

# Measuring self-regulated learning in the workplace

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*In knowledge-intensive industries, the workplace has become a key locus of learning. To perform effectively, knowledge workers must be able to take responsibility for their own developmental needs, and in particular, to regulate their own learning. This paper describes the construction and validation of an instrument (the Self-Regulated Learning at Work Questionnaire) designed to provide a measure of self-regulated learning (SRL) behaviour in the workplace. The instrument has been validated through a pilot study with a cohort of 170 knowledge workers from the finance industry. Results indicate that the five scales of the instrument are reliable and valid, testing a broad range of sub-processes of SRL. The instrument can be used to identify knowledge workers who demonstrate different levels of SRL in workplace contexts for further exploration through qualitative studies and could also provide the basis of professional development tools designed to explore opportunities for self-regulation of learning in the workplace.*

## Introduction

Since the end of the second world war, the growing importance of knowledge-based work, particularly in western economies, has led to the emergence of a new class of worker, the knowledge worker (Brinkley *et al.*, 2009), a term popularized by Peter Drucker (1957). Knowledge workers 'think for a living': knowledge is their raw material, and new knowledge is their product (Davenport, 2005). Davenport describes knowledge workers as having 'high degrees of expertise, education or experience',

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highlighting that ‘the primary purpose of their jobs involves the creation, distribution or application of knowledge’. Whereas the workplace has traditionally been viewed as a context where learning was applied, much recent research has focused on workplaces as locations where learning actually takes place (Harteis & Billett, 2008). This is especially true of knowledge-intensive industries, where there is a need for learning to occur continually as knowledge workers act autonomously to solve complex and novel work problems (Hager, 2004). In knowledge-intensive workplaces, formal training approaches have become less effective and appropriate as each worker’s learning needs are bespoke and dynamic (Littlejohn & Margaryan, 2013). In these workplaces, learning is primarily achieved through intentional informal learning that is deeply intertwined and mediated through everyday work tasks (Collin, 2004; Eraut, 2004; Tynjälä, 2008) and other people (Collin, 2008; Eraut, 2007). Responsibility for learning shifts from the training department to the learner, who must manage their own learning for work within the constraints afforded by their work role and organizational context (Fuller & Unwin, 2004). Individual workers plan and evolve their learning by setting learning goals, monitoring progress and adapting strategies to suit precise learning requirements (Schulz & Stamov Roßnagel, 2010). These processes mirror the sub-processes of self-regulated learning (SRL; Zimmerman, 2000).

As part of a larger study examining the workplace learning strategies of knowledge workers (Milligan *et al.*, 2015), this study aimed to develop a valid and reliable measure of self-regulation of learning that could be efficiently deployed in knowledge work contexts. The purpose of this paper is to describe the design of the instrument and report its internal reliability and convergent validity. This paper begins with a review of models of SRL and their application in the workplace, as well as how SRL has been measured in formal education and the potential value of similar measures in workplace contexts. The next section describes how the instrument was constructed from a number of existing measures, adapting these, as necessary, to the workplace context. Then, an initial statistical validation of the instrument in a population of knowledge workers drawn from the finance industry is presented. Internal reliability is explored through calculation of Cronbach’s alpha values and principal component analysis. Convergent validity is explored through correlation analysis. The paper concludes with a discussion of the initial results provided in this study, and reflects on the limitations of the instrument and its potential value in opening up new approaches to examining knowledge worker learning in the workplace.

## Self-regulated learning

Self-regulation is the ‘self-generated thoughts, feelings and actions that are planned and cyclically adapted to the attainment of personal goals’ (Zimmerman, 2000). SRL has been studied extensively in formal educational contexts, leading to the development of a number of closely related models of SRL (for a comparative review, see Puustinen & Pulkkinen, 2001), including those outlined by Zimmerman (2000) and Pintrich (2000). These models are united by their adoption of a phased and cyclical view of the regulation of learning where, for instance, self-reflection of previous learning efforts affects subsequent goal setting (Zimmerman & Kitsantas, 1999). Zimmerman’s model of SRL (Zimmerman, 1989, 2000) takes as its starting point Bandura’s social cognitive theory (1986), elaborating a model that describes the self-regulation of learning by recognizing three principal phases: forethought, performance and self-reflection (Zimmerman, 2000). Within the three phases, Zimmerman’s work has identified a number of sub-processes describing the different SRL behaviours an individual may enact as they self-regulate their learning (see Table 1 for the list reported in Zimmerman, 2011). Pintrich (2000) describes a four-phase framework, emphasizing monitoring as a discrete phase alongside planning, control and reflection phases that correspond closely to Zimmerman’s phases. Within Pintrich’s framework, a similar range of behaviours is described, adopting a slightly different vocabulary. For instance,

Table 1: SRL phases and sub-processes as outlined by Zimmerman (2011)

| Phases        | Forethought          | Performance               | Self-reflection          |
|---------------|----------------------|---------------------------|--------------------------|
| Sub-processes | Goal setting         | Task strategies           | Self-evaluation          |
|               | Strategic planning   | Volition strategies       | Causal attribution       |
|               | Self-efficacy        | Self-instruction          | Self-satisfaction/affect |
|               | Outcome expectations | Imagery                   | Adaptive/defensive       |
|               | Task interest/value  | Time management           |                          |
|               | Goal orientation     | Environmental structuring |                          |
|               |                      | Help-seeking              |                          |
|               |                      | Interest enhancement      |                          |
|               |                      | Self-consequences         |                          |
|               |                      | Metacognitive monitoring  |                          |
|               |                      | Self-recording            |                          |

SRL, self-regulated learning.

Pintrich's framework includes learning strategies such as elaboration and critical thinking.

Using these models as their base, a number of quantitative instruments designed to measure SRL and its sub-processes have been developed (e.g. Pintrich *et al.*, 1991). The use of these instruments in formal educational contexts has established a link between higher SRL scores and positive academic outcomes. These instruments have subsequently been used to develop interventions to enhance and promote self-regulatory behaviour (Hofer *et al.*, 1998). The development of an equivalent measure for workplace contexts would allow comparison of the workplace learning behaviours of high and low self-regulating learners in the workplace, as well as guiding development of interventions which would foster and support the development of these SRL behaviours in the workplace.

A recent meta-analysis of SRL in formal training contexts illustrated the extent to which SRL theories have shaped our understanding of how individuals adapt their learning behaviour (Sitzmann & Ely, 2011), emphasizing particularly the goal-oriented nature of work-related learning. Sitzmann and Ely argue that the ability to regulate one's own learning is likely to have an even greater impact on learning in informal situations; for instance, where workers have to identify or create their own learning opportunities (Enos *et al.*, 2003) or when it is critical that workers are able to monitor their own learning effectively. Van Eekelen *et al.* (2005) conducted a qualitative study exploring higher education teachers' SRL occurring during practice. The study used interviews and diaries as instruments to gather data about instances of learning termed 'learning episodes'. Van Eekelen and colleagues found evidence of teachers changing their practice, which was assumed to be a sign of learning, but uncovered little evidence of self-regulation during learning episodes which were largely externally regulated. Another qualitative study, conducted by Margaryan *et al.* (2013), explored how knowledge workers in a multinational energy company planned and attained their learning. The authors found evidence of workers self-regulating their learning. However, their SRL practices were not delineated into discrete phases, as described in conventional SRL models. Taken together, the studies by van Eekelen *et al.* and Margaryan *et al.* indicate that informal learning in the workplace, that is continual, dynamic and deeply intertwined with work goals, may not occur precisely as described by SRL theories originating from formal education, but does involve the same range of sub-processes. By looking at these sub-processes in detail, we can improve our understanding of which sub-processes are most important for informal workplace learning.

Schulz and Stamov Roßnagel (2010) adapted a German translation of the Motivated Strategies for Learning Questionnaire devised by Pintrich *et al.* (1991) to fit a workplace context by altering the wording and eliminating items not relevant for workplace learning. The authors then used the adapted items to explore informal workplace learning in a mail order company. This study concluded that an individual's ability to self-regulate his/her learning (described by the authors as 'learning competence' drawing on previous work exploring student learning by van den Boom *et al.*, 2004) was a predictor of (self-identified) success in informal learning. The study identified specific SRL sub-processes that are important attributes of successful learners, including the ability to set learning goals, to plan, monitor and evaluate learning, and possessing a positive learning orientation. Other studies have explored specific aspects of self-regulation using quantitative measures that target specific sub-processes or groups of sub-processes. Warr and Downing (2000) explored learning strategies of adult technical trainees, linking particular strategies such as rehearsal and written help-seeking to knowledge change as a measure of learning success. Studying workers in a range of sectors, Rigotti *et al.* (2008) developed a measure of self-efficacy matched to workplace roles as a tool to explore self-efficacy across organizational contexts. To date, however, there is no single instrument that incorporates the broad range of SRL behaviours identified by Zimmerman and Pintrich.

Not all studies exploring **informal intentional learning in the workplace** have focused on self-regulation of learning. In a study of information and communication technology (ICT) workers, Gijbels *et al.* (2012) used the related concept of Self-Directed Learning (SDL) to explore how an individual's Self-Directed Learning Orientation (SDLO) influences their participation in work-related learning. SRL and SDL are closely linked concepts (Pilling-Cormick & Garrison, 2007) focused on individual control of the processes of setting goals and priorities for learning. The two concepts have different origins, with SRL emphasizing the internal (motivational and cognitive) processes of learning, whereas SDL focuses on external control. Gijbels *et al.* (2012) found that SDLO is a significant and strong predictor of work-related behaviour. One weakness of the Gijbels *et al.* study is that SDLO is a single construct, and therefore although the Gijbels *et al.* study demonstrated that learners who score highly on an SDLO scale take up more learning opportunities over a fixed time period, it is difficult to dissect this relationship further. The use of an instrument based on SRL would allow the identification of specific sub-processes highlighting particular behaviours which predict learner-led work-related learning success.

In formal education, self-report instruments such as the Motivated Strategies for Learning Questionnaire (MSLQ: Pintrich *et al.*, 1991), or the Metacognitive Awareness inventory (MAI: Schraw & Dennison, 1994), have proved useful in providing reliable measures of SRL behaviour in a variety of contexts (Barnard-Brak *et al.*, 2011). Self-report instruments can be deployed efficiently to large cohorts and facilitate statistical analyses which can highlight associations between SRL 'scores' and other behaviours and factors. Self-report measures are recognized as imperfect, with researchers such as Winne and Jamieson-Noel (2002) demonstrating that learners overestimate their ability when compared with more objective measures such as observation or trace-based methods. However, self-report is a useful method for collecting data on the implicit variables inherent in on-the-job learning that are difficult to measure (Berings *et al.*, 2006). Although individuals may not be capable of accurately reporting on inner processes, they are able to validly answer questions about a variety of constructs, including their moods, attributes, plans, attitudes and beliefs (see Ericsson & Simon, 1980; Haefl & Howard, 2010). Other studies have indicated that self-report measures are sufficiently reliable in measuring behaviours in real-world contexts (Chan, 2009). **The goal of this study was to develop a quantitative instrument that would able to differentiate between individuals exhibiting high and low levels of SRL behaviour.** The SRL score generated by the instrument is intended as a relative, rather than absolute measure, and therefore a self-report instrument is suitable. Similar studies such as those by

Schulz and Stamov Roßnagel (2010) and Warr and Downing (2000) have also utilized self-report instruments.

## Instrument construction

The availability of a large number of pre-existing validated instruments, such as the MSLQ (Pintrich *et al.*, 1991), to assess SRL activity provides a useful starting point for the development of a new SRL instrument. Rather than create new items, the strategy followed for the development of the Self-Regulated Learning in the Workplace Questionnaire was to review a range of existing instruments, selecting those items which addressed aspects of self-regulation judged to be relevant within the workplace context and adapting the wording of items to reflect the workplace setting. This approach reflects that of Schulz and Stamov Roßnagel (2010) who developed a similar instrument by adapting a German language version of the MSLQ.

Although this instrument is designed primarily to provide a measure of SRL behaviour (as measured by three separate scales corresponding to the three phases of SRL identified by Zimmerman, 2000), two further scales were also included in the instrument. First, a scale was designed that could provide a measure of (primarily informal) learning an individual has undertaken recently (the Workplace Learning Activity [WLA] scale). This scale will be used in correlation analysis to explore the convergent validity of the SRL scales. Second, a scale intended to provide a measure of the opportunities for learning available to each respondent was included [the Workplace Learning Context (WLC) scale]. Learning may be affected by role characteristics, such as whether there are opportunities to interact with different people, to be creative, or to solve problems, and the WLC scale allows these non-individual factors to be accounted for. The design and development of all five scales is described below.

### WLA scale

The first scale in the instrument is designed to provide a measure of the recent workplace learning activities undertaken by respondents. To measure this variable, a custom scale was designed by searching the literature regarding informal workplace learning. A number of studies had attempted to develop similar measures, including: Gijbels *et al.* (2012), who studied how individuals' ability to self-direct their learning affected the learning activities they undertook; Schulz and Stamov Roßnagel (2010), who examined recent informal learning in a study exploring the effect of age differences on learning competence; and Crouse *et al.* (2011), who defined a set of learning activity types abstracted from a literature review of informal learning activities in the workplace. By collecting and reviewing the items developed by these authors, a scale containing a broad set of learning activities undertaken by knowledge workers was designed. The scale consists of 11 items [example item: How frequently have you participated in the following learning activities in the last year? Acquiring new information (e.g. by searching the Internet or company knowledge base) from 1 = rarely or never, to 5 = very often or continually]. This scale was placed at the beginning of the instrument to focus respondents' attention on this range of informal learning activities prior to responding to the other items of the instrument.

### SRL scales (SRL-F, SRL-P, SRL-SR)

The next three scales are designed to provide a measure of an individual's ability to regulate their own learning. Although related, the three scales are discrete, and relate to the three phases of SRL described by Zimmerman (2000): forethought, performance and self-reflection. Using Zimmerman's list of sub-processes as a starting point (Table 1), the authors sought to develop an instrument (the Self-Regulated Learning at Work Questionnaire: SRLWQ) covering a broad range of learning behaviours relevant to intentional informal learning in the workplace. The list of sub-processes identified by Zimmerman was reviewed. Sub-processes linked closely to formal education (e.g.



Table 2: Phases and sub-processes included in SRLWQ

| Phase         | Forethought  | Performance   | Self-reflection                             |
|---------------|--|---|---|
| Sub-processes | Goal setting<br>Strategic planning<br>Self-efficacy<br>Task interest/value | Task strategies<br>Elaboration<br>Critical thinking<br>Help seeking<br>Interest enhancement | Self-evaluation<br>Self-satisfaction/affect |

SRLWQ, Self-Regulated Learning at Work Questionnaire.

self-instruction, attention focusing, environmental structuring and imagery) were excluded. Two additional sub-processes (strategies: elaboration and critical thinking) identified in Pintrich's work and considered particularly relevant to workplace contexts were included. This review resulted in the phase/sub-process structure as presented in Table 2.

Next, the authors reviewed a number of previously validated instruments designed to measure SRL or its sub-processes. Items from five instruments (see below) were selected in order that each sub-process should be covered by a range of items. In summary, the three SRL scales were structured as follows. The scale measuring the forethought phase consisted of 17 items representing four sub-processes. The scale measuring the performance phase included 19 items representing five sub-processes. Finally, the scale designed to measure self-reflection consisted of six items representing two sub-processes.

The five instruments used as sources for items are as follows.

#### *Motivated Strategies for Learning Questionnaire (MSLQ)*

This instrument by Pintrich *et al.* (1991) is composed of 81 items designed to assess students' motivational orientation in their use of different learning strategies, and covers a comprehensive range of SRL sub-processes. The original instrument utilizes a 7-point Likert scale (from 1 = not at all true, to 7 = very true for me), and consists of three sections: motivation (31 items), learning strategies (31) and resource management (19 items). This instrument is closely aligned to Pintrich's framework of phases and areas of regulation (Pintrich, 2000) and was originally applied in formal higher education. Sixteen items were used from this instrument [example item: (MSLQ-64) 'When reading for this class, I try to relate the material to what I already know' reworded as SRLWQ-29: 'When I'm learning, I try to relate new knowledge I find to what I already know'].

#### *Learning Strategies questionnaire (LS)*

This instrument by Warr and Downing (2000) originated from the domain of organizational psychology and consists of 21 items measuring six aspects (reproduction, extrinsic and intrinsic work reflection, interpersonal help-seeking, help-seeking from written material, and practical application) of workplace learning behaviour. Five items of the scale were used in the instrument, slightly reworded to match the style of other items [example item: (LS-10) 'I generally try to understand how new information fits in to how I do my work' was reworded as SRLWQ-47: 'I try to understand how new information I've learned impacts my work'].

#### *Occupational Self-efficacy scale (OS)*

Self-efficacy is defined as the confidence an individual has in her or his ability to cope with difficult tasks or problems, or the belief in one's own ability to successfully fulfil a task (Bandura, 1977). In organizational research, the concept of self-efficacy is viewed as a domain-specific component, referring to the competence that an individual perceives he or she has concerning his/her ability to successfully fulfil the tasks

involved in his or her job (Rigotti *et al.*, 2008). This six-item scale came originally from an organizational psychology context, and was used in its entirety without rewording [e.g. '(OS-1/SRLWQ-48) I can remain calm when facing difficulties in my job because I can rely on my abilities'].

#### *Metacognitive Awareness Inventory (MAI)*

This 52-item instrument by Schraw and Dennison (1994) (evaluated by true/false answers and an accompanying scoring guide) is underpinned by a two-factor model of metacognition which includes reflective aspects of learning and regulation of cognition. This scale has been validated in higher education. Eleven items were selected, reworded for the workplace context, and adapted to fit a 5-point Likert scale [example item: (MAI-22) 'I ask myself questions about the material before I begin' reworded as SRLWQ-16: 'I ask myself questions about each learning task before I begin'].

#### *Online Self-Regulated Learning Questionnaire (OSLQ)*

This instrument by Barnard-Brak *et al.* (2010), based directly on Zimmerman's model, consists of 24 statements designed to measure the respondents' ability to self-regulate their learning in environments that are *wholly* or *partially* online. Four items from this scale were used [example item: (OSLQ-1) 'I set standard for my assignments in online courses' reworded as SRLWQ-12: 'I set personal standards for performance in my job'].

### **WLC scale**

The ability and capacity to learn is an individual characteristic, but learning may also be context dependent, and therefore it was important that the instrument also included a measure of the workplace context in which each respondent is working. Learning may be affected by role characteristics, such as whether there are opportunities to interact with different people, to be creative, or to solve problems. An existing scale, developed by Schalk and van Woerkom (2009) as part of a study investigating the relationship between age, workplace context and employability, was included in the instrument. The scale is comprised of six items designed to provide a measure of the (perceived) learning opportunities available to the individual in his/her particular workplace/role context. As the scale was originally designed for a workplace context, no rewording was necessary and the scale was used unaltered [example item: (WLC-1/SRLWQ-54) 'My job requires me to be creative'].

Items to collect demographic information (age, role, number of years in current organization) were also included to provide a simple profile of the sample measured. A full list of items from the SRLWQ instrument is included as an appendix to this paper and online at <http://dx.doi.org/10.6084/m9.figshare.1146236>. The instrument was piloted internally within the research group, and also with a small sample from the target audience to check for problems with format, length, wording, clarity and coherence. This phase resulted in only minor changes to the wording of some items and accompanying guidance.

### **Sample and analysis**

Participants were knowledge workers in the finance industry. The sample cohort for this pilot study was provided by the Chartered Institute for Securities and Investment, and other professional development bodies serving the finance industry. The instrument was made available online and a link distributed on member mailing lists. These mailing lists have approximately 15,000 subscribers. Two hundred forty responses were collected within a 3-week time period in early 2013. By eliminating those participants who did not fully complete the survey instrument, the sample was reduced to 170. Although the professional bodies are based in the United Kingdom, their membership is international. Although the response rate is low, there is no reason to believe that the sample is unrepresentative of the overall population. The sample comprised 99 male and 71 female respondents. The average age of respondents was

38.12 years old ( $SD = 10.97$ ). Respondents reported a range of work roles: 38 senior managers, 41 supervisors and 91 frontline staff. The average time worked in the current organization was 9.3 years ( $SD = 10.73$ ). SRL scores for each participant were derived by adding the scores for the three SRL scales. The minimum and maximum scores observed were 92 and 207, respectively (the possible range was from 42 to 210). The average SRL score obtained was 155.19 ( $SD = 21.8$ ).

The dataset was analysed with the SPSS software package (IBM Corporation, Armonk, NY, USA). Statistical analysis was conducted to determine the utility of the instrument in terms of internal reliability (Cronbach's alpha) and convergent validity (Pearson correlation). In order to understand the underlying constructs in the scales, a principal component analysis (Darlington *et al.*, 1973) was conducted for each of the five scales using varimax (orthogonal) rotation when more than one factor could be extracted. The results of this analysis are described below.

## Results and discussion

### Internal reliability of the scales

Internal reliability of the instruments was measured by calculating Cronbach's alpha values for the five scales. All five scales showed Cronbach's alpha as greater than 0.8, indicating strong internal reliability (Table 3).

### Exploratory factor analysis

The underlying structure of each scale was investigated using exploratory factor analysis (de Winter *et al.*, 2009). An analysis of the 11-item WLA scale yielded a single factor (number of items: 11;  $\alpha = 0.85$ ; total explained variance: 45.58 per cent; Table 4) labelled workplace learning activity, with highest loadings for intentional informal learning, such as problem-solving activities. The item which showed weakest loading was one representing the most 'formal' WLA: WLA7: 'Attending a training course or using self-study materials'.

The three SRL scales corresponding to the three phases of Zimmerman's model were analysed in turn. Each phase of the SRL process was measured by a separate scale in order to highlight the factor structure underlying the different phases. Analysis of the SRL-F (forethought phase) scale [number of items: 17;  $\alpha = .89$ ; total explained variance: 63.94 per cent; Table 5] yielded a four-factor structure:

- F1: 'strategic planning' (number of items: 7;  $\alpha = 0.81$ ; total explained variance: 35.7 per cent; example item: 'I use specific strategies for different types of things I need to learn'). This factor is related to the actions undertaken to plan and organize learning in the workplace.
- F2: 'self-efficacy' (number of items: 4;  $\alpha = 0.81$ ; total explained variance: 12.88 per cent; example item: 'Whatever comes my way in my job, I can usually handle it') corresponds to the self-efficacy component of the SRL forethought phase,

Table 3: Cronbach's alpha for SRLWQ instrument scales

| Scale                            | Number of items | $\alpha$ |
|----------------------------------|-----------------|----------|
| WLA: Workplace Learning Activity | 11              | 0.85     |
| SRL-F: forethought               | 17              | 0.89     |
| SRL-P: performance               | 19              | 0.88     |
| SRL-SR: self-reflection          | 6               | 0.86     |
| WLC: Workplace Learning Context  | 6               | 0.84     |

SRLWQ, Self-Regulated Learning at Work Questionnaire.



Table 4: Component matrix (1 component extracted): exploratory factor analysis for Workplace Learning Activity scale

| Items   | Factor 1 |
|---|----------|
| [8] Observing or replicating colleagues' strategies to complete a task or solve a problem | 0.75     |
| [2] Working alone or with others to develop solutions to problems                         | 0.75     |
| [3] Working alone or with others to develop new ideas                                     | 0.74     |
| [5] Performing new tasks  | 0.74     |
| [11] Receiving feedback on tasks from work colleagues                                     | 0.66     |
| [4] Following new developments in your field  | 0.64     |
| [6] Asking colleagues for advice  | 0.62     |
| [9] Finding better way to do a task by trial and error                                    | 0.60     |
| [10] Reflecting on previous actions   | 0.58     |
| [1] Acquiring new information (e.g. by searching the internet or company knowledge base)  | 0.50     |
| [7] Attending a training course or using self-study materials                             | 0.45     |

Note: Extraction method: principal component analysis. Total explained variance: 41.79%.

indicating the extent to which an individual feels confident to be able to accomplish all the tasks in his/her job.

- F3: 'goal setting' (number of items: 3;  $\alpha = 0.70$ ; total explained variance: 9.53 per cent; example item: 'I meet the goals that I set for myself in my job'). This factor relates to an individual's ability to set long or short-term goals for their learning in the workplace.
- F4: 'task interest/value' (number of items: 3;  $\alpha = 0.80$ ; total explained variance: 5.83 per cent; example item: 'It is important for me to learn new things in this job'). This factor relates to the individual's personal interest in their task and the value they associate with its completion. Learners who are able to find personal interest or intrinsic value in a task are more likely to regulate their own learning (Zimmerman, 2000).

For the performance phase scale, three factors were identified by this analysis (Table 6; total explained variance: 55.08 per cent).

- P1: 'elaboration strategies' (number of items: 6;  $\alpha = 0.79$ ; total explained variance: 37.9 per cent; example item: 'During learning I treat the resources I find as a starting point and try to develop my own ideas from them'). This factor covers a number of sub-processes relating to help-seeking and elaboration behaviour.
- P2: 'task strategies' (number of items: 6;  $\alpha = 0.75$ ; total explained variance: 9.25 per cent; example item: 'I write down a plan to describe how I hope to achieve my learning goals'). This factor represents a range of strategies and approaches an individual may employ to further his/her learning.
- P3: 'critical thinking' (number of items: 3;  $\alpha = 0.80$ ; total explained variance: 7.9 per cent; example item: 'I try to play around with ideas of my own related to what I am learning'). This last factor describes an individual's ability to think critically about their learning.

Finally, for the self-reflection phase scale, two factors were identified (Table 7; total explained variance: 72.77 per cent).

- SR1: 'self-satisfaction' (number of items: 3;  $\alpha = 0.85$ ; total explained variance: 59.35 per cent; example item: 'I consider how what I've learned relates to my team'; Table 7). Self-satisfaction refers to an individual's ability to recognize the intrinsic value of their recent learning beyond its immediate value (e.g. to longer-term goals or to the organization rather than just the individual).

Table 5: Rotated component matrix: exploratory factor analysis for SRL forethought phase scale

| Items   | Factors                    |                    |                      |                             |
|---|----------------------------|--------------------|----------------------|-----------------------------|
|   | 1<br>Strategic<br>planning | 2<br>Self-efficacy | 3<br>Goal<br>setting | 4<br>Task<br>interest/value |
| [19] I use specific strategies for different types of things I need to learn                        | 0.81                       |                    |                      |                             |
| [16] I ask myself questions about each learning task before I begin                                 | 0.74                       |                    |                      |                             |
| [18] When planning my learning, I adapt strategies that have worked in the past                     | 0.69                       |                    |                      |                             |
| [14] I set goals to help me manage the time I spend learning  | 0.65                       |                    |                      |                             |
| [15] I set realistic deadlines for learning when I have identified a learning need.                 | 0.62                       |                    |                      |                             |
| [13] I set long-term goals (monthly or yearly) for myself in order to direct my learning activities | 0.59                       |                    |                      |                             |
| [17] I think of several ways to solve a problem and choose the best one                             | 0.54                       | 0.82               |                      |                             |
| [48] I can remain calm when facing difficulties in my job because I can rely on my abilities.       |                            | 0.80               |                      |                             |
| [49] When I am confronted with a problem in my job, I can usually find several solutions.           |                            | 0.76               | 0.73                 |                             |
| [50] Whatever comes my way in my job, I can usually handle it.                                      |                            | 0.54               | 0.60                 |                             |
| [51] My past experiences in my job have prepared me well for my occupational future.                |                            |                    | 0.41                 |                             |
| [52] I meet the goals that I set for myself in my job.  |                            |                    |                      | 0.85                        |
| [53] I feel prepared for most of the demands in my job.   |                            |                    |                      | 0.84                        |
| [12] I set personal standards for performance in my job   |                            |                    |                      | 0.77                        |
| [21] It is important for me to learn new things in this job   |                            |                    |                      |                             |
| [22] Learning that I undertake in this job is important to me                                       |                            |                    |                      |                             |
| [20] I think I will be able to use what I learn in this job in the future                           |                            |                    |                      |                             |

Note: Extraction method: principal component analysis for SRL forethought phase scale. Rotation method: varimax with Kaiser normalization (rotation converged in six iterations). Total explained variance: 66.15%.  
SRL, self-regulated learning.

Table 6: Rotated component matrix: exploratory factor analysis for SRL performance phase

| Items   | Factors                        |                         |                           |
|---|--------------------------------|-------------------------|---------------------------|
|   | 1<br>Elaboration<br>strategies | 2<br>Task<br>strategies | 3<br>Critical<br>thinking |
| [37] When I am unsure about something I look it up  | 0.77                           |                         |                           |
| [38] I fill in the gaps in my knowledge by getting hold of the appropriate material                             | 0.73                           |                         |                           |
| [39] When faced with a challenge in my job I try to understand the problem as thoroughly as possible            | 0.58                           |                         |                           |
| [30] When I'm learning, I bring together information from different sources (for example: people and resources) | 0.54                           |                         |                           |
| [29] When I'm learning, I try to relate new knowledge I find to what I already know                             | 0.53                           |                         |                           |
| [31] I try to apply ideas from my previous experience to my job where appropriate                               | 0.52                           |                         |                           |
| [23] I write down a plan to describe how I hope to achieve my learning goals                                    |                                | 0.66                    |                           |
| [28] I organize my time to best accomplish my goals   |                                | 0.64                    |                           |
| [24] I ask myself how what I'm learning is related to what I already know.                                      |                                | 0.64                    |                           |
| [25] I change strategies when I don't make progress while learning  |                                | 0.62                    |                           |
| [26] When learning I make notes (including diagrams, etc.) to help organise my thoughts                         |                                | 0.60                    |                           |
| [27] I focus on the meaning and significance of new information   |                                | 0.52                    |                           |
| [33] I try to play around with ideas of my own related to what I am learning                                    |                                |                         | 0.80                      |
| [32] During learning I treat the resources I find as a starting point and try to develop my own ideas from them |                                |                         | 0.79                      |
| [34] In my job I think about possible alternative ways to do my tasks   |                                |                         | 0.59                      |

Note: Extraction method: principal component analysis for SRL performance phase scale. Rotation method: varimax with Kaiser normalization (rotation converged in three iterations). Total explained variance: 55.08%.  
SRL, self-regulated learning.

- SR2: 'self-evaluation' (number of items: 3;  $\alpha = 0.82$ ; total explained variance: 16.24 per cent; example item: 'I ask myself if there were other ways to do things after I finish a task'; Table 7). This factor relates to an individual's ability to think about his/her recent learning experience and evaluate the actual learning that had occurred.

Overall, the factor structure obtained for the three SRL scales is as shown in Table 8. There were 9 of the 11 sub-processes originally identified represented.

Table 7: Rotated component matrix: exploratory factor analysis for SRL self-reflection phase scale

| Items  | Factors                |                      |
|--|------------------------|----------------------|
|  | 1<br>Self-satisfaction | 2<br>Self-evaluation |
| [46] I consider how what I've learned relates to my team                               | 0.88                   |                      |
| [47] I try to understand how new information I've learned impacts my work              | 0.86                   |                      |
| [45] I think about how what I've learned fits in to the 'bigger picture' at my company | 0.77                   |                      |
| [43] I ask myself if there were other ways to do things after I finish a task.         |                        | 0.87                 |
| [44] I think about what I've learned after I finish.                                   |                        | 0.82                 |
| [42] I know how well I have learned once I have finished a task                        |                        | 0.75                 |

Note: Extraction method: principal component analysis for SRL self-reflection phase scale. Rotation method: varimax with Kaiser normalization (rotation converged in three iterations). Total explained variance: 75.7%.  
SRL, self-regulated learning.

Table 8: Phases and sub-processes emerging from principal component analysis of the three SRL scales

| Scale  | SRL-Forethought  | SRL-Performance                                     | SRL-Self-reflection                         |
|--------|--|---|---|
| Factor | Goal setting<br>Strategic planning<br>Self-efficacy<br>Task interest/value | Task strategies<br>Elaboration<br>Critical thinking | Self-evaluation<br>Self-satisfaction/affect |

SRL, self-regulated learning.

Table 9: Component matrix: exploratory factor analysis for the Workplace Learning Context scale (one component extracted)

| Items   | Factor 1 |
|---|----------|
| [56] I have opportunities to develop my own special abilities | 0.84     |
| [57] I can vary how I do my work                              | 0.81     |
| [54] My job requires me to be creative                        | 0.79     |
| [59] My job requires me to learn new things                   | 0.72     |
| [55] I can choose my job assignments                          | 0.70     |
| [58] My job requires a high level of skill                    | 0.61     |

Note: Extraction method: principal component analysis. Total explained variance: 57.84%.

The WLC scale yielded a single-factor structure encompassing all items (number of items: 6;  $\alpha = 0.84$ ; total explained variance: 55.11 per cent; example item: 'I can vary how I do my work'; Table 9), confirming the factor structure originally reported by Schalk and van Woerkom (2009). This factor relates to the perceived learning opportunities afforded by the role.

## Correlations

The instrument was also tested for convergent validity, to test the relationship between individual factors. In their study of work-related learning among ICT workers, Gijbels *et al.* (2012) demonstrated a positive correlation between self-directed learning orientation and learning opportunities undertaken, arguing that self-directed learners are better able to identify learning opportunities, overcome barriers to learning and show learning initiative. Similarly, those who were not self-directed would fail to identify learning opportunities and fail to seize opportunities to learn. Although distinct concepts, SRL and self-directed learning are closely related (Pilling-Cormick & Garrison, 2007), and in this study a similar hypothesis was formulated to test the convergent validity of the SRL scales (H1): *High SRL score is positively correlated with Workplace Learning Activity*. Learners who are better able to self-regulate their learning (including individual sub-processes) will be more aware of their learning needs, and more proactive about their learning, undertaking more workplace learning opportunities than their peers who are less able to self-regulate their learning. To test our hypothesis, the correlation analysis between the factors identified by the principal component analysis of the SRL scales (F1, F2, F3, F4, P1, P2, P3, SR1, SR2), as well as Total SRL score, WLC and WLA was conducted. Results indicate that Total SRL score is positively correlated with WLA (H1), and that each of the factors identified by the principal component analysis individually reflects this positive correlation (Table 10).

## Conclusions

This research aimed to develop and validate an instrument to measure SRL in the workplace. Starting from existing validated instruments developed in formal education settings, the instrument was adapted and designed to cover a broad range of sub-processes of SRL described by Pintrich (2000) and Zimmerman (2000). The instrument was then deployed as an online survey and completed by knowledge workers from the finance industry. Each of the five scales in the instrument show strong internal reliability. A clear factor structure was obtained for each of the five scales, though some items in the instrument did not load for any factor and were subsequently eliminated from further analysis. The strong internal reliability of the factors identified by the principal component analysis suggests that the factor structure indicated by the analysis is robust. The factors identified by principal component analysis, as well as total SRL score and the WLA factor, were used to perform a correlation analysis, confirming the hypotheses that SRL score would positively correlate with workplace learning activities undertaken and confirming the convergent validity of the instrument.

The correlation analysis indicates that the SRLWQ instrument can be used to identify individuals who regulate their own learning to different extents within their work role and this can be valuable both for practice and research. Recognizing those individuals who are more and less capable of self-regulation, and supporting them through the provision of support structures tailored to their specific needs become means by which organizations can support their knowledge workers to become and remain effective employees. A modified version of this instrument could be deployed as a psychometric tool to allow organizations to match employees with specific profiles to different roles or provide tailored support. Similarly, by gaining a better understanding of their capacity to regulate their own learning, knowledge workers can assume greater responsibility for their own learning and development. Employees could use a version of the instrument to assist them to reflect on their practice and identify areas for learning and development. For research, the availability of a tool that can differentiate between workers who regulate (different aspects of) their own learning to different degrees provides an opportunity for in-depth analysis of the value of different SRL sub-processes in the workplace. The SRLWQ instrument is, however, only an initial step. To understand the nature of self-regulation of learning in the workplace more fully, the SRLWQ is intended to be used in conjunction with other methods. For example, in an extension of the present study, the SRLWQ has been used to identify



Table 10: Pearson correlations between workplace learning activity, workplace learning context and self-regulated learning dimensions

|  | 1. | 2.     | 3.     | 4.     | 5.     | 6.     | 7.     | 8.     | 9.     | 10.    | 11.    | 12.    |
|--|----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1. Workplace Learning Context          | 1  | 0.48** | 0.43** | 0.32** | 0.25** | 0.32** | 0.36** | 0.39** | 0.31** | 0.38** | 0.31** | 0.26** |
| 2. Workplace Learning Activity         |    | 1      | 0.61** | 0.50** | 0.20** | 0.28** | 0.46** | 0.48** | 0.52** | 0.45** | 0.42** | 0.40** |
| 3. Total SRL score                     |    |        | 1      | 0.84** | 0.55** | 0.67** | 0.58** | 0.79** | 0.81** | 0.70** | 0.72** | 0.61** |
| 4. F1: strategic planning              |    |        |        | 1      | 0.38** | 0.53** | 0.39** | 0.57** | 0.73** | 0.51** | 0.51** | 0.43** |
| 5. F2: occupational self-efficacy      |    |        |        |        | 1      | 0.61** | 0.23** | 0.37** | 0.30** | 0.29** | 0.31** | 0.24** |
| 6. F3: goal setting                    |    |        |        |        |        | 1      | 0.30** | 0.49** | 0.45** | 0.35** | 0.39** | 0.32** |
| 7. F4: task interest/value             |    |        |        |        |        |        | 1      | 0.47** | 0.40** | 0.30** | 0.42** | 0.20** |
| 8. P1: elaboration strategies          |    |        |        |        |        |        |        | 1      | 0.57** | 0.62** | 0.49** | 0.40** |
| 9. P2: task strategies                 |    |        |        |        |        |        |        |        | 1      | 0.53** | 0.51** | 0.41** |
| 10. P 3: critical thinking             |    |        |        |        |        |        |        |        |        | 1      | 0.49** | 0.43** |
| 11. SR: self-satisfaction              |    |        |        |        |        |        |        |        |        |        | 1      | 0.58** |
| 12. Self-reflection 2: self-evaluation |    |        |        |        |        |        |        |        |        |        |        | 1      |

SRL, self-regulated learning. \*\*  $p < 0.01$ .

knowledge workers with high and low SRL scores (Milligan *et al.*, 2014). These workers were then interviewed to determine the learning strategies they favour and learning strategies compared to determine the nature of any differences between the two groups. Further studies are also needed to develop our understanding of the precise nature of self-regulation of learning in the workplace. The ability to self-regulate one's learning is a key component of effective workplace learning; however, it is important to recognize that effective learning in the workplace is dependent on other factors. For example, in addition to self-regulation, Tynjälä and Kallio (2009) have identified further three components of professional expertise: *Factual knowledge*, which is based around conceptual or theoretical knowledge often codified in books, reports and other media sources; *Experiential knowledge*, which is difficult to codify and is acquired through professional practice; and *Sociocultural knowledge*, which is embedded in the social practices of groups and communities, providing a framework for interactions. Studies of workplace learning must seek to understand the ability to self-regulate alongside these other components, as well as recognizing the organizational context within which the learning is situated.

It is important to consider some of the limitations of the instrument, and of the current study. As highlighted in the introduction, the SRLWQ is a self-report measure and therefore may not provide a true measure of the extent to which an individual is capable of self-regulating their learning. Self-report instruments are however widely used in the study of SRL and represent an appropriate mechanism for selecting learners who exhibit different behaviours as long as there is some recognition that the measures are relative, rather than absolute. This instrument is not intended to be used in isolation, but rather as one component of a wider study. Conducting research studies in any workplace can be a challenge as access to research subjects is restricted. We used a convenience sampling method to recruit participants for this study, but nevertheless achieved a poor response rate. For the purposes of this study, however, there is no reason to believe that the sample is unrepresentative. For future studies, alternative recruitment strategies which ensure a more coherent research cohort would be adopted. This pilot study has determined an initial factor structure for the SRLWQ instrument, but some items did not load, and further studies with these items reworded or replaced are needed to fully develop the instrument. Furthermore, the data collected for this study were from workers in a single industry. Ideally, similar studies would be conducted with workers in different work contexts to test and ensure the validity of the instrument as a measure of individual self-regulation of learning across a range of knowledge-intensive industries.

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## Appendix

### Self-Regulated Learning at Work Questionnaire

#### Items

The items used in the instrument are given below. The code to the left of each item (see key at end) indicates its origin.

Personal details:

[1- PD] Age \_\_\_\_\_

[2- PD] Gender

☐ Male

☐ Female

[3- PD] Your primary job role

☐ Senior Manager

☐ Supervisor

☐ Frontline Staff

[4- PD] How many years have you worked for your current primary employer?  
\_\_\_\_\_ years.

**Workplace Learning Activity scale: WLA**

|   |
|---|
| Question/Guidance:<br>Knowledge workers learn continually as they work, though they may not always be aware that they are learning. This section presents some possible learning activities you may have experienced during your work.<br>How frequently have you participated in the following learning activities in the last year?   |
| <i>1 = never, 2 = once or twice, 3 = sometimes, 4 = many times, 5 = very often or always</i>  |
| Items   |
| [1-LA-R-1] Acquiring new information (e.g. by searching the internet or company knowledge base)<br>[2-LA-R-2] Working alone or with others to develop solutions to problems<br>[3-LA-R-3] Working alone or with others to develop new ideas<br>[4-LA-R-4] Following new developments in your field<br>[5-LA-R-5] Performing new tasks<br>[6-LA-S-1] Asking colleagues for advice<br>[7-LA-C-1] Attending a training course or using self-study materials<br>[8-LA-C-5] Observing or replicating colleagues' strategies to complete a task or solve a problem<br>[9-LA-C-6] Finding better way to do a task by trial and error<br>[10-LA-C-8] Reflecting on previous actions<br>[11-LA-C-9] Receiving feedback on tasks from work colleagues |



### Self-Regulated Learning scales: SRL-F, SRL-P and SRL-SR

| <p>Question/Guidance: Please indicate the extent to which the following statements describe your behaviour. <i>There are no correct or incorrect responses to these questions: please indicate how you typically behave, rather than how you think you should behave.</i></p> |   |
|---|---|
| <p><b>Scale: 1 = not at all true for me, 2 = sometimes true for me, 3 = quite true for me, 4 = true for me, 5 = very true for me</b></p>  |   |
| SRL Phase   | Items   |
| SRL-F FORETHOUGHT   | <p>[12-F-OSLQ-1] I set personal standards for performance in my job<br/> [13-F-OSLQ-2] I set long-term goals (monthly or yearly) for myself in order to direct my learning activities<br/> [14-F-OSLQ-4] I set goals to help me manage the time I spend learning<br/> [15-F-OSLQ-4] I set realistic deadlines for learning when I have identified a learning need.<br/> [16-F-MAI-22] I ask myself questions about each learning task before I begin<br/> [17-F-MAI-23] I think of several ways to solve a problem and choose the best one<br/> [18-F-MAI-3] When planning my learning, I adapt strategies that have worked in the past<br/> [19-F-MAI-18] I use specific strategies for different types of things I need to learn<br/> [20-F-MSLQ-4] I think I will be able to use what I learn in this job in the future<br/> [21-F-MSLQ-10] It is important for me to learn new things in this job<br/> [22-F-MSLQ-27] Learning that I undertake in this job is important to me<br/> [48-F-OS-1] I can remain calm when facing difficulties in my job because I can rely on my abilities.<br/> [49-F-OS-2] When I am confronted with a problem in my job, I can usually find several solutions.<br/> [50-F-OS-3] Whatever comes my way in my job, I can usually handle it.<br/> [51-F-OS-4] My past experiences in my job have prepared me well for my occupational future.<br/> [52-F-OS-5] I meet the goals that I set for myself in my job.<br/> [53-F-OS-6] I feel prepared for most of the demands in my job.</p> |

| SRL Phase              | Items   |
|------------------------|---|
| SRL-P PERFORMANCE      | <p>[23-P-MAI-37-39-41] I write down a plan to describe how I hope to achieve my learning goals</p> <p>[24-P-MAI-43] I ask myself how what I'm learning is related to what I already know.</p> <p>[25-P-MAI-40] I change strategies when I don't make progress while learning</p> <p>[26-P-MSLQ-32] When learning I make notes (including diagrams, etc.) to help organise my thoughts</p> <p>[27-P-MAI-30] I focus on the meaning and significance of new information</p> <p>[28-P-MAI-45] I organize my time to best accomplish my goals</p> <p>[29-P-MSLQ-64] When I'm learning, I try to relate new knowledge I find to what I already know</p> <p>[30-P-MSLQ-53] When I'm learning, I bring together information from different sources (for example: people and resources)</p> <p>[31-P-MSLQ-81] I try to apply ideas from my previous experience to my job where appropriate</p> <p>[32-P-MSLQ-51] During learning I treat the resources I find as a starting point and try to develop my own ideas from them</p> <p>[33-P-MSLQ-66] I try to play around with ideas of my own related to what I am learning</p> <p>[34-P-MSLQ-71] In my job I think about possible alternative ways to do my tasks</p> <p>[35-P-MSLQ-68] When I can't understand a task, I ask my colleagues for help.</p> <p>[36-P-MSLQ-75] I try to identify colleagues in my workplace whom I can ask for help if I need it</p> <p>[37-P-LS-16] When I am unsure about something I look it up</p> <p>[38-P-LS-18] I fill in the gaps in my knowledge by getting hold of the appropriate material</p> <p>[39-P-MSLQ-22] When faced with a challenge in my job I try to understand the problem as thoroughly as possible</p> <p>[40-P-MSLQ-24] I like opportunities to engage in tasks that require me to learn</p> <p>[41-P-MSLQ-16] I prefer tasks that arouse my curiosity, even if I need to learn to achieve them</p> |
| SRL-SR SELF-REFLECTION | <p>[42-S-MAI-7] I know how well I have learned once I have finished a task</p> <p>[43-S-MAI-18] I ask myself if there were other ways to do things after I finish a task.</p> <p>[44-S-MAI-24] I think about what I've learned after I finish.</p> <p>[45-S-LS-5] I think about how what I've learned fits in to the 'bigger picture' at my company</p> <p>[46-S-LS-7] I consider how what I've learned relates to my team</p> <p>[47-S-LS-10] I try to understand how new information I've learned impacts my work</p>   |

Workplace Learning Context scale: WLC

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| Question/Guidance: Please indicate the extent to which your current role provides opportunities for learning and development. <i>There are no correct or incorrect responses to these questions.</i>   |
| Scale: 1 = never, 2 = once or twice, 3 = sometimes, 4 = many times, 5 = very often or always   |
| Items  |
| [54-WLC-1] My job requires me to be creative<br>[55-WLC-2] I can choose my job assignments<br>[56-WLC-3] I have opportunities to develop my own special abilities<br>[57-WLC-4] I can vary how I do my work<br>[58-WLC-5] My job requires a high level of skill<br>[59-WLC-6] My job requires me to learn new things |

Key:  
F = Forethought phase  
P = Performance phase  
S = Self-reflection phase  
Code for items: [no. in the current instrument—phase—origin—item no. in the original instrument], e.g. [1-F-OSLQ-1] = [item no. 1—forethought phase—OSLQ instrument—item no. 1]