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Primary and lower secondary students' learning agency and social support

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Abstract

Making initiatives and having ownership over one's learning is a key for applying and creating knowledge, acquiring new abilities, actively steering one's life and the engaging in change in society. Understanding the preconditions for such learning should be in the core of designing learning environments and the primary interest of frontline learning research. This study focuses on exploring students' sense of their learning agency in studying and the role of teacher and peer support in cultivating it. We examined how primary (grades 1-6) and lower secondary school students (grades 7-9) perceive their learning agency (LA), its relationship with the experienced teacher and peer support in studying. Also, differences between the girls and boys, and schools located in low and high SES neighborhoods was examined. We assessed the structure and level of learning agency by using a new measurement and explorative structural equation modeling (ESEM). Results show that learning agency consists of interdependent elements of motivation to learn, self-efficacy beliefs about learning and strategies for learning in meaning making, problem solving and scaffolding in studying. The experienced learning agency was related to social support experienced in several ways. Also differences in learning agency and social support in terms of grade level, gender and SES were detected. Results indicate that meaning making especially calls for intentional support from teachers in lower secondary grades and that girls and boys have partly different support needs in terms of cultivating strong sense of learning agency.

Keywords: *learning agency; primary school students; lower secondary school students; peer support; explorative structural equation modeling*

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1. Introduction

There is an evident need for cultivating learning that enables us to solve complex ill-defined problems, create new knowledge, innovative and actively learn through life. How to enhance such learning has been a central interest of the researchers, educational practitioners, and educational policy makers across the globe for quite some time (Griffin, McGraw & Care, 2012; Ananiadou & Claro, 2009; Darling-Hammond, Flook, Cook-Harvey, Barron, & Osher, 2019; Häkkinen et al, 2016; Ministry of Education, 2012). For instance, many educational policy documents list the goals of effective learning for future, such as 21st century learning and innovation skills (OECD, 2013; Pellegrino, 2017). Both educational policy documents and learning science emphasize continuous skillful and active learning (Schober et al., 2013; Waeytens et al., 2002; Vainikainen & Hautamäki, 2020). This is reflected in commitment to continuous education in many national and organizational strategies for future (Marsick & Watkins, 1992; Maurer & Weiss, 2010). There is also a degree of consensus across the policies, and theorisations that learning allowing knowledge creation and steering one's own life is more than adoption of existing knowledge and skills. Such higher order learning is characterized by active, skillful, and creative problem solving, thinking skills, knowledge creation and recognizing others as resources for learning (e.g., Anderson et al. 2001; Dwyer et al., 2014; Greiff et al., 2013; Roseth et al., 2008; Vainikainen et al., 2015; see also seminal work by Bandura, 1989 and Bloom et al., 1956). There is ample amount of evidence that engaging in such learning activities is related to range of positive study attributes, such as intrinsic motivation (Vansteenkiste et al., 2009), positive study-related emotions (Saariaho et al., 2016; Pekrun et al., 2002), and lower risk of suffering study burnout (Näykki et al., 2018). The characteristics and scope of such learning have been well documented in the literature, especially research on self- and co-regulated learning has brought understanding of strategies and skills needed in this kind of higher order learning (Hadwin, Järvelä, & Miller, 2011; Järvenoja, Volet, & Järvelä 2013; Pintrich, 2004). There is also a growing understanding of complex set of elements such as emotions and motivation that are intertwined with learning regulation (e.g., Anttila, Pyhältö, Pietarinen & Soini, 2018; Mega, Ronconi, & De Beni, 2014; Schunk & Zimmerman, 2008; Valle et al., 2003).

Unfortunately, readiness to engage in higher order learning cannot be taken for granted. It calls for not only cultivating learning skills but also learner's initiative and intentional effort regards to their learning i.e., learning agency (cf. Resnick, 1995). Cultivating learning agency of students can be considered as a focal task of school in making sure that all children have the opportunity to build learning agency. Hence, it is a focal task for school and preferably should start as early as possible (Evans & Rosenbaum, 2008). However, the range of studies exploring higher order learning beyond learning skills or single attribute of learning, is still limited. Our study tackles the challenge by exploring how primary and lower secondary school students perceive their learning agency in terms of problem solving, meaning making and seeking scaffolding for learning in school and how it is related to the teacher and peer support experienced while studying. Differences in the sense of learning agency between girls and boys, and schools located in low and high SES neighborhoods will be also examined. In addition, the article will contribute to the arsenal of methods by providing a novel measure for exploring students' learning agency.

2. Theoretical framework

2.1 Student's learning agency

Having agency in ones learning entails choosing when, what, and where one is learning, and having adequate skills to do it, independently and in collaboration with other (Clarke, Howley, Resnick, & Rose, 2016; Scardamalia & Bereiter, 2006). Agency refers to learner's initiative and ownership of learning that for example self-regulation of learning assumes (Pintrich, 2004). Such learning cannot be reduced to a single attribute of the learner or to a particular skill. This is also why it may be challenging to recognize and support it in school

environment. A student may have adequate learning skills, even skills of self-regulation, but if they lack the motivation to learn, nothing will happen. Further skills and the motivation to learn do not guarantee student's learning agency if the student does not believe in their abilities to learn.

Accordingly, learning agency calls for will and power to engage and steer learning and believe that one can do it. By drawing on two influences on agency: social structures and self-appraisals, we claim that *learning agency* needs to be conceptualized both as a function of social structures of learning environment and capacity of the learner (Biesta & Tedder, 2007). This does not mean that individual students will or can always control their learning in different contexts and social structures which form a framework of learning agency, however, structures are continuously changed and reshaped by individuals (Giddens, 1984; Pintrich, 2004). The individual self-appraisals include the learner's will and intention to act (Bandura, 1989), and belief in their ability to influence things and the actual power they have through skills and strategies of action (Clarke et al., 2016). Based on these conceptualizations we argue that learning agency consists of the interrelated elements of student's motivation to learn continuously (I want), efficacy beliefs about their learning (I am able), and intentional strategies for facilitating and managing new learning (I can and do) (Pyhältö, Pietarinen & Soini, 2016; Soini, Pietarinen, Toom, & Pyhältö, 2015; Soini, Pietarinen, & Pyhältö, 2016).

Motivational, self-efficacy and skill elements of learning allow learner's initiative and ownership in terms of learning. As such, these cognitive elements (i.e., motivation, efficacy beliefs and intentional strategies for learning) are just decontextualized preconditions for learning, however, to manifest learning agency they have to be situated and applied in learning (Darling-Hammond et al., 2019; Lave & Wenger, 1991). It has been proposed that particularly problem solving (Hmelo-Silver, 2004), meaning making (Coburn, 2001; Weick, Sutcliffe, & Obstfeld, 2005) and seeking scaffolding for learning (Cheng et al., 2015; Lave & Wenger, 1991) are increasingly needed in the future and therefore have high applicability value for students later in their lives. Therefore, cultivating the motivation, efficacy and skills in school learning – not just in some subjects but as an overall capability - is essential. Problem solving, which includes where the identification and problem finding is needed (Dillon, 1982) and solution is not immediately obvious (Scherer & Gustafsson, 2015) allows identifying and exploiting opportunities and taking control over the future. In school learning it refers to learners' will, and their active efforts to try to process problems encountered in learning and persistently aim to solve them (Pintrich, 2004; Valle, 2003). Meaning making refers to interpreting and making sense of situations, as well as recognizing emotions and identity process related to them (e.g., Zittoun & Brinkmann, 2012) and maintaining wellbeing (e.g., Park, 2011). In school learning this involves learners attempt to understand what the learning task entails, why it is important to master, and what the relevant things are related to it. Seeking scaffolding includes activities through which learner actively seeks help and builds supporting social elements to facilitate learning. Scaffolding helps to perform tasks beyond current personal resources through the social resource for learning (e.g., Hadwin, Järvelä, & Miller, 2011). In school this means participating in building school's social learning environment. Engagement in such learning throughout school career and cross-curriculum allows an active approach to learning and taking agency over learning at any level of education (Kagan, 2005; Resnick, 1987). We argue that these are crucial for learning agency in school, and to be able to adopt learning as life orientation. To sum up this implies (see H1) that student's sense of learning agency is embodied by problem solving, meaning making and seeking scaffolding for learning (Darling-Hammond et al., 2019; Hmelo-Silver, 2004; Timperley & Parr, 2005, Weick, Sutcliffe, & Obstfeld, 2005; Cheng et al., 2015; Lave & Wenger, 1991). Each of these comprises motivation, efficacy beliefs, and intentional strategies for facilitating and managing new learning (Soini et al., 2016; Pietarinen, Pyhältö, & Soini, 2016; Pyhältö et al., 2015; Scherer & Gustafsson, 2015; Valle, 2003).

Learning agency is a capacity of an individual embedded in and constrained and enabled by individual-environment dynamics (Clarke et al., 2016). Hence, the degree of learning agency can vary due to both

individual and contextual affordances and constrains. Deficits in learning agency may lead to challenges in adopting skills and strategies of learning and put students in unequal positions in terms of learning. For example, research on learning regulation has identified differences between boys and girls. In general, the results have shown that girls tend to outshine boys in self- and co-regulative learning skills in primary and lower secondary school (Weis, Heikamp, & Trommsdorff, 2013; Raffaelli, Crockett, & Shen 2005; Duckworth & Seligman, 2006; Fischer, Schult, & Hell 2013). In other studies, no gendered differences have been detected in self-regulated learning between boys and girls (Wanless et al., 2013). Accordingly, further studies are needed to explore whether there are gendered differences in learning agency, potentially contributing to differences in learning outcomes. Moreover, previous studies have shown that socio-economic background contributes to student learning (Lindfors, Minkkinen, Rimpelä, & Hotulainen, 2018; Myllyniemi & Kiilakoski, 2018). Students who study in schools located in low SES areas are less familiar with engaging in higher order learning activities compared with students in schools located in high SES neighborhoods (Størksen et al., 2015; Xing, Liu, & Wang, 2019). A reason for this might be that it is more challenging to sustain a socially supportive learning environment enabling sense of learning agency for students in low SES neighborhoods schools. For instance, it calls for more investment promoting student well-being, taking time to talk about interpersonal problems or showing patience with students' misbehavior leaving fewer resources to invest in engaging students in higher order learning compared to schools in high SES neighborhoods (Bottiani, Duran, Pas, & Bradshaw, 2019). So far, in Finland, differences in students' learning outcomes between the schools located in different neighborhoods have been modest. Yet, results of a few studies imply that differences might be increasing (Berisha & Seppänen, 2017; Bernelius, 2013; Bernelius & Vaattovaara, 2016). We presume that first signals of such development might be first detected in students' sense of learning agency before they are realized in differences in learning outcomes. Based on this, we hypothesise that students' perceived learning agency is related to the gender and schools' neighborhood SES and primary school students and girls report a higher sense of learning agency in terms of seeking scaffolding, meaning making, and problem solving than boys and students at lower-secondary school (Duckworth & Seligman, 2006; Fischer, Schult, & Hell 2013; Liu et al., 2016; Raffaelli, Crockett, & Shen 2005; Salmela-Aro & Tynkkynen, 2012; Wang & Eccles, 2012) (see H3). This further implies that girls (Ciarrochi et al., 2017; Hombrados-Mendieta et al., 2012), primary school students, and students from high SES living area (Størksen et al., 2015; Xing, Liu, & Wang, 2019) are likely to report higher levels of social support from teachers and peers compared to boys, lower secondary students or students from low SES living areas (Weis, Heikamp, & Trommsdorff, 2013; Raffaelli, Crockett, & Shen, 2005; Duckworth & Seligman, 2006; Fischer, Schult, & Hell, 2013; Camara et al., 2017; Rautanen, Soini, Pietarinen, & Pyhältö, 2022; Wentzel et al., 2017) (see H4).

2.2 Teacher and peer support for studying – school's social structure for enhancing learning agency

Student learning agency is relational and hence highly socially embedded (Edwards, 2005; Clarke et al., 2016). Accordingly, the quality and the quantity of social support for studying is likely to have an impact on the degree of learning agency displayed by the students, and its development. Social support refers to the social resources that are perceived as being available (Cohen et al., 2000) for studying. In school, such resources typically include (but are not limited to) teachers and peers (Kiefer et al., 2015). Teachers and peers provide the primary source of both informational support, including feedback, advice, affirmation and problem solving that enables students to cope with study and learning related challenges (e.g., Malecki & Demaray, 2003; Liu et al., 2016; Wentzel et al., 2016), and the emotional support comprising care, trust, encouragement, acknowledgement and sense of belonging to the school community (e.g., Malecki & Demaray, 2003; Liu et al., 2016; Wentzel et al., 2016). There is a strong body of evidence showing that receiving informational support from teachers enhances students subject matter interest, study engagement, school achievement (Ahmed et al., 2010; Wentzel, 1998), and enables them to overcome study-related challenges (e.g., Liu et al., 2016; Wentzel et al., 2017). In turn, emotional support from teachers has been shown to promote students'

positive attitudes to schoolwork and school satisfaction (e.g., Liu et al., 2016; Ulmanen et al., 2016; Wang & Eccles, 2012; Wentzel et al., 2017; Jiang, Huebner, & Siddall, 2013), as well as to protect students against study burnout, anxiety and stress (Salmela-Aro et al., 2008 Roy, Kristensen, Groholt, & Clench-Aas, 2009; Tennant et al., 2015). Students who receive emotional support from their teachers are also less likely to engage in risky behavior and more likely to show high levels of academic achievement (Flashpohler et al., 2009; Gini et al., 2008).

Results on the impact of peer support are less consistent (e.g., Kiefer et al., 2015; Kindermann, 2007; Skinner et al., 2008; Wang & Eccles, 2012). While in some studies informational and emotional support from peers has been found to enhance study engagement, school adaptation, perceiving school work valuable, and positive emotions about studying such as joy of learning (Ulmanen, Soini, Pietarinen, & Pyhältö, 2016; Wang & Eccles, 2012 Furrer & Skinner, 2003; Estell & Perdue, 2013; Kiefer et al., 2015; Urdan & Schoenfelder, 2006; Wentzel et al., 2017; Ulmanen, Soini, Pietarinen & Pyhältö, 2014), in other studies a negative relationship between the peer support and study engagement have been detected (Liu et al., 2016). It has been suggested that this results from the mediating role of peer group attitudes about studying (Wang & Eccles, 2012). If peers share negative attitudes about studying, the peer support is likely to increase disruptive behavior and disengagement from studying (Sage & Kindermann, 1999; Ulmanen et al., 2014; Ryan, Pintrich & Midgley, 2001; Wang & Eccles, 2012), while sharing positive attitudes about studying is likely to increase study engagement. We presume that receiving social support for studying from peers that require the displaying of a positive attitude to studying is likely to be related to increased levels of learning agency among the students. There is also research evidence that social support provided by teachers and peers complement each other (see also Rautanen, Soini, Pietarinen & Pyhältö, 2022).

Prior research has also detected differences in experiences of social support in terms of gender, age, and background of the student. Girls have been shown to report more teacher support in their schoolwork and they also experience more peer support in their schoolwork (Lam et al., 2012; Wentzel et al., 2017), particularly in lower grades (Liu et al., 2016). Moreover, students from high SES living areas have been shown to report higher levels of social support from both teachers and peers (Størksen et al., 2015; Xing, Liu, & Wang, 2019). Against this backdrop, we claim that informational and emotional support from teachers and peers is likely to cultivate student's learning agency in terms of problem solving, meaning making and seeking scaffolding and differences in experienced support influence on learning agency. Accordingly, we hypothesise that the sources of support that complement each other, i.e., informational and emotional support for studying from teachers and peers, are positively related to the students' perceived learning agency in terms of seeking scaffolding, meaning making and problem solving in both grades (see H2) (e.g., Liu et al., 2016; Rautanen et al., 2022; Wenzel et al., 2017) (see H2).

3. Aim, research questions and hypothesis

The aim of this study was to understand the composition of perceived learning agency (LA) among primary and lower-secondary school students, and how it is related to their sense of social support for studying from teachers and peers. The following research questions and hypothesis derived from those are addressed (see also Figure 1):

RQ 1: Is the perceived learning agency among students comprising of intertwined composition of motivation, efficacy beliefs, and intentional strategies of learning embodied by problem solving, meaning making and seeking scaffolding for learning?

> Hypothesis 1: A primary and lower-secondary school student's sense of learning agency is embodied by problem solving, meaning making and seeking scaffolding for learning.

RQ 2: How are the sources of social support related to the student's perceived learning agency in terms of seeking scaffolding, meaning making and problem solving in both grades?

Hypothesis 2: The sources of support that complement each other, i.e., informational and emotional support for studying from teachers and peers, are positively related to the student's perceived learning agency in terms of seeking scaffolding, meaning making and problem solving in both grades.

RQ 3: Is the students' perceived learning agency related to the gender, grade, and school's neighborhood SES?

Hypothesis 3: The students' perceived learning agency is related to the gender and school's neighborhood SES and primary school students and girls report a higher sense of learning agency in terms of seeking scaffolding, meaning making, and problem solving than boys and students at lower-secondary school.

RQ 4: Is the students' perceived social support related to the gender, grade, and school's neighborhood SES?

Hypothesis 4: Girls, primary school students, and students from high SES living area are likely to report higher levels of social support from teachers and peers compared to boys, lower secondary students or students from low SES living areas.

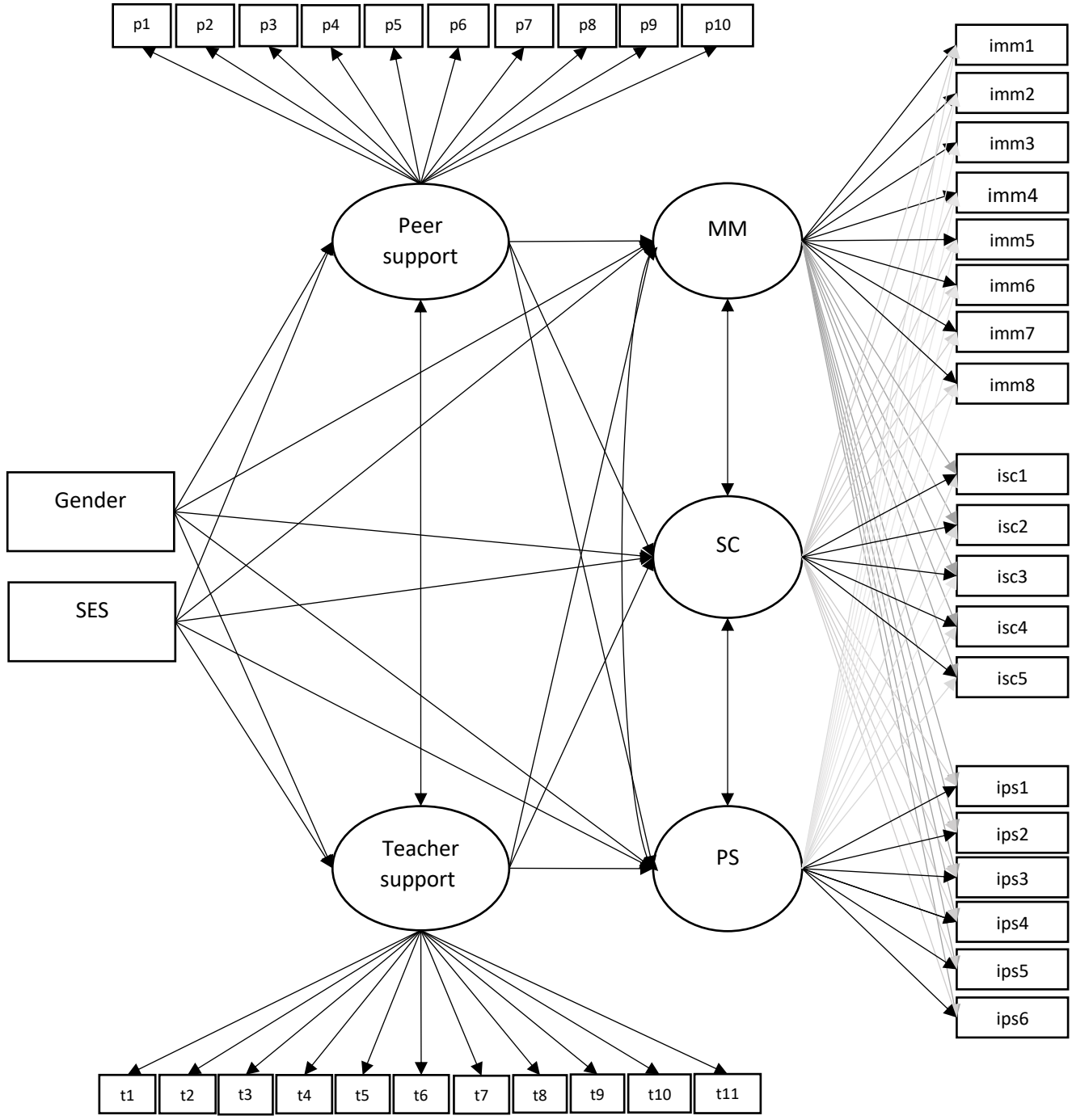

Figure 1. Hypothesized ESEM path model between the student's leaning agency [i.e., meaning making (MM), seeking scaffolding (SC), and problem solving (PS)], school-related social support from teachers and among peers, gender, and school's neighbourhood SES.

4. Method

4.1 Participants and the data collection

In Finland, comprehensive school includes primary school (grades 1–6) and secondary school (grades 7–9) and nearly all children complete the 9-year long compulsory basic education. The data were collected from two cohorts of students: 4th graders (n=2401, 50% girls, 58% high SES, age 10) and 7th graders (n=1545, 51% girls, 59% high SES, age 13) from 71 comprehensive schools from 245 school classes around Finland. The schools selected in the study represented the demographic variation of the schools in Finland: they were situated throughout the country and varied in terms of size, location (rural/urban) and the SES level (high/low) (referring to the levels of income, employment, and education of the habitants of the surrounding area of the school). The student population of the schools ranged from 50 to 1255 students. The researchers collected the data during school days in Fall 2017. They introduced the study to the students, gave them instructions on how to complete the survey and collected the written surveys from the students. Researchers received consent for study participation from the chief officers of the school district, the case schools, and the students and their parents. Participation in the study was voluntary and no extra credits were given to the students for participation. Furthermore, students were informed that neither their parents nor their teachers would see their answers. The total response rate of the survey was 90% in the primary school cohort and 89% in the secondary school cohort. According to the guidelines of Finnish National Board on Research Integrity no ethical review for the study was required (Finnish National Board on Research Integrity (TENK)).

4.2 Learning agency -survey

Learning agency (LA) was assessed by using new measurement developed by research group. It includes three subscales that measure student's sense of learning agency in the school context: seeking scaffolding (5 items), meaning making (8 items), and problem solving (6 items) each of them involving motivation to learn, efficacy beliefs and intentional strategies for learning. The subscales were tested and further developed based on three-phase piloting procedure. First, six students from grades 4 to 8 were asked to answer the pilot survey and freely comment on the items. Several ambiguous items were removed, and conceptual clarifications were made to the items based on discussions with the students. Second, the subscales were statistically studied for a sample of 93 fourth graders. The three subscales of learning agency were identified with principal axis factoring (PAF) and exploratory factor analysis (EFA) using multiple rotation options. The consistency and stability of the Cronbach's alpha reliabilities was also studied in different PFA and EFA solutions. Finally, the final three factor structure was also validated with the explorative structural equation modeling (ESEM) with the partial samples of the national school data gathered, including students from 4th, 5th 6th, 7th 8th, and 9th grades. Due to this three-phase piloting procedure, the number of originally developed items was compressed to the half within each subscale during the piloting.

The subscales were developed to assesses students' motivation to learn (I want), efficacy beliefs, (I am able), and intentional strategies (I can and do) occurred in the three higher order learning activities. The *seeking scaffolding* scale measures students' motivation, efficacy beliefs, and strategies to seek actively help for learning when needed (α = .79 in Grade 4 and α = .81 in Grade 7). The *meaning making* scale measures students' motivation, efficacy beliefs, and strategies to construct, understand and make sense of learning intentionally (α = .86 in Grade 4 and α = .86 in Grade 7), while, the *problem solving* scale measures students' motivation, efficacy beliefs, and strategies to find alternative solutions to problems encountered in learning (α = .82 in Grade 4 and α = .86 in Grade 7). Each scale contains at least one item from each element of learning agency (motivation, efficacy, strategy). The scales were measured using a 7-point Likert scale (*1 = totally disagree, 7 = totally agree).* They are presented in the Appendix in Table A1.

School-related social support was examined by assessing social support from teachers and guardians and among peers (Rautanen, Soini, Pietarinen & Pyhältö, 2021). The *teacher support* scale assessed emotional support (i.e., respect, empathy, and care) and informational support from teachers for studying (α = .94 in Grade 4 and α = .95 in Grade 7; 11 items, e.g. "My teachers give me encouragement and support", "I often receive constructive feedback from teachers", "The teachers are interested in my opinions"). The *peer*

support scale measured emotional and informational support for studying. It comprised items concerning both giving and receiving social support for studying (α = .92 in Grade 4 and α = .93 in Grade 7; 10 items, e.g., "I have the courage to offer my friends help with their studies", "I have the courage to ask others for help with my studies", "My classmates' encouragement inspires me in my studies"). Students rated peer and teacher support using a 7-point Likert-type scale ranging from 1 (*totally disagree*) to 7 (*totally agree*). Moreover, gender and the socio-economic characteristics of the living area surrounding each school (and student), i.e., low or high SES living area, were used as background variables.

4.3 Analysis

We used SPSS for the preliminary analyses of the data and Mplus statistical package (Version 8.0, Muthén & Muthén, 1998–2017) for the further analyses. The amount of missing data in the observed variables typically varied from between 2% and 7%, except for 15–16% for two items. Little's test of Missing Completely at Random (MCAR) was significant showing that the data were not missing completely at random (x2 = 26840.708, DF = 23967, p=.000). Missing data were accounted for in further analysis for using full information maximum likelihood (FIML) to estimate models without imputing the missing data. Further, the model parameters were estimated by means of maximum likelihood robust (MLR) estimation, which is robust to the nonnormality of the observed variables (MLR estimator; Muthén & Muthén, 1998–2017).

In the first phase of analyses, we examined the structure of LA by exploratory factor analysis (EFA) using multiple different rotations. Cronbach's alpha reliabilities were also studied. EFA supported the three-factor model that consisted of meaning making, seeking scaffolding, and problem solving factors. All correlations between items were statistically significant and in expected directions (see Appendix, Table A2). In the second phase of analyses, we validated the factor structure by using explorative structural equation modeling (ESEM). In ESEM, items loaded on their main factors, and cross-loadings were "targeted", but not forced, to be as close to zero as possible with the oblique target rotation procedure (Tóth-Király, Bõthe, Rigó, & Orosz, 2017). The following guidelines were applied to interpret the magnitude of the factor loadings defined as excellent above 0.71, very good between 0.63 and 0.70, good between 0.55 and 0.62, fair between 0.44 and 0.33, and poor below 0.30 (Comrey & Lee, 2013). Due to the nested data (i.e., schools, classes, and students) the intra-class correlation coefficients (ICC) and design effects (Deff) were examined using classes clustering variables (see e.g., Snijders and Bosker, 2012). In Deff, values over 2 and in ICCs, values over .05 indicate a clustering effect in the data (Muthén & Satorra, 1995; Peugh, 2010). The analysis showed that the data was moderately clustered (i.e., ICCs varied between .02–.10 in the whole data and in gender groups and grade levels) and this was considered in the analysis with a complex option if possible (Muthén & Satorra, 1995; Peugh, 2010) [1].

After identifying/confirming the final factor structure of students' learning agency, we tested hypothesized path model between the latent variables of teacher support, peer support, and student's learning agency (i.e., seeking scaffolding, meaning making and problem solving) (see Figure 1). Gender and SES were included as observed dichotomous variables in the model. The model fit was evaluated using the following criteria for the goodness-of-fit indices: the root mean square error of approximation (RMSEA) below 0.06, the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) over 0.90, the standardized root mean squared residual (SRMR) below 0.05, and the normed fit index (NFI) over 0.90 (Byrne, 2012; Hooper et al., 2008; Hu & Bentler, 1999).

[1] Complex option was used in the analysis of the data related to fourth graders. In the data related to seventh graders, the size of the data limited the use of the complex option when the number of free parameters exceeded the number of clusters. Thus, clustering effect could not be considered in the analysis of the data related to seventh graders. However, comparing the results obtained with and without complex option suggested that there were no significant differences in the result obtained in different ways.

5. Results

5.1. The student's sense of learning agency

The ESEM analysis for the correlated three-factor model of learning agency resulted good fit with the data after modifications of two added residual covariances (see Table 1.). The hypothesized ESEM three-factor model worked adequately in both student cohorts (i.e., factor loadings above .30) (see Table 1). One item (SC3) cross loaded moderately between the seeking scaffolding and meaning making factors among younger student cohort (i.e., fourth graders). However, item (SC3) had an expected factor load to the meaning making factor in the cohort of seventh graders.

Table 1

Standardized parameter estimates and Goodness-of-fit summary for the ESEM solutions of the Learning agency Scale separately within 4th graders and 7th graders.

	4th graders (N=2392)				7th graders (N=1546)			
Items	SC (l)	MM (l)	PS (l)	res.var	SC (l)	MM (l)	PS (l)	res.var
SC1	**.55**	.12	*.00*	.62	**.40**	.33	-.12	.68
SC2	**.74**	*.02*	*.01*	.44	**.69**	*.08*	*-.02*	.47
SC3	**.32**	.30	*-.02*	.71	**.45**	.23	-.11	.69
SC4	**.88**	*-.08*	*-.05*	.32	**.88**	-.13	*.05*	.30
SC5	**.79**	-.06	*.08*	.37	**.87**	-.16	.10	.31
MM1	*.00*	**.61**	.03	.60	*.02*	**.57**	.10	.57
MM2	.14	**.57**	-.02	.59	.06	**.61**	*.04*	.55
MM3	*-.01*	**.49**	.14	.62	*.00*	**.71**	*.02*	.48
MM4	.05	**.72**	-.09	.54	.14	**.46**	*.05*	.65
MM5	*-.07*	**.61**	.07	.60	.09	**.33**	.17	.72
MM6	.09	**.54**	.09	.56	.12	**.53**	*.10*	.53
MM7	*.02*	**.57**	.15	.51	-.09	**.66**	.15	.46
MM8	*.02*	**.69**	-.00	.52	*.01*	**.69**	*.01*	.51
PS1	.08	*.03*	***.58***	.59	.06	.17	**.54**	.51
PS2	*.00*	*-.10*	***.76***	.53	-.10	*.01*	**.80**	.42
PS3	-.10	.29	**.41**	.63	*-.03*	.13	**.58**	.56
PS4	*.00*	.14	***.57***	.53	*-.00*	.18	**.59**	.46
PS5	*-.03*	*-.08*	***.82***	.45	*-.01*	-.17	**.87**	.44
PS6	.09	*-.004*	**.64**	.536	.19	*.08*	**.52**	.52

	Factor correlations	
	4th grade	7th grade
SC - MM	.53	.54
SC - PS	.46	.43
PS - MM	.78	.74

Grade	N	χ^2	df	p	CFI	TLI	RMSEA	90% CI	SRMR
4	2392	580.56	117	.000	.96	.94	.04	.04-.04	.02
7	1540	563.20	116	.000	.95	.93	.05	.05-.05	.03

Note. ESEM=Exploratory structural equation modeling; SC=seeking scaffolding; MM=meaning making; PS=problem solving; res.var.=residual variance; l=factor loadings, target loadings are in bold; Non-significant parameters (p≥.05) are italicized; χ2=chi-squared test; df=Degrees of Freedom; CFI = Comparative fit index; TLI = Tucker–Lewis Index; RMSEA = root mean square error of approximation; 90% CI = 90% confidence interval of the RMSEA; SRMR = standardized root mean square residual.

All correlations between the three elements of the learning agency were statistically significant and in expected directions (see Table 1). Problem solving and meaning making correlated stronger with each other than with seeking scaffolding in both student cohorts (i.e., 4th and 7th graders). This indicated that the students' intentions to find alternative solutions to problems encountered in learning is stronger related to the need for understanding and making sense of learning than seeking actively help for learning.

The results confirmed the first hypothesis (H1) by showing that students' sense of learning agency, i.e., capacity to engage in higher order learning activities such as complex problem solving, meaning making and seeking scaffolding for learning at the school is relational, and cannot be reduced to a single attribute of the learner. In other words, students' motivation, efficacy beliefs, and strategies to construct, understand and make sense of learning intentionally (i.e., meaning making), to find alternative solutions to problems encountered in learning (i.e., problem solving) and seek actively help for learning (i.e., seeking scaffolding) are interrelated but separate constructs, in fourth and seventh graders' experiences.

5.2 The interrelationship between the sense of learning agency and perceived social support

The results showed statistically significant grade, gender, and SES differences between students in sense of learning agency and received social support from teachers and peers (see Table 2). Due to the large sample size the effect sizes of differences were also studied using Cohen's d besides the p-values from the t-tests (Lakens, 2013). Primary school students (i.e., 4th graders) reported a statistically significantly higher sense of learning agency than lower-secondary school students (i.e., 7th graders) in terms of enhancing their learning by meaning making, seeking scaffolding and problem solving (Cohen's d ranging from .41 to .57). Girls reported higher sense of seeking scaffolding and meaning making than boys, while boys reported slightly higher problem solving than girls. However, as Table 2 shows, the gender differences were not as strong as the grade differences (Cohen's d ranging from .08 to .28). Students from high SES areas perceived all three elements of learning agency to be slightly higher than students from low SES areas (Cohen's d ranging from .08 to .12).

There were also statistically significant grade, gender, and SES differences between students in terms of the perceived social support from teachers and peers (see Table 2). Primary school students reported statistically significantly higher teacher and peer support than lower-secondary school students (Cohen's d ranging from .41 to .46). Girls reported statistically significantly higher teacher support and peer support than boys. However, the gender difference in teacher support was not as strong as in peer support. In turn, the observed statistically significant differences between students from different SES-areas were minor (see Cohen's d ranging from .03 to .09). The analysis further showed that the observed correlations between the explored scales were statistically significant and in the expected directions in both student cohorts (see Table 2). The findings confirmed mainly the fourth hypothesis (H4) that girls and students from high SES living areas perceive more social support from teachers and peers. They are also more familiar with these learning activities that contribute to sense of learning agency compared to boys or students from low SES living areas.

Table 2

Means, Standard Deviations, Cohens' d and Observed Correlations

Grade differences	**4th graders (n=2396)**		**7th graders (n=1546)**		
	M	*SD*	*M*	*SD*	Cohen's d
Seeking scaffolding	5.80	1.10	5.27	1.19	.46
Meaning making	4.79	1.19	4.31	1.16	.41
Problem solving	5.00	1.14	4.34	1.18	.57
Teacher support	5.37	1.22	4.80	1.26	.46
Peer support	5.60	1.12	5.13	1.16	.41
Gender differences	**Girls (n=1961)**		**Boys (n=1932)**		
	M	*SD*	*M*	*SD*	Cohen's d
Seeking scaffolding	5.76	1.11	5.44	1.19	.28
Meaning making	4.76	1.17	4.46	1.20	.25
Problem solving	4.69	1.22	4.79	1.18	.08
Teacher support	5.24	1.24	5.05	1.29	.15
Peer support	5.66	1.04	5.17	1.22	.43
SES differences	**Low SES (n=1635)**		**High SES (n=2309)**		
	M	*SD*	*M*	*SD*	Cohen's d
Seeking scaffolding	5.54	1.20	5.63	1.14	.08
Meaning making	4.54	1.24	4.65	1.16	.09
Problem solving	4.66	1.22	4.80	1.18	.12
Teacher support	5.08	1.28	5.19	1.25	.09
Peer support	5.39[a]	1.19	5.43[a]	1.14	.03
Correlations	***1***	***2***	***3***	***4***	***5***
1. Seeking scaffolding	-	.54	.41	.55	.53
2. Meaning making	.54	-	.70	.50	.56
3. Problem solving	.44	.69	-	.44	.48
4. Teacher support	.55	.50	.48	-	.59
5. Peer support	.57	.59	.58	.67	-

Note 1. Means within a row sharing the same subscripts are not significantly different at the alpha=.05 level in pairwise *t*-test. The scales range from 1 to 7.

Note 2. All observed mean correlations were statistically significant at the p<.01 level. Fourth graders are below the diagonal and seventh graders are above diagonal.

The tested theoretical ESEM path model, where experienced social support from teachers and peers were positively correlated with the student's sense of learning agency, is presented in Figure 2. In addition, gender and neighborhood SES have been included as dichotomous covariates in the tested model. According to the several fit indicators, the tested path model fit the data well in both student cohorts (4th graders: N=2363; χ^2=3111.91, df=766, p=.000; CFI=.93; TLI=.92; RMSEA=.04; 90% CI=.04-.04; SRMR=.04; 7th graders: N=1528; χ^2=2985.06, df=764, p=.000; CFI=.92; TLI=.91; RMSEA=.04; 90% CI=.04-.05; SRMR=.04). The statistically significant p value of the chi-square test is due to the large sample size used in this study.

The model supported hypothesis 2 by showing that experienced teacher support and peer support are positively associated to each other (β = .71/.64) and with meaning making (MM), seeking scaffolding (SC) and problem solving (PS), and the associations differ depending on the source of the support and type of experienced higher order learning that contributes to sense of learning agency (see Figure 2). More specifically, the results showed that the perceived peer support had a stronger positive correlation with each

of the experienced learning contributing to students' sense of learning agency compared to perceived teacher support in both student cohorts. The peer support had the strongest positive correlation with problem solving (β = .59/.51) and the weakest with seeking scaffolding (β = .40/.38) in both student cohorts (4th graders/7th graders). Instead, teacher support had the strongest positive correlation with seeking scaffolding (β = .29/.32), and the weakest with problem solving (β = .14/.12) in both student cohorts. However, the perceived teacher support seemed to be especially crucial for lower secondary school students' meaning making (β = .17/.33), i.e., experienced motivation, efficacy beliefs, and strategies to construct, understand and make sense of one's own learning intentionally.

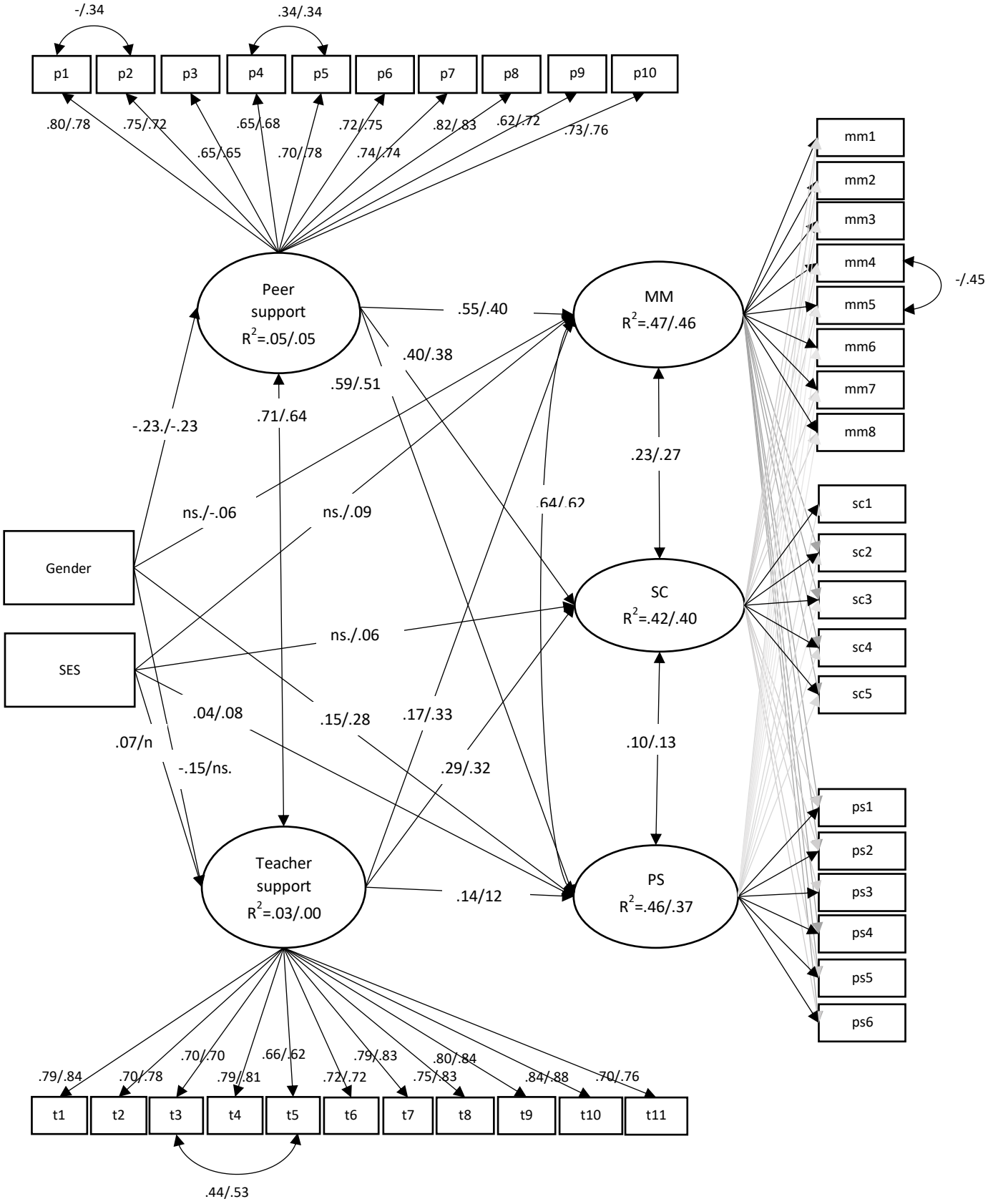

Figure 2. ESEM path model between student's learning agency, [i.e., meaning making (MM), seeking scaffolding (SC), and problem solving (PS)], school-related social support (i.e., teacher and peer support among fourth and seventh graders (Note: see Table A3 in Appendix the detailed results of ESEM

corresponding the factor loads of LA; standardized model, all parameters are statistically significant at $p < 0.05$).

The results showed that fourth (β = -.23) and seventh (β = -.23) grade girls reported higher levels of peer support compared to boys. Fourth grade girls (β = -.15) also reported higher levels of teacher support than boys. Further, girls were less familiar with problem solving as an efficient learning than boys in both student cohorts (β = .15/.28) and, in turn, seventh (β = -.06) grade girls were more familiar with the perceived meaning making as a way of learning. However, the living area surrounding each school, i.e., low or high SES area, did not correlate with experienced social support and experienced learning activities as much as gender. As an indicative result, fourth graders from a high SES area were more familiar with the perceived problem solving as learning (β = .04) and teacher support (β = .07) than students from a low SES area. Instead, seventh graders from high SES areas perceived meaning making (β = .09), seeking scaffolding (β = .06) and problem solving (β = .08) activities more familiarly in their learning than students from low SES area.

The results also showed that especially experienced school-related teacher and peer support, and also gender and the school's neighborhood SES were positively correlated with fourth and seventh graders' motivation, efficacy beliefs, and strategies to make sense of own learning intentionally (i.e., MM, R^2= .47/.46), to find alternative solutions to problems encountered in learning (i.e., PS, R^2= .46/.37) and seek actively help for learning (i.e., SC, R^2= .42/.40).

All in all, the findings confirmed partly our hypothesis (H3) that girls and primary school students report a higher sense of learning agency. More precisely, girls reported higher sense of seeking scaffolding and meaning making than boys, while boys reported slightly higher problem solving than girls. In turn, the results confirmed mainly our hypothesis (H4) that girls, primary school students, and students from high SES living areas perceive more social support from teachers and peers. That is, primary school students and girls reported higher teacher support and peer support than boys. However, the gender difference in teacher support was not as strong as in peer support and differences between students from different SES-areas were minor.

6. Discussion and Conclusion

6.1 Theoretical and practical implications

We explored fourth and seventh graders' learning agency realized in the motivation, self-efficacy, and skill they experienced in engaging in problem solving, meaning making and seeking scaffolding for learning. Also, interrelations between experienced teacher and peers support, and the sense of learning agency was examined. The results confirmed that the learning agency is a multifaceted construct and that these elements of learning agency i.e., will, ability beliefs and skills in terms of learning, are ingrained in solving problems for learning, constructing meaning by bridging prior understanding to current learning tasks, and identifying relations in learned contents and actively seeking help and social scaffolds for learning. The results imply that to understand higher order learning and support it at school, all the elements of learning agency should be considered.

Overall, students reported high levels of active help seeking for learning, implying that they actively used the social structure of the learning environment as a resource for learning. However, at the same time, they reported lower levels of problem solving for learning and meaning making, indicating that motives, efficacy beliefs and skills related to these higher order learning activities could be further enhanced. Solving problems and making meaning in learning in school also correlated with each other more strongly than with seeking scaffolding for learning. It seems that attempts to make sense of the goal of learning is related to trying persistently and in various ways to solve the problems encountered in learning. This implies that encouraging and supporting students when they ponder on learning tasks and even question their relevance will increase their resilience with the task and is hence a good investment in supporting learning.

The study detected differences in learning agency in terms of grade level, gender, and SES. Fourth graders reported higher levels of learning agency than seventh graders, which may be explained by students' decreasing engagement in studying as the school path proceeds (Janosz, Archambault, Morizot, & Pagani, 2008; Li & Lerner, 2011). At the same time, teacher support was more strongly associated with learning agency in lower secondary school. This may imply lower secondary school students' motivation, efficacy beliefs, and strategies to construct, understand and make sense of own learning intentionally (i.e., meaning making) calls for more intentional support from teachers in lower secondary grades. It could be also argued that supporting higher order learning in adolescence may require more effort – or even new kinds of pedagogical practices that enable students to reconstruct their relationship with learning in school and their role as learners.

In term of gender differences, Finnish girls usually appear to be better adjusted to school and perform better than boys. However, our findings on the gender differences were less straight forward. While girls reported more active help seeking and attempted to make sense of the learning, boys reported more will, efficacy beliefs and skills of solving problems for learning. Accordingly, both girls and boys showed a rather strong sense of learning agency, yet it was manifested differently across the learning activities. This implies that not only learning outcomes, but also experiences of higher order learning is partly gendered in school. However, the differences detected were more complex and nuanced that those previously reported regarding school adjustment (Liu et al., 2016; Wang & Eccles, 2012) and school achievement (Bursal, 2017; OECD, 2019,). Results imply that girls and boys may have partly different support needs in terms of cultivating a strong sense of learning agency. While girls might benefit from encouragement in problem solving, boys may profit from support in meaning making and seeking scaffolding for learning.

The results also showed that a school's neighborhood SES was modestly related to fourth and seventh graders' sense of learning agency i.e., motivation, efficacy beliefs, and strategies to make sense of one's own learning intentionally, to find alternative solutions to problems encountered in learning and actively seeking help for learning. A potential reason for the result might be that the students from high SES areas have more experience with learning activities characterized by the learning agency compared to students from low SES areas. This could also be an early sign of increasing differences in learning outcomes starting with the erosion of students' sense of learning agency, at its worst resulting in inequality in learning opportunities in Finland, if the school cannot act as a buffer against risk factors such as low SES.

Teacher and peer support were both related to experiences of learning agency in general. However, there were both school grade and gender differences in the support experienced; fourth graders and girls reported higher levels of social support from both peers and teachers than seventh graders and boys. The differences were more significant in terms of support from peers. This result is in line with previous findings that girls experience more peer support, especially from their classmates, than boys (Camara et al., 2017; Rautanen et al., 2020; Wentzel et al., 2017). It seems that learning in school for girls is more strongly embedded in peer interaction compared to boys. Girls seem to seek and offer help actively and experience having it. Further investigation showed that the peer support was more strongly related to experiencing learning agency than support from teachers. However, students in lower secondary school seemed to benefit more from teacher support in constructing meaning and making sense of learning goals and understanding the links between learning tasks and contents than primary school students. This implies that higher order learning is challenging for adolescents, probably due to other developmental challenges that they are going through, and it needs to be very intentionally supported by teachers.

The social support experienced had different roles in facilitating different elements of learning agency. For both student groups, peer support had a stronger association with problem solving than other learning activities. In turn, teacher support had a stronger interrelation with seeking scaffolding for learning. Yet, the teacher support was strongly linked to the peer support, and it may be argued that to build a learning environment, facilitating learning agency calls for building opportunities both to receive and give peer support. This further requires teacher effort to scaffold peer support i.e., constructing meaning and solving problems

together, and using peers as a resource for learning in their pedagogical practices. Especially in lower secondary school, students need teacher support to (re)construct the agentic learner role in school and find balance in seeking peer acceptance and meeting the learning goals. Based on our results, the social support seems to play a key role as a resource for enhancing students' learning agency, but support from a range of sources seems to have distinct roles in enhancing it. Moreover, the results indicate that the sources of social support provided by the school environment complement each other. Accordingly intentional regulation of individual-environment dynamics in the teacher-student and peer interaction can provide the means for cultivating complementary elements of learning agency.

Engagement in higher order learning may be viewed as important from several perspectives. Constructing strong learning agency in school is likely to have far reaching effects on students' ability for intentional and meaningful learning throughout their lives. This further is a prerequisite for active citizenship, being able to participate in society, and hence a crucial prerequisite for functional community life. Therefore, it may be argued that equality of not just education but the whole society depends on the ability of educational systems to support and facilitate learning agency of all children. We detected some variation in students' sense of learning agency, such differences may become problems if they reflect or result in differing opportunities to engage in agentic learning in school, having further impact on different educational and career trajectories and even life orientations. Moreover, enhancing learning agency among children is also the main strategy for bringing human resources into use in solving the massive global challenges and creating new ways of living. Hence, we claim that merely supporting some competencies or strategies of learning is not enough if children are unable to develop a strong sense of learning agency that carries them throughout their life.

6.2 Methodological reflections

This cross-sectional large-scale two cohort student explored the relationships between students' sense of learning agency and social support received from teachers and peers in the school context. The novel *learning agency* (LA) -measurement was develop for this purpose. Path analysis confirmed a pattern of correlations that explained the students' sense of learning agency and the social support they received for their own learning in the school context. Due to the cross-sectional design, conclusions about the causality between the attributes cannot be made (e.g., Lleras, 2005).

The study contributed to methodological advancement in the field of learning sciences by introducing a new measure for studying a student's sense of learning agency across the school path. The validity and reliability of the LA survey was adequate. However, construct validation of the learning agency sub-scales, and longitudinal studies across the school systems and country-contexts, are needed to further validate the LA measure. Reliability and validity of the teacher and peer support scale was also sufficient. The support scale has been validated in prior studies (Rautanen et al., 2021).

All in all, despite some limitations, our study provides important insights into the factors contributing to students' sense of learning agency that are emphasized and enhanced in the school curricula and educational system/s. The LA can potentially be used to identify early signs of disengagement from higher order learning activities in school preceding the actual decrease in school achievement.

Key points

- Engaging in higher order learning requires strong sense of learning agency.
- Learning agency consists of will and power to act in terms of learning and believe that one can do it.

- The novel learning agency (LA) -measurement was develop for studying learning agency of primary and lower secondary students.
- Differences in learning agency and social support in terms of grade level, gender and SES were detected.
- The social support from teachers and peers had different relationships with different elements of learning agency.

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APPENDIX

Table A1. *Students' learning agency (LA) subscales and reliability analysis (translated from Finnish)*

Items		***Elements of the LA***
Seeking scaffolding, α=.79/.81 (4th/7th graders)		
SC1	It is important that I tell the teacher when I have problems at school	motivation
SC2	It is important for me to ask if I don't understand the task set by the teacher	motivation
SC3	I feel confident enough to ask for extra help if I experience difficulties in my studies	efficacy
SC4	I ask for help if I am not able to complete the task, we have been set	strategy
SC5	I can confidently ask about a topic I don't understand	strategy
Meaning making, α=.89/.89 (4th/7th graders)		
MM1	I often look for more information in order to understand the things I am studying	strategy
MM2	I get interested in a subject when I realize how it connects to something, I have previously learned about	motivation
MM3	I can independently work out problems that were unresolved during lesson time	strategy
MM4	I get interested in what I'm studying when I understand how it connects to things in my own life	motivation
MM5	I learn better when I can find an example from my own life that relates to what I am studying	efficacy
MM6	I try to think back to what I have previously learned about a topic when I am learning something new	strategy
MM7	I find it stimulating to think about school work outside of lesson time	motivation
MM8	I often reflect on what I am learning	strategy
Problem solving, α=.89/.91 (4th/7th graders)		
PS1	I want to finish even the most difficult homework assignments	motivation
PS2	I enjoy tasks that require me to solve problems	motivation
PS3	I often come up with alternative solutions to the tasks I've been given	strategy
PS4	It's a good idea to consider the different perspectives on topics we are learning about	efficacy
PS5	I perform best in tasks in which there is a specific solution to a problem	efficacy
PS6	I am usually able to solve problems related to my studies	efficacy

Table A2. *Correlations between the items in Learning agency subscales in fourth and seventh graders' cohorts*

		Correlations																		
Items		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*10*	*11*	*12*	*15*	*16*	*17*	*19*	*20*	*21*	*22*	*25*
1	SC1	-	.48	.39	.40	.38	.32	.23	.16	.21	.15	.27	.36	.32	.33	.32	.26	.30	.27	.27
2	SC2	.53	-	.37	.60	.59	.32	.22	.21	.25	.22	.34	.30	.38	.33	.37	.29	.33	.25	.31
3	SC3	.36	.33	-	.42	.44	.22	.16	.15	.24	.18	.29	.27	.25	.32	.32	.20	.29	.25	.30
4	SC4	.46	.61	.36	-	.71	.28	.18	.23	.27	.21	.36	.29	.30	.30	.31	.26	.36	.24	.27
5	SC5	.46	.58	.38	.67	-	.30	.19	.26	.28	.23	.37	.26	.30	.28	.28	.24	.34	.26	.32
6	PS1	.25	.29	.26	.24	.29	-	.55	.45	.53	.46	.49	.42	.43	.44	.32	.29	.43	.46	.39
7	PS2	.25	.25	.25	.19	.23	.46	-	.50	.49	.61	.45	.40	.38	.38	.31	.30	.37	.46	.37
8	PS3	.22	.19	.19	.14	.20	.35	.38	-	.53	.46	.42	.44	.43	.37	.33	.34	.37	.41	.35
10	PS4	.25	.23	.25	.23	.31	.44	.40	.47	-	.50	.57	.43	.41	.48	.36	.37	.46	.47	.42
11	PS5	.19	.23	.26	.20	.26	.43	.56	.40	.47	-	.46	.30	.31	.35	.33	.32	.35	.39	.35
12	PS6	.27	.28	.26	.24	.34	.43	.42	.38	.52	.49	-	.40	.36	.42	.37	.39	.45	.41	.40
15	MM1	.29	.27	.29	.23	.27	.34	.33	.40	.36	.33	.31	-	.42	.54	.35	.30	.42	.46	.40
16	MM2	.31	.35	.31	.32	.33	.35	.30	.35	.37	.33	.34	.41	-	.49	.46	.41	.48	.45	.44
17	MM3	.27	.25	.30	.22	.28	.36	.31	.38	.40	.36	.37	.42	.35	-	.36	.33	.49	.51	.49
19	MM4	.30	.32	.32	.26	.31	.33	.32	.31	.37	.34	.35	.42	.50	.37	-	.61	.40	.42	.39
20	MM5	.21	.22	.28	.19	.24	.29	.32	.37	.40	.37	.38	.39	.37	.34	.51	-	.40	.35	.34
21	MM6	.29	.32	.31	.31	.33	.35	.34	.35	.39	.39	.42	.41	.45	.40	.41	.41	-	.45	.53
22	MM7	.27	.30	.35	.27	.32	.42	.42	.37	.42	.43	.37	.42	.40	.44	.46	.41	.46	-	.61
25	MM8	.28	.31	.33	.26	.31	.35	.32	.37	.40	.38	.36	.41	.40	.45	.43	.40	.50	.56	-

Note. All correlation is significant at the p<0.01 level. Fourth graders (n=2392) are below the diagonal and seventh graders (n=1546) above the diagonal.

Table A3. *Standardized parameter estimates for the scales of learning agency in path model (ESEM) consisting of the associations between latent social support variables separately within 4th graders and 7th graders (see Figure 2)*

	4lk (N=2363)				7lk (N=1528)			
ITEMS	**SC (λ)**	**MM (λ)**	**PS (λ)**	**res.var**	**SC (λ)**	**MM (λ)**	**PS (λ)**	**res.var**
SC1	**.56**	.11	*.00*	.60	**.39**	.41	-.21	.63
SC2	**.74**	*.03*	*-.01*	.44	**.68**	.13	-.07	.47
SC3	**.32**	.34	*-.05*	.70	**.44**	.27	-.14	.68
SC4	**.87**	*-.07*	*-.06*	.34	**.88**	-.15	.06	.32
SC5	**.80**	-.09	.10	.37	**.91**	-.22	.13	.28
MM1	*-.01*	**.64**	*.01*	.60	*.01*	**.56**	.12	.58
MM2	.13	**.58**	*-.03*	.59	*.05*	**.60**	*.05*	.55
MM3	*-.01*	**.52**	.12	.63	*-.02*	**.70**	*.04*	.49
MM4	*.04*	**.69**	*-.05*	.55	.12	**.47**	*.06*	.65
MM5	-.08	**.57**	.12	.62	.07	**.35**	.17	.72
MM6	.07	**.56**	*.08*	.56	.10	**.52**	.13	.54
MM7	*.00*	**.63**	*.10*	.50	-.10	**.66**	.16	.47
MM8	*-.00*	**.72**	*-.03*	.52	*.02*	**.65**	*.06*	.51
PS1	.07	*.03*	**.57**	.60	.05	.19	**.53**	.51
PS2	*-.01*	*-.03*	**.69**	.56	-.11	*.10*	**.71**	.45
PS3	-.11	.27	**.43**	.62	*-.03*	.10	**.62**	.54
PS4	*.00*	*.07*	**.65**	.51	*-.01*	.15	**.64**	.44
PS5	*-.05*	*-.03*	**.76**	.49	*-.01*	*-.11*	**.81**	.46
PS6	.08	*-.09*	**.73**	.50	.18	.09	**.52**	.51

Note. SC=seeking scaffolding; MM=meaning making; PS=problem solving; res.var.=residual variance; λ=factor loadings, target loadings are in bold; Non-significant parameters (p≥.05) are italicized