International Journal Educational Psychology
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The Value of Pedagogical Preferences: A Case of Personality and Learning Environments in Higher Education

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Date of publication: October 24th, 2020
Edition period: October 2020 – February 2021

To cite this article: Davies, J. L., & Wilson, T. L. (2020). The Value of Pedagogical Preferences: A Case of Personality and Learning Environments in Higher Education**.** *International Journal of Educational Psychology*, 9(3), 269-289. doi: 10.17583/ijep.2020.5634

To link this article: http://dx.doi.org/10.17583/ijep.2020.5634

IJEP – International Journal of Educational Psychology Vol. 9 No.3 October 2020 pp. 269-289

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Abstract

To improve learning outcomes, research evidence has accumulated regarding the principles of teaching and learning; however, students' perceptions of teaching methods have received little scientific investigation toward enhanced quality of their learning. To provide a demonstration of the value of researching student perceptions of the learning environments in which they find themselves, a sample of preference ratings (n = 69) was examined to test the hypothesis there exist among the Five Factor personality dimensions correlates of preference ratings for three environments: teacher-led, independent-autonomous, and groups. Results confirmed preference for group learning in our sample and statistically reliable zero-order positive correlations between group-based learning preference and both extraversion and openness scores and between preference for teacher-led environments and openness scores. First-order correlations showed no significant changes in accounted preference variation when controlling the other personality factors scores. These findings are discussed with respect to likely social-cognitive and neurodevelopmental bases of group learning effectiveness and the utility of investigating student preferences for improving the quality of learning.

Keywords: teaching practices, personality type, group work, student preference

ISSN: 2014-3567
DOI: 10.17583/ijep.2020.5634

IJEP – International Journal of Educational Psychology Vol. 9
No. 3 October 2020 pp. 269-289

El Valor de las Preferencias Pedagógicas: Un Caso de Personalidad y Entornos de Aprendizaje en la Educación Superior

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Resumen

Para mejorar los resultados del aprendizaje, se han acumulado pruebas de investigación sobre los principios de la enseñanza y el aprendizaje; sin embargo, las percepciones de los estudiantes sobre los métodos de enseñanza han recibido poca investigación científica para mejorar la calidad de su aprendizaje. Para proporcionar una demostración del valor de investigar las percepciones de los estudiantes sobre los entornos de aprendizaje en los que se encuentran, se examinó una muestra de calificaciones de preferencia (n = 69) para probar la hipótesis que existe entre los correlatos de las dimensiones de personalidad de los Cinco factores de las calificaciones de preferencia para tres entornos: dirigido por el profesor, autónomo independiente y grupos. Los resultados confirmaron la preferencia por el aprendizaje en grupo en nuestra muestra y correlaciones positivas de orden cero estadísticamente confiables entre la preferencia de aprendizaje basada en el grupo y las puntuaciones de extraversión y apertura y entre la preferencia por entornos dirigidos por maestros y las puntuaciones de apertura. Las correlaciones de primer orden no mostraron cambios significativos en la variación de las preferencias contadas al controlar las puntuaciones de otros factores de personalidad. Estos hallazgos se discuten con respecto a las posibles bases socio-cognitivas y del desarrollo neurológico de la eficacia del aprendizaje grupal y la utilidad de investigar las preferencias de los estudiantes para mejorar la calidad del aprendizaje.

Palabras clave: prácticas docentes, tipo de personalidad, trabajo en grupo, preferencia del estudiante

ISSN: 2014-3567
DOI: 10.17583/ijep.2020.5634

A movement is afoot within educational psychology to not only add more knowledge of teaching and learning principles but to demonstrate the potential value of education research for enhancing the quality of student learning (Biggs & Tang, 2012; Entwistle, 2019). One step toward the goal of improving learning quality is to discover those teaching practices that are satisfying to the student. Educational psychology has long understood the varying ways students process information and their personal motivations to succeed (Biggs, 1987; Curry, 1983) and has been long successful in improving learning through evidence-based methodologies (e.g., Horak & Horak, 1982; Parent, Forward, Cantor, & Mohling, 1975). Historically as well, education research has uncovered beneficial relationships among personality factors and individual approaches to learning (e.g., Duff, Boyle, Dunleavy, & Ferguson, 2004), often called learning *styles* (Dunn, Dunn, & Price, 1989; Felder & Spurlin, 2005; Furnham, 1992; Honey & Mumford, 1992; Sternberg, Grigorenko, & Zhang, 2008; cf. Curry, 1990; Riener & Willingham, 2010).

While knowledge of these factors related to academic success has increased over the decades, little evidence has accumulated regarding the quality and meaningfulness to the student of their learning toward "action theories" immediately applicable by educators (Entwistle, 2019). However, learning preferences have been largely neglected by educational science and only investigated within limited academic contexts (e.g., Chamorro-Premuzic, Furnham, Dissout, & Heaven, 2005; Murphy, Gray, Straja, & Bogert, 2004), without reference to academic outcomes (e.g., Khine, Fraser, Afari, Oo, & Kyaw, 2017), or with limited generalizability (Costa, Ransberg, & Rushton, 2007). Given that previous research shows a paucity of formal investigations into student pedagogical preferences, our purpose was to provide exploratory data not previously obtained to indicate the usefulness of investigating student preferences toward the enhancement of learning quality. In other words, a rich matrix of psychological data is promised by an analysis of reported relative preferences over the kinds of learning environments that teachers provide them in higher education, toward the development of action theories for educators. This article reports our attempt to achieve a modest demonstration of the value of learning environment preferences using a correlational design to discover the linear relationships between students' preference ratings and their personality factor scores.

In the past achievement-focused research indicated enhanced academic performance to be a matter of matching the instructor's teaching methods to students' learning styles, or the ways they learn best (Dunn, Dunn, & Price, 1989; Kolb, 1984). In fact, it was suggested by Felder (1993) that for teachers to reach as many students as possible, a variety of teaching modalities should be used to accommodate the multiplicity of learning styles. But the matching approach was challenged in various reviews (e.g., Pashler, McDaniel, Rohrer, & Bjork, 2008) and by critiques (e.g., Riener & Willingham, 2010; Stander, Grimmer, & Brink, 2019) even while education research continued toward best practices by focusing on either side of the match. On the learning side, there has been an emphasis of theory and research on study process and motivation (Biggs, 1987; Biggs, Kember, & Leung, 2001; Lake, Boyd, & Boyd, 2017; Swanberg & Martinsen, 2010) and on levels of academic engagement (Johnson & Johnson, 2009; Skinner, Furrer, Marchand, & Kindermann, 2008). As for the teaching side, there has been particular interest in learning environments. Since the late 1990s, periodicals have targeted the environments, broadly defined, that teachers create and use within evidence-based practice. For example, recent studies have demonstrated enhanced student engagement as well as improved retention of information and increases in academic achievement within peer-group environments (see Vermette & Kline, 2017, for a review). Given this strong interest in the practical implications of learning environments, it would seem reasonable for quality teaching to discover whether there is value in knowing student preferences for them.

Learning environments are created within the variety of teaching modalities educators use and they are specified by the way information is delivered to the student and the social context of this delivery (Fraser, 2014; Friedman, & Alley, 1984; Mathews & Jones, 1994). Today's higher education employs a number of teaching modalities and a review of their relative effectiveness for student achievement is beyond the scope of the present research. For our purposes, three categories of teaching modality were stipulated on the assumption that modalities correspond to one of at least three logically separable learning environments created for the teacher's purposes. The first is *teacher-led* environments that include delivery of information in traditional lectures, small tutorial groups, one-to-one mentoring, and so on. Learning environments that are *independent* are distinguished by individual

student settings in which one learns autonomously. These may include individual study and independent achievement activities such as individual presentations, self-evaluations and, more recently, the flipped classroom (Jensen, Holt, Sowards, Ogden, & West, 2018). The third category includes the interactive learning environments created by educators who use *group-based* modalities (e.g., Frey, Fisher, & Everlove, 2009), including cooperative learning in workshops (Johnson & Johnson, 2009) and collaborations on products such as group presentations (Marton, 2015).

It is certainly true the concept of "group work" as a teaching modality is nothing new; practitioners and educationalists have appreciated the resourceful benefits of group-based learning environments and have incorporated it in their pedagogy for decades (Halpern & Hakel, 2003; Vygotsky, 1978), both in schools and universities (Ashman & Gillies, 2003) and across cultures (House, 2005). In a comparison study, 2nd grade students in classrooms that stressed cooperative learning were found to perform better on a measure of reading comprehension than those in traditional classrooms (Law, 2008). A meta-analysis of educators who use the collaborative group modality performed by Frey, et al. (2009) reported similar enhancing results. In their review, Nokes-Malach, Richey, and Gadgil (2015) recently suggested that the causes for the effectiveness of group learning environments were cognitive: the social interactions that groups provide assist learners in their memory retrieval and extend working memory capacity. One study in support of enhanced knowledge retrieval was an analysis conducted on a sample of approximately 5,000 Japanese adolescent science students from the Third International Mathematics and Science Study (TIMSS). The results showed that the use of small-group cooperative learning activities was associated with higher science achievement scores (House, 2005).

Cognitively, group-based environments may provide a means of focus for an individual's learning processes. Building on the work of Piaget (1970) and Ausubel (1968), cognitive approaches to educational psychology have focused principally on the learner's information processing, i.e., the access, use, accommodation, and often reconciliation of prior knowledge with new knowledge (Vermette & Kline, 2017). Group learning environments also support correcting one's knowledge and reinforcing one's growing knowledge. Group learning has been shown to stimulate individuals to engage in known creative cognitive processes, such as sharing prior

knowledge, retrieving ideas, and self-explaining whilst critically evaluating each other (Halpern & Hakel, 2003). Positive outcomes of collaborative group environments have been most recently emphasized by Entwistle (2019), drawing upon Marton's (2015) variation theory, that students involved in group work may often give more effort to their learning when preparing for collaborative tasks and attaining sufficient understanding to share concepts with peers.

Behaviorally as well, group-based learning environments may be effective for teaching due to their reinforcement value. In a previous study of the preferences of 212 students for seven teaching modalities, confounded with the topics studied, results showed "small groups" and "discussion group" modalities were positively correlated with agreeableness and openness scores while two factors were identified in the preference data structure: interactive and non-interactive teaching types (Chamorro-Premuzic, Furnham, & Lewis, 2007). In addition to the obvious social rewards made available by performing group activities with one's peers, it may be personally satisfying for students to accomplish learning outcomes as a group. For example, students may find group work rewarding because of the grades they attain relative to the time they take to attain them (Öhrstedt & Scheja, 2018). Whether it is efficiency that makes group-based learning satisfying and, consequently, an effective teaching method, or it is the interactive nature of the learning that is rewarding, we had sufficient reason to predict group learning environments would be generally preferred to others.

If individual differences predict preference for group learning environments, neuroscientific understanding of the student's developing brain may provide physiological clues to the effectiveness of group-based environments. For example, it is now common knowledge that neural connections are continually reshaped by experience and this plasticity appears pronounced in the amygdalae of adolescents (LeDoux, 2002), critical to attentional focus and social-emotional response. In addition, certain areas of the frontal lobe undergo measurable changes through adolescence (Choudhury, Charman, & Blakemore, 2008) and further research has shown adolescents find greater reward in risk-taking when among peers than when alone (Blakemore & Robbins, 2012). In group learning environments those risks may take the form of sharing contrary opinions and the critical evaluation of others' ideas that would not have taken place outside the social

context. Thus, there appear to be cognitive, behavioral, and neurodevelopmental factors related to the effectiveness of learning in group-based environments. It would seem most beneficial, therefore, to know the relative preference students give to their learning in group environments.

The present study gathered preference ratings for 21 teaching methods across a variety of learning environments. We first wanted to discover what a sample of typical university students consider to be the most desired teaching and learning environments and whether there exist relationships between those preferences and the personality dimensions of the Five Factor model (Costa & McCrae, 1992; see also Furnham, 2011). We expected a greater mean preference rating for group-based learning than teacher-led and independent learning environments and that one's preference for group-based learning would be linearly related to psychometrically specified personality dimensions. On the basis of Eysenck's (1992) argument that there exists an asymmetry between the sociability and emotionality factors in the standard five factor personality model, we anticipated preference ratings for group learning environments would be predicted by self-reported levels of the more sociable factors extraversion, agreeableness, and openness. Our overall intention, therefore, was to demonstrate that measurable pedagogical preferences are related to personality factors, providing the first steps toward understanding their basis and laying the empirical ground on which further investigation of learning preferences can build.

Method

Participants

The sample was 69 undergraduate students (46 self-identified as women) from a large urban university in the Northwest of England. The population of students from which the availability sample was drawn may be generally described as about 50% working class and 50% middle class from a variety of cultural backgrounds with a majority of white British background. Participants' ages ranged from 18-40 with 93.2% of the sample falling in the traditional age between 19-22 years. Six of the originally sampled 75 individuals returned incomplete questionnaires and their responses were removed from the analysis. Although the remaining sample was small, we had every reason to believe the size was sufficient to detect the relationships we predicted. Given that we expected significant elements in the correlation

matrix with coefficients on the order of .30 to .45, a power analysis following Hulley, Cummings, Browner, Grady, and Newman (2013) indicated a minimum sample size of 68 to maintain the Type II error (β) at .05, for $\alpha < .05$ two-tailed tests of such linear relationships. We also desired collection of data at one time and setting to avoid introducing further variability to the data and, for pragmatic purposes, we sought not to use more resources than necessary in this first exploration of learning environment preferences.

The sample was comprised of English-speaking volunteers undertaking modules that required attendance on campus either on a full-time or part-time basis. None received compensation for their participation. Prior to the study the volunteers gave their written consent to participate, informed by statements of minimal risk, confidentiality, means of data protection, and their right to revoke the agreement for any reason. All participants in this study were treated in accordance with the APA guidelines for human research protections and the university's research ethics committee.

Measures and Procedure

A short version of the NEO-PI-R (Costa & McCrae, 1992) assessed the five personality dimensions of neuroticism (emotional stability), extraversion, openness to experience, agreeableness, and conscientious. This inventory has been found to have strong reliability and validity (Mathews, Dreary, & Whiteman, 2003) and has been a useful tool for assessing relationships between personality and a number of variables including cognitive competence, self-esteem, and teaching effectiveness (McCrae, Kurtz, Yamagata, & Terracciano, 2010).

To assess preferences of teaching and learning environments, a self-report inventory was purposefully designed to collect agreement ratings with 21 teaching method statements within three learning environment categories: (a) *teacher-led*, including lectures, demonstrations, video presentations, guest speakers, teacher-led tutorials, teacher-led activities, and personalized academic support; (b) *independent (autonomous)*, including independent study, individual class activities, individual presentations, information seeking, self-evaluations, individual tutorials, and individual virtual learning; and (c*) group-based*, including seminar groups, collaborative presentations, peer evaluations, debate, group assignments and tasks, group tutorials, and

virtual learning in groups. Participants provided their ratings using a 5-point Likert scale with these labels: 1 = *always*, 2 = *usually*, 3 = *sometimes*, 4 = *seldom*, and 5 = *never*. While the psychometric properties of the preference scales were necessarily unknown as it was developed for our specific purpose, an attempt was made to determine its content validity. Five independent judges were invited to categorize the 21 methods equally into three categories of their own choosing and then to give a "label" to each category. Agreement among the categorizations was 100%, indicating category transparency, and the labels given to the categories were semantically consistent.

In the first 30 minutes of an otherwise standard lecture session, questionnaire booklets that assessed the five personality traits and collected the learning preference ratings for the 21 teaching methods were distributed, completed, and then collected by the class instructor. Participants were assigned code numbers on their questionnaires to ensure anonymity and thanked for their assistance.

Results

The sample's quantitative description was comparable to the means and distributions reported by others recently (e.g., Chamorro-Premuzic, et al., 2007; McCrae, et al., 2010) using the NEO-PI-R measure (Costa & McCrae, 1992). The mean preference ratings for the modalities within each learning environment category, *teacher-led*, *independent*, and *group-based*, were normally distributed. All measures' distributions showed kurtosis attributable to the small sample size: three of the eight variables' scores, *Agreeableness*, *Openness*, and *Independent* environment preferences, were slightly leptokurtic on analysis. The sample also self-reported slightly higher mean openness scores than we anticipated. Nonetheless, each of the NEO-PI-R factor scores in the sample showed acceptable levels of internal consistency, with all Cronbach's alphas > .69. The learning environment preference ratings were less consistent across the seven teaching modalities within each category and likely due to their variety. Table 1 displays the descriptive statistics obtained for the distributions of scores for personality factors and learning environment preferences.

Table 1
Descriptive Statistics for Trait Dimensions and Learning Environment Preferences

$n = 69$	Mean	*SE*	α [a]
Extraversion	25.68	0.69	.78
Agreeableness	30.46	0.60	.71
Conscientiousness	30.39	0.66	.69
Neuroticism	23.93	0.58	.81
Openness	32.42	0.56	.77
Teacher-led Environments[b]	3.68	0.38	.58
Independent Environments[b]	3.18	0.61	.51
Group-based Environments[b]	4.05	0.45	.65

[a] Cronbach's alpha
[b] 5-point ordinal scale across seven modalities

The expectation that group learning environments would be preferred by undergraduates to other learning environments received empirical support. A one-way repeated measures ANOVA on mean preference ratings resulted in significant differences among all three learning environments with teacher-led modalities ($M = 3.68$) preferred over independent learning pedagogies ($M = 3.18$) and group-based environments preferred most of all ($M = 4.05$), $F(2,66) = 22.02$, $MSe = .60$, $p < .001$. The planned contrast between preferences for group-based and non-group teaching modalities showed the group learning environments were preferred to the others, $t(67) = 5.38$, $p < .01$.

The matrix of Pearson product-moment correlations supported the hypothesis of personality correlates with evidence of the direction and magnitude of linear relationships among the five personality factor scores and preference ratings for the three learning environments. As predicted, and shown in Table 2, the extraversion ($r = .32$) and openness ($r = .25$) factors were positively correlated with preference for group-based work; agreeableness scores, however, were not correlated with this preference ($r = .05$), nor with preferences for any learning environment category. The missing relationship with agreeableness could very well indicate a sampling bias. Agreeableness scores were reliably correlated with conscientiousness and neuroticism scores. Preference for teacher-led learning environments

also resulted in relationships with personality factor scores, although these were divergent: openness was positively related to teacher-led preference ratings (r = .31) while extraversion's relationship was weak and negative (r = -.11). There were no other significant relationships found among learning environment preference scores and scores for the conscientiousness and neuroticism (emotional stability) factors.

Table 2
Correlation Matrix of Personality Factor Scores and Learning Environment Preferences

	NEO-PI-R Factor				Environment		
Variable	Agree	Consc	Neur	Open	Teacher	Independent	Group
Extraversion	-.084	-.052	-.095	.054	-.108	.052	.323 [b]
Agreeableness		.506 [b]	-.309 [b]	.233	.128	.196	.012
Conscientiousness			-.295 [a]	.009	-.009	.214	.104
Neuroticism				-.090	-.049	-.056	-.129
Openness					.307 [a]	.175	.246 [a]
Teacher-led						.529 [b]	.304 [a]
Independent							.252 [a]

n = 69
[a]$p < .05$, [b]$p < .01$, two-tailed.

Additional analysis was intended to explore the characteristic personality factors that directly or indirectly align with learning environment preference. Table 3 presents first-order correlations of personality and preference scores controlling for each of the other four personality factors. Although no significant partial correlations for independent learning obtained, the zero-order correlation between teacher-led environments and openness increased slightly when controlling for extraversion (pr = .32) and decreased when controlling for agreeableness (pr = .29). The correlation between group-based learning preference and extraversion scores showed no reliable change when controlling for each of the other factors, nor did the correlation of group-based preference ratings with openness scores.

Table 3
First-order Correlations of Personality Factor Scores and Learning Environment Preferences

Correlation	Extra	Factor Controlled Agree	Consc	Neur	Open
Teacher-led					
Extraversion		-.098	-.109	-.113	-.113
Agreeableness	.120		.154	.119	.061
Conscientiousness	-.015	-.086		-.025	-.012
Neuroticism	-.060	-.010	-.055		-.023
Openness	.315 [a]	.287 [a]	.307 [a]	.304 [a]	
Independent					
Extraversion		.070	.065	.047	.043
Agreeableness	.201		.104	.188	.162
Conscientiousness	.217	.136		.207	.216
Neuroticism	-.051	.005	.008		-.041
Openness	.173	.136	.177	.171	
Group-based					
Extraversion		.315 [a]	.331 [b]	.315 [a]	.320 [b]
Agreeableness	.041		-.047	-.030	-.048
Conscientiousness	.128	.114		.070	.105
Neuroticism	-.104	-.132	-.103		-.111
Openness	.242 [a]	.250 [a]	.246 [a]	.237 [a]	

[a] $p < .05$, [b] $p < .01$, two-tailed.

Discussion

We intended this study as a starting place to address the shortage of analysis on students' preferences for the learning environments they find in higher education, and to demonstrate the relationships of preferences with salient personality factors. Results supported our expectation that students in our sample preferred group-based environments the most. We also found in the sample that the personality factors openness and extraversion were positive correlates of this preference. These findings provide strong support for positive linear relationships between these students' preference for teaching modalities that involve interactive group tasks and two sociable personality factors. Interestingly, the openness factor was a positive correlate

of teacher-led environment preference ratings. These relationships support findings of Chamorro-Premuzic, et al., (2007) with respect to teaching modality preferences although the results did not replicate a similar relationship for the agreeableness factor.

More contributively, our findings demonstrate that psychometric investigations of students' teaching and learning preferences may have practical value toward a more complete psychology of effective teaching practice. For example, we might conclude from these data that level of openness is predictive of preference for both teacher-led and group-based environments. In contrast, the correlations of these preferences with the extraversion factor suggest those with higher levels of extraversion favor groups over teacher-led modalities. From these psychometric findings we can speculate that the social-interactive and shared experience, or what may be considered the "extraverted" features, of group-based learning environments are the likely drivers of student engagement in them. In these times of increasing demands on academic staff, requirements to innovate, and limitations on resources, the provision of environments where students learn from each other would seem to have practical benefit as well.

Taking caution regarding the limitations of this brief study, it is clear that variability in the data could be reduced with increased sample size such that additional detected relationships in the correlation matrix may emerge. Teaching modalities also could have been decomposed further than the practices surveyed here such that the preference self-report included more specific teaching activities such as in-lecture reflection activities or polling and other electronic response techniques that involve some social interaction. However, our purpose was not to describe the preferable features of teaching methods themselves but rather to probe into those characteristics of the one's personality that provide insights into teaching practice. In addition, the failure to replicate the linear relationship of preference for group environments with the agreeableness factor (cf. Chamorro-Pemuzic, et al., 2007) may suggest some bias in the sample. Nevertheless, the characteristics of the distribution of agreeableness scores indicate no such departure from typical findings using the NEO-PI-R measure with student populations. Replication of these findings is in order before stronger claims can be made about the value of investigating pedagogical preferences and their related individual differences.

While the present findings may be limited in external validity, at minimum they demonstrate revealing relationships of personality factors with the positive regard the typical university student has for group-based learning. Famously, Vygotsky (1978) drew attention to the "zone of proximal development" that is achievable through collaboration with others for effective learning, especially with a "capable partner" (p. 86). On this view, learning in groups may be preferred because it not only provides an environment to foster thinking, as do other learning environments, but it may support students' thinking about their thinking, or metacognitions, in ways that independent and isolated learning environments cannot. For example, the best opportunity for students to learn problem solving skills is when working with others in the classroom (Johnson & Johnson, 2009). It was found that students' social interactions in group learning environments gave them the chance to support each other academically and personally, referred to as "promotive interactions" by Johnson, Johnson, and Holubec (2008), by actively supporting their peers' learning as they develop transferable skills. Furthermore, Frey, et al., (2009) argued that in today's world of increasing technologies and social digital media that may isolate students, learning in peer groups may be preferred for the environment's support of professional development.

Drawing further on recent neuroscientific findings, we also believe it is possible developmental factors of the adolescent brain may underlie undergraduates' preference for group-based learning and its effectiveness. To highlight this possibility, the received view of brain development in adolescence and early adulthood has been recently challenged with the finding that structural changes in brain structure continue into this period and, as a consequence, cognitive processes undergo changes as well, particularly within social contexts (Choudhury, S., Charman, T., & Blakemore, S. J., 2008). Neuroimaging studies have provided evidence for differential changes in decision-making processes owing to structural changes in the impulse control and reward systems of the traditional age undergraduate brain (e.g., Wise, 2004). In particular, studies have shown adolescents to be hyper-sensitive to external rewards, including the social rewards of feedback when in peer contexts (Blakemore & Robbins, 2012; Gardner & Steinberg, 2005). It seems plausible that the brain of the typical student more strongly responds to the social interaction and feedback of the group learning environment and,

consequently, enjoys the enhanced retention of knowledge and working memory capacity the environment can provide (Nokes-Malach et al., 2015).

To be sure, some authors have pointed out potential problems with teaching modalities that involve group learning environments. Returning to the review by Nokes-Malach, et al. (2015), one critique of these modalities is that during group-based learning, without careful preparation of the group tasks, there can be challenges to the student's cognitive load, or working memory capacity, that can in effect "overload" memory and reduce the teaching methods' efficacy. It is also true that group work, in theory, should assist the cognitive demand of difficult tasks because complementary knowledge may be divided and shared among members of the group. Perhaps this question could be asked at the level of neuroscience if, for example, the developing adolescent reward system shows reduced responsiveness under certain conditions of cognitive demand, as they may happen, in group learning contexts. These demands might include repetitive switching from speaker to listener, multiple simultaneous perspectives, or great amounts of memory to be retrieved. Similarly, group dynamic factors may interfere with the enhanced constructive engagement of the group learning environment. One student who dominates the discussion and disrupts the interactive engagement intended can turn effective practice into diminished returns and, we would speculate, students do not generally prefer an environment contrary to our intentions. Johnson and Johnson (2009) suggested students need to interact in ways that promote cocreation of knowledge, such as demonstrating pro-social behavior and encouraging the deep processing of ideas. Clearly, the benefits and presumptive reasons for students' group learning preference depend on good planning of the educational activities involved.

It has been suggested that teaching decisions should have their basis in knowledge of how students learn (Biggs & Tang, 2011). We explored preferences for the environments in which students learn to better understand the personality-related features of learning environments that make them engaging and effective pedagogies. In this way the psychology of student perceptions can assist educators in discerning those factors that form the basis of quality learning across a range of instructional methods and assessment techniques. Educational psychologists are encouraged to continue investigation of pedagogical preferences and the psychosocial variables related to them, to extend the external validity of this study and to understand

more deeply those features of learning preferences that can improve the quality of student learning. In this regard, neuroscience on the brain's responses to particular teaching modes and learning environments may be fruitful as well. The strong relationships with personality factors reported here demonstrate that investigations of student preference for learning environments have value because they can provide teachers with knowledge of quality teaching to be put into practice.

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