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Assessment of students' agency in Finnish and Spanish university courses: Analysis of measurement invariance

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ABSTRACT

This study reports on the measurement invariance of the Agency of University Students Scale in data consisting of Finnish and Spanish university students (n = 645) and presents cross-national findings on student agency assessment. Multigroup confirmatory factor analysis confirmed the metric invariance for 10 factors, which allows comparisons of covariance structures and correlation analyses, and can, for example, be used to examine background factor effects on agency across groups. At least partial scalar invariance was confirmed for six factors, allowing comparisons of mean values between Finnish and Spanish students. Differences were found in the experiences of personal and relational resources of agency. The analysis discusses the utility of the AUS Scale for large-scale studies of student agency across countries.

1. Introduction

Agency has been set as a critical goal for formal education because of its key role for individuals in influencing their lives and contributing to societal change (Brown and Westaway, 2011; Jeffery, 2011; OECD, 2022). The relevance of agency has been acknowledged for lifelong learning (Su, 2011), problem solving (Damsa et al., 2010), creative action (Eteläpelto et al., 2013), transforming work practices (Collin et al., 2018; Hökkä et al., 2017) and constructing meaningful careers and personal well-being (Eteläpelto et al., 2013; O'Meara et al., 2014). However, systematic attention to university students' agency in educational practices is scant (e.g. Case, 2015; Su, 2011). This is partly due to a noticeable dearth of conceptual models, measurement instruments and practical tools that would address the multidimensionality inherent in the construct of agency and illuminate students' perceptions of their individual as well as relational and participatory resources for agency in various educational contexts and cultures. Moreover, large-scale studies in the field are scarce, calling for quantitative, theory-based, valid measurement instrument development to respond to this knowledge gap.

The development of tools capturing professional agency in the work life context (e.g. Pyhältö et al., 2015; Vähäsantanen et al., 2019) has, thus far, received more focus than the assessment of student agency in educational settings. A rare exception to the latter context is a scale by Soini et al. (2015), narrowing down a measurement on pre-service teachers' sense of professional agency in teaching practice with an emphasis on facilitating and managing learning in the classroom. The present instrument, the Agency of

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University Students Scale (AUS; Jääskelä et al., 2017, Jääskelä et al., 2020), with a multidimensional structure, was developed for use in higher education courses across disciplines. The AUS, with its original 11-factor model, was validated in a sample of Finnish university students ($n = 270$), showing sound psychometric properties (Jääskelä et al., 2020). Before this study, however, its applicability had not been tested outside the Finnish context.

Our objective is to elucidate the use and utility of the AUS Scale (Jääskelä et al., 2017, Jääskelä et al., 2020) in cross-national research to gain broader insight into university students' agency experiences in different educational contexts and fields. The ultimate aim is to contribute to the development of internationally applicable agency-supportive practices in higher education. In the present study, we pursued this objective by examining the measurement invariance of the AUS Scale in the higher education contexts of Finland and Spain. To conduct meaningful and valid cross-national research on students' agency, careful examination of the scale's measurement invariance at several levels is first needed. Thus, we set out to examine the following research questions: To what extent does the factorial invariance of the AUS Scale hold between student agency data collected in Finland and Spain? In addition, are there potential mean-level differences in the data regarding factors meeting the invariance criteria?

1.1. Conceptualisation of agency on the AUS Scale

Previous literature has highlighted various foci in the conceptualisation of agency, which we will briefly outline below. To gain a comprehensive understanding of student agency in higher education, student agency was reconceptualised as a multidimensional whole. Our view of agency encompasses a student's perspective interwoven with resources experienced by the student within a course's context. We draw on our multidimensional construct analysis (Jääskelä et al., 2017, Jääskelä et al., 2020), based on which we define student agency as having access to and being empowered to act through *personal resources* (Self-Efficacy and Competence Beliefs), *relational resources* (Teacher Support, Trust for Teacher and Equal Treatment) and *participatory resources* (six constructs capturing, e.g. opportunity to influence, interest and wish to participate and becoming empowered in peer interaction). These agentic resources allow a student to engage in purposeful, intentional and meaningful action and learning in study contexts. Aligning with Su (2011), we view that, in addition to cognition and action, person-centred aspects of agency highlighting affective experiences in learning are relevant to understanding student agency. Thus, we pay attention to affective aspects of agency, which have been scarcely dealt with in the current literature. Furthermore, according to recent positions (e.g. Eteläpelto et al., 2013; Goller, 2017) rejecting a permanent capabilities perspective, we highlight agency as a dynamic construct that develops and is transformed in interaction with the environment.

In developing the above-described multidimensional conceptualisation of student agency, we drew from earlier literature where agency is conceptualised as *intentional and purposeful action*, or a dynamic *capability or capacity* for action implying will, autonomy, freedom and choice (Biesta and Tedder, 2007; Edwards and D'Arcy, 2004; Emirbayer and Mische, 1998; Oolbekkink-Marchand et al., 2017; Schoon and Heckhausen, 2019). The construct of agency has been elaborated on in scientific fields, such as psychologically oriented research (e.g. Bandura, 2001, 2006; Deci and Ryan, 2004; Eccles and Wigfield, 2002), the social sciences (e.g. Archer, 2003; Giddens, 1984) and the educational sciences (e.g. Lipponen and Kumpulainen, 2011; Nieminen et al., 2021; Su, 2011). We argue that a synthesis of these offers a more comprehensive understanding of agency in a higher education context where capabilities for action are empowered by various types of resources, that is contextual and relational affordances intertwined with self-efficacy, competence beliefs and interests.

Drawing from accounts of the social–cognitive sciences, agency is related to self-processes, self-reflection and beliefs about one's own capabilities (e.g. Bandura, 2001, 2006; Deci and Ryan, 2004; Schunk and Zimmerman, 2012), which act as mediating factors from thoughts to intentional action. Therefore, we included self-efficacy beliefs as one aspect of personal resources on the AUS Scale. Self-efficacy beliefs involve individuals' subjective judgements about their capabilities to perform the tasks needed to achieve their goals (Bandura, 2006; Schunk and Zimmerman, 2012). Strong self-efficacy beliefs alone will not, however, lead to purposeful performance if a person perceives a lack of knowledge and skills to succeed (Schunk, 2012). Hence, attention should also be paid to individuals' competence beliefs, which refer to the self-evaluation of one's knowledge, skills and strategies against the demands of the task (Schunk and Zimmerman, 2012).

Our conceptualisation of participatory resources as a critical dimension of student agency derives from the literature/theoretical approaches of the social sciences, especially sociological tradition and educational sciences. This literature focuses on the actualisation of agency in multilevel interactions between the individual(s) and the environment and pays attention to the constraints and opportunities for making choices and initiatives for agentic action, including opportunities for influencing learning and instruction practices and experiencing interest and value in active participation and collaboration with peers. Within the sociological traditions, the core of agency lies in *individuals' possibilities for autonomous (self-defined, meaningful and intentional) action* under the constraints of structural, contextual factors (e.g. Giddens, 1984; see also Leien et al., 2020). These factors are known to be maintained through norms, practices and power relations in any institutionalised action (Berger and Luckmann, 1994). Consequently, agency is manifested to the extent that individuals *can actively participate, make choices and influence* events that affect their lives (e.g. Berger and Luckmann, 1994).

In educational settings, the facilitation of students' autonomy can mean involving them in decision making concerning the pedagogical process and offering opportunities for active learning and personal growth (Bechter et al., 2019; Elen et al., 2007; Harju and Åkerblom, 2017, Lea et al., 2003). Agency is also critically supported by volitional goal-oriented action fuelled by *intrinsic interest* (e.g. the desire to understand; Deci and Ryan, 2004; Wehmeyer et al., 2009) and *the utility value* perceived in attaining goals (Wigfield et al., 2012). Accordingly, a student's will to engage in agentic participation in a course depends on perceiving the value of how the course is germane to their personal goals (Schunk and DiBenedetto, 2016). Furthermore, it has been noted (Matusov et al., 2016) that opportunities to practice agency in learning environments are likely to be bound to normative notions of agency, such as expectations

of certain kinds of optimal or purposeful learning and teaching in the prevalent educational discourse. Theories of learning emphasise the critical role of learners' participatory action, such as active knowledge construction in dialogue with others (e.g. commenting, presenting views), taking responsibility for epistemic and regulative actions and utilising peer support in communal learning situations (e.g. Damşa et al., 2010; Edwards, 2005; Greeno, 2006; Martin, 2004; Reeve and Tseng, 2011; van Boxtel et al., 2000). Participation that allows students to purposefully calibrate their personal learning needs and aims and act as co-creators of knowledge and practices has been seen to manifest and nourish agency (see Salmela-Aro, 2017; authorial agency, Nieminen et al., 2021). In the development of the AUS, it was deemed important to include students' self-assessment of their participation in instructional dialogue and collaboration with peers, because exclusive reliance on observed behaviour would not give insight into how empowered the students perceive themselves in the participatory structures of their courses (see e.g. Billet, 2008; Eteläpelto et al., 2005; Hökkä et al., 2017). Accordingly, we make the claim that attention should be paid first to students' active engagement in *participatory action,* second, to students' *experience of ease of participation* (i.e. having space to contribute to learning dialogue; see Lipponen and Kumpulainen, 2011), and third, to the extent to which they feel *empowered by interactions with others* (e.g. having opportunities for receiving and providing support; cf. others as resources, Edwards, 2005).

In addition to personal and participatory resources, an increasing amount of research has drawn attention to relational resources of agency. Dialogic spaces for agency are not automatically afforded in learning situations (Eteläpelto et al., 2005; Lipponen and Kumpulainen, 2011), and relational support, particularly the experience of emotional security and trust, must be intentionally fostered and facilitated (Harris et al., 2018). Sociocultural views note the power to act and take stances depends not only on an individual's will but also on contextual affordances, such as reciprocal and dialogic relationships between the teacher and students (Eteläpelto and Lahti, 2008; Greeno, 2006; Lipponen and Kumpulainen, 2011). Agency is also linked with learners' power relationships and experiences of equality (Eteläpelto et al., 2005).

2. Method

2.1. Context of the study

Both universities involved in this study (one in Finland and one in Spain) are multidisciplinary public research institutions offering training from the bachelor's to the doctoral level. They have a similar number of students (around 15,000 and 16,000 students in the Finnish and Spanish universities, respectively). In their pedagogical orientation, they follow the Bologna process recommendations, which have linkages to student agency, for example in increasing students' capacity for studying (see European Commission, n.d.; European Students' Union, 2018). The educational strategy of the Finnish university underscores students' growth for academic expertise and societal impact. In turn, the Spanish university strives for a commitment to values such as solidarity and integrity. These strategic guidelines do not provide a direct mandate for modes of pedagogical practices, such as how to assess and support student agency. At the teaching practice level, there is no uniform pedagogy being implemented in either university. The teachers at both universities have wide autonomy concerning the decisions on teaching methods they choose to use in their courses. Both universities annually provide support for teacher development, such as by promoting student-centred practices. In addition, both are traditional on campus/in-presence universities with notable technology presence with blended forms in teaching and learning, usually including an institutional learning platform for specific tasks or uploading resources.

2.2. Participants and data collection

A total of 645 university students (270 at the Finnish university and 375 at the Spanish university) completed the Agency of University Students (AUS) Scale questionnaire near the end of their courses before receiving grades. Table 1 shows the sample

Table 1
Description of respondents by country.

	Finland (n = 270)	Spain (n = 375)
Participants' mean age	22.66 years (SD = 4.63, range = 18–55; missing data for two persons)	22.45 years (SD = 6.24, range = 17–81; missing data for eight persons)
Median number of credits at the university	68.52 (SD = 82.45, range = 0–459, missing data for 34 persons)	84.00 (SD = 79.00, range = 0–600; missing data for 55 persons)
Gender	167 women; 102 men; missing data for one person	212 women; 155 men; missing data for eight persons
Type of programme	Master's degree programme courses	Master's degree programme courses
Number of courses in the data	10	22
Median number of respondents in the courses	11 (SD = 26.7, range = 4–79)	12 (SD = 14.1, range = 4–60)
Level of the study courses	Basic level (n = 5) Intermediate level (n = 4) Advanced level (n = 1)	Basic level (n = 9) Intermediate level (n = 8) Advanced level (n = 5)
Discipline the courses represent	Economics (n = 1) Education (n = 2) Humanities (n = 2) Natural sciences (n = 3) Psychology (n = 1) General studies (n = 1)	Computer engineering (n = 1) Economics (n = 2) Education (n = 4) Humanities (n = 2) Natural sciences (n = 7) Psychology (n = 2) Law (n = 2) General studies (n = 2)

characteristics of both countries.

Data were collected using an online survey before COVID-19 in both countries. Data were collected first in Finland (Jääskelä et al., 2020). Subsequently, to obtain comparable sets of data, we selected courses in the Spanish university that best corresponded to the Finnish data profile in terms of discipline, subject, content and level. For example, from the degree programme in physics, we chose a basic course on mechanics for first-year students in both countries. Diverse forms of instruction were used in the courses at both sites, involving a mixture of lecturing and student activation through individual and group tasks.

The AUS questionnaire was translated from Finnish to the Spanish university's two official languages using official translators. Next, a group of Spanish researchers, teachers and students (native speakers, bilingual speakers) tested and evaluated the comprehensibility of the translated instructions and items. Then Spanish team members and Finnish researchers discussed the semantic equivalence of the terms used. This meant several modification rounds, so the translation maintained the original meanings. Finally, the questionnaires were back-translated to Finnish and compared to the initial Finnish version.

All participants responded voluntarily and anonymously to the questionnaire as part of their respective courses. Students whose questionnaire data were used in the analyses gave written consent. The students were informed that only group-level analyses would be reported. National ethical requirements and principles drawn up at the European level (ALLEA – All European Academies, 2017) concerning ethical conduct and research integrity were followed in both countries. Our research included only a minimum risk for participants. According to the standard for both countries' institutional review board approvals, a statement by the ethical boards of the universities was not required.

2.3. Measure

The AUS Scale (Jääskelä et al., 2017, Jääskelä et al., 2020) was used to measure students' perceived resources of agency in their courses. The AUS was validated earlier in the Finnish university context, with data supporting a 10-factor model (Jääskelä et al., 2017). In the same national context, the scale was refined with a new dataset ($n = 270$) and revalidated with confirmatory factor analysis (CFA), resulting in an 11-factor model (set *a priori*, residuals allowed to correlate) with acceptable fit indexes: χ^2 (1,529; $n = 270$) = 2, 527.96, RMSEA = 0.05, SRMR = 0.07 (Jääskelä et al., 2020).

The most recent version of the AUS (Appendix C) comprises 58 items forming 11 latent factors (Jääskelä et al., 2020). Each factor includes three to seven items rated using a five-point Likert scale (1 = fully disagree, 2 = partly disagree, 3 = neither agree nor disagree, 4 = partly agree and 5 = fully agree). The factors measure students' personal, relational and participatory resources, providing opportunities for practicing agency in the courses. Two factors – Self-efficacy and Competence beliefs – pertain to *personal resources*. The former measures students' overall confidence as a learner in completing the course (Bandura, 2006), and the latter focuses on beliefs concerning understanding course content (e.g. Schunk and Zimmerman, 2012). Three factors – Trust for the teacher, Teacher support and Equal treatment – pertain to *relational resources* between the teacher and students in the course. These factors stem from research emphasising students' experiences of trust and emotional support as well as power relationships in agency construction (e.g. Eteläpelto and Lahti, 2008; Harris et al., 2018), especially reflected as an individual's experiences and interpretations of the relationships and opportunities afforded through the teacher's orchestrative action (Lipponen and Kumpulainen, 2011). Six factors concern *participatory resources*. From these, Participation activity encompasses a student's self-assessment of one's active involvement in the interactive learning situations offered in the course (e.g. Reeve and Tseng, 2011). The other five factors capture a student's experience with affordances for agency (e.g. Berger and Luckmann, 1994; Deci and Ryan, 2004; Edwards, 2005): Opportunities to influence (e.g. students' viewpoints were taken into account), Opportunities to make choices (e.g. choosing contents in line with one's learning goals; different options to complete the course), Ease of participation (e.g. the possibility of expressing views without ridicule), Peer support (e.g. experiencing other students as resources for learning) and Interest and utility value (e.g. desire to learn to understand; perceiving the value of the course in attaining one's learning goals).

2.4. Data analysis strategy

A multigroup CFA was conducted to examine the factorial invariance of the measurement (French and Finch, 2008; Putnick and Bornstein, 2016) and, correspondingly, whether the AUS Scale functions similarly in Finnish and Spanish data. The four test levels to compare a scale's measurement structure include the following: 1) configural, 2) metric, 3) scalar and 4) strict invariances. First, the *configural invariance* between groups (here, countries) was tested to find out whether the overall factor structure was similar across groups; that is, the theoretical (latent) factors could be measured by the same items. Configural invariance requires that the items load statistically significantly on the same factors in both countries. If configural invariance does not hold, this means that some items are not associated with the latent factor and should be removed from the factor.

Second, we tested *metric invariance*, which indicated whether factor loadings could be set as equal between countries. If the metric invariance holds, it suggests that a latent factor has the same meaning across the groups; that is, analyses based on individual differences are comparable between groups. In that case, we can compare covariances, correlations, regression coefficients and path coefficients between groups. However, this does not justify comparisons of group means. At this stage, intercepts are estimated at the item level separately for both groups. Therefore, the means of latent factors are zero.

Third, *scalar invariance* was tested to determine that, in addition to the factor loadings, the intercepts of observed variables could be set as equal. If scalar invariance holds, the mean differences of the items are fully explained by the mean differences of the latent factor. Thus, comparisons of the mean values between groups were possible at the latent factor level.

Even though the configural, metric and scalar invariance already allow possible comparisons between groups, the invariance of

residual variances (also called *unexplained variance* or *error variance*) of the items is sometimes tested. *Strict invariance* holds if factor loadings, intercepts and residual variances can be set as equal between countries, which would optimally increase model parsimony but is seldom achieved.

Testing measurement invariance may result in the finding that the factor loadings and intercepts of the observed variables can only be partially set as equal between country-specific groups. In this case, a sufficient level of invariance should be evaluated. In the AUS Scale, the number of items per factor varies from three to seven. Following guidelines presented in Putnick and Borstein (2016) and El-Den et al. (2020), we set a criterion that more than half of the items – at least a minimum of three items in a factor – should be invariant to consider the factor *partially invariant*.

Analyses were conducted using Mplus (Version 8.0; Muthén and Muthén, 1998–2017). All models were estimated using the full information maximum likelihood method with robust standard error and scaled chi-square test value (MLR estimator in Mplus). The model invariances were tested using the Satorra–Bentler scaled chi-square difference test (Satorra, 2000). In the case of a statistically significant difference in test values, modification indices were used to identify the measurement structure inconsistency between countries.

Evaluating the goodness of fit of the whole AUS model, standardised root mean square residual (SRMR) and root mean square error of approximation (RMSEA) indicators were utilised as the only appropriate indexes in complex models constituting several variables and factors (see, e.g. Beauducel and Wittmann, 2005; Raykov, 1998; Shi et al., 2019). For example, Shi et al. (2019) note that the use of RMSEA is reliable in large models (as the AUS model represents) regardless of the sample size, but do not recommend the use of the comparative fit index (CFI) and Tucker–Lewis index (TLI) when testing the model fit in the large model with a sample size under 500 (our sample sizes are 270 and 375).

Measurement invariance was tested separately for each factor to gain knowledge of possible differences in factor loadings, intercepts and error variances, and to most efficiently identify items on the factors for which the invariance does not hold (Shi et al., 2109). Testing the measurement invariance at the level of the whole instrument would not have achieved this goal, as preliminary testing revealed many large modification indices, suggesting that the model did not identify distinctions between factors. At the first step, the multigroup model was estimated without any constraints (configural invariance). Second, factor loadings were fixed to be equal between countries (metric invariance). Third, factor loadings and intercepts of observed variables were fixed to be equal between countries (scalar invariance). Fourth, factor loadings, intercepts and residual variances of observed variables were fixed to be equal between countries (strict invariance). Model fits were evaluated using the chi-square test, RMSEA, CFI, TLI and SRMR. For a good-fitting model, chi-square test values are non-significant, CFI and TLI are near 0.95 and RMSEA and SRMR are below 0.06 and 0.08, respectively (Hu and Bentler, 2009). Based on the test results of separate factors, items and factors of good fit were incorporated into the final model, and the goodness of fit of the entire AUS model was evaluated. Finally, those factors that met scalar invariance, mean differences between countries were examined using Cohen's *d* (translating to mean the difference divided by the pooled standard deviation).

3. Results

3.1. Descriptive statistics for the AUS Scale in country-specific groups

Fig. 1 which is constructed based on the mean values and standard deviations of all 58 items of the original AUS Scale, visualises that each item has variation and mean values are positioned approximately in the middle of the scale without any floor or ceiling effects. Mean values varied between 2.43 and 4.83 in the Finnish data and between 2.47 and 4.70 in the Spanish data (a total range from a minimum of one to a maximum of five). The standard deviation was near 1.0 for most items and varied between 0.7 and 1.35.

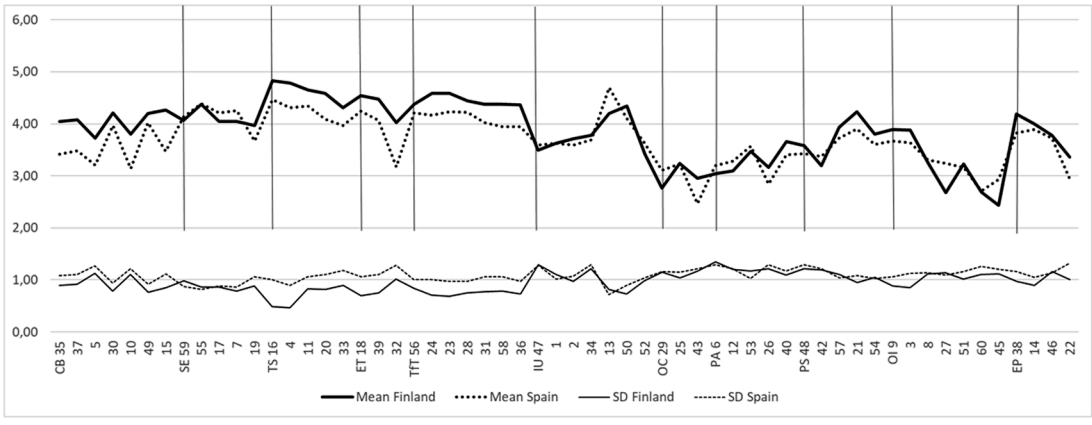

Fig. 1. Means and standard deviations of 58 items for the Finnish and Spanish data.

3.2. Baseline model for the AUS Scale in Spanish data

To examine whether the original 11-factor model developed with the Finnish data also fit the Spanish data, we estimated the confirmatory factor model of the Spanish data against the Finnish factor structure. The model fit the data well (RMSEA = 0.055 [95% CI is 0.053, 0.058] and SRMR = 0.075). Configural invariance was, however, only met for 10 factors. Standardised factor loadings for items (Appendix A) were statistically significant, except for items 48, 57, 21 and 54 in the Spanish data; these items represent the factor of Peer support (four out of five items) in the validated Finnish AUS Scale (Jääskelä et al., 2017, Jääskelä et al., 2020). Furthermore, standardised factor loadings for four items (5, 10, 52 and 27) were statistically significant, though they were lower than 0.30. For further analyses, in which the AUS factors were tested separately, we excluded all five items (48, 57, 21, 54 and 42), tapping the factor of Peer support and continued analyses using the 10-factor model as the base model. Therefore, a few items with statistically significant but relatively lower loadings were included in the analyses.

3.3. Invariance testing for the AUS factors

Table 2 displays a summary of the invariance testing for the 10-factor AUS model in the Finnish and Spanish data. The extended version of the results concerning the factor-specific invariance tests, estimating configural, metric, scalar and strict invariances, and critical item-level considerations are presented in the supplementary file, Appendix B. Table 2 shows that when the factors were tested separately, configural invariance held for all 10 factors. Metric invariance was also fully met for eight out of ten factors, and for the remaining two factors, it was possible to establish partial metric invariance. Next, we elaborate on the results concerning the estimation of the model for each factor separately.

3.3.1. Competence beliefs

Evidence was found only for partial scalar invariance (see Appendix B, Table 2.1). Concerning four of the seven intercepts (for items 5, 10, 35 and 37), support was found for setting equivalent intercepts across the two countries. These items capture students' self-evaluation of the extent to which they perceive that they have sufficient background knowledge to learn new things in the course (Appendix C). Testing strict invariance did not provide support for setting item residuals equivalent across the two countries. All residual variances were statistically significantly larger in the Spanish data than in the Finnish data.

3.3.2. Self-efficacy

It was possible to establish *strict invariance*, except for item 19, for which there was no support for setting the intercept to be equal across countries (see Appendix B, Table 2.2). In conclusion, concerning the four items of this factor, measurement invariance was supported for capturing a student's general belief in successfully completing this course.

3.3.3. Teacher support

Partial scalar invariance was met (see Appendix B, Table 2.3). Support was found for setting four of the five intercepts (items 11, 16, 20 and 33) so they are equal across countries. Scalar invariance could thereby be shown for items capturing emotional support students reported receiving from the course's teacher (Appendix C). Support was not found for setting the residual variances of the observed variables equal across countries. Except item 11, the residual variances of items were statistically significantly larger in Spain than in Finland.

Table 2
Summary of the invariance testing for the ten AUS factors.

Invariance levels	Configural invariance[1]	Metric invariance[2]	Scalar invariance[3]	Strict invariance[4]
Factor in the AUS scale				
1 Competence beliefs (7 items)	Yes	Yes	Partial 4/7	No
2 Self-efficacy (5 items)	Yes	Yes	Partial 4/5	Yes
3 Teacher support (5 items)	Yes	Yes	Partial 4/5	No
4 Equal treatment (3 items)	Yes	Yes	No	No
5 Trust for teacher (7 items)	Yes	Yes	Yes	No
6 Interest and utility value (7 items)	Yes	Yes	Partial 5/7	No
7 Opportunities to make choices (3 items)	Yes	Yes	No	No
8 Participation activity (5 items)	Yes	Partial 3/5	No	Partial 4/5
9 Opportunities to influence (7 items)	Yes	Yes	Partial 5/7	Partial 4/7
10 Ease of participation (4 items)	Yes	Partial 3/4	No	No

Note. Invariance holds if
[1] all the items load statistically significantly to the same factors across the groups
[2] the magnitude of item loadings are equal across the groups
[3] item intercepts are equal across the groups; and
[4] residual variances are equal across the groups.

3.3.4. Equal treatment

Only metric invariance was met (see Appendix B, Table 2.4). Scalar and strict invariance did not hold; support was not found for setting either item intercepts (items 18, 39 and 32) or residual variances of observed variables so they are equal across countries. Factor variance was statistically significantly larger in Spain than in Finland, and all the residual variances of the items were statistically significantly larger in Spain than in Finland.

3.3.5. Trust for teacher

Support was found for setting intercepts to be equal across countries. Hence, the scalar invariance was met. However, support was not found for setting residual variances of observed variables so they are equal across countries (see Appendix B, Table 2.5). Four residual variances were statistically significantly larger in the Spanish data than in the Finnish data.

3.3.6. Interest and utility value

Partial scalar invariance was met (see Appendix B, Table 2.6). Support was found for setting five of the seven intercepts (for items 1, 2, 34, 47 and 52) to be equal between countries. In the items in which support was documented for scalar invariance, students were asked to rate their general interest and utility value regarding the course, whereas items that did not meet scalar invariance (items 13 and 50) may have been ambiguous by asking the respondents to provide ratings on intrinsic motives vs. extrinsic motives for learning (see Appendix C). Support was not found for setting the residual variances of the observed variables equally across countries. Four residual variances were statistically significantly larger in Spain than in Finland.

3.3.7. Opportunities to make choices

Only metric invariance was met (see Appendix B, Table 2.7). Support was not found for setting the intercepts (scalar invariance) or residual variances of observed variables (strict invariance) to be equal across countries. The factor variance was lower in Spain, and two residual variances were statistically significantly larger in Spain than in Finland.

3.3.8. Participation activity

Metric invariance was partially met for three items (12, 26 and 40). After allowing two factor loadings (items 53 and 6) to vary between countries, the model fit the data well (see Appendix B, Table 2.8). Support was not found for scalar invariance, that is setting intercepts so they are equal across countries; however, support was found for setting residual variances of observed variables as equal across countries (except for item 53).

3.3.9. Opportunities for influence

Partial scalar invariance was met (see Appendix B, Table 2.9). There was support for five out of seven intercepts (items 3, 8, 9, 51 and 60) to be set as equal across countries. These items, for which scalar invariance could be established, assess student-perceived opportunities to influence the course in general (items 3, 8 and 9), goals set for the course (item 51) and assessment methods (item 60; Appendix C). Strict invariance was established for other items except for 3, 9 and 51, where residual variances were statistically significantly larger in Spain than in Finland.

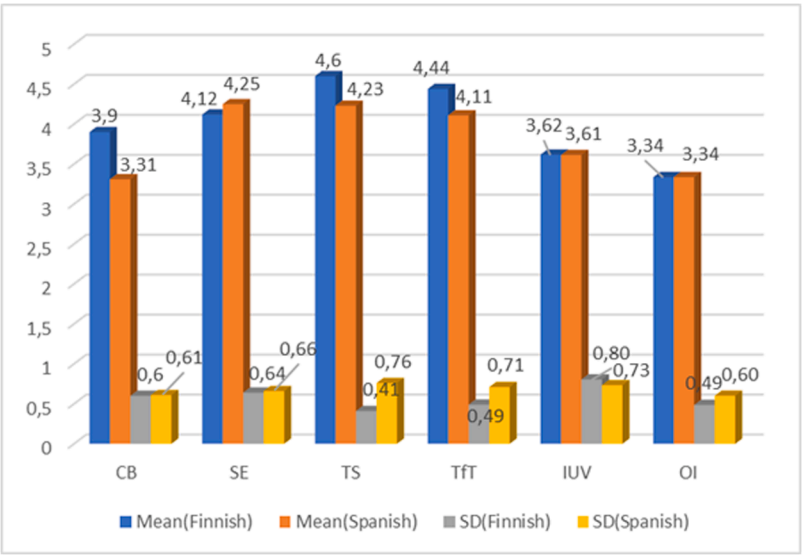

Fig. 2. Means and standard deviations of the six AUS factors for the Finnish and Spanish data.
Note. CB = Competence beliefs; SE = Self-efficacy; TS = Teacher support; TfT = Trust for teacher; IUV = Interest and utility value; OI = Opportunities to influence

3.3.10. Ease of participation

Metric invariance was partially met for three out of four items (14, 22 and 38). However, support was not found for setting either intercepts or residual variances of observed variables to be equal across countries. All residual variances were statistically significantly larger in the Spanish data (see Appendix B, Table 2.10).

3.4. The final 10-factor model of the AUS Scale

In conclusion, 10 out of 11 factors (excluding the factor of Peer support) were incorporated into the final model. For this model, measurement invariance was established at the metric, scalar and strict levels. More specifically, for 10 factors, either partial or full metric invariance was established, and for six of these factors, partial or full scalar invariance was also established. The model fit for the 10-factor model was acceptable: χ^2 (2,613) = 4,846.15; RMSEA = 0.051, SRMR = 0.080. Standardised factor loadings for items (Appendix A) were all statistically significant, yet there were two items (27 and 52) for which the factor loadings were slightly under or just above 0.30.

3.5. Comparisons of mean values in AUS factors

Based on the findings obtained in factorial invariance testing, comparisons of mean values between the Spanish and Finnish data could be conducted for the following six factors: Competence beliefs, Self-efficacy, Teacher support, Trust for teacher, Interest and utility value and Opportunities to influence. The comparative analyses of the mean levels of agency indicated the following statistically significant mean differences between countries. The findings indicated lower perceptions of competence beliefs among the Spanish (see Fig. 2) than the Finnish students (Cohen's $d = .97$, $p < .001$). However, Spanish students provided higher ratings of self-efficacy than Finnish students (Cohen's d = -.22, $p < .016$). Spanish students reported experiencing lower support from their teachers than Finnish students (Cohen's $d = .58$; $p < .001$), and Spanish students reported less trust in their teachers than Finnish students (Cohen's $d = .53$; $p < .001$). No differences between the countries emerged for interest and utility value or for having opportunities to influence the course.

4. Discussion

The complex nature of the construct of agency generates a critical need to develop psychometrically sound measurement instruments to assess student agency. In the present study, relevant theoretical aspects of the construct are considered and operationalised to provide a multidimensional understanding of student-perceived agency in various higher educational contexts. To our knowledge, no cross-nationally validated scales are widely available yet for student agency assessment in higher education. Nor is there the comparative empirical documentation of student agency based on large-scale study designs. Thus, this study presents a novel contribution to the field, specifically regarding cross-national research, by analysing and documenting the level of measurement invariance of the multidimensional AUS Scale (Jääskelä et al., 2020) in data ($n = 645$) collected in Finland and Spain. The findings of these analyses and preliminary comparisons of the AUS mean values between the two countries are reported and discussed.

The results of the measurement invariance analyses of the AUS Scale suggested that after excluding one factor (Peer support), support was received for configural and metric invariance. An identical factorial structure with 10 factors could be confirmed for the Spanish and Finnish data. Metric invariance was fully met for eight factors and partially met for two factors. This allowed further analyses of invariance testing and analyses based on individual differences between groups. Furthermore, six factors met at least partial scalar invariance, which made it possible to compare the countries' mean values on these dimensions.

From the original 11 factors, one – Peer support – produced non-significant factor loadings in Spanish data. Consequently, revisions may be needed to maintain peer relationships in the construction of agency (e.g. Edwards, 2005) and to capture its core components. The literature has paid ample attention to 'co-agency', 'relational agency', 'shared epistemic agency' and 'participatory qualities of interaction' and emphasised interdependence in solving challenging problems in studies and work (Damsa et al., 2010; Edwards, 2005; Glăveanu, 2015; Stenalt, 2021). The literature also underscores reciprocal action, including individuals' own contribution to the collaboration and support received from others (e.g. Edwards, 2005). The operationalisation of peer support as a resource should acknowledge at least the following perspectives: students' experiences of their own potential to put effort into collaborating with others and their perception of other students as resources for one's own learning. The future development of the measurement model would benefit from adding items capturing students' perception of their investment and action in collaboration (see Klemenčič, 2015; Stenalt, 2021).

Findings from analyses testing metric invariance suggested factor loadings in eight of the 10 factors met full invariance across Finnish and Spanish data. Furthermore, evidence for partial metric invariance was observed for the factors of Participation activity and Ease of participation. These factors included three items that could be set as equal between countries. Hence, the latent factors represent theoretically coherent content. In conclusion, the 10 factors of the AUS Scale were comparable in capturing individual variations in the intended dimension of agency, enabling the comparison of covariance structures between Finnish and Spanish data. This will make possible the future examination of associations between pedagogical practices (e.g. forms of learning and instructional methods) and agency factors. Moreover, an examination is possible concerning an array of background factors' effects (e.g. study success, age, gender and social and familial factors; see, e.g. Klemenčič, 2015) on agency across countries.

At least partial scalar invariance was found for intercepts in six of 10 factors – Competence beliefs, Self-efficacy, Teacher support, Trust for the teacher, Interest and utility value and Opportunities to influence – allowing the comparison of factor means between

countries. Comparative analyses indicated Spanish students perceived their self-efficacy (i.e. overall confidence as a learner) as higher than Finnish students, whereas Finnish students had higher competence beliefs (self-estimation of having a sufficient knowledge base for learning) and they indicated perceiving higher emotional support from and trust for their teacher than Spanish students. As no previous comparative data are available, to the best of our knowledge, these findings must be interpreted with caution. For example, the PISA 2018 study (Volume III, measuring students' self-efficacy and fear of failure) indicated highly similar findings for Finnish and Spanish 15-year-olds' self-reported self-efficacy (e.g. 'When I'm in a difficult situation, I can usually find my way out of it'.). Therefore, the findings of this study, indicating lower self-efficacy for Finnish students, was surprising. The mean scores of the Spanish and Finnish samples are in accordance with the recent self-efficacy studies conducted in other countries which have indicated a generally high-level of self-efficacy among higher education students (e.g. Fokkens-Bruinsma et al., 2021; Navayuth and Yurayat, 2022). In a large-scale study of Spanish higher education students over three years, Ayllón et al., (2019) demonstrated that both students' self-efficacy and teachers' need-supportive teaching have positive associations with student achievement. Unfortunately, similar data are not available for Finnish students. Notably, the present samples may comprise subgroups (e.g. concerning gender or study fields), which could be a focus of further analyses.

Perhaps higher competence beliefs (i.e. the student's sense of having sufficient knowledge to understand contents and learn new things) among Finnish students may be due to potentially higher competition for Finnish university admissions and relatively high competence in certain fields. It can also be linked with mandatory requirements for teacher pedagogical studies at the Finnish university, which contribute to teachers' abilities to adapt their instruction to students' competences.

The differences in student-perceived teacher–student relations may reflect divergences in school culture and educational practices in these countries and national cultural values. For example, relatively informal communication practices and low hierarchies between teachers and students – typical for Finnish schools and universities – may contribute to Finnish students' experiences of higher trust in teacher–student relations. Power distance is considered a national cultural value in Hofstede's (2001, 2010) cultural dimensions. Finland scores lower than Spain in this value, suggesting decentralised power, equal rights and direct, participative communication. A hierarchical order and power centralisation prevail in Spain. The two countries belong to different cultural clusters derived from religion, language and the geographic continuum (Ronen and Shenkar, 2013) – Latin Europe and Nordic – which may play a role in these disparities.

Four factors out of 10 – Equal treatment, Opportunities to make choices, Participation activity and Ease of participation – did not meet scalar invariance at item intercepts. Additionally, non-invariance at single-item intercepts was found in the remaining six factors that partially met scalar invariance. These findings offer valuable information for developing AUS Scale items (see supplementary file, Appendix B). For example, the current items in the AUS Scale concerning students' perceptions of equal treatment are partly formulated as general statements without linking them directly to the teacher's treatment of students in the course. This may have caused varying interpretations of items' meaning among respondents. Furthermore, the finding of non-invariance concerning the item intercepts in the Opportunities to make choices factor suggests that some item meanings are not universally shared and may not reflect the typical course practices to which students are accustomed. Generally, Spanish students responded differently (i.e. lower ratings than Finnish students) on items that included emotional stances regarding participation (e.g. *daring* to challenge matters presented in the course, item 22) or concerning emotional aspects of teacher–student relations (e.g. teachers' *friendly attitude* towards students, item 4). In some cases, the difference may be linked to different cultural connotations of terms and translation difficulties and replacing words expressing emotion with more neutral wording (e.g. replacing the adjective *friendly* with *positive* in item 4), which could enhance the invariance of item intercepts.

Strict invariance could be met only for the Self-efficacy factor, but partial strict invariance was established for two factors: Participation activity and Opportunities to influence. Residual variances were not equal for the remaining seven factors across countries, as they were systematically and statistically significantly larger in the Spanish than the Finnish data. These results indicated that, among the Spanish students for most items, there was more error variation in responses, and the item-level reliability was slightly higher in the Finnish than in the Spanish data.

The AUS scale items were initially operationalised based on the conceptualisations drawn from theoretical literature. We conceptualized student agency as a multidimensional whole including several dimensions in the domains of personal, relational and participatory resources. Success in development of a valid measurement instrument is dependent on the extent to which one succeed in creating items for the supposed latent factors that would be valid across different groups. If the factor structure differs or is not comparable between the groups, it suggests that respondents differ on how they understand the items and respond to them. In the development of the AUS Scale, the factor of Peer support is an example of a challenge which surfaced in the invariance analyses with data from students from different countries. This does not, however, mean that the aspect of peer relationships would be irrelevant for agency. Instead, it means that we have not yet succeeded in capturing representative items that coherently would constitute the (higher order) latent factor. As acknowledged in the research (e.g. Ginevra et al., 2015; Virtanen et al., 2018), it is difficult to accomplish full measurement invariance between groups across countries on multi-item self-report surveys measuring latent constructs that are not directly observable. The reasons respondents respond differently to questions might relate, for example to instrument translation, the data collection situation, cultural differences in students' response styles, familiarity with question formats and responses' social desirability (Davidov et al., 2014; Wetzel et al., 2013).

4.1. Limitations

This study used a relatively small sample of Finnish and Spanish university students, which may have affected the results when examining a model as complex as the AUS Scale (i.e. having several factors). Respondents in both countries are from one university.

Correspondingly, the empirical findings should be treated with caution when considering them in a broader national context.

Although effort was exerted to choose students from courses representing the same disciplines, subjects and stages of their studies and highly similar information was provided to respondents on the study's aims, data collection procedures and instructions, the data collection situations varied in the countries. Data collection in the Finnish university's courses was implemented in classroom situations within the presence of the researcher, who could motivate students to participate and from whom the students could request clarification. In Spain, the key researcher also organised the data collection, but data collection in some courses was implemented through self-paced online responses within the given time frame.

Moreover, the AUS Scale was constructed to capture students' self-evaluations of a multidimensional set of resources fostering agency. These include resources embedded in the study contexts, such as opportunities and support for participation, relational resources available and activated by students, themselves, and notably, students' competence beliefs, their interests and values in social interactions and relationships with their peers and teachers in their studies. Other researchers have indicated it is also relevant to explicitly pay attention to and examine the relationships between resources and affordances of agency and the individual's will (e.g. volition and subsequent investment) to engage in agentic action (see, e.g. Klemenčič, 2015; Stenalt, 2021). In our piloting work, we supplemented the AUS Scale with a scale capturing students' perceptions of the extent to which the pedagogical structure and practices of the courses they attend include student-centred, activating formats and opportunities for enquiry-based learning. In further development of the AUS Scale, we will enrich its coverage by including items capturing aspects linked with transformative agency (see Lund and Vestøl, 2020), such as students' opportunities and will to engage in creative collaboration, solving of open problems and addressing complex challenges and their assessment of the extent to which these experiences have been meaningful in advancing their learning and have empowered their reflexive awareness and capabilities to engage in agentic action. According to Lund and Vestøl (2020), transformative agency departs from conventional notions of agency; it stems from encounters with and examinations of conflicts or contradictions in the collective activity and develops in the joint activity of envisioning new possibilities. Future research could, thus, enrich understanding of the field by including also indicators of transformative agency in association with relational agency (see Edwards, 2005), where one's thoughts and actions are aligned with others' in interpreting problems of practice.

4.2. Implications for practice and future research

The development of valid and reliable measurement instruments to assess student agency across educational contexts is critical for estimating the level of agency among higher education students at the institution or discipline level and for developing practices for fostering agency tailored to these contexts. The possibility of making group comparisons of students' agency perceptions is a key interest of stakeholders in the development of quality assurance and higher education equality. This study provides knowledge of the measurement invariance of the AUS Scale between university students in Finland and Spain and invites additional cross-national research. The knowledge gained supports benchmarking processes and sharing good practices for promoting students' agency between universities and for comparisons between countries. Large-scale studies collecting data from a range of countries are at their initial stages of obtaining evidence of the validity of the AUS Scale and developing the instrument. Additionally, the development of a short version of the AUS Scale for international collaboration would be valuable, requiring the careful consideration and identification of redundant items based on invariance testing. However, it could increase the questionnaire's usability without decreasing the scale's validity (e.g. Virtanen et al., 2018). One interesting direction of future research is the utilisation of a person-oriented approach to examine the latent profiles of student agency across countries (e.g. Jääskelä et al., 2020).

Similar to Klemenčič (2015), we acknowledge the importance of examining student agency in a temporal fashion and targeting students' reflexivity. In our ongoing work, we have taken several steps in that direction. We have further developed the AUS Scale by including open-ended questions asking students to reflect on potential sources of change in their agency during their studies. In addition, we have piloted and will develop a practical tool (utilising learning analytics techniques) that provides diagnostic feedback to students. We aim to promote students' self-reflection of agency from various perspectives, capturing their interpretation of their agency as agentic orientation, investment and action. We also are launching a three-year follow-up of students in which we examine the temporal construction of higher education students' agency during their studies utilising several time points and methods such as scales, small group discussions, interviews tapping resources of agency and prompts inquiring about engagement in agentic action (suggested, e.g. by Stenalt, 2021).

4.3. Conclusion

This study is a unique contribution to the development of a cross-national measurement tool for assessing university student agency as a multidimensional construct. It deepens our understanding of the critical elements of the AUS Scale in country-specific contexts. The findings confirmed metric invariance for the 10-factor model (excluding the factor of Peer support from the initial scale) and, from these, scalar invariance for the six-factor model of the AUS Scale and provided support for the use of the AUS Scale in comparative studies on student agency. Comparisons of the six factors' mean values revealed some differences in student agency experiences concerning personal and relational resources of agency between Finnish and Spanish students. Overall, the AUS Scale was shown to have the potential for large-scale studies of student agency across countries and to be a promising tool for development work supporting agency in higher education institutions.

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No potential conflict of interest was reported by the authors.

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Supplementary materials

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