Psychometric properties of the teachers', parents' and peers' versions of the Perceived Autonomy Support Scale for Active Commuting to and from School (PASS-ACS) in children and adolescents

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A R T I C L E   I N F O

A B S T R A C T

This research aimed to adapt the teachers', parents', and peers' Spanish versions of the Perceived Autonomy Support Scale for Exercise Settings to the active commuting to and from school context (Perceived Autonomy Support Scale for Active Commuting to and from School, PASS-ACS) among children and adolescents. In Study 1 (n = 236 students), a four-item one-factor solution of the teachers', parents', and peers' versions of the PASS-ACS was identified through an exploratory factor analysis. In Study 2 (n = 712 students), confirmatory factor analyses verified the structure and reliability of the four-item one-factor solution in the teachers', parents', and peers' version of the PASS-ACS, which remained invariant across gender. The structural equation modeling provided evidence for the predictive validity as its results supported the self-determination theory tenets. The PASS-ACS is the first valid and reliable measure to assess students' perceptions of autonomy support for active commuting to and from school from teachers, parents, and peers.

1. Introduction

Although health benefits associated with daily physical activity for children and adolescents are widely known (Wu et al., 2017), there is a large body of evidence documenting that the majority of young people do not meet physical activity recommendations (i.e. at least 60 min of moderate-to-vigorous physical activity daily) (World Health Organization, 2017). Active commuting to and from school (ACS) not only contributes to meet youth physical activity recommendations (Martin et al., 2016), but also plays a key role in the physical, psychological, cognitive, social, and economic domains of well-being among young people (Waygood et al., 2017). However, a drastic decline of the rate of ACS among children and adolescents has been found in the last years (Chillón et al., 2013). In order to design and implement active commuting interventions to promote walking and cycling as active modes of commuting to and from school, there is a need to identify the main determinants and correlates grounded in theoretical frameworks. From a behavioral point of view of school transportation

(Mitra, 2013), the decision to adopt a particular mode of commuting to and from school would be likely influenced by a variety of external (e.g. policy), individual (e.g. motivation, attitudes, beliefs), household (e.g. household composition, access to private automobiles, social and economic status), urban environmental (e.g. urban spatial space, neighborhood built environment), and social environmental (e.g. parental or peer support) factors. As parents and other school community agents may play a key role in effectively promoting children's and adolescents' ACS (Mandic et al., 2015; Silva et al., 2014; Simons et al., 2013), further research based on theoretical frameworks such as self-determination theory (SDT; Ryan and Deci, 2017, 2019) is required.

1.1. Self-determination theory as a theoretical framework to analyze and measure autonomy support for active commuting to and from school

SDT is a prominent theoretical framework that has been widely used to understand the social and individual factors influencing human behavior and well-being in different contexts. Consistent with its

theoretical tenets (Ryan and Deci, 2017, 2019; Vallerand and Lalande, 2011), socio-contextual factors, such as autonomy support, which is based on promotion of self-initiative, opportunity to choose, independent problem-solving skills, and participation in the decision-making process, may influence motivation via satisfaction of the basic psychological needs (BPN). Specifically, SDT establishes the existence of three BPN: autonomy, which represents the desire to experience ownership of one's actions; competence, which reflects the desire to effectively interact with the one's environment; and relatedness, which symbolizes the desire to be meaningfully connected and integrated with others. In this line, previous studies in different school physical activity settings showed that perceived autonomy support from different social agents (i.e. teachers, parents, or peers) was positively related to BPN satisfaction, which, in turn, was positively associated with autonomous motivation and physical activity levels (Gonzalez-Cutre et al., 2014; Hagger et al., 2009; Sevil-Serrano et al., 2018).

Despite the importance attributed to social support in promoting ACS among the school population (Mandic et al., 2015; Silva et al., 2014; Simons et al., 2013), there are no valid and reliable instruments grounded in SDT to date that measure students' perceptions of autonomy support for ACS from different social agents. This lack of instruments has partly limited the understanding of the motivational processes involving ACS behavior using the SDT framework. Moreover, the effects of multicomponent school-based interventions on students' perception of autonomy support for ACS provided by different social agents of the school community could not be measured.

Previous research has pointed out that the Perceived Autonomy Support Scale for Exercise Settings (PASSES) is a valid and reliable scale to assess students' perceptions of autonomy support for physical activity from physical education teachers, parents, and peers (Hagger et al., 2007). This instrument consists of a 12-item one-factor model, which obtained good fit indices in the factor analysis along with an adequate internal consistency and temporal stability for the teachers', parents', and peers' versions. Additionally, evidence for cross-cultural invariance was provided among different populations and contexts (Hagger et al., 2007). The PASSES has also been validated in the Spanish context to measure physical education teachers' (Moreno-Murcia et al., 2008), parents', and peers' (Gonzalez-Cutre et al., 2014) autonomy support for physical activity. These studies in the Spanish context offered psychometric support for the 12-item one-factor model in terms of internal structure validity, predictive validity, internal consistency, and temporal stability.

The PASSES should be adapted to other forms of physical activity such as ACS for several reasons. Firstly, walking (one of the most usual modes of school transportation) has been identified as the most natural form of physical activity and it has peculiar characteristics that should be considered. It does not require specific skills, equipment and resources or economic cost compared with other activities or sports. Secondly, the prevalence of physical activity and ACS is different. Current global trends reveal that four out of five adolescents do not meet physical activity guidelines, while between 40% and 70% of children commute actively to school (Guthold et al., 2020). Thirdly, the main determinants and correlates of ACS and physical activity are also distinct. For example, physical activity is mainly positively related to self-efficacy, previous physical activity, and parental support (Martins et al., 2017), while ACS is mainly positively associated with safety, walkability, and neighborhood social interactions, and negatively with distance to school and car ownership (Ikeda et al., 2018). Therefore, the role of teachers, parents, and peers in these two behaviors (general physical activity and ACS) may be different. In this regard, parents may be concerned about their children's exercise and sport but not about their children's active commuting to and from school.

1.2. The current research

This research aimed to adapt the teachers' (Moreno-Murcia et al.,

2008), parents', and peers' Spanish versions (Gonzalez-Cutre et al., 2014) of the PASSES to the ACS context, and to examine the psychometric properties of the resulting version (i.e. Perceived Autonomy Support Scale for Active Commuting to and from School, PASS-ACS) among children and adolescents. To accomplish this objective, two studies were developed with two independent samples of students. In Study 1, we explored the factor structure of this instrument in the ACS context. In Study 2, we confirmed this factor structure, tested the gender invariance, analyzed the instrument's reliability and tested the associations of students' perceptions of autonomy support with the BPN satisfaction and intrinsic motivation for ACS (predictive validity).

2. Study 1

The objective of Study 1 was to explore, via an exploratory factor analysis, the factor composition and structure of the teachers', parents', and peers' versions developed for the PASS-ACS.

2.1. Materials and method

2.1.1. Participants

The participants were 236 students (117 boys and 119 girls), aged between 11 and 17 years old (M_{age} = 13.21, SD_{age} = 1.72), from four Spanish cities. In particular, 89 were primary school students (45 boys and 44 girls, M_{age} = 11.49, SD_{age} = 0.75) and 147 were secondary school students (72 boys and 75 girls; M_{age} = 14.17, SD_{age} = 1.31).

2.1.2. Instruments
2.1.2.1. Perceived autonomy support for active commuting to and from school from teachers, parents, and peers. Primary and secondary school students' perceptions of autonomy support for ACS provided by different agents of the school community (e.g. teachers, parents, and peers) were measured with the three adapted Spanish versions (Gonzalez-Cutre et al., 2014; Moreno-Murcia et al., 2008) of the PASSES (Hagger et al., 2007) to the ACS context. The 12 item-scale was answered separately by the students for each social agent. The three versions were preceded respectively by the following statement: My teachers…/My parents…/My peers… The responses to each item were collected via a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

2.1.3. Procedure
The guidelines proposed by Bartram et al. (2018) were followed in order to adapt the teachers', parents', and peers' Spanish versions of the PASSES to the ACS context. To this end, four experts adapted each of the respective items from the PASSES to the ACS context. For example, expressions such as "My physical education teacher/peers/parents encourage me to do active sports and/or vigorous exercise in my free time" were replaced by "My teachers/peers/parents encourage me to walk or cycle to and from school". Next, three other experts assessed the content of each item to ensure its understanding and to guarantee that they were measuring the variable for which they were originally developed. It should be noted that the seven experts who participated in the scale adaptation process were graduates in Exercise and Sport Sciences with a PhD in Sport Sciences. Three of them were experts in the SDT framework and the other four in ACS and physical activity-related variables. Subsequently, a pilot study (n = 12) was conducted with primary and secondary school students in order to verify that there were no problems with the understanding of the items for each of the three versions proposed. As a whole, the instrument adaptation process gathered validity evidence based on content.

Then, primary and secondary schools were selected by convenience to develop the Study 1. Once school authorization was obtained, the research group met with the teachers to present the main aim of the study and to give them the student's written informed consent to participate in this study. The written consent was obtained from each

student prior to data collection as a prerequisite for participation. The administration of the teachers', parents', and peers' versions of PASS-ACS was conducted in a classroom setting without the presence of the teachers. The participation in this study was voluntary and confidential in order to comply with all ethical procedures for data collection. Students who did not complete the full questionnaire were excluded. This research obtained the approval of the Ethics Committee on Human Research of the University of Granada (number 162/CEIH/2016).

2.1.4. Data analysis

The robustness to apply an exploratory factor analysis was assessed by the Kaiser-Meyer-Olkin (KMO) statistic, acceptable with values over 0.80 (Lloret-Segura et al., 2014), and the Barlett's sphericity test. The exploratory factor analysis was conducted using the principal component method together with the *varimax* orthogonal rotation (Lloret-Segura et al., 2014). This rotation technique allows minimizing the small coefficients and maximizing the large coefficients in order to obtain profiles that can be easily associated with a particular subset of variables, facilitating the interpretation of the factors obtained (Lloret-Segura et al., 2014). A pre-established number of factors was not specified to perform this analysis. The interpretation of the items extracted was conducted following the criterion outlined by Hair, Black, Babin, and Anderson (2018) (i.e. primary factor loading above 0.50 and secondary factor loading below 0.32).

2.2. Results

For the exploratory factor analysis both the KMO statistic and the Bartlett's sphericity test showed acceptable values for the teachers' (KMO = 0.90; χ^2 [66] = 1496.55, p < .001), parents' (KMO = 0.93; χ^2 [66] = 2113.81, p < .001), and peers' (KMO = 0.94; χ^2 [66] = 2243.55, p < .001) versions of the PASS-ACS. Table 1 shows the descriptive statistics and factor loadings of each of the twelve items for the teachers', parents', and peers' versions of the PASS-ACS. Only items 5, 9, 10, and 12 of the three versions met the psychometric requirements proposed by Hair et al. (2018). The remaining items did not comply with these requirements and were removed for further analyses.

2.3. Discussion

The objective of Study 1 was to explore the factor composition and structure from the teachers', parents', and peers' versions of the PASS-ACS. The results derived from each one of the three exploratory factor analyses resulted in a four-item one-factor solution for the PASS-ACS-Teachers, PASS-ACS-Parents, and PASS-ACS-Peers. Given that every latent variable must be represented by at least three or four indicators (Hair et al., 2018; Kline, 2015; Lloret-Segura et al., 2014), the four-item one-factor structure was considered to be appropriate and, therefore, there was no need to reformulate those items that did not show optimal psychometric properties. Likely, the poor psychometric performance of these items could be due to the psychological experiences captured by these items, as either they are not fully representative for students in the ACS context or they have not been meaningfully perceived by students when they commute to and from school. As recommended by previous studies (Kalajas-Tilga et al., 2019; Polet et al., 2019), having a reduced version of four items for this instrument would also avoid unnecessary redundancies to measure the same construct and allows measuring perceived autonomy support in a shorter and quicker way. This is especially important considering that the same items are repeated for each social agent. Therefore, the 36 items of the three versions of PASSES were reduced to only 12 items in PASS-ACS (i.e. four items per version).

3. Study 2

The objectives of Study 2 were to verify the four-item one-factor

Table 1
Results from the exploratory factor analysis and descriptive statistics for the PASS-ACS.

My teachers.../My parents.../My peers...	PASS-ACS-Teachers M (SD)	F1	F2	PASS-ACS-Parents M (SD)	F1	F2	PASS-ACS-Peers M (SD)	F1	F2
Item 1. Want me to walk or cycle to and from school [Quieren que vaya andando o en bici al colegio/instituto]	2.62 (2.16)		0.80	4.20 (2.47)		0.84	3.35 (2.30)		0.89
Item 2. Understand why I choose to walk or cycle to and from school [Entienden por qué debo ir andando o en bici al colegio/instituto]	4.54 (2.40)	0.36	0.60	4.86 (2.40)	0.36	0.75	4.32 (2.47)	0.46	0.63
Item 3. Display confidence in my ability to walk or cycle to and from school [Confían en mi capacidad para ir andando o en bici al colegio/instituto]	5.06 (2.34)	0.39	0.59	5.39 (2.28)	0.43	0.70	4.77 (2.39)	0.48	0.60
Item 4. Encourage me to walk or cycle to and from school [Me animan a ir andando o en bici al colegio/instituto]	3.57 (2.50)	0.33	0.76	4.28 (2.47)	0.62	0.54	3.66 (2.87)	0.42	0.78
Item 5. Listen to my comments about walking or cycling to and from school [Escuchan mis comentarios sobre ir andando o en bici al colegio/instituto]	3.36 (2.40)	**0.71**		4.25 (2.48)	**0.86**		3.76 (2.45)	**0.80**	
Item 6. Encourage me positively when I walk or cycle to and from school [Me animan de forma positiva cuando voy andando o en bici al colegio/instituto]	3.54 (2.48)	0.59	0.57	4.91 (2.41)	0.49	0.68	3.71 (2.37)	0.55	0.66
Item 7. I am able to talk to them about walking or cycling to and from school [Soy capaz de hablar con ellos sobre ir andando o en bici al colegio/instituto]	3.81 (2.51)	0.77	0.37	4.45 (2.48)	0.73	0.37	4.53 (2.48)	0.81	0.35
Item 8. Make sure I understand why I need to walk or cycle to and from school [Se aseguran de entender por qué tengo que ir andando o en bici al colegio/instituto]	3.36 (2.41)	0.79	0.38	4.35 (2.48)	0.59	0.61	3.88 (2.47)	0.73	0.46
Item 9. Answer my questions about walking or cycling to and from school [Contestan a mis preguntas sobre ir andando o en bici al colegio/instituto]	3.39 (2.40)	**0.80**		4.43 (2.51)	**0.83**		3.66 (2.38)	**0.80**	
Item 10. Care about my walking or cycling to and from school [Se preocupan por cuando voy andando o en bici al colegio/instituto]	2.97 (2.35)	**0.76**		4.68 (2.49)	**0.65**		3.46 (2.36)	**0.53**	
Item 11. I am able to share my experiences of walking or cycling to and from school with them [Soy capaz de compartir con ellos mis experiencias de cuando voy andando o en bici al colegio/instituto]	3.69 (2.50)	0.57	0.40	4.68 (2.49)	0.79	0.35	4.29 (2.46)	0.81	0.54
Item 12. I trust my teachers'/parents'/peers' advice about walking or cycling to and from school [Confío en el consejo que mis profesores/padres/amigos me dan sobre ir andando o en bici al colegio/instituto]	4.13 (2.43)	**0.66**		4.89 (2.44)	**0.78**		4.32 (2.41)	**0.76**	

Note: F1 = Factor 1; F2 = Factor 2. Factor loadings higher than 0.32 are displayed. The items in brackets represent the Spanish version of the instrument.

internal structure obtained in the Study 1 by means of a confirmatory factor analysis, and to inspect both its invariance across gender via multi-group factor analysis and its reliability through an internal consistency and temporal stability analysis. Additionally, this study also examined the instrument's predictive validity via structural equation modeling by analyzing the relationships between BPN satisfaction in ACS, intrinsic motivation for ACS, and students' perceptions of autonomy support for ACS provided by teachers, parents, and peers. Grounded in SDT (Ryan and Deci, 2017; Vallerand and Lalande, 2011) and previous research in different school physical activity settings (Gonzalez-Cutre et al., 2014; Hagger et al., 2009; Sevil-Serrano et al., 2018), this study hypothesized that students' perceptions of autonomy support for ACS from these three sources would positively predict satisfaction of autonomy, competence, and relatedness needs and, in turn, BPN satisfaction would positively predict intrinsic motivation in ACS. It was also expected that the effect of students' perceptions of autonomy support for ACS from these three sources on intrinsic motivation would be significantly mediated by the BPN satisfaction.

3.1. Materials and method

3.1.1. Participants

The participants were 712 students (342 boys and 370 girls), aged between 11 and 17 years old (M_{age} = 13.07, SD_{age} = 1.70), from four medium-to-large-sized Spanish cities of north-east, south, and south-east. All schools (N = 10) were public, located in urban areas and were shown to be on average of Spanish standard school. Specifically, 303 primary school students (149 boys and 154 girls; M_{age} = 11.52, SD_{age} = 0.55) and 409 secondary school students (193 boys and 216 girls; M_{age} = 14.16, SD_{age} = 1.32) participated.

Regarding the students' mode of commuting to and from school, 126 (41.60%) primary school students and 295 (72.13%) secondary school students actively commuted to and from school, while 54 (17.82%) primary school and 49 (11.98%) secondary school students passively commuted to school when the distance between home and school was less than 2.00 km. Meanwhile, when the distance between home and school was higher than 2.00 km, 110 (36.30%) primary school students and 51 (12.47%) secondary school students commuted passively to school, while 13 (4.28%) primary school and 14 (3.42%) secondary school students actively commuted to and from school.

Concerning the time spent commuting to and from school, 499 (70.08%, 199 primary school and 300 secondary school) students spent less than 15 min, 179 (25.14%; 88 primary school and 91 secondary school) students spent between 15 and 30 min, 26 (3.65%; 10 primary school and 16 secondary school) students spent between 31 and 60 min, and 8 (1.13%; 6 primary school and 2 secondary school) students spent more than 60 min.

With regard to the people who often accompany students to and from school, 349 (52 primary school and 297 secondary school) students were accompanied by friends, 324 (203 primary school and 121 secondary school) students were accompanied by their mothers, 220 (115 primary school and 105 secondary school) students were accompanied by their fathers, 215 (39 primary school and 176 secondary school) students went to school by themselves, 165 (77 primary school and 88 secondary school) students were accompanied by theirs siblings, 29 (17 primary school and 12 secondary school) students were accompanied by their grandparents and, finally, 50 (25 primary school and 25 secondary school) students were accompanied by other people (no information was provided by them).

To analyze the temporal stability, the measurement instrument was administered twice in a time interval of two weeks to an independent sample of 67 secondary school students (34 boys and 33 girls) between 12 and 18 years old (M_{age} = 14.06, SD_{age} = 1.79) from one of the four Spanish cities that participated in this study.

3.1.2. Instruments

3.1.2.1. Perceived autonomy support for active commuting to and from school from teachers, parents, and peers. The four-item factor structure obtained in the exploratory factor analysis of the Study 1 was used to assess the students' perceptions of autonomy support for ACS from teachers, parents, and peers.

3.1.2.2. Basic psychological need satisfaction in active commuting to and from school. Students' perceptions of autonomy, competence, and relatedness need satisfaction in ACS were assessed using the Basic Psychological Need Satisfaction in Active Commuting to and from School Scale (Burgueño et al., 2020). The instrument was preceded by the statement "What do you think about your usual mode of commuting to and from school?". The scale consists of 12 items grouped into four items per factor to measure the satisfaction of the need for autonomy (e.g. "I feel that I can choose how to commute to and from school"), competence (e.g. "I feel able to walk or cycle to and from school"), and relatedness (e.g. "I feel extremely comfortable when someone accompanies me to school"). Each item is responded via a 5-point Likert-type scale, from 1 (strongly disagree) to 5 (strongly agree). In the validation study conducted by Burgueño et al. (2020), the confirmatory factor analysis supported a 12-item three-factor correlated model (χ^2 [df = 51] = 73.17, p < .001; χ^2/df = 1.44; CFI = 0.99; TLI = 0.99; SRMR = 0.025; RMSEA = 0.034 [90% CI = 0.021–0.047]), which remained invariant across gender and age. The internal consistency analysis displayed acceptable values for autonomy (α = 0.81, ρ = 0.84, AVE = 0.58), competence (α = 0.92, ρ = 0.92, AVE = 0.74), and relatedness (α = 0.82, ρ = 0.83, AVE = 0.55) need satisfaction in ACS.

3.1.2.3. Intrinsic motivation in active commuting to and from school. To assess intrinsic motivation, one of the six factors composing the Behavioural Regulation in Active Commuting to and from School Questionnaire (Burgueño et al., 2019) was used. This factor consists of four items (e.g. "I enjoy walking or cycling to and from school"), which are responded via a 5-point Likert-type scale, from 0 (not true for me) to 4 (very true for me). The items were preceded by the statement "I go or would go to and from school walking or cycling because…". In the validation study conducted by Burgueño et al. (2019), the confirmatory factor analysis of the whole instrument supported a six-factor correlated model (χ^2 [df = 215] = 550.17, p < .001; χ^2/df = 2.56; CFI = 0.93; TLI = 0.92; SRMR = 0.050; RMSEA = 0.062 [90% CI = 0.056–0.069]), which was invariant across gender and age. The internal consistency analysis revealed adequate values for intrinsic motivation in ACS (α = 0.91; ρ = 0.91).

3.1.3. Procedure

For data collection, the same guidelines and criteria outlined in the procedure section in the Study 1 were used.

3.1.4. Data analysis

Data were statistically processed using the Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, version 22.0; Armonk, NY, USA) and AMOS (version 22.0; Armonk, NY, USA). Validity evidence based on the internal structure of the teachers', parents', and peers' versions of the instrument were provided via confirmatory factor analysis. Under the assumption of multivariate normality (Mardia's coefficient = 0.97, critical rate = 1.86 for teachers version; Mardia's coefficient = 5.69, critical rate = 7.47 for parents version; Mardia's coefficient = 5.96, critical rate = 7.97 for peers version) (Kline, 2015), confirmatory factor analyses with the maximum likelihood method were conducted. A variety of fit indices were employed to assess the goodness of fit for each factor model: ratio between χ^2 and degrees of freedom (χ^2/df), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA) with a confidence interval at 90% (90%CI). In general, values less than 5 for the χ^2/df

statistic, higher than 0.95 for CFI and TLI, lower than 0.080 for SRMR, and 0.060 for RMSEA are representative of a good fit (Hu and Bentler, 1999). The standardized regression weights are adequate with values over 0.50 and the standardized residual covariances with values below 2.58 in absolute terms (Hair et al., 2018).

Invariance across gender was tested by means of a multi-sample factor analysis following the methodological proposal by Putnick and Bornstein (2016). This proposal tests the tenability of four progressively constrained models in order to examine configural invariance (i.e. no equality constraints), metric invariance (i.e. equal item loadings), strong invariance (i.e. equal item loadings and item intercepts, concurrently), and strict invariance (i.e. equal item loadings, item intercepts, and item error variances, concurrently). The absence of statistically significant differences in the χ^2 test between two successively constrained models is considered to be an indicative of the invariance of the instrument (Fan and Sivo, 2009).

Reliability evidence was determined through both an internal consistency and a temporal stability analysis. Internal consistency was inspected via an estimation of the Cronbach alpha (α) coefficient, Raykov's composite reliability (ρ) coefficient, and average variance extracted (AVE). Both α and ρ are acceptable with values over 0.70 (Viladrich et al., 2017), while AVE is suitable with values higher than 0.50 (Hair et al., 2018). Temporal stability was examined by means of the intra-class correlation coefficient (ICC). This value should be above 0.70 to be considered acceptable (Fleiss, 2011).

Following the two-step methodological approach outlined by Kline (2015), structural equation modeling was performed to provide predictive validity evidence. The first step (i.e. measurement model) consisted in examining the bidirectional relationships among all study variables via confirmatory factor analysis. The second step (i.e. hypothesized structural modeling) examined the theoretical motivational sequence established by SDT (i.e. perception of autonomy support from teachers, parents, and peers → BPN satisfaction → intrinsic motivation). In accordance with Kline (2015), the maximum likelihood method together with the bootstrapping procedure with 5000 iterations was applied given the violation of the assumption of multivariate normality (Mardia's coefficient = 232.83, critical rate = 75.79).

3.2. Results

3.2.1. Confirmatory factor analysis

With respect to the PASS-ACS-Teachers, its four-item factor structure obtained a good fit: χ^2 (2, n = 712) = 0.19, p = .911; χ^2/df = 0.09; CFI = 0.999; TLI = 0.999; SRMR = 0.003; RMSEA = 0.001 (90% CI = 0.001–0.029). Table 2 shows significant (p < .001) standardized regression weights ranging from 0.62 to 0.80. The standardized residual covariances were between −0.09 and 0.16.

In relation to the PASS-ACS-Parents, its four-item factor structure showed a good fit: χ^2 (2, n = 712) = 3.82, p = .148; χ^2/df = 1.91; CFI = 0.999; TLI = 0.996; SRMR = 0.011; RMSEA = 0.036 (90% CI = 0.001–0.090). Table 2 shows significant (p < .001) standardized regression weights ranging from 0.59 to 0.85. The standardized residual covariances were between −0.48 and 0.60.

With regard to the PASS-ACS-Peers, its four-item factor structure revealed a good fit: χ^2 (2, n = 712) = 3.98, p = .137; χ^2/df = 1.99; CFI = 0.999; TLI = 0.996; SRMR = 0.010; RMSEA = 0.037 (90% CI = 0.001–0.091). Table 2 shows significant (p < .001) standardized regression weights ranging from 0.72 to 0.85. The standardized residual covariances were between −0.23 and 0.60.

3.2.2. Gender invariance analysis

Table 3 showed no statistically significant difference (p > .05) in the χ^2 test between the successive progressively constrained models for the PASS-ACS-Teachers, PASS-ACS-Parents, and PASS-ACS-Peers. Therefore, the null hypothesis of invariance across gender could be accepted for the teachers', parents', and peers' versions of the PASS-

Table 2
Descriptive statistics, standardized regression weights, and squared multiple correlations for the PASS-ACS items in confirmatory factor analysis.

	Range	M (SD)	Skewness	Kurtosis	Variance	λ	SMC
PASS-ACS-Teachers items							
5. Listen to my comments about walking or cycling to and from school [Escuchan mis comentarios sobre ir andando o en bici al colegio/instituto]	1–7	3.40 (2.37)	0.36	−1.17	2.96	0.69	0.48
9. Answer my questions about walking or cycling to and from school [Contestan a mis preguntas sobre ir andando o en bici al colegio/instituto]	1–7	3.44 (2.36)	0.36	−1.18	2.06	0.80	0.64
10. Care about my walking or cycling to and from school [Se preocupan por cuando voy andando o en bici al colegio/instituto]	1–7	3.06 (2.32)	0.64	−1.10	2.87	0.68	0.46
12. I trust my teachers' advice about walking or cycling to and from school [Confío en el consejo que mis profesores me dan sobre ir andando o en bici al colegio/instituto]	1–7	4.27 (2.40)	−0.18	−1.46	3.57	0.62	0.38
PASS-ACS-Parents items							
5. Listen to my comments about walking or cycling to and from school [Escuchan mis comentarios sobre ir andando o en bici al colegio/instituto]	1–7	4.33 (2.41)	−0.28	−1.50	1.48	0.83	0.70
9. Answer my questions about walking or cycling to and from school [Contestan a mis preguntas sobre ir andando o en bici al colegio/instituto]	1–7	4.28 (2.38)	−0.23	−1.48	4.03	0.59	0.34
10. Care about my walking or cycling to and from school [Se preocupan por cuando voy andando o en bici al colegio/instituto]	1–7	4.48 (2.39)	−0.33	−1.47	2.29	0.79	0.62
12. I trust my parents' advice about walking or cycling to and from school [Confío en el consejo que mis padres me dan sobre ir andando o en bici al colegio/instituto]	1–7	5.01 (2.31)	−0.75	−0.99	1.77	0.85	0.73
PASS-ACS-Peers items							
5. Listen to my comments about walking or cycling to and from school [Escuchan mis comentarios sobre ir andando o en bici al colegio/instituto]	1–7	4.80 (2.42)	−0.56	−1.30	1.81	0.83	0.70
9. Answer my questions about walking or cycling to and from school [Contestan a mis preguntas sobre ir andando o en bici al colegio/instituto]	1–7	4.37 (2.45)	−0.27	−1.55	1.60	0.85	0.72
10. Care about my walking or cycling to and from school [Se preocupan por cuando voy andando o en bici al colegio/instituto]	1–7	4.43 (2.48)	−0.30	−1.56	2.76	0.72	0.51
12. I trust my peers' advice about walking or cycling to and from school [Confío en el consejo que mis amigos me dan sobre ir andando o en bici al colegio/instituto]	1–7	5.07 (2.33)	−0.77	−1.00	2.36	0.77	0.59

Note: λ = Standardized regression weight; SMC = Squared multiple correlation.

Table 3
Multi-group factor analysis of gender invariance.

	χ^2	df	χ^2/df	CFI	TLI	SRMR	RMSEA (90%CI)	Model Comparison	$\Delta\chi^2$	Δdf
PASS-ACS-Teachers										
1. Configural invariance	0.67	4	0.16	0.999	0.999	0.006	0.001 (0.001, 0.001)	–	–	–
2. Metric invariance	0.83	7	0.12	0.999	0.999	0.008	0.001 (0.001, 0.001)	2 *versus* 1	0.16	3
3. Strong invariance	6.41	11	0.58	0.999	0.999	0.008	0.001 (0.001, 0.018)	3 *versus* 2	5.58	4
4. Strict invariance	10.42	15	0.70	0.999	0.999	0.015	0.001 (0.001, 0.019)	4 *versus* 3	4.01	4
PASS-ACS-Parents										
1. Configural invariance	6.25	4	1.56	0.998	0.995	0.019	0.028 (0.000, 0.068)	–	–	–
2. Metric invariance	10.53	7	1.50	0.997	0.995	0.021	0.027 (0.000, 0.057)	2 *versus* 1	4.28	3
3. Strong invariance	21.51	11	1.95	0.995	0.992	0.024	0.032 (0.022, 0.054)	3 *versus* 2	10.98	4
4. Strict invariance	33.40	15	2.23	0.993	0.990	0.038	0.033 (0.026, 0.062)	4 *versus* 3	11.89	4
PASS-ACS-Peers										
1. Configural invariance	4.17	4	1.04	0.999	0.999	0.003	0.001 (0.001, 0.047)	–	–	–
2. Metric invariance	4.35	7	0.62	0.999	0.999	0.004	0.001 (0.001, 0.027)	2 *versus* 1	0.18	3
3. Strong invariance	10.54	11	0.96	0.999	0.999	0.005	0.001 (0.001, 0.031)	3 *versus* 2	6.19	4
4. Strict invariance	12.99	15	0.87	0.999	0.999	0.011	0.001 (0.001, 0.025)	4 *versus* 3	2.45	4

ACS.

3.2.3. Reliability analysis

The examination of internal consistency revealed acceptable values for the students' perceptions of autonomy support for ACS from teachers (α = 0.80, ρ = 0.79, AVE = 0.60), parents (α = 0.85, ρ = 0.85, AVE = 0.50), and peers (α = 0.87, ρ = 0.87, AVE = 0.63). Temporal stability analysis showed an ICC value of 0.81 (95%CI = 0.75–0.88) for students' perceptions of autonomy support for ACS from teachers, 0.88 (95%CI = 0.82–0.92) from parents, and 0.89 (95%CI = 0.82–0.93) from peers.

3.2.4. Predictive validity analysis

The measurement model showed an adequate fit: χ^2 (325, n = 712) = 683.91, p < .001, χ^2/df = 2.10; CFI = 0.97; TLI = 0.96; SRMR = 0.041; RMSEA = 0.039 (90%CI = 0.035–0.044). The standardized regression weights were statistically significant (p < .001) and ranged from 0.46 to 0.88. The correlations among factors ranged from 0.15 to 0.76. All these results supported the robustness of the measurement model.

The hypothesized theoretical model also obtained acceptable fit indices: χ^2 (328, n = 712) = 770.89, p < .001, χ^2/df = 2.35; CFI = 0.96; TLI = 0.95; SRMR = 0.064; RMSEA = 0.044 (90%CI = 0.040–0.048). As Fig. 1 shows, students' perceptions of autonomy support for ACS from teachers, parents, and peers positively predicted the BPN satisfaction for autonomy (β = 0.22, p = .025; β = 0.26, p < .001; β = 0.27, p < .001), competence (β = 0.28, p < .001; β = 0.29, p < .001; β = 0.25, p < .001), and relatedness (β = 0.16, p = .038; β = 0.21, p = .014; β = 0.18, p = .035), respectively. In turn, the BPN satisfaction for autonomy (β = 0.24, p < .001), competence (β = 0.31, p < .001), and relatedness (β = 0.15, p = .049) positively predicted intrinsic motivation. In addition, the satisfaction of the three BPN significantly mediated the relationships between students' perceptions of autonomy support from teachers (indirect effects: β = 0.06; 95%CI = 0.03, 0.20, p = .003), parents (indirect effects: β = 0.07; 95%CI = 0.03, 0.16, p = .004) and peers (indirect effects: β = 0.06; 95%CI = 0.02, 0.12, p = .041), and intrinsic motivation. The explained variance was 15% for autonomy need satisfaction, 20% for competence need satisfaction, 10% for relatedness need satisfaction, and 28% for intrinsic motivation. As a whole, these results support the instrument's predictive validity.

3.3. Discussion

The objective of Study 2 was to analyze the psychometric properties of the four-item one-factor structure previously obtained for the teachers', parents', and peers' versions of the PASS-ACS. These results provide evidence to consider the PASS-ACS as a valid and reliable scale to measure the students' perceptions of autonomy support for ACS from teachers, parents, and peers.

The results of the confirmatory analyses for the teachers', parents', and peers' versions of the PASS-ACS supported the four-item one-factor structure. In each version, all standardized regression weights of these four items were significant and higher than 0.50. Furthermore, the standardized residual covariances did not exceed 2.58 as an absolute value, which allows one to dismiss the presence of misspecifications in its internal structure. The multi-sample factor analysis to examine gender invariance showed that the four-item one-factor structure was invariant between boys and girls for the three perceived social agents. This would mean that the PASS-ACS Teachers, PASS-ACS Parents, and PASS-ACS Peers can be used to explore the possible gender differences in perceived autonomy support for ACS from different social agents.

On the other hand, the adequate level of internal consistency for teachers', parents', and peers' versions of the PASS-ACS was verified with acceptable values from Cronbach's alpha, Raykov's composite reliability coefficient, and the average variance extracted. Likewise, the temporal stability for the three versions of the PASS-ACS was supported via the intraclass correlation coefficient. As a whole, the internal consistency and temporal stability analyses suggest that the three versions of the PASS-ACS have been found to be reliable for measuring the students' perceptions of autonomy support for ACS from three of the most important social agents of the school community.

The results from the structural equation modeling provided predictive validity evidence for the PASS-ACS. These findings are congruent with other previous studies in different school physical activity settings that showed that perceived autonomy support from different social agents (e.g. teachers, parents, or peers) was positively related to BPN satisfaction (Sevil-Serrano et al., 2018) which, in turn, was positively related to intrinsic motivation (Gonzalez-Cutre et al., 2014; Hagger et al., 2009). Although autonomy support has been particularly associated with autonomy need satisfaction in physical activity settings (i.e. leisure-time physical activity, physical education, sport), it is also positively related to competence and relatedness need satisfaction (Raabe et al., 2019; Vasconcellos et al., 2019). These results would imply that autonomy support for ACS from teachers, parents, and peers may cause that young people felt autonomous to choose an active mode of commuting to and from school (i.e. autonomy need satisfaction), felt competent and with the required skills to walk or cycle to school (i.e. competence need satisfaction) and felt understood and connected with their parents and peers who commute to and from school with them (i.e. relatedness need satisfaction). Consistent with the SDT tenets, the fulfilment of these BPN was positively associated with intrinsic motivation in ACS. Nonetheless, it should be highlighted that competence need satisfaction was the strongest predictor of intrinsic motivation
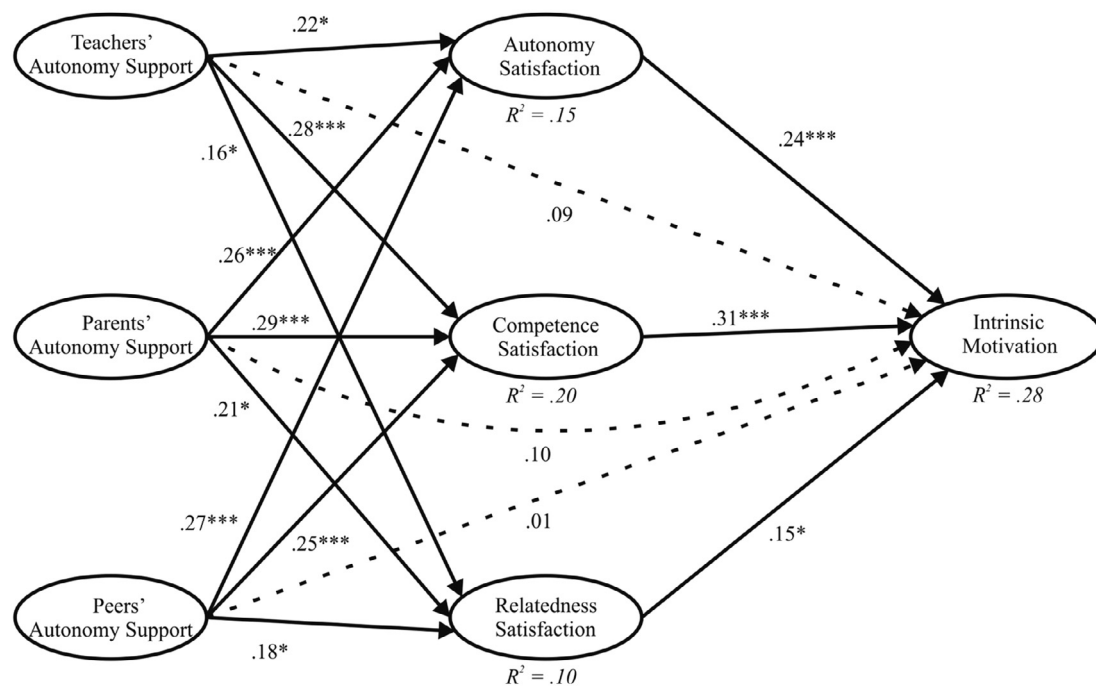
Fig. 1. The relationships between the students' perceptions of autonomy support from teachers, parents, and peers, autonomy, competence, and relatedness need satisfaction, and intrinsic motivation in active commuting to and from school. *Note:* The dotted arrows represent nonsignificant predictive relationships. Only latent variables are shown in the ellipses to clearly present the obtained results. ***$p < .001$, **$p < .01$, *$p < .05$.

toward ACS, suggesting the importance for young people to feel effective and confident of commuting actively to school. These feelings could be closely linked to the involvement of enjoyment and fun in the ACS behavior.

Therefore, it would be fundamental to develop a multicomponent school-based intervention based on SDT, adopting a whole school approach involving teachers, parents, and peers to increase the ACS rates. Particularly, given that perceived autonomy support from parents was the strongest predictor of the students' BPN satisfaction in the present study, school-based interventions should include not only teachers, as seen in most of the previous studies (Villa-González et al., 2018), but also parents and peers as key figures in the ACS promotion.

4. General discussion

In order to design, implement and evaluate an effective intervention to promote walking and cycling to and from school, it is necessary to validate well-developed instruments to identify the determinants and correlates involved in ACS. Based on SDT (Ryan and Deci, 2017, 2019), this research aimed to adapt the Spanish teachers', parents', and peers' versions of the PASSES (Gonzalez-Cutre et al., 2014; Moreno-Murcia et al., 2008) to the ACS context, and to examine the psychometric properties in a sample of primary and secondary school students. The results derived from these two sequential studies showed evidence to consider the teachers', parents', and peers' versions of the PASS-ACS as psychometrically robust measures to assess the students' perceptions of autonomy support for ACS provided from these three social agents. To the best of our knowledge, there were no valid and reliable scales to date to measure the perceived autonomy support in the ACS setting. Previous studies have examined students' perceptions of autonomy support for ACS from different social agents (i.e. teachers, parents, and friends) using qualitative approaches (Simons et al., 2013) or with questionnaires which measured social support without a solid conceptual framework (Huertas-Delgado et al., 2017; Silva et al., 2014). Therefore, this is the first valid and reliable scale in the ACS context grounded in SDT that measures students' perceptions of autonomy support for ACS provided by three of the most important agents of the

school community. Thus, this research contributes to the literature by providing three versions of the PASS-ACS that can be used to identify the teachers', parents', and peers' involvement in their children's active school transport. Likewise, this study also provides some preliminary insight into the motivational dynamics underlying ACS using the SDT framework.

Despite the good psychometric properties showed by the four-item one-factor structure of the teachers', parents', and peers' versions of the PASS-ACS, a series of limitations and future perspectives should be considered. First, given the absence of a random sampling technique in this study, we should interpret the obtained results carefully, limiting its generalization to the whole population. Second, the teachers', parents', and peers' versions of the PASS-ACS were validated only in Spanish students. Taking into consideration these limitations, future studies should analyze the psychometric properties of this instrument in populations with different features (e.g. other religions, races, and ethnicities), ages (e.g. preschool and undergraduate students), and socio-cultural contexts to provide more evidences of its validity and reliability. In particular, to explore the cross-cultural invariance for the PASS-ACS would be a prerequisite for its rigorous and objective comparison given that it will allow researchers to make statistical inferences at an international level in relation to the students' perceptions of autonomy support for ACS provided by teachers, parents, and peers. Third, as mothers and fathers play different roles in their children's physical activity levels (McDavid et al., 2012; Sevil-Serrano et al., 2018), it would be also interesting to examine separately the perception of autonomy support for ACS from mothers and fathers. Analyzing other socialization agents such as siblings or grandparents is also a new avenue of research. Fourth, some important correlates of ACS such as built environment was not evaluated in the present study (Ikeda et al., 2018). Future research should also examine the relations between the features of the neighborhood environment around children's or adolescents' residence and school and the motivational processes of ACS.

5. Conclusions

In summary, the PASS-ACS has shown to be a psychometrically