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Development of the Self-Regulated Learning Teacher Belief Scale

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*The present study describes the development and psychometric properties of the Self-Regulated Learning Teacher Belief Scale (SRLTB). The SRLTB is a self-report teacher scale with 10 items assessing teachers' beliefs about introducing self-regulated learning (SRL) in primary education. The process of item and scale development as well as testing and scale refinement procedure is presented. An explorative study (*n*=399) revealed a one-factor structure representing adherence of teachers for SRL in primary school. Next, Rasch analysis revealed good fit of the scale to the unidimensional continuum model. In a following study (*n*=553), construct validity of the SRLTB was confirmed. Finally, implications and limitations of the SRLTB for studying SRL are discussed. In general, the SRLTB appears to be a useful instrument for examining teacher beliefs about self-regulated learning practices in primary schools.*

Background

Self-regulated learning (SRL) refers to independent, academically effective forms of learning that involve metacognition, intrinsic motivation, and strategic action (Zimmerman, 1989, 1990, 2002). The metacognitive component covers planning, setting goals, organizing, self-monitoring, and self-evaluating at various points during the process of acquisition. The motivational component emphasizes high self-efficacy, self-attributions, and intrinsic task interest. Finally, the behavioral component refers to selecting, structuring, and creating environments that optimize learning (Zimmerman, 2002).

Self-regulated learning in primary school

Most research on self-regulated learning has involved learners in upper-primary grades through college (Perry, Phillips, & Dowler, 2004) reflecting the long-held view that young children have difficulty coordinating and articulating the cognitive and metacognitive processes required to complete complex, multi-faceted tasks (Perry & VandeKamp, 2000, p. 822; see also Perry, 1998; Winne, 1997; Zimmerman, 1990). Because learners vary widely in their use of self-regulated learning strategies (Zimmerman, 1990), it is of course difficult to determine the minimum age when children are ready to regulate their own learning. Nevertheless, most theories assume that children develop the capacity to self-regulate during the primary school years (Bronson, 2000; Featherstone & Bayley, 2001; Zimmerman, Bonner, & Kovach, 1996). Recent observations of and interviews with young children (kindergarten through grade 3) showed them to self-regulate – plan, monitor and self-evaluate – their learning activities during complex learning tasks (Martinez-Pons, 2002; Neuman, 1996; Turner, 1995; Perry, 1998; Perry et al., 2004; Perry & VandeKamp, 2000).

Since self-regulatory processes are teachable (Zimmerman, 2002), teachers play a crucial role in promoting SRL. Indeed, Perry and colleagues (Perry & VandeKamp, 2000; Perry, VandeKamp, Mercer, & Nordby, 2002; Perry et al., 2004) repeatedly indicated that adjustments teachers made to the learning environment and their teaching practices had positive effects on their pupils' development of SRL. Examples of these positive consequences for pupils are: improved self-monitoring, heightened awareness of the quality of their performance, and increased dedication to learning (Boekaerts & Minnaert, 1999; Chung, 2000; Perry et al., 2004; Perry & Vandekamp, 2000; Perry et al., 2002; Purdie & Hattie, 1996; Purdie, Hattie, & Douglas, 1996; Schunk & Zimmerman, 1998; van Grinsven & Tillema, 2006). And importantly, a large body of research shows that learners who have been trained in self-regulated learning processes display high levels of motivation and achievement (Boekaerts, 1997; Cleary & Zimmerman, 2002; Perry & Vandekamp, 2000; Schunk, 1996; Zimmerman, 2002; Zimmerman & Schunk, 2001).

Despite these promising research findings, few teachers currently prepare pupils to learn on their own and are still steering and guiding the learning process (Boekaerts, 1997; Zimmerman, 2002; Zimmerman & Schunk, 2001), being unsure about how much and what kinds of guidance young children need to become masters of their own learning (Perry & Vandekamp, 2000), or more in general consider themselves not yet equipped to turn pupils into self-regulated learners (Boekaerts, 1997). As a result, pupils are not invited to use nor develop their cognitive or motivational self-regulatory skills, but are still mostly expected to reproduce and apply the new information that the teacher has presented or made available (Boekaerts, 1997). Although research results in this field indicated the importance to adjust teaching environments in order to promote self-regulated learning (Palmer & Wehmeyer, 2003; Perry, 1998; Wehmeyer & Palmer, 2000; Wehmeyer, Sands, Doll, & Palmer, 1997; Willoughby, Porter, Belsito, & Yearsley, 1999), little is known about the extent to which primary school teachers embrace the concept of self-regulated learning and if teachers consider it as suitable for primary school practice. Gaining insight in how primary school teachers think about an innovation such as self-regulated learning for primary school practice could provide valuable information in explaining the occurrence or absence of such SRL practices.

Teacher beliefs

A way to investigate teachers' thinking is examining their beliefs. Indeed, there is a consensus that beliefs are part of a group of constructs describing the structure and content of a person's thinking and providing an understanding of his/her actions (Bryan & Atwater, 2002; Kagan, 1992; Nespor; 1987; Pajares, 1992; Richardson, 1996). Although knowledge and beliefs are intertwined (Calderhead, 1996; Nespor, 1987; Verloop, Van Driel, & Meijer, 2001), beliefs act as a filter through which new phenomena are interpreted and subsequent behavior mediated (Calderhead & Robson, 1991; Ertmer, 2005; Fang, 1996; Goodman, 1988; Hermans, van Braak, & Van Keer, in press; Kagan 1992; Nespor, 1987; Pajares, 1992, 1997; Smith & Croom, 2000).

A substantial body of research has emerged suggesting that teacher beliefs fulfil a significant role in understanding teacher practice (Ashton, 1990; Calderhead, 1996; Clark & Peterson, 1986; Ertmer, 2005; Harwood, Hansen, & Lotter, 2006; Kane, Sandretto, & Heath, 2002; Pajares, 1992; Richardson, 1996; Wilson, 1990). They influence perceptions and judgements as well as their personal practical theories of teaching and knowledge (Errington, 2004; Ertmer, 2005; Haigh, 1998; Marland, 1997; Pajares 1992) drive instructional pedagogy (Minor, Onwuegbuzie, Witcher, & James, 2002; Pajares, 1992; Richardson, 1996) and therefore having a direct impact on teachers' practice (Warfield, Wood, & Lehman, 2005). Although inconsistencies have been described, the preponderance of research supports the assumption of a basic congruence between teachers' beliefs and their classroom practice (Calderhead, 1996; Carter, 1990; Ertmer, 2005; Fang, 1996; Kane et al., 2002; Smith, 1993; Verloop et al., 2001).

Logically, the literature suggests an impact of teacher beliefs on innovation in learning and teaching (Calderhead, 1996; Errington, 2001, 2004; Hofer & Pintrich, 1997; McDiarmid, 1990; Pajares, 1992; Richardson, 1996; Tatto, 1998). Teacher beliefs are seen as a blueprint for what is or is not possible; an open or closed door to promote, inhibit or resist change, and a collective climate that can foster or inhibit innovation (Errington, 2004, p. 40). Thus, to change teaching practices, teachers' beliefs should be taken into consideration (Hart, 2002; Minor et al., 2002). Consideration of the structure of belief systems covering several specific sets of beliefs, could show why some teachers change their practice and others do not (Warfield et al., 2005).

The promising conclusions of previous research on promoting self-regulated learning in primary school, the congruence between teacher beliefs and their classroom practices, the impact of teacher beliefs on educational innovation and the lack of a teacher-belief scale measuring preference for self-regulated learning in primary school, indicated that the development of a new instrument to assess the beliefs of primary school teachers would be worthwhile from a theoretical as well as practical perspective.

Methodology

In this section the scale development and the formation of an item pool is reported. Next, procedures involving testing and refinement of an early version of the instrument are described. Finally, the actual field testing of the revised Self-Regulated Learning Teacher Belief Scale took place.

Scale development

The initial aim of this study was to develop an instrument assessing primary school teacher beliefs about the introduction of self-regulated learning in daily classroom practice. Starting point in the development of such a scale were motives and arguments of primary school teachers to introduce or further develop self-regulated learning in their classroom. These motives and arguments focus on (general) attitudes towards SRL; personal experiences with SRL; and the benefits, difficulties and disadvantages encountered or expected when developing a teaching environment fostering SRL. Based on the literature review, opportunities and benefits as well as drawbacks and resistances to introduce SRL in primary school were identified. These characteristics were converted into positive and negative arguments regarding SRL on primary education level. Table 1 presents an overview of such arguments based on literature examining educational practices, specific innovation projects and implementation processes of self-regulated learning (Butler, 1998, 2002; Paris & Newman, 1990; Perry, 1998; Randi & Corno, 2000) and related constructs such as active learning (Kyriacou, 1992; Simons, 1997; Stern, 1997), independent learning (Van Tooren & Beckers, 1999), learner-centred learning (Frisby, 1998; Lambert & McCombs, 1998; McCombs & Whisler, 1997; Weimer, 2002), student-directed learning (Platz, 1994) and authentic instruction (Newmann & Wehlage, 1993; Newmann, Marks, & Gamoran, 1996). Although substantial theoretical differences between self-regulated learning and these other concepts were recognized, strong similarities were assumed in perceived

opportunities and resistances towards the introduction and implementation of these related concepts. For the same reason, literature examining implementation processes on secondary school level was also included. In order to clearly distinguish SRL from related concepts, and to avoid misinterpretation of what SRL stands for, the teacher questionnaire included a concrete description of the SRL concept (Appendix 1).

Next, the selected arguments were formulated as statements reflecting possible consequences when introducing SRL and possible impacts of SRL in the classroom; both positive as well as negative. Based on a profound search of the literature, 39 statements were listed. On theoretical grounds and for reasons of surveyability, all statements were subdivided into four groups: three groups representing learning environment context levels (Roelofs, Visser, & Terwel, 2003), namely pupil level, teacher level and school context level; and a fourth group containing statements on more general level. Although this subdivision facilitated item construction, most items could be assigned to more than one level.

The items were formulated as statements to which the teachers could respond on a five-point Likert-scale with 0='strongly disagree', 1='disagree', 2='nor agree/nor disagree', 3='agree' and 4='strongly agree' as possible responses.

Testing and refinement

The questionnaire items describing teacher beliefs about self-regulated learning in primary school were reviewed by an expert panel of six practising primary school teachers to determine the face validity of the questions. Teachers were asked to review the clearness and unambiguousness of all formulated statements. The statements were also reviewed by eight researchers in the field of educational sciences to establish content validity. Both teachers and researchers agreed that the set of statements was complete in covering arguments and counter arguments to introduce self-regulated learning practices in primary school. No arguments were omitted, nor were there new arguments added. Based on comments raised by teachers and researchers some items were revised slightly concerning phrasing and clarity.

Table 1

Statements reflecting positive and negative consequences when introducing self-regulated learning in the classroom practice

Arguments in favour of introducing SRL	Counter arguments for introducing SRL
growing number of pupils resisting teacher-centered instruction (LL)	learners are not ready for high degrees of SRL (LL)
pupils should be prepared for continuing learning throughout their lifetimes (LL)	pupils may find SRL threatening: they are more comfortable in a passive role (LL)
teachers increasingly seek methods to engage and motivate pupils (LL)	SRL results in poor test results (LL)
need for continual learning in the teachers' professional live (TL)	teachers are not sufficiently trained to teach differently from their present approach (TL)
more varied and attractive job as teacher (TL)	teachers are not always capable to implement SRL despite their interest in active learning (TL)
better responding to differences among pupils (TL)	interdisciplinary projects involve more than one teacher (TL)
need of teaching strategies and methods appreciated by all children (TL)	creating opportunities to stimulate independence take time (at least initially) (TL)
developments in our society concerning autonomous knowledge acquisition, problem solving, reflection, and application of knowledge and skills in other domains (GL)	teachers are more comfortable or competent in the role of information-giver than in the role of coach (TL)
an increasing data flow (GL)	SRL requires additional time for coordination (e.g., organizing and keeping track of pupils projects; necessary research on short notice in response to pupils' questions that go beyond the prescribed curriculum) (TL)
	possible conflicts with required curriculum (SL)
	class size often too large (SL)
	maladjusted teaching aids and instructional material for high SRL (SL)
	parental expectations (SL)
	difficulties for examining SRL-skills (GL)
	not practicable in primary school (GL)

Note. LL=Learner Level; TL=Teacher Level; SL=School Level; GL=General Level.

Actual field testing

Two samples were included in the present study. Data collected from a first sample of primary school teachers in Dutch speaking schools of the Brussels Capital Region and surrounding suburban area (Belgium) were used for scale construction. This sample consisted of 399 primary school teacher from 91 schools stratified according to governance (private/public), region (urban/suburban) and occurrence of educational priorities policy resources (yes/no). Consistent with the population mean, 76.1 % of the sample was female. Teachers' average age was 37.0; 33.2 % of the teachers were younger then 30 years. In the whole group, 56.9 % had been working as a teacher longer than 10 years (in a range from 0 to 44). The majority of the teachers (64%) were working in grades 4-6 of primary school (pupils of 9-12 years). The reason for higher percentages of participation in the top grades is that principals were asked to primarily invite higher grade teachers (4-6) to fill in the questionnaire. On average, the teachers' class size was nearly 20 pupils.

A second sample was used to confirm the stability of the scale structure. This sample consisted of 553 primary school teachers spread over 68 schools in the regions of Antwerp (29.1%), Brussels (26.6%) and Ghent (39.6%) (Belgium). The sample was stratified according to governance (private/public) and region. The majority of the participants was female (81.4%). Average age of all teachers was 37.9 years (range 23-65). Teachers' seniority in education was 14.5 years (range 1-45 years). Mean class size was slightly over 19 pupils.

Results

The study was conducted in two stages. The first stage involved analyses of data collected from the first teacher sample (Brussels and surrounding area, Belgium) involving an exploratory factor analysis (EFA) followed by Rasch analysis for respectively examining the underlying structure of the item pool and testing the fit between data and a unidimensional continuum model. Accordingly, the second stage involved analyses of the second sample data (region of Antwerp, Brussels and Ghent). Confirmatory factor analysis (CFA) was used to further examine and confirm scale structure stability.

Stage 1: Exploring scale structure

Exploratory factor analysis

Preliminary analyses revealed five items with limited discriminating character (items scoring lower then 1.00 or higher then 3.00 on average on a 0-4 scale) which were removed from the item pool. As hypothesized, factor analysis did not reveal the presupposed learning environment levels that were used to arrange items. A logic explanation was that these four levels (learner level, teacher level, school level and general level) are too strongly interdependent. An item such as 'Pupils should more often decide about the sequence and duration of their learning activities' was categorized on pupil level for whom it has a direct consequence, however if pupils have to deal with more responsibility in making such decisions, it is obvious that this affects the teacher approach (differences in preparation, guidance, supervision, etc.) and even school's view on organizing learning (class organization, infrastructure, etc.). In addition, the item is also formulated in a way that it could easily be included within the fourth general motive level. A majority of the items showed similar ambiguity to classify them over several or all four levels.

On theoretical grounds, items reflecting general teachers' beliefs about the introduction of self-regulated learning in primary school were selected out of the remaining 35 items.

Although reducing the number of items would inevitably result in a loss of content, items with high indirect influence on the introduction of self-regulated learning (e.g., 'The more pupils can make decisions during learning, the bigger their motivation'; 'Some pupils get little benefit out of frontal teaching') and highly referring to contextual variables of influence on the occurrence of self-regulated learning (e.g., 'Self-regulated learning is doomed to failure in classrooms with more than 20 pupils'; 'Self-regulated learning does not fit into a well-structured and disciplined learning environment that parents expect') were excluded. This process resulted in a 12 item selection. All statements did not presume teachers already take actions in developing self-regulated learning practices within their own teaching environment.

Table 2
Factor loadings for the Self-Regulated Learning Teacher Belief Scale (n= 399)

Items		Factor
02	Pupils should be able to make decisions about the sequence and duration of their learning activities more often	.638
03	Pupils should be able to decide when they work on an assignment more often	.618
07	Self-regulated learning is practicable in primary education	.598
10	Pupils have the required self-discipline to take responsibility for their learning in primary school	.567
06	Each pupil should be given the opportunity to regulate his/her own learning	.504
09	Self-regulated learning leads to a more efficient collaboration between pupils	.498
08	Self-regulated learning provides pupils with a more thorough preparation for their transition to secondary education	.486
04	A self-regulated environment makes it easier to take into account pupils' experiences and interests	.450
05	Pupils have the capacity to determine what they want to learn	.443
01	Self-regulated learning makes pupils evaluate their learning approach better	.425

A first analysis showed two items with structure coefficients lower than .30; they were removed. After a second analysis, both the scree test (Catell, 1966) and the Minimum Average Partial technique (Velicer, 1976; Zwick & Velicer, 1986) were used in order to determine the number of factors to retain. Both techniques suggested one factor solution – labelled 'SRL teacher beliefs' – with an eigenvalue of 3.5 corresponding with an explained variance of 34.9%. The SRL teacher beliefs scale measures the extent to which teachers consider self-regulated learning as suitable and fitting for primary school practices. An overview of the factor loadings for all items is presented in Table 2. Cronbach's alpha for the 'SRL Beliefs' scale was .79. Item to scale correlations ranged from .38 to .55.

Rasch measurement model

Rasch measurement provides a model of expected responses in which both the performance of the teachers and the difficulty of the items are compared in terms of fitting a unidimensional continuum model (Andrich, 1978). In short, when empirical data fit the model of expected responses, item parameters can be estimated independently from the characteristics of the calibrating sample, and person parameters can be freed from the difficulty of the specific items considered. Thus, analyzing data according to the Rasch model gives a range of details checking whether or not adding the scores is justified in the data. This is called the test of fit between the data and the model. In this study, Rasch analysis was used to assess (a) the range of the items' difficulty levels, (b) the distribution of the teachers' abilities to score the items, (c) the distribution of items' difficulty levels, and (d) the item fit statistics. The same sample was used for Rasch analysis, only data for teachers providing complete responses were analysed. This left a sample of n=381 valid responses. A Rasch measurement model was applied through the rating scale analysis program RUMM2010 (Andrich, Sheridan, & Luo, 2004).

The columns 2-6 of Table 3 list the basic data relating the responses to different categories on each item. The proportion of respondents who rated each category varied substantially across items. The proportions varied from .00 for strongly disagree for item 1 and 9 (respectively 'An outcome of self-regulated learning is pupils better evaluating their

learning approach'; and 'Self-regulated learning leads to more efficient collaboration among pupils') to .19 for item 5 ('Pupils are capable to determine what they want to learn'). The pattern of agreement across categories for items 4 and 5 varied, with 64% strongly disagreeing or disagreeing with item 5 ('Pupils are capable of determining what they want to learn') and 79% agreeing or strongly agreeing to item 4 ('Pupils' experiences and interests are more easily taken into account within a self-regulated learning environment'). These extreme patterns of responding affected the mean item values.

Separability of the items. The separability reliability index is the Rasch analogue to the Cronbach alpha (.79). In this case sample separability was .80 and was considered to be good. Separability focuses on whether the scale was defined by a distinct hierarchy of items.

Mean values of items. The mean values for each item are indicated as logits and are listed in the middle of Table 3 (column 7). Logits represent the log odds of teachers agreeing and with zero representing the overall mean of agreement. Positive logit values indicate persons with a higher level of agreement and items that required higher levels of positive beliefs towards the introduction of self-regulated learning in primary school. As expected, the most unpopular item (Item 5, 'Pupils are capable of determining what they want to learn') that was endorsed as strongly agree or agree by only 7% of respondents and had a logit value of 1.601. In other words it took a great deal of motivation for self-regulated learning to say strongly agree or agree to this item. Item 4 ('Pupils' experiences and interests are more easily taken into account within a self-regulated learning environment'), on the other hand, was endorsed strongly agree or agree by 79% and had a logit value of -0.629, making it relatively easy to endorse.

Table 3
Analysis outcome of the Rasch measurement model (n=381)

	Proportion responding in each answer category					Mean values (logits) for items and fit (chi-square)		Item thresholds			
Item	0	1	2	3	4	Mean (SE) Location	Fit Chi Sq	1	2	3	4
01 Self-regulated learning makes pupils evaluate their learning approach better	.00	.09	.25	.54	.12	-0.73 (0.07)	4.48	-3.14	-.31	29	3.16
02 Pupils should be able to make decisions about the sequence and duration of their learning activities more often	.04	.29	.38	.23	.06	0.38 (0.07)	8.04	-2.71	-.44	.80	2.35
03 Pupils should be able to decide when they work on an assignment more often	.03	.28	.38	.27	.03	0.56 (0.07)	5.48	-2.99	-.69	.43	3.26
04 A self-regulated environment makes it easier to take into account pupils' experiences and interests	.01	.03	.17	.61	.18	-0.63 (0.08)	2.90	-1.03	-1.18	-.44	2.65
05 Pupils have the capacity to determine what they want to learn	.19	.45	.29	.06	.01	1.60 (0.07)	12.33*	-2.32	-.61	1.04	1.90
06 Each pupil should be given the opportunity to regulate his/her own learning	.01	.06	.25	.51	.18	-0.71 (0.07)	12.98**	-1.87	-.91	.26	2.52
07 Self-regulated learning is practicable in primary education	.01	.07	.31	.46	.15	-0.46 (0.07)	3.25	-1.75	-1.19	.36	2.58
08 Self-regulated learning provides pupils with a more thorough preparation for their transition to secondary education	.02	.08	.25	.45	.21	-0.48 (0.06)	5.70	-1.49	-.70	.18	2.02
09 Self-regulated learning leads to a more efficient collaboration between pupils	.00	.06	.27	.52	.14	-0.77 (0.07)	1.97	-2.50	-.86	.40	2.96
10 Pupils have the required self-discipline to take responsibility for their learning in primary school	.07	.39	.36	.16	.01	1.24 (0.07)	2.47	-3.11	-.79	.42	3.47

Note. Significant chi-square values indicate poor fit: *p<.01; **p<.001. Item threshold values 1, 2, 3, and 4 represent the steps between answer categories.

Item-map. The results are also presented graphically in an item map (Figure 1) on which both items and people are calibrated on a logit scale. In Figure 1 the numbers on the far left are from -4.0 (low self-regulated learning belief) to around +5.0 (very high self-regulated learning belief). These are the logit scale values on which the items and persons are calibrated. Each X in Figure 1 represents 3 teachers and the left hand side shows the distribution of teachers across these calibrated logit values. On the right hand side of Figure 1 are the items. The items are also displayed in terms of beliefs on the same calibrated scale from easiest to endorse to those more difficult to endorse. The positive logit values represent the items that demand the highest levels of self-regulated learning belief. The number represents the item number (see Table 3) and the response category. The first part of the decimal number represents the item and the portion after the decimal point represents the rating on each item. For instance at the top I10.4 represents the step from agree to strongly agree for item 10; further down I05.3 represents the step from disagree to neither agree nor disagree for item 05; and at the bottom there is I01.1 which represents the threshold from strongly disagree to disagree for item 1.

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------------------------------------------------------------------------
LOCATION          PERSONS     ITEMS [ uncentralised thresholds]
------------------------------------------------------------------------
  5.0                       |
                            |
                            | I10.4
                            |
                            |
  4.0                       |
                            | I03.4
                            |
                         X  | I05.4
                            |
  3.0                    X  |
                            |
                         X  | I05.3 I02.4
                        XX  | I01.4
                        XX  |
  2.0                       | I04.4 I07.4 I09.4
                        XX  | I06.4
                      XXXXX | I10.3
                       XXXX | I08.4
                      XXXXX |
  1.0              XXXXXXXX | I02.3
              XXXXXXXXXXXX  | I03.3 I05.2
                 XXXXXXXXX  |
              XXXXXXXXXXXX  | I10.2
                 XXXXXXXXX  |
  0.0             XXXXXXXXX  |
       XXXXXXXXXXXXXXXXXXX  | I03.2 I07.3 I02.2
                     XXXXX  | I09.3 I08.3
                    XXXXXX  | I06.3 I01.3
                       XXX  | I05.1
 -1.0                  XXXX  |
                       XXXX  | I08.2 I04.3 I01.2
                             |
                             |
                         XX  | I04.1 I07.2 I09.2 I06.2
 -2.0                     X  | I08.1 I10.1 I04.2
                             |
                             | I02.1 I07.1
                             | I06.1 I03.1
                             |
 -3.0                        |
                             |
                             | I09.1
                             |
                             |
 -4.0                        | I01.1
------------------------------------------------------------------------
           X = 3 Persons
------------------------------------------------------------------------
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Figure 1. Item-map for self-regulated learning motivation (*n*=381)

Teachers' self-regulated learning beliefs ranged from around -4 to +5 logits. Inspection of Figure 1 shows that it did not take much self-regulated learning belief to indicate a disagreement with items 01 and 09. On the other hand, one would need a higher self-regulated

learning belief to respond strongly agree to item 10. Few teachers had very high self-regulated learning belief that was above the level of strongly agree on the 10 items. The placement of teachers and items on the same scale allowed one to consider how well the different items matched the teachers' range of self-regulated learning beliefs. For instance, the items did appear to tap the self-regulated learning beliefs for the majority.

Item-fit. Examination of the chi-square values in Table 3 (Column 8) showed that there were some item response inconsistencies with the model (i.e., significant chi-square values for 2 out of the 10 items) for items 5 and 6. Under such conditions the properties of the Rasch model do not hold and the raw score on the item may not be used as a valid indicator of a teacher's beliefs towards self-regulated learning. The teachers tended to give aberrant responses to these questions and the total raw score on the scale did not seem to be a valid indicator of a unidimensional SRL belief of the respondents. Both items will be considered during further examination (see 3.2).

The items are five-point rating scales but in a Rasch analysis there are four thresholds or steps, from 0 to 1, 1 to 2, 2 to 3, and 3 to 4. These thresholds are shown in Table 3 (last four columns). Generally, the level of self-regulated learning belief should increase with the threshold of responding. That is it would require more self-regulated learning belief to move from strongly disagree to disagree and then to neither agree nor disagree and then to agree and finally it requires the most motivation to answer strongly agree. The thresholds should be ordered in terms of beliefs from low to high and from negative to positive. An exception is the thresholds 1 and 2 for item 04.

Stage 2: Confirming scale structure

Confirmatory factor analysis

A confirmatory factor analysis (CFA) with one-factor structure was used in the second independent sample in order to further investigate the unidimensional structure stability of the Self-Regulated Learning Teacher Belief scale (as obtained in the first sample). AMOS 6.0 (Arbuckle, 2003; Arbuckle & Wothke, 1999) was used to assess how well the data fit the hypothesized one-factor structure. Several fit indices were calculated to provide information on the adequacy of the fitted model: (a) the χ^2 and p-value, (b) the Root Mean Square Error of Approximation (RMSEA), (c) the Goodness of Fit Index (GFI) and the Adjusted Goodness of Fit Index (AGFI) (Bentler, 1990). A cutoff value close to .06 for RMSEA is needed before a relatively good fit can be concluded (Hu & Bentler, 1999). Brown and Cudeck (1993) stated that values of RMSEA in the range between .05 to .08 indicate a fair fit. GFI and AGFI should be above .90 to indicate an adequate fit.

The ten belief items were hypothesized as indicators of the SRL belief factor. The results of the CFA are presented in Figure 2. The CFA, based on the 10 SRL belief items, confirmed the suggested structure that was obtained from the exploratory factor analysis on the previous sample. The items with response inconsistencies were included in the CFA. The results show a good fit between the hypothesized model and the observed data [$\chi^2(34)=130.7$, $p<.001$]. The goodness of fit estimates were GFI=.94; AGFI=.90, and RMSEA=.074 with 90% interval of 0.061 and 0.088. All indexes indicated a good fit for the proposed scale structure. As can be seen in Figure 1, the residuals (e) were allowed to be correlated for one item pair (e01 and e03). This led to a significant decrease in χ^2 compared to the model without correlated residuals (from 367.2 to 130.7). This acceptance of substantial overlap between both pairs of items was theory driven. Indeed, items 1 and 3 have strong content related, both assessing the need for more SRL opportunities for pupils ('Pupils should more often decide about the sequence and duration of their learning activities'; and 'Pupils should more frequently be able to decide themselves when they work on an assignment').

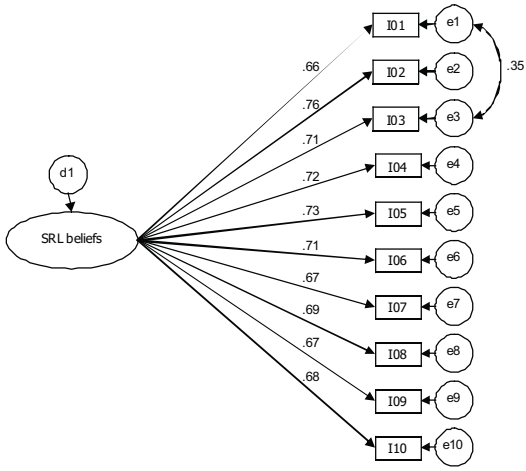

Figure 2. Results of the Confirmatory Factor Analysis: Structure/pattern coefficients for the SRLTB items (*n*=553).

Conclusion and discussion

The purpose of this study was to develop an instrument in order to examine teachers' beliefs towards introducing the concept of self-regulated learning in primary education. The study resulted in the development of the Self-Regulated Learning Teacher Beliefs Scale (SRLTB). Results of the present study provided support for the reliability and validity of the SRLTB scores. In an exploratory stage, initial validity data on the SRLTB was shown to be positive as demonstrated by factor analytic results. Maximum likelihood exploratory factor analysis revealed a one-factor structure. In addition, the results showed the SRLTB to be internally consistent (alpha=.79). Furthermore, the analysis of responses using a Rasch measurement model provided an alternative means of describing and calibrating teacher responses in relation to self-regulated learning beliefs. At the level of the overall scale there was a good fit of the total scale to the measurement model. Finally, confirmatory factor analysis confirmed the one-factor structure and unidimensionality of the SRLTB scale. Results showed good fit for the proposed scale structure.

However, some limitations should be mentioned concerning psychometrics with regard to the factor and Rasch analyses. First, it might be considered disappointing that the scale initially designed to evaluate teacher beliefs towards SRL introduction in primary school including a broad range of related aspects, did not survive the statistical analysis. Because of initial unsatisfactory factor analysis output, items assessing several domains of indirect influence on SRL (e.g., pupils' social background, parental influences) were excluded. The same went for categorising beliefs over different learning environmental levels (pupil, teacher, school and more general level). As expected, differences among these levels were too fuzzy and the supposed level differentiation was strongly interrelated. Further refining the scale implicated the loss of a considerable amount of information regarding arguments to introduce SRL. Indeed, the instrument was further developed by cutting back the item pool and emphasizing on more general teachers' beliefs about SRL. This resulted in a workable scale of 10 items with good psychometric values.

Second, the analysis of these responses using a Rasch measurement model provided an alternative means of describing and calibrating teacher responses regarding their beliefs toward self-regulated learning. At the level of the overall scale there was a good fit of items to the measurement model. Nevertheless, two items were misfitting, meaning that they attracted a large number of aberrant response patterns. The question, however, remains and is mostly conceptual rather than statistical (see Athanasou & Lamprianou, 2005): is it desirable to expect a near-perfect statistical unidimensionality in a questionnaire where teachers may have diverse beliefs?

Indeed, beliefs do not necessarily form a cohesive unit: individuals may hold contradictory beliefs making it difficult to determine how particular beliefs influence instruction (Klien, 1996; Pajares, 1992; Pearson, 1985; Warfield et al., 2005). After all, unidimensionality is a statistically ideal but never achieved situation when empirical data are used. For example, do we have to remove items from the scales and replace them because of statistical misfit? Specifically, do we want to remove an item where 64% of the teachers disagreed or items were 79% of the teachers agreed? To the degree that we really want to identify teachers that may need some additional help to implement self-regulated learning, it may be desirable to keep those items in order to use them diagnostically. Discussing a very similar issue, Bohlig, Fisher, Masters, and Bond (1998) suggested: '... let us presume that the items... were all included for some very good (substantive, theoretical, construct-related) reasons. Then, less than pleasing fit statistics say 'Think again', not 'Throw it out' (p. 607). Indeed, the misfitting items were for both theoretical as construct-related reasons of importance in the scale. In our opinion, these items make a substantive distinction in teachers' SRL beliefs (system) because among others they represent the shift in teachers' SRL beliefs from a self-controlled to a self-regulated level in promoting the self-regulatory competence of pupils (Zimmerman, 2000; Zimmerman & Kitsantas, 1997). The corresponding items all measure teacher beliefs in which the relevance and practicability of self-regulated learning for a primary education level are questioned. Teachers scoring high on these items will inevitably distinguish themselves as strong proponents of self-regulated learning in primary school. Therefore, removing these items on statistical basis would indeed increase statistical fit but unfortunately decrease the utility of the instrument.

Future research is needed to evaluate the psychometric properties and usefulness of the SRLTB as a measure of teachers' beliefs towards introducing self-regulated learning in primary school. Some suggestions are formulated. Pajares (1992) recommended researchers to make a distinction between teachers' broader, general belief systems and their educational beliefs. In addition, even educational beliefs should also be narrowed further to specify what those beliefs are about (Ertmer, 2005; Pajares, 1992). These recommendations were all taken into account when developing a scale assessing teachers' beliefs about the feasibility of self-regulated learning in primary school. From these narrow beliefs, two paths of further investigation might be considered meaningful.

First, it would be interesting to position teachers' SRL beliefs within a broader teacher belief system (Brian & Atwater, 2002; Errington, 2004; Nespor, 1987; Pajares, 1992) by comparing our more specific belief scale to more general teachers' educational belief scales such as for example the Primary Teacher Questionnaire (Smith, 1993), the Educational Beliefs Questionnaire (Silvernail, 1992) or the Beliefs about Primary Education Scale (Hermans, van Braak, & Van Keer, 2008). Likewise, interesting insight into beliefs towards self-regulated learning would arise when comparing our scale with other specific belief scales such as for example the Teacher Belief Q-Sort (Rimm-Kaufman, Storm, Sawyer, Pianta, & LaParo, 2006).

Second, another relevant question is whether teachers with strong positive beliefs towards SRL in primary school, will also give priority to the development of such practices in their personal classroom. In this question lies a fundamental issue regarding beliefs and teacher beliefs in particular: the relation between teacher beliefs and classroom practices. It was already mentioned that most research findings supported the assumption of congruence between beliefs and practice (Calderhead, 1996; Carter, 1990; Ertmer, 2005; Fang, 1996; Kane et al., 2002; Smtih, 1993; Verloop et al., 2001). Yet, inconsistencies are plausible (Calderhead, 1996; Fang, 1996; Kane et al., 2002) and teachers' explanations for such inconsistencies often included references to contextual constraints (Ertmer, 2005). In general, literature lets us assume that if teachers have positive beliefs toward SRL they are inclined to promote this concept in primary school. In this perspective, an instrument has been developed measuring such practices simultaneously with the SRLTB. This instrument, the Self-Regulated Learning Inventory for Teachers (SRLIT) assesses primary school teachers' realisations in promoting pupil's self-regulated learning (Lombaerts, Engels, & Athanasou, 2007). Comparisons between teachers' SRL beliefs and their actual realisations using respectively the SRLTB and SRLIT, will certainly provide further insight in specific teacher beliefs towards self-regulated learning and more in general the congruence between beliefs and practices in the field of SRL. Both paths would

inevitably establish a further understanding of the self-regulated learning concept for primary school. Understanding the relationship between SRL beliefs, more general educational beliefs and self-regulated learning practices would improve research and practice related to teacher change in general.

Finally, caution is recommended in the interpretation of SRLTB scores as these remain measures as reported by teachers concerning their personal beliefs. Besides the complex relation between beliefs and practice, difficulties inherent in trying to measure beliefs accurately will always remain (Ertmer, 2005; Pajares, 1997). Indeed, beliefs exist in tacit form (Kagan, 1992; Kane et al., 2002; Nespor 1987) which requires making inferences based on what teachers say, intend and actually do (Ertmer, 2005). Therefore further research is needed to provide more evidence of the construct validity of the SRLTB scale and to relate these indicators of teacher beliefs to observed classroom behaviour. The work described here on the Self-Regulated Learning Inventory for Teachers should be considered a beginning. The questionnaire is included in the article to stimulate further research on the nature of teacher (SRL) beliefs and their relationship to other aspects of the primary classroom.

In conclusion, the Self-Regulated Learning Teacher Belief Scale has the potential to provide valuable insights into primary school teachers' beliefs towards the introduction of self-regulated learning at this particular level of education. Findings from the use of the SRLTB might stimulate discussions with teachers about the position, importance, usefulness and practicability of a far-reaching orientation towards self-regulated learning in their classrooms so that their pupils' SRL, and ultimately their learning, can be improved. Accordingly, it can serve as an instrument for reflection and the use of the instrument may offer teachers some ideas for changing practice. Additionally, assessing teachers' beliefs is important to check whether they are sufficiently shared within the school team (Antonietti & Giorgetti, 2006). For various reasons teacher beliefs may be in favour or against an educational innovation such as self-regulated learning. The degree of openness to new or different ideas will probably influence what teachers consider as possible within the light of other held beliefs about related or general pedagogical beliefs (Errington, 2004). Furthermore, the instrument might also serve as a template for the development of similar instruments for evaluating teachers' SRL or related beliefs. Although further research is required, the SRLTB appears to be a valid and workable instrument contributing to the conceptualization of self-regulated learning in primary schools.

Appendix

Teacher description of SRL in the questionnaire

The concept of 'self-regulated learning'

We compare 'learning to self-regulate' with riding and steering a bike. Imagine a pupil steering a bike. He can and has to decide about a lot of things: *where to go* to, *how fast* to drive, which *road to choose*. If it is a longer ride, he should also consider when to insert a short stop, e.g., to *check* the road map, to *control* if he is still on the right track, or to check out something that comes across, etc. At the same time, he also assumes responsibility: when driving in an unknown environment, he must *gather information* about the area first, *map out a route* to take... and can't blame someone else if he drives in the wrong direction.

You will have noticed that a lot of words are presented in italic. After all, the same terms could be used when describing self-regulated learning. When fully self-regulating, pupils would:

- determines what he wants to learn (*where to go*)
- finds out what he needs for it (*gathering information*)
- developing a plan to tackle a learning task (*map out a route*)
- determining the working tempo (*how fast*)
- deciding how to learn (*road to choose*)
- regularly controlling progress (*control*)
- making adjustments until the desired results are attained

During the bicycle story, you may have wondered it is quiet dangerous to send out pupils on their own during a long trip in an unknown environment. The same goes for self-regulated learning. Full self-regulated learning is not attainable in compulsory education. Still, in educational settings, a learner can take responsibility for several tasks, traditionally taken care of by the teacher.

Also, self-regulated learning is not a synonym of 'learning on your own'. Working together with fellow pupils, and seeking other pupils' advice are essential within self-regulated learning. Indeed, a bicycle ride can be made together with others.

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Le but de cette étude était de décrire le développement ainsi que les caractéristiques psychométriques de la Self-Regulated Learning Teacher Belief Scale (SRLTB). La SRLTB est une échelle de 10 questions qui mesure les convictions des professeurs concernant l'introduction d'apprentissage indépendant (SRL) dans l'éducation primaire. Le processus de développement des questions et de l'échelle, et d'autre part la procédure de test et de raffinement d'échelle sont présentés. Une analyse factorielle exploratoire (EFA) a révélé une structure

*unifactorielle représentant la disposition des professeurs (*n=*399) à l'apprentissage indépendant dans l'école primaire. Ensuite, une analyse Rasch a montré que l'échelle obtient des indices d'ajustement satisfaisants pour le modèle unidimensionnel considéré. Les résultats des analyses factorielles confirmatoires sur un second échantillon (*n=*553) ont confirmé la structure proposée. Finalement, l'article conclue avec quelques implications pratiques et limitations de l'étude. En général, la SRLTB peut être considérée comme un instrument utile pour examiner convictions des professeurs concernant des pratiques d'apprentissage indépendant au niveau de l'éducation primaire.*

Key words: Primary education, Scale development, Self-regulated learning, Teacher beliefs.

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Current theme of research:

Self-regulated and lifelong learning.

Most relevant publications in the field of Psychology of Education:

Lombaerts, K., Engels, N., & Athanasou, J.A. (2007). Development of the self-regulated learning inventory for teachers. *Perspectives in Education, 25*(4), 29-47.

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Most relevant publications in the field of Psychology of Education:

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Current theme of research:

Curriculum development, wellbeing in teaching and learning, school culture as a basis for professional development.

Most relevant publications in the field of Psychology of Education:

Aelterman, A., Engels, N., Van Petegem, K., & Verhaeghe, J.P. (2007). The well-being of teachers in Flanders: The importance of a supportive school culture. *Educational Studies, 33*(3), 285-298.

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Current theme of research:

Integration of ICT in primary education, ICT & Curriculum, ICT & teacher beliefs, technology planning in schools, parental involvement.

Most relevant publications in the field of Psychology of Education:

Tondeur, J., van Braak, J., & Valcke, M. (2007). Towards a typology of computer use in primary education. *Journal of Computer Assisted Learning, 23*, 197-206.

van Braak, J., & Kavadias, D. (2005). The influence of social-demographic determinants on secondary school children's computer use, experience, beliefs and competence. *Technology, Pedagogy and Education, 14*(1), 43-60.

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Current theme of research:

Application of the Rasch model in educational and vocational assessment and the use of the Brunswik lens model in social judgement theory.

Most relevant publications in the field of Psychology of Education:

Athanasou, J.A. (2006). An evaluation of a formal professional examination in adult continuing education. *Australian Journal of Adult Learning*, *46*(2)202-223.

Athanasou, J.A. (2006). The career interest Test – A brief standardized assessment of interests for use in educational and vocational guidance. *Revista Espanola de Orientacion y Psicopedagogia, 17*(1), 5-17.

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