

LEARNING ACHIEVEMENT IN STEM SUBJECT: COMMONALITIES AND DIFFERENCES IN LATVIA AND FINLAND A COMPARATIVE STUDY

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Abstract. Education is a never ending learning process. Learning achievement in STEM is the academic disciplines of science technology engineering and mathematics. This article reports a study on the impact of learning achievement in STEM subject in Latvia and Finland. This report bring collection of knowledge and information from other writers and OECD. Learning achievement is the result of an activity that has been done, created both individually and in groups- education. Active learning increases student performance in STEM subjects (Science, Technologies, Engineering, and Mathematics). The basic qualification for school teachers in Finland is the master's degree and in Latvia the basic or minimum qualification for teaching needed to have at least bachelors' degree and teaching certificate. Research evidence shows that performance in Latvia was slightly below the OECD average in STEM subjects.

The impact of socio-economic factors as student's performance must be taken into account with comparative studies both in Finland and Latvia, and how Latvia and Finland achieve their expected goals?

The theoretical study is trying to investigate the reasons of differences in learning achievement in Latvian and Finnish schools; also what influences learners success and achievement in mathematics and science. It is important from a pedagogical point of view to provide student with relevant practical and theoretical information and to promote their knowledge.

Keywords: stem subjects, learning achievement, education, performance.

Introduction

Teaching is interactive in a way that observes students' existing conceptions. Teaching is about facilitating students' learning: Students are encouraged to construct their own knowledge and understanding and to strive towards becoming an independent learner. A student – centered teacher tries to recognize students' differing needs and take these as the starting point, when planning the course (Biggs, 1999; Kember & Kwan, 2002; Prosser & Trigwell, 1999; Prosser, Trigwell & Taylor, 1994; Samuelowicz & Bain, 1992, 2001; Trigwell & Prosser, 1996b; Vermut & Verloop, 1999). Teachers' approaches to teaching are influenced by their conceptions of teaching. Studies of University teachers'

conceptions of teaching have showed a range of variation (Kember & Kwan, 2002; Prosser, Trigwell & Taylor, 1994; Samuelowicz & Bain, 1992). Many countries, such as a Norway, UK, and Sri Lanka have made decisions about the compulsory pedagogical training of University teachers (Gibbs & Coffey, 2004).

Teaching and learning are not two distinct phenomena. Approaches to teaching are shown to be related to students' learning approaches and subsequently to their learning outcomes. If a teacher's focus is on what he or she does or on transmitting knowledge, students are more likely to adopt a surface approach to learning and focus on the production of knowledge. If a teacher adopt a deep approach to learning and focus on deeper understanding of the phenomena they are studying (Entwisted, Skinner, Entwistle, & Orr, 2000; Trigwell, Prosser, & Waterhouse, 1999).

Research evidence shows that making further improvements in teaching and learning- e.g. towards the government aims to reduce the proportion of low achievers and increase the proportions of top performers by 2020- it will require additional investments in continuous teachers' professional development. Considering the long service of many Latvian teachers, many of whom completed initial teacher training more than twenty years ago, this is particular relevant (OECD, 2013b). Teacher qualification in Latvia equals those of OECD countries as teachers at all levels are required to have a tertiary degree (equivalent to ISCED Level 5A and 5B) to obtain the right to teach. While some OECD countries like Estonia, Finland, Korea, Norway and Sweden apply selective criteria to enter pre-service training (for public primary and secondary education) others like Belgium, Germany, Luxembourg, the Netherlands and Poland have none (OECD, 2014b) Latvia belongs to the latter category.

Teacher's motivational aspect and teaching methods in Latvia and Finland

Teachers are an essential resource for learning. An education system cannot exceed the quality of its teachers (Barber & Mourshed, 2007). Trigwell, Ashwin, Lindblom-Ylänne, and Nevgi (2004) have investigated relations between approaches to teaching and motivational aspects in teaching. They have reinterpreted ideas of motivation in a way that fits into this perspective. They see that the aspects of teachers' motivation and interest which are evoked will be related to their perception of the situation they are in. They see motivation as an integral part of teacher's awareness, which can change according to their perception of the situation.

According to Banduras' definition self-efficacy as "generative capability in which cognitive, social, emotional, and behavioral sub skills must be organized and effectively orchestrated to serve innumerable purposes". Perceived

self-efficacy is a belief that one can perform using one's skills and abilities adequately in a certain circumstances (Bandura, 2000: 36-37). If approaches to teaching reflect what teachers understand teaching to be, motivational aspects of teaching, such as self-efficacy beliefs, do not seem to incorporate particular views on the purpose of teaching. Self-efficacy is about teachers' beliefs regarding their ability to perform their academic tasks (Lindblom-Ylänne & Nevgi, 2003; Trigwell et al.; 2004). Gordon & Debus (2002) have shown that teachers with high self-efficacy beliefs are likely to engage in a wide range of more productive teaching practices than teachers with low self-efficacy.

Teachers in Finland are very independent. They can decide almost everything: how they will teach, what they will select from the basic (national) curriculum, when they will teach each particular topic. The fact that that teachers have so much independence and respect influence young people as they are deciding what program they will follow in the University. If they choose teacher education, they know they will be entering a profession that enjoys broad trust and respect in the society one that plays an important role in shaping the country's future (OECD, 2010). The focus of education is on learning rather than testing. There are no national tests for pupils in basic education in Finland. Instead, teachers are responsible for assessment in their respective subjects on the basis of the objectives included in the curriculum (Mikkola, 2000). The Finnish education system has received international recognition in recent years. A study of Finnish elementary and secondary teacher's beliefs identified two types of mathematics teachers, traditional and innovative teachers. The traditional teacher emphasizes student thinking and deeper learning (Kupari, 1996).

A master's degree has become an essential precondition to raising the status of the profession in some high-performing countries. This ensures that the workforce possesses the knowledge and skills to drive school improvement efforts forward. Finland for example, has distinguished itself as high performers, and all teachers obtain a Master's degrees based on research and practice (Barber & Mourshed, 2007). Where teaching is seen as an attractive profession, its status can further be enhanced through selective recruitment that makes teachers feel that they are embarking on a career sought after by high-fliers (Schleicher, 2011).

The education system in Latvia is highly decentralized. Fewer teachers in Latvia think that their profession is valued in society, and a smaller proportion would become teachers if they could decide again (OECD, 2017). The Latvian government has defined a member of education objectives, including improving the motivation and professional capacity of teachers and academic personal. Teachers are at the centre of reform efforts for good reason. Although many external factors impact student learning and achievement, the single best predictor of student learning and achievement within the school in the quality of the teacher. The Latvian government recognizes its education system will only improve if it

can attract quality teachers into the profession, and maintain them by paying fair wages and investing in their professional development. (Teacher Remuneration in Latvia: An OECD perspective).

Since regaining independence in 1991 Latvia have gone through many changes that have also affected the educational system. While natural sciences and mathematics had been emphasized in the Soviet curriculum and in the society at large (Stoloff, 1989), the focus has since then shifted towards other topics. Although the teachers' beliefs in Latvia are oriented towards constructivism both primary and secondary teachers put the teacher in the center of educational experience when reporting on their classroom practice. While both primary and secondary teachers in their beliefs and practice support the similar hierarchy of constructivist elements, primary teachers are more attuned to reporting the implementation of elements of constructivism in their classroom than secondary teachers (Pipere, 2005). In 2006 and 2008 new standards in basic and secondary education were introduced in Latvia.

Educational performances in Latvia and Finland

In PISA 2015, learners' performance in Latvia was slightly below the OECD average in mathematics and reading and close to the OECD average in science, although performance in science decreased between 2012 and 2015. The impact of socio-economic factors on students' performance was below the OECD average. In Latvia education is compulsory from age 5 to age 16 (including pre-school for 5-6 years old). Early childhood education and care (ECEC) starts at age 1, 5, and enrolment rates for 4-year-olds were above the OECD average in 2014 (90 %, compared to OECD average of 86 %). At upper secondary level, attainment rates are comparatively high, but enrolment and graduation rates for vocational education are below the OECD average. Tertiary education attainment rates for 25-34 year olds are around the OECD average (Education Policy Outlook:Latvia@OECD 2017). In comparison to the OECD countries' average results of Latvian students have been statistically significantly better at solving 12, but less successful- at solving 27 out of 109 mathematics items included in PISA 2012. In the remaining 70 items the results of Latvian students correspond to the average level achieved by the students of OECD countries.

In Latvia the average performance in reading of 15- year olds in 488 points, compared to an average of 493 points in OECD countries. Girls perform better than boys with statistically significant differences of 42 points (OECD average: 27 points higher for girls). In science literacy, the main topic of PISA 2015, 15-year olds in Latvia score 490 points compared to an average of 493 points in OECD countries. Girls perform better than boys with a statistically significant

difference of 11 points (OECD average: 3.5 points higher for boys). On average 15 year – olds score 482 points in mathematics compared to an average of 490 points in OECD countries. Girls performed better than boys with a none statistically significant differences of 2 points (OECD) average: 8 points higher for boys).

Assessment in Finnish schools comes strictly from their teachers. The decentralized nature of Finnish schools allows for this. Primary schools do not use testing in order to concentrate on teaching, which allows for flexibility in curriculum design for teachers (Sahlberg, 2007: 56). After fifth grade, the law prohibits numerical grading in order to prevent student competition (ibid; p. 155). This lack of testing may relate to Finnish success in PISA. The Finnish National PISA Report cited that 7 % of Finnish students felt anxiety when working on mathematics at home, compared to 52 % of Japanese students and 53 % of French students (ibid, p. 156) each student receive report once a year, and teachers may administer an additional report halfway through the year (Finnish National Board of Education, n.d 8). At the end of compulsory school, students receive a certificate of completion (ibid).

International education surveys have placed the spotlight on countries with educational performance. PISA especially, with only three rounds thus far, has had a huge impact in the educational world. Finland traditionally not an avid participant in IEA studies has attracted much attention due to its performance in PISA. The top performance of Finland in all three administrations of PISA, and on all assessed literacy areas, has given the country new status as a global leader in education. The quality of education and consistency across the PISA surveys in Finland coupled with its high performance make the country even more alluring to those seeking educational models. In other words, Finland's performance in PISA has created an educational frenzy manifest in considerable attraction to the Finnish educational system (Phillips & Ochs, 2004: 773).

In Latvia all teachers need to be qualified to work in a school and must complete study programmes leading not only to higher pedagogical education, but also to teacher qualification at the respective level of education. Most of these programmes prepare teachers for teaching in particular subjects completion of a given programmed entitles graduates to teach the subject at the respective level of education. Exemptions exist for early childhood teachers and primary school teachers (classes 1-4) who also receive a teacher qualification for the respective level of education but are entitled to teach most subjects, i.e. they are generalists (Eurypedia, 2014).

A teacher needs a critical mind and ability to reflect. Reflection can be an action and on action (Niemi & Jakky-Sihvonen, 2009). For example, in the teacher education in Finland teachers' competence must include the readiness to analyze the situation like a researcher and to make conclusions and decisions to act or to

change something in a given situation (Niemi & Jakky-Sihvonen, 2009) consequently, when new teacher learning models are developed in Latvia it has to be taken into account that teachers' education has never met such demands and most teachers lack appropriate learning experience. Teaching must be made a more attractive profession: OECD evidence suggests that one of the most powerful success factors in education is attracting quality graduates. While this is not only a matter of the salary, remuneration does matter. Latvia pays teachers less than other European countries. We believe that any new system of teacher pay will require basic salaries to increase in real terms. In Latvia, the profession is more feminized than in OECD countries; improving the image of teaching for both women and men would permit a more positive and balanced view of the profession (Kelleher, 2011).

According to Van Driel et al. (2001) practical theories that guide teachers in teaching are based on practical knowledge. Teachers' practical knowledge is constructed by the teachers in the context of their work integrating experimental knowledge and formal knowledge. Math and science teachers' formal knowledge can be describe as follows "chemists know the chemistry content, however they lack the knowledge of how to merge the content with high level pedagogic outcomes" (Ege et al., 1997). This is obvious examining the scope of mathematics teachers' study program content for mastering the subject content, knowledge about students, teaching and learning, instruction and assessment techniques classroom management etc., in other words, the launching pad to become a teacher.

According to European Commission (OECD, 2016) in recent years, Latvia has made remarkable progress in reducing its early school leaving rate and improving basic skills attainment. Latvia is gradually introducing a new financing model in the higher education system, with elements to reward quality. In Latvia the tertiary educational attainment rate is high, but supplying graduates to knowledge-intensive sectors and attracting international students remain a challenge. The gender gap in education is a challenge across the board, with women outperforming men significantly both in terms of qualifications and basic skill proficiency.

Finland continues a comprehensive curriculum reform to modernize school education. The aim of the curriculum reform is to modernize teaching and learning through new pedagogies, a new learning environment as well as a new school culture. The national core curriculum for pre-primary and basic education was renewed in 2014, and involved all stakeholders, particularly education providers and educational personnel and for general upper secondary schools was renewed in 2015. The national core curriculum provides strategic guidance for developing local curricula that determine the exact education context. Finland, local curricula

are based on a core curriculum that was updated under the wider curriculum reform in general education adopted in December 2014.

Conclusion

Finland has a rather homogeneous and distinctive culture of its own. Latvia has more marked differences in culture, which have their roots in Latvia's modern history. The Latvian government recognizes its education system will only improve if it can attract quality teachers into the profession and paying good salaries and investing more for professional development. Latvia is young independent country and has gone through many changes, including educational system. Since active social participation in STEM education is crucial in the process of education and achievement. The activity of learning requires social and cultural recognition and thus the goals of the pedagogical process have to be relative to the social and cultural process. Supervision of the teachers needs to be continues, by the school, school teacher and regional education inspectors. Given training and instruction for inspectors, would improve teachers' performance and standard. Teacher's motivation and accountability is the key instrument for good committed teaching. The teacher's role is changing along with the new learning situations and environments of the modern era.

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