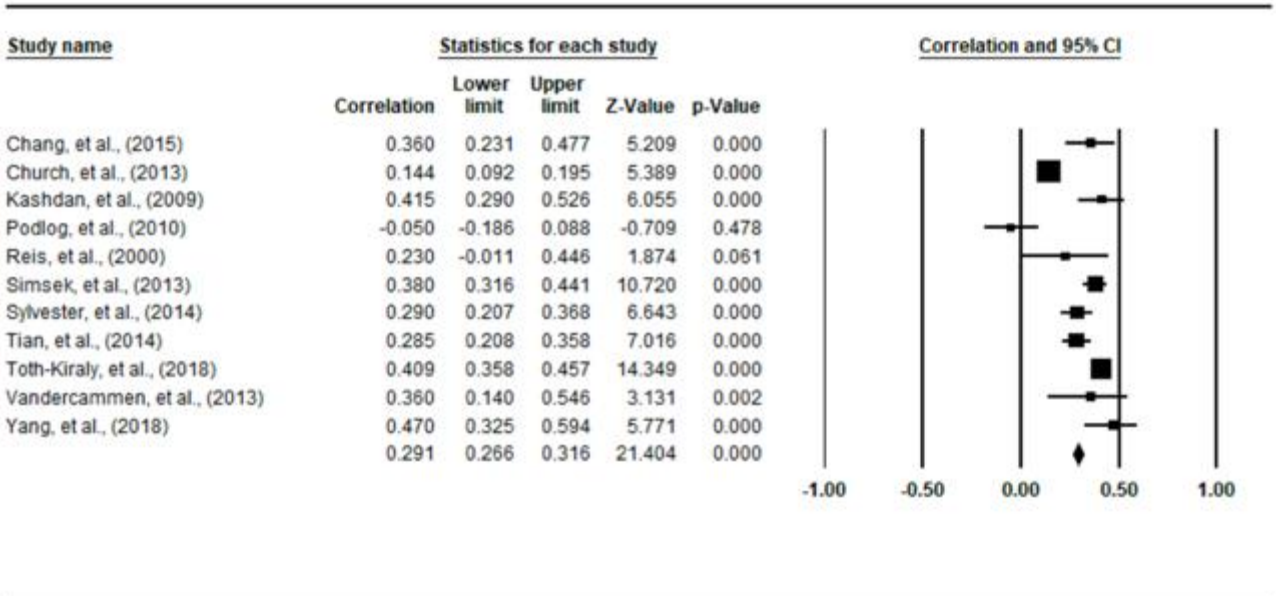

Figure 5. Random-effects model forest plot showing relative weights for effects of the association between autonomy and negative affect

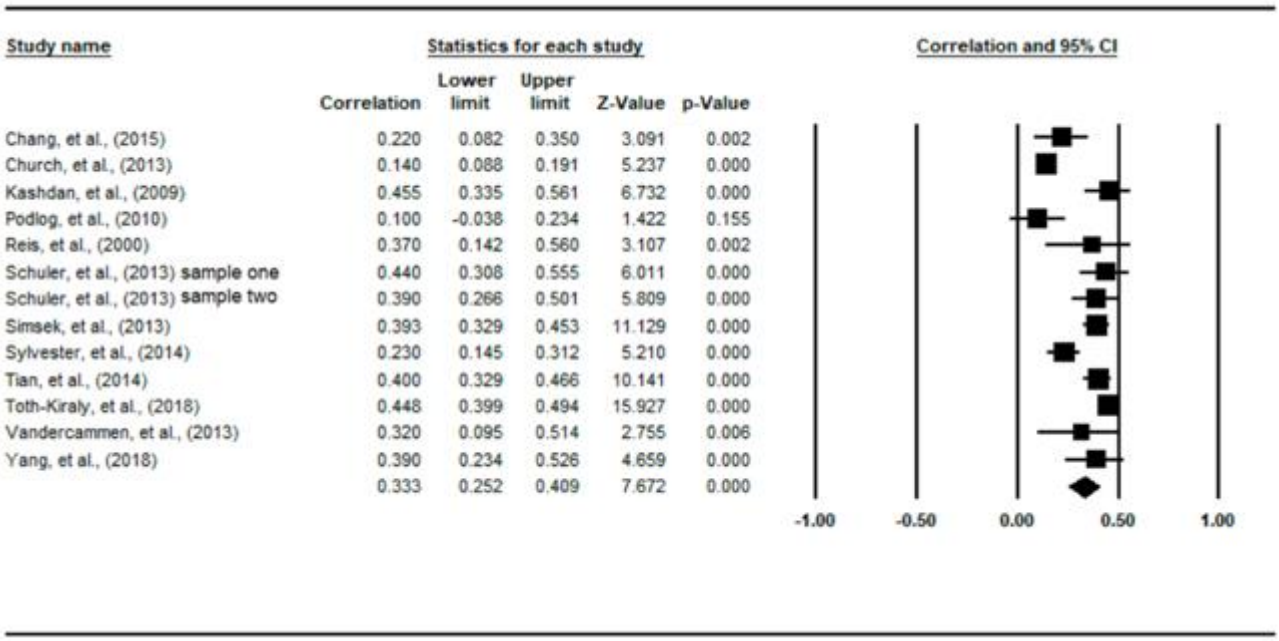

Figure 6. Random-effects model forest plot showing relative weights for effects of the association between competence and negative affect

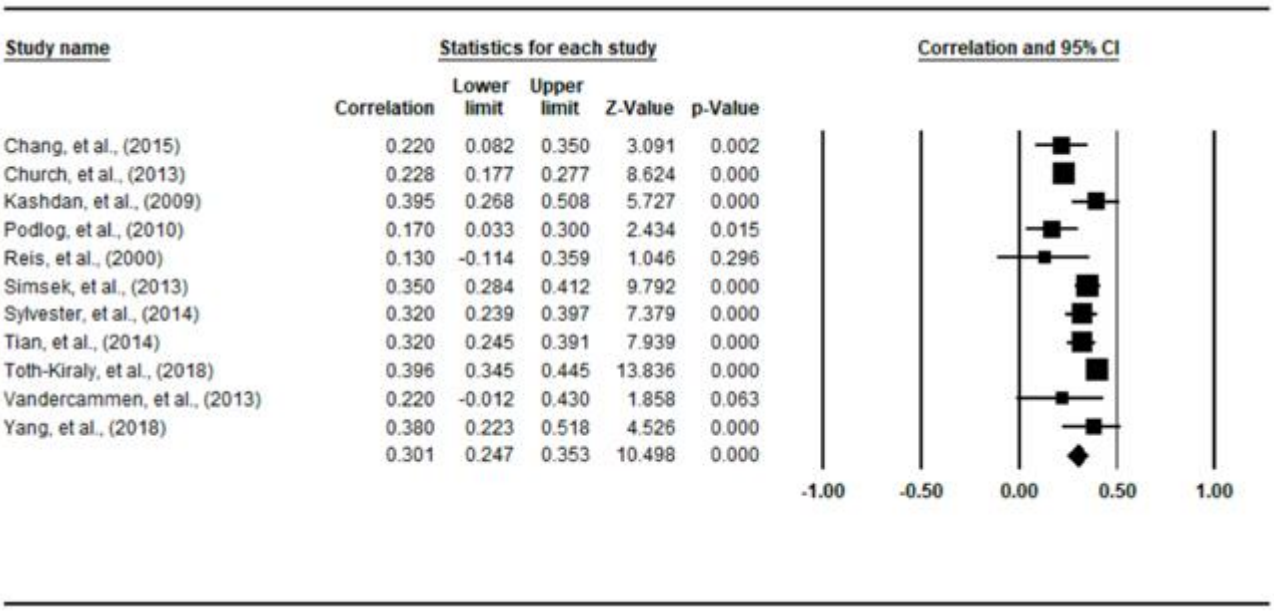

Figure 7. Random-effects model forest plot showing relative weights for effects of the association between relatedness and negative affect

For the meta-analytic effect sizes for the association between satisfaction of autonomy, competence, and relatedness needs with positive affect, method of moments meta-regression assessed the moderating effect of the percentage of female participants in each sample and the mean age of samples. Samples with a higher percentage of females showed a significantly larger effect size as follows: autonomy (slope = 0.006, *SE* = 0.002, 95% CI [0.001, 0.010], *p* = 0.01), competence (slope = 0.007, *SE* = 0.002, 95% CI [0.002, 0.011], *p* = 0.01), and relatedness (slope = 0.009, *SE* = 0.002, 95% CI [0.005, 0.013], *p* = 0.01). Samples which included participants with a higher mean age did not show significantly greater effect sizes. The results were as follows: autonomy (slope = 0.004, *SE* = 0.005, 95% CI [−0.005, 0.013], *p* = 0.35), competence (slope = 0.003, *SE* = 0.005, 95% CI [−0.007, 0.014], *p* = 0.52), and relatedness (slope = −0.006, *SE* = 0.005, 95% CI [−0.017, 0.002], *p* = 0.14).

For the meta-analytic effect sizes for the association of satisfaction of the three needs with negative affect, method of moments meta-regression also assessed the moderating effect of the percentage of female participants in each sample and the mean age of samples. Samples with a higher percentage of females showed a significantly larger effect size for the relationships of greater competency need satisfaction and relatedness need satisfaction with less negative

affect.

The results were as follows; autonomy (slope = 0.006, *SE* = 0.002, 95% CI [0.001, 0.010], *p* = 0.11), competence (slope = 0.005, *SE* = 0.002, 95% CI [0.001, 0.009], *p* = 0.01), and relatedness (slope = 0.006, *SE* = 0.002, 95% CI [0.003, 0.009], *p* = 0.01). Samples which included participants with a higher mean age did not show significantly greater effect sizes. The results were as follows: autonomy (slope = 0.001, *SE* = 0.007, 95% CI [−0.012, 0.015], *p* = 0.84), competence (slope = 0.002, *SE* = 0.005, 95% CI [−0.009, 0.005], *p* = 0.73), and relatedness (slope = −0.002, *SE* = 0.003, 95% CI [−0.010, 0.006], *p* = 0.56).

For the six meta-analyses, categorical moderator analyses examined the impact of the type of population, scale used to assess basic needs satisfaction, and scale used to assess affect. In order for there to be variance in the category, meta-analytic moderator analyses required a minimum of two effect sizes in each category. Table 2 and 3 show the results of these moderator analyses.

Studies using the Balanced Measure of Psychological Needs (BMPN) and Basic Psychological Need Satisfaction and Frustrations Scale (BPNSFS) showed significantly stronger associations between greater satisfaction of autonomy and competence needs with higher positive affect than studies using other basic needs scales. Studies using the Basic Psychological Needs Scale (BSNS) and Need for Competence Scale (NCS) showed especially strong associations between greater need satisfaction and lower negative affect.

Table 2. Moderator results for autonomy, competence, relatedness and positive affect

Moderator results for autonomy and positive affect

Category	*r*	95% CI	Z	P	K
Sample Type, *Q*(2) = 28.54, *p* = 0.001					
Employee	0.32	[0.23, 0.41]	6.50	0.001	3
Mixed	0.42	[0.15, 0.64]	3.00	0.003	3
Student	0.39	[0.29, 0.48]	7.30	0.001	8
Basic Needs Satisfaction measure, Q(3) = 73.17, *p* = 0.001					
BPNS	0.34	[0.00, 0.62]	1.94	0.053	2
BMPN	0.55	[0.26, 0.75]	3.44	0.001	2
Other	0.29	[0.20, 0.37]	6.30	0.001	4
BPNSFS	0.52	[0.49, 0.56]	21.92	0.001	2

Moderator results for competence and positive affect

Category	*r*	95% CI	Z	P	K
Sample Type, *Q*(2) = 47.63, *p* = 0.001					
Employee	0.51	[0.41, 0.60]	8.48	0.001	2
Mixed	0.44	[0.30, 0.55]	5.77	0.001	3
Student	0.42	[0.33, 0.55]	8.07	0.001	8
Basic Needs Satisfaction measure, Q(3) = 73.17, *p* = 0.001					
BPNS	0.46	[0.17, 0.67]	2.97	0.003	2
BMPN	0.50	[0.29, 0.66]	4.28	0.001	2
Other	0.31	[0.25, 0.39]	8.84	0.001	3
BPNSFS	0.59	[0.53, 0.64]	15.45	0.001	2
NCS	0.50	[0.42, 0.58]	10.50	0.001	2

Moderator results for relatedness and positive affect

Category	*r*	95% CI	Z	P	K
Sample Type, *Q*(1) = 24.70, *p* = 0.001					
Mixed	0.35	[0.22, 0.48]	4.84	0.001	3
Student	0.44	[0.37, 0.50]	11.73	0.001	10
Basic Needs Satisfaction measure, Q (3) = 73.17, *p* = 0.001					
BPNS	0.42	[0.23, 0.58]	4.20	0.001	4
BMPN	0.54	[0.22, 0.75]	3.14	0.002	2
Other	0.38	[0.30, 0.46]	8.46	0.001	3
BPNSFS	0.39	[0.34, 0.44]	13.23	0.001	2

Note. BPNS = Basic Psychological Needs Scale. BMPN = Balanced Measure of Psychological Needs. BPNSFS = Basic Psychological Need Satisfaction and Frustration Scale. Need for Competence Scale

For the meta-analyses between positive affect and competence, and negative affect and competence, samples with participants who were employees had a larger effect size than samples comprising a mix of participants or students.

Discussion

The meta-analysis consolidated findings from previous research on the associations between satisfaction of the basic needs for autonomy, competence, and relatedness with affect. For the three meta-analyses which consolidated the associations between the three components of basic needs satisfaction and positive affect, there were 16 samples for each meta-analysis, which comprised 7335 (autonomy), 6832 (competence), and 6710 (relatedness) individual participants. For the three meta-analyses which measured the associations between the three components of basic needs satisfaction and negative affect, there were 11 samples for autonomy and relatedness, and 13 samples for competence, which comprised 5114 (autonomy), 5481 (competence), and 5114 (relatedness) individual participants.

Across studies of the relationship between basic needs satisfaction with positive affect, there was a significant meta-analytic association between greater satisfaction of each of the basic needs with higher positive affect, with overall weighted effects of r = .39 for autonomy, r = .45 for competence, and r = .39 for relatedness. Across the relationship between basic needs satisfaction with negative affect, there was a significant meta-analytic association between greater satisfaction of each of the basic needs with less negative affect, with overall weighted effects of r = -.30 for autonomy, r = -.33 for competence, and r = -.30 for relatedness.

Table 3. Moderator results for autonomy, competence, relatedness and negative affect

Moderator results for autonomy and negative affect

Category	*r*	95% CI	Z	P	K
Sample Type, $Q(1) = 40.08$, $p = 0.001$					
Mixed	-0.34	[-0.25, -0.42]	7.00	0.001	2
Student	-0.32	[-0.20, -0.42]	5.20	0.001	6
Basic Needs Satisfaction measure, Q(3) = 73.17, $p = 0.001$					
BPNS	-0.39	[-0.33, -0.44]	12.30	0.001	2
Other	-0.15	[-0.09, -0.20]	5.66	0.001	2

Moderator results for competence and negative affect

Category	*r*	95% CI	Z	P	K
Sample Type, $Q(2) = 26.71$, $p = 0.001$					
Employee	-0.41	[-0.29, -0.51]	6.54	0.001	2
Mixed	-0.32	[-0.15, -0.47]	3.61	0.001	2
Student	-0.34	[-0.22, -0.45]	5.26	0.001	7
Basic Needs Satisfaction measure, Q(3) = 48.45, $p = 0.001$					
BPNS	-0.41	[-0.35, -0.46]	12.97	0.001	2
Other	-0.23	[-0.01, -0.44]	1.95	0.051	2
NCS	-0.41	[-0.32, -0.50]	8.34	0.001	2

Moderator results for relatedness and negative affect

Category	*r*	95% CI	Z	P	K
Sample Type, $Q(1) = 14.85$, $p = 0.005$					
Mixed	-0.34	[-0.29, -0.39]	12.25	0.001	2
Student	-0.29	[-0.22, -0.35]	7.80	0.001	6
Basic Needs Satisfaction measure, Q(3) = 48.45, $p = 0.001$					
BPNS	-0.36	[-0.30, -0.42]	11.33	0.001	2
Other	-0.22	[-0.17, -0.27]	8.70	0.001	2

Note. BPNS = Basic Psychological Needs Scale. NCS = Need for Competence Scale

Theoretical assumptions regarding basic needs satisfaction and affect are supported by the meta-analytic findings that across previously reported studies greater basic needs satisfaction is associated with more positive affect and less negative affect. Motivation fueled by basic needs that leads to desired outcomes that satisfy the need may result in positive emotional experiences. For example, if an individual is able to act autonomously rather than being directed by others, it may encourage positive feelings of contentment and decrease negative feelings (Patall, Cooper, & Robinson, 2008; Sheldon, Ryan, & Reis, 1996; Chang, Huang, & Lin, 2015). When an individual is able to develop competency in interactions with the environment, it may encourage positive feelings of self-efficacy and decrease negative feelings of shame (Bandura et al., 1999). When an individual is able to relate to others, it may encourage positive feelings of joy and decrease negative feelings of loneliness.

If an individual behaves in a way that satisfies basic needs and subsequently experiences increased positive emotions and decreased negative emotion, it is reasonable to expect that this may lead to a trajectory of further need satisfaction and beneficial emotion changes (Devloo, Anseel, De Beuckelaer, & Salanova, 2015; Gillison, Stangage, & Skevington, 2008). Thus, the constructs may be reciprocally related and mutually reinforcing (Tian et al., 2014). In the educational context, these results are in line with theoretical assumptions (Reeve, 2009; Ryan & Deci, 2000) that satisfaction of student basic needs leads to higher enjoyment or increased positive affect in the classroom. Higher enjoyment in the learning environment may then lead to more independent self-determined learners, once again revealing the reciprocally related and mutually reinforcing nature of the constructs (Wang, Liu, Kee, & Chian, 2019).

For the meta-analyses between competence and positive affect, and competence and negative affect, there was a significant difference in the weighted effect size for employees when compared to mixed and student samples. This finding may be viewed in light of the aforementioned reciprocal relationship (Devloo et al., 2015; Tian et al., 2014). For example, employees may be more likely to engage in work tasks in which they have developed a sense of competency and experience reinforcement stemming from increased positive affect and lessened negative affect. This may result in a continuing cycle of satisfaction of competency needs followed by desirable affect changes. Recent research may support this notion, Henning et al., (2019) found a decrease in the association between competence and positive affect after retirement. Hence, the continuing cycle of competence satisfaction may be diminished after an individual ceases work.

With the exception of the relationship between autonomy and negative affect, studies with a higher percentage of female participants had significantly stronger associations between need satisfaction and affect. This may be due to the large portion of students in the sample used for the current meta-analyses. For example, females tend to perform better than males within educational contexts (Chee, Pino & Smith, 2005) and this might lead to more satisfaction of competency needs. In addition to this, females have been found to have higher levels of self-determination (Ayub, 2010). Therefore, if a connection exists between basic needs satisfaction and positive affect and negative affect, females may be benefiting from the reciprocal effects of the interaction. The meta-analyses found no difference in strength of associations between younger and older participants.

Twelve different needs satisfaction scales were utilized across studies. Moderator analyses showed significant differences in the effect sizes of studies using different measures of basic needs satisfaction. For analyses of the relationship between basic needs satisfaction and positive affect, studies using the Balanced Measure of Psychological Needs (BMPN) and Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS), had significantly stronger effect sizes. The BMPN and BPNSFS scales are more balanced in terms of questions related to each need, and more domain specific, assessing domain specific need fulfilment and affect, than some other scales (Gagne, 2003; Sheldon & Hilpert, 2012). Therefore, treating self-determination and basic needs satisfaction as a multidimensional construct may help to more clearly capture features of basic needs satisfaction (Sheldon & Hilpert, 2012). In each meta-analysis the BMPN and BPNSFS scales were only used in two studies, thus these interpretations are tentative.

For the three meta-analyses between basic needs satisfaction and negative affect, the Basic Psychological Needs Satisfaction (BPNS) scale had significantly stronger effect sizes when compared to other scales. These other scales tended to be short scales that were devised by researchers to assess basic needs satisfaction and were generally not validated. For the competence and negative affect meta-analysis, the Need for Competence Scale (NCS) when compared to

"other" scales also had a significantly stronger association. The BPNS and NCS, being more extensively validated scales, may be more effective in capturing features of basic needs satisfaction that are particularly relevant to negative affect. Caution is also advised when interpreting this result as in each meta-analysis the BPNS and NCS scales were only used by two studies. Five different affect scales were employed across studies, with the majority utilising the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). Due to the PANAS being the only questionaire utilised more than once, moderator analyses were not performed for type of affect scale.

There are some limitations of the current research that should be considered when interpreting the results of the meta-analyses. All results were based on correlation research and therefore causation should not be inferred. Secondly, the overall weighted effect sizes were based upon studies currently available. Moderator results should be interpreted as quasi-experimental, as there was not random assignment within studies for participant type or measures. Future research might investigate further the role both of aspects of basic needs satisfaction in relation to affect and the psychometric properties of measures of basic needs satisfaction and affect in the context of their connections with each other.

Further basic needs satisfaction research may benefit from utilizing experimental methods to understand what aspects of satisfaction of autonomy, competence, and relatedness needs have the greatest impact upon positive and negative affect. This may include testing which might be the most beneficial online or in-person interventions leading to increases in positive affect and decreases in negative affect. Further, this may be beneficial in the educational setting to establish what aspect of the basic needs are particularly salient for students, in order to make the most of the reciprocally related and mutually reinforcing relationship between basic needs and affect. It may be useful to investigate the role of length of interventions in bringing about benefits. Once the cycle of reciprocal interactions between basic needs satisfaction and affect is better understood, the most salient aspects of autonomy, competence, and relatedness can be enhanced. For example, in relation to increasing positive affect and decreasing negative affect, enhancing relatedness may entail strengthening previously formed relationships or widening one's social circle or a mix of both. Understanding what aspects of basic needs satisfaction impacts upon affect will serve to make interventions drawing on basic needs satisfaction more effective.

In conclusion, the present investigation found that across studies there is a significant association between greater satisfaction of autonomy, competence, and relatedness needs with more positive affect; and between greater satisfaction of autonomy, competence, and relatedness needs with less negative affect. This research adds to the body of literature linking basic needs satisfaction and affect; and supports pre-existing theoretical assumptions.

Compliance with Ethical Standards

Ethical Approval

Ethical approval will not be required because this study will retrieve and synthesis data from already published studies.

Declaration of Conflicting Interests

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