Revista de Produtos Educacionais e Pesquisas em Ensino
REPPE
Edição Especial
III Congresso Internacional de Ensino - CONIEN
Universidade do Minho - Braga, Portugal, 2024

FACTORS INFLUENCING A SCIENCE OF LEARNING TRAINING PROGRAM FOR SCHOOL TEACHERS IN EUROPE

FATORES QUE INFLUENCIAM UM PROGRAMA DE FORMAÇÃO EM CIÊNCIA DA APRENDIZAGEM PARA PROFESSORES NA EUROPA

Catarina Neto[1]
Marc Beardsley[2]
Ana Silveira[3]
Merike Saar[4]
Nataša Simić[5]

Abstract

This paper was developed as part of a Science of Learning training program during a 3-year European project and aims to identify factors that may be influencing the application of findings from the Science of Learning to teacher practice. Data from 298 schoolteachers was collected through a self-reported questionnaire applied in Portugal, Spain, Estonia, and Serbia, and is qualitatively refined with in-service teachers and trainers' feedback on the factors influencing the feasibility and effects of the training program. The results presented to consider changes in teachers' knowledge, skills and beliefs, and the changes in their students' behavior and academic accomplishments, highlighting the evidence of the existence in teachers of beliefs and concerns that may interfere with effective Self-Regulated Learning instruction. This Contributions from this study intend to lay the ground for future research and interventions to support teachers, students, society, and government demystifying beliefs that are not consistent with Self-Regulated Learning.

[1] Kokoro Association, Porto, Portugal; currently affiliated with the Centre for Research and Innovation in Education, ESE, Polytechnic of Porto, Porto, Portugal, which is funded by National Funds through the FCT - Fundação para a Ciência e a Tecnologia, I.P., under the scope of the project UIDP/05198/2020.
[2] Department of Information and Communication Technologies, Universitat Pompeu Fabra, Spain.
[3] Kokoro Association, Porto, Portugal.
[4] School of Digital Technologies, Tallinn University, Estonia.
[5] University of Belgrade - Faculty of Philosophy, Institute of Psychology, Serbia.

Keywords: Science of Learning; Educational neuroscience; Self-regulated learning.

Resumo
Este artigo foi desenvolvido como parte de um programa de formação em Ciência da Aprendizagem durante um projeto europeu de três anos e tem como objetivo identificar os fatores que podem influenciar a aplicação das evidências da Ciência da Aprendizagem na prática dos professores. Os dados de 298 professores foram recolhidos através de um questionário autoaplicado realizado em Portugal, Espanha, Estônia e Sérvia, e foram qualitativamente refinados com o feedback de professores e formadores sobre os fatores que influenciam a viabilidade e os efeitos do programa de formação. Os resultados apresentados consideram as mudanças no conhecimento, habilidades e crenças dos professores, assim como as mudanças no comportamento e desempenho acadêmico dos seus alunos, destacando a evidência da existência, nos professores, de crenças e preocupações que podem interferir com o ensino eficaz de Aprendizagem autorregulada. As contribuições deste estudo pretendem estabelecer as bases para futuras pesquisas e intervenções destinadas a apoiar professores, alunos, sociedade e governo, desmistificando crenças que não são consistentes com a Aprendizagem autorregulada.

Palavras chave: Ciência da Aprendizagem; Neurociência na educação; Aprendizagem autorregulada.

Introduction

Transferring research findings from the Science of Learning (SoL) to educational practice seems to be in everyone's interest (AMIEL; TAN, 2019; ZIMMERMAN, 2008). So, why is this knowledge still far away from being applied within the educational community? The objective of this paper is to explore factors that may be influencing the application of findings from the SoL to teacher practices, from the implementation of a SoL training program with schoolteachers from four European countries (Estonia, Portugal, Serbia and Spain).

Recent research explored pre-service teacher beliefs related to the Self-Regulation of Learning (SRL) in which some pre-service teachers have been found to hold opposing beliefs about SRL – in other words, holding beliefs that are both consistent and inconsistent with SRL can interfere with the quality of learning activity design and enactments (DARMAWAN *et al.*, 2020; VOSNIADOU *et al.*, 2021). This paper explores the SRL beliefs of in-service teachers representing different parts of Europe. Additionally, the outcomes of the SoL training program are assessed following the work of Desimone (2009) which states that for teachers to acquire new skills in professional development and successfully apply them in the classroom, their professional development must: (a) improve teacher knowledge and abilities, (b)

improve students' behavior and academic accomplishments, and (c) lead to a change in beliefs through changes in instruction (DESIMONE, 2009).

Theoretical contribution

ILLUMINE: SoL-informed training program for schoolteachers

The ILLUMINE program was designed and implemented respecting guidelines for educational interventions (HERLITZ *et al.*, 2020; PLUMMER *et al.*, 2014). Participation was limited to small groups, instructional examples shared in the training were adapted to match the context of participating teachers (previously diagnosed needs), and a collaborative environment was nurtured among teachers through lesson co-design activities and the regular sharing of ideas and experiences. Additionally, trainers were capacitated to use a learner-centered approach that prioritized the co-construction of knowledge (VOSNIADOU *et al.*, 2021). Piloting of the program was done in the 2021/2022 and 2022/2023 school years with teachers either directly enrolling in a course open to any school (Estonia) or joining a course made available to their specific schools (Portugal, Serbia, Spain). Participation by teachers was voluntary and involved completing a minimum of six two-hour sessions. The workshop content focused on evidence-based teaching strategies from the SoL, such as retrieval practice, distributed practice, brain breaks, and reframing – and the co-design and implementation of research lessons (SAAR; LAANPERE, 2022). The teacher-led research lessons had groups of teachers test one or more strategies with students and document their experience using a template informed by Teacher Inquiry (SAAR; RODRÍGUEZ-TRIANA; PRIETO, 2022) and Japanese Lesson Study (DOIG; GROVES, 2011) approaches. The final work of participants was added to an online platform to share with the educational community (BEARDSLEY; ALBÓ; DAVINIA, 2023).

Methodological approaches

Study design

A mixed-methods design was used to run a multi-sited qualitative study (MOORE *et al.*, 2019). Trainers in each of the four countries administered questionnaires, ran two focus groups, and produced field notes from direct observation during workshops and focus group sessions (FIX *et al.*, 2022). The Institutional Committee for Ethical Review of Projects at Universitat Pompeu Fabra approved the study design.

Participants

A total of 298 teachers from Estonia, Portugal, Serbia, and Spain completed an online self-report questionnaire that was distributed to local teachers in each region prior to the start of the training program. Most respondents were female (*n*=228, 76.5%), age 40 or over (*n*=207, 69.5%), had more than 16 years of teaching experience (*n*=161, 54.0%), and were upper or post-secondary teachers (*n*=180, 60.4%). When comparing respondent demographics across regions, survey respondents from Serbia were younger (73.0% were age 49 or under) and had fewer years of teaching experience (56.0% had less than 16 years). In Estonia, there were more respondents from basic education (56.1%) than upper or post-secondary teachers. Further, 99 teachers participated in the workshop sessions (Estonia = 36, Portugal = 25, Serbia = 18, Spain = 20) in two rounds.

Self-reported questionnaire

The self-report questionnaire was constructed using sub-scales from the Beliefs about Learning and Teaching (BALT) Questionnaire (DARMAWAN *et al.*, 2020). SRL (*Nature of Constructive Learning, ConL*), with 13 items to evaluate teacher beliefs consistent with SRL, and SRL (*Quick and Natural Learning, NatL*), with 9 items to evaluate teacher beliefs inconsistent with SRL, were the sub-scales used. Both are rated using a 5-point Likert scale (1 Strongly Disagree - 5 Strongly Agree). Reliability was assessed as an indicator of convergence validity through Cronbach's alpha

coefficient. Values of this coefficient that are larger than 0.70 indicate good scale reliability. As such, both sub-scales used were considered reliable. In the case of the subscale *Quick and Natural Learning*, values in Portugal and Spain are below 0.70, but are in line with results of the reference study (DARMAWAN *et al.*, 2020).

Trainers' observations

In total 9 ILLUMINE trainers carried out fieldwork, observing and recording teacher comments and attitudes towards the training and implementation of research lessons during workshops and focus group sessions. The focus groups were held before and following the training program, with an approximate duration of 90 minutes each and an average of 8 teachers participating. The aim of the focus groups was to give participants a chance to elaborate more on some topics covered by the questionnaires but in this study, we focus on the trainers' observations and notes during these focus groups. The trainers were asked to present their observations using a Word file template which the researchers used to carry out the coding. To analyze the trainer observations, an inductive approach that is characterized by a systematic search for patterns in data, was used (ELO; KYNGÄS, 2008).

Results and Discussion

Beliefs consistent with self-regulation of learning (Nature of Constructive Learning)

Questionnaire results show high overall agreement with items expressing beliefs consistent with SRL (3.93 ± .482). For example, the items with highest level of agreement in all countries were '*Learning is better when students connect new information to what they already know*' (4.43 ± .660) and '*When students activate their existing knowledge about a topic, they learn more*' (4.30 ± .718). Nevertheless, important differences can be found among items. One item, '*Learning is more effective when students know a lot about a topic*', has a lower level of agreement than other items (3.13 ± 1.043). Teachers from Spain have the lowest level of agreement with the statement (2.64 ± 1.074) whereas teachers from Serbia the highest (3.56 ± .925). Additionally, teachers from Estonia have a low level of agreement with the item,

'*Learning is better when students can evaluate their level of understanding*' (3.38 ± .868). Results are consistent with previous research (DARMAWAN *et al.*, 2020) involving pre-service teachers that found that pre-service teachers had high overall agreement with items related to beliefs consistent with SRL. Although the item with the lowest level of agreement among pre-service teachers was '*Learning is more effective when students know a lot about a topic*' (4.37, using a 6-point Likert scale).

Beliefs inconsistent with self-regulation of learning (Quick and Natural Learning)

Results show high overall disagreement with items expressing beliefs inconsistent with SRL (2.36 ± .575). The items with the highest level of disagreement were '*You cannot be taught how to learn*' (1.57 ± .737) and '*Children know all they need to know about learning when they are born*' (1.63 ± .820); in Estonia another item has a high level of disagreement – '*It is a waste of time to try to understand something that does not make sense to you the first time you read it*' (1.53 ± .905) – and in Spain teachers highly disagreed with the item '*Some people are good learners and you can't teach people how to learn*' (1.44 ± .620). Yet, two items have higher levels of agreement than others: '*Successful students learn things quickly*' (3.39 ± .964), and '*If students are going to be able to learn something, it will make sense to them the first time they hear it*' (3.01 ± 1.094). Teachers from Portugal and Spain slightly agreed with both items, whereas teachers from Estonia and Serbia only slightly agreed with the first item. Previous research found that pre-service teachers expressed low agreement with items related to beliefs inconsistent with SRL, except for the item '*Successful students learn things quickly*' which had the highest level of agreement (3.22, using a 6-point Likert scale) (DARMAWAN *et al.*, 2020).

Teachers' beliefs and their sociodemographic characteristics

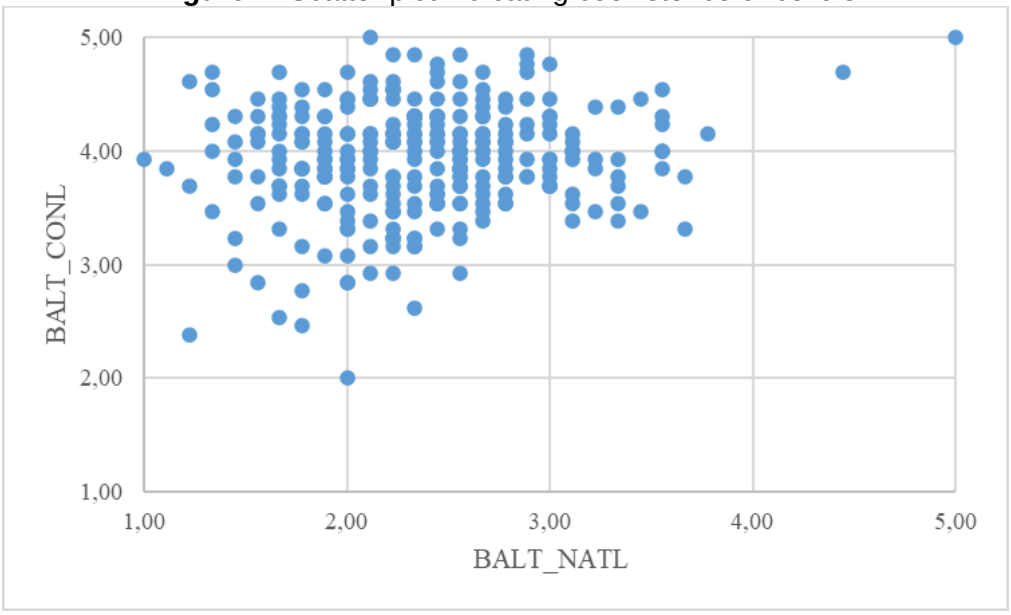
Pearson's correlation coefficient was run to assess the correlation between subscales, including separation items, and sociodemographic characteristics. Statistical significance was considered at 0.05. Results show that teacher beliefs inconsistent with SRL (NatL) are positively correlated with teacher age ($r = 0.131$, $p < 0.05$) and years of teaching experience ($r = 0.170$, $p < 0.05$). In other words, older

teachers and those with more teaching experience tend to have higher levels of agreement with beliefs inconsistent with SRL.

Coexistence of SRL-consistent and SRL-inconsistent belief

Figure 1 presents a scatter plot of the two subscales, Nature of Constructive Learning (ConL) and Quick & Natural Learning (NatL). The plot shows that most respondents (n=285; 95.6%) slightly agree, agree, or strongly agree with beliefs regarding the Nature of Constructive Learning consistent with SRL, and only a few of these respondents (n=45; 15.1%) also slightly agree, agree or strongly agree with beliefs in Quick & Natural Learning (inconsistent with SRL). In other words, only a small number of the teachers show coexistence of these two opposing beliefs, but the fact that these teachers agree with both may interfere with effective SRL instruction and ultimately, jeopardize student academic performance. When analyzing the coexistence of beliefs consistent and inconsistent with SRL, previous research with pre-service teachers also found that the majority of respondents agreed with beliefs regarding the sub-scale ConL, and only a few of these respondents also agreed with beliefs in the sub-scale NatL DARMAWAN *et al.*, 2020). Thus, although a minority, there are both pre-service and in-service teachers holding these two opposing beliefs.

Figure 1: Scatter plot indicating coexistence of beliefs



Source: Authors (2023)

Factors perceived by trainers as influencing the effects of the training program

Trainers were asked to document factors influencing the effects of the training on teacher educational practices. Two factors relating to obstacles hindering changes in educational practices emerged: time and curriculum. Time was a theme in each of the four countries. For example, Trainer 5 reported: "*Teachers stated they don't have enough time to do everything that is required of them, because of the high workload in schools*." Time is a well-documented obstacle in similar educational interventions (HARDING *et al.*, 2018). Curriculum did not emerge as a theme in Estonia but did so in the other three countries. For example, Trainer 1 noticed: "*Teachers stated that their curriculum is too demanding for their students, especially in the context of big classes, a lot of administration and lack of professional support*." Limited time can also be a consequence of curriculum overload as communicated by Trainer 3: "*Teachers complain how the curriculum goals are enormous for the amount of the time in the school year*." The absence of similar data in Estonia may relate to the characteristics of participants and/or the National Curriculum (in general, teachers in Estonia are regarded as very autonomous - though they must follow the National Curriculum, they are free to choose how they do it regarding learning materials and methods. Also, schools have the liberty to distribute additional hours for certain subjects that the school considers necessary in their own context). Harding *et al*. (2018) listed additional factors that can jeopardize the effects of educational interventions such as the practicality of the resources introduced to teachers (local language, ready-to-use). These obstacles did not emerge as they were considered in the design of the training program. Trainer 3 reported that: "*Preparing resources in Portuguese was a need shared in the first workshops and after addressed, teachers shared their contentment with that*."

Despite the obstacles, themes relating to the impact of the training on both teachers and students emerged. Following Desimone (2009) aspects to successful teachers' professional development, it was observed that participating teachers: (a) improved their knowledge and ability to use evidence-based teaching strategies, assessed by how teachers designed, reflected upon, and communicated their implemented research lessons – for example Trainer 4 "*Teachers were very involved in the activities and shared that they were more confident in communicating and collaborating with their peers*." and Trainer 2: "*The most useful were other teachers' advice and testimonials.*" (b) improved their students' level of engagement, as shown

by teacher observations of student behavior – for example Trainer 5: "*Teachers reported on behavioral changes in students as well, mostly in terms of increased engagement and motivation*" and Trainer 7: "*In reflecting on the activities they implemented with their students, teachers often commented on the behavior of their students to indicate whether they had positive or negative impressions of the strategy usage – with most discovering positive impressions by students.*" (c) improved their abilities to connect with students from different cultural, economic, and social backgrounds and with different learning paces – for example, Trainer 6 noted: "*Teachers claimed that when students heard about the interventions, their behavior changed: students were eager for the interventions to succeed and got more involved (both in the classroom as well as doing their home tasks).*" and Trainer 1: "*After they conducted new teaching strategies from this project with their students, they tend to say that all students reacted positively, especially those who were not that engaged in regular classes.*"

Change in beliefs and future work

The existence in teachers of beliefs inconsistent with SRL as well as the coexistence of two opposing beliefs (consistent and inconsistent with SRL) may interfere with effective SRL instruction and, ultimately, affect student academic performance (BOSHUIZEN; VOSNIADOU; LEHTINEN, 2020; VOSNIADOU *et al.*, 2020; VOSNIADOU *et al.*, 2021). A recent study with in-service teachers that applied the BALT questionnaire found that teachers expressing significantly higher agreement with beliefs inconsistent with SRL *(learning is quick and natural and does not need to be taught*) were more likely to design activities that required no or very little constructive cognitive engagement (VOSNIADOU *et al.*, 2023). Thus, teachers with more working experience might be more prone to traditional teaching methods due to their pre-service training not being based on the contemporary knowledge about teaching and learning, so in-service teachers need special attention in professional development programs. Future interventions with SoL training programs for schoolteachers may include groups of teachers of different age and experience.

Our results show a positive effect on teacher practices with a resulting impact on student behavior – at least with regards to the research lessons. This suggests that teachers with varying beliefs about learning, and even those holding contradictory

beliefs (i.e., holding beliefs about learning that are both SRL-consistent and SRL-inconsistent) can benefit from a practice-oriented and collaborative approach to learning evidence-based teaching strategies. However, the lasting effects of such training are largely dependent on the individual teacher as significant obstacles such as lack of time and curriculum demands need to be overcome. This is summarized in the statement by Trainer 4: "*Teachers say that they have little time to implement new learning strategies as the subjects curricula are too big and demanding in terms of time, and often the large number of students per class hinders this implementation of innovative teaching practices*" and Trainer 7: "*Despite strong interest in the strategies and professional development approach, participants stated that teachers often lack time to revise lesson activities and learn to use the strategies.*"

Final considerations

Despite limitations of this study stemming from its design (e.g., lack of control group or post-training quantitative data), we believe that results obtained within the ILLUMINE project can be relevant for teacher trainers and policy makers. In this paper we argue that teachers may be at odds with their beliefs and practices due to the conflict with their beliefs and concerns (e.g. time, curriculum goals and pressure) that could affect the feasibility and effects of SoL-informed training programs (and possibly professional development programs of other types).

In fact, when designing, planning, and implementing the ILLUMINE as a professional development training program, we expected effects to be associated with teachers' increased knowledge and skills, a positive change in beliefs, and an improvement in their students' behavior and academic accomplishments. But we also acknowledged that changes in teachers' beliefs towards their change in instruction may take a long time to be accomplished. Yet overcoming the challenges in intervening in school contexts, we may conclude that the training results are positive and allowed to understand more deeply the factors influencing the effects of such a training program.

SoL-informed training programs must be available for teachers, using a common conceptual framework to elevate the quality of professional development trainings and, subsequently, to demystifying teachers' beliefs that are not consistent with SRL enabling them to change their teaching practice for the maximum benefit of

both teachers and students. Furthermore, attention should be given to the most common reason stated to explain the observed stand-off towards a change in teachers' teaching practices: that there was not enough time to include both the evidence-based teaching strategies from the science of learning and the content of the curriculum. Future interventions should focus on supporting teachers, students, society, and government demystifying this belief of prioritizing the content of the curriculum in detriment of students' strategies for learning that supports students not only during their school education but also in their lifelong learning process.

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