

Chemistry novice teachers' professional knowledge, know-how and the support needs in professional development

Heidi Handolin-Kiilo

This article discusses the knowledge, know-how and the support needs of the chemistry teachers' during their first years of teaching. Finnish chemistry teacher education gives its students an academic education, qualification to teach and at the same time equipment for lifelong learning. The construction of teachers' knowledge and know-how is especially based on the Grossman theory model. This article is based on a licentiate thesis, which deals with chemistry teacher graduates of first years of expertise in the schools and the challenges of the work and the needs for support. Research information on chemistry subject teachers' knowledge and wellbeing at their profession and at the school community is needed when developing relevant chemistry subject teacher education. Knowledge and research information of the possible support needs in professional development is also needed when developing forms of aid and supporting novice teachers (beginning teachers) to stay in the profession of teaching, continuous life-long learning, professional knowledge and know-how.

Newly qualified teachers, the so-called novice teachers (beginning teachers), transition from education to working life (induction) and it is seen as a major challenge from the perspective of the Finnish educational system and also worldwide (e.g. Handolin-Kiilo, 2015;. Heikkinen, Markkanen, Pennanen & Tynjälä, 2014; Ulvik & Hellevi, 2009). Support needs for science teachers professional development has been a concern for a long time (e.g. Lin & Chiu, 2000). These challenges have been studied widely, but novice science and chemistry teachers and their skills form challenges, which have been studied yet quite a bit (e.g., Abell 2008;. Davis, Petish, & Smithey, 2006; Handolin-Kiilo, 2015, the Mediterranean island, 2009).

Chemical subject teacher knowledge and know-how refers to everything that is associated with the teacher's knowledge, awareness, know-how, competence and skills, as well as the entire teacher's job description. Shulman's (1987) studies suggest that the teacher's expertise should include at least the following seven areas: content knowledge, general pedagogical knowledge (GPK), curriculum knowledge, pedagogical content knowledge (PCK), knowledge of learners and their characteristics, knowledge of educational contexts and knowledge of educational ends, purposes and values. The Grossman (1990) theory model of teacher knowledge is built from pedagogical content knowledge, subject matter knowledge, knowledge of context and general pedagogical knowledge.

The beginning of a novice teacher's career is full of stressful and time-consuming challenges and learning new things, of which he or she must survive to continue the teacher's career (e.g. Kyriacou & Kunc, 2007;. Taimisto, 2013). Challenges for the chemistry novice teachers are e.g. issues concerning practical working (experiments), safety, discipline, assessment, planning,

lack of peer support, workload, stress, large group sizes in the class, subject content and application of the subject content, as well as other tasks by the teacher in the school community (Handolin et al. 2010). In particular, the workload is felt as a great challenge for novice teachers (Handolin-Kiilo, 2015). On the other hand, teachers like their own job very much (Handolin-Kiilo, 2015).

In order to survive with honor from the first years in working life the novice teachers think that they need support to overcome the challenges and to develop their teaching skills (e.g. Davis et al, 2006). To continue the development of their own skills, capabilities already arise in the chemistry teacher education. For example, in the chemistry subject teacher education, one of the initial and center objectives of the University of Helsinki is to educate chemistry teachers who are lifelong learners, researchers and are able to follow the teaching of chemistry and emerging applications in the future (Aksela, 2010).

To secure a quality education for the future continuum in teacher training programs is needed, where the teachers of basic training, new teachers' induction programs and continuing education (professional development programs) form an unbroken whole path of lifelong learning (e.g. Handolin & Aksela, 2011; Innola & Mikkola, 2014). The induction phase refers to a teaching career stage at which the teacher is a graduate of the teacher and the teacher has moved to teach in a school (e.g. Bianchini & Brenner, 2009; The European Commission, 2010; Handolin-Kiilo, 2015). Support aids aimed at novice teachers could be, for example, internal support help provided from the school or organized by other parties, such as further training (continuing education, professional development programs) or so called induction programs (Handolin-Kiilo, 2015).

Other support mechanisms could be e.g. mentoring, reflection and peer support, as well as the applicable education teaching materials (e.g. Abbot, Moran & Clarke, 2010; Nielsen, 2010). Also, novice teachers, community and school leaders could support novice teachers: for example, by providing a planned induction which may have an important role for the novice teacher when they enter a new school (e.g. Gavish & Friedman, 2010.). When developing the teacher's professional skills, know-how and knowledge by delineated chemistry teacher education and continuing education (professional development) programs, at the same time influencing the entire teaching and, therefore, also it may contribute to pupils' learning (Abell, 2008; European Commission, 2010). For Finnish science and mathematics teachers professional development programs (continuing education) have been organized systematically since 1996. Since 2002, the LUMA Centre has organized a diverse teacher training, which is conducted every year in the virtual in Finland (Aksela, 2008).

There is not only one solution to support the chemistry novice teachers. There are different kinds of teachers and each of them wants to survive in their own way and style (Ulvik et al, 2006; Davis et al, 2006). Novice teachers should not be left alone with the challenges that they are facing every day. Today's novice teachers are the ones who will teach the following decades, if they get a chance to develop and improve themselves. They manage to teach and stay at work if they feel that they are necessary and an important part of society (Handolin-Kiilo & Aksela,

2015). It seems that the meaning of systematic teacher professional development in the field of lifelong learning partway has increased when at the same time a high rate of digitalizing and the winds of change in the school systems are blowing. These also bring with them, from the perspective of the research, a number of interesting new questions.

Heidi Handolin-Kiilo

Ph.D. student, Ph.Lic. (chemistry and mathematics lecturer)

The Unit of Chemistry Teacher Education, Department of Chemistry, University of Helsinki

heidi.handolin@helsinki.fi

Specialization: Interested in the development of teachers' professional skills and support, and using ICT in teaching chemistry. The topic of the doctoral dissertation concerns the use of ICT in Chemistry teaching.

References

- Abbot, L., Moran, A. & Clarke, L. (2010) Northern Ireland beginning teachers' experiences of induction: the 'haves' and the 'have nots'. *European journal of teacher education*, 32 (2), 95-110.
- Abell, S. K. (2008). Research on science teacher knowledge. In Abell, S. K. & Lederman, N. G. (Ed.). *Handbook of research on science education* (s. 1105-1149). New York, Routledge.
- Aksela, M. (2008). The Finnish LUMA centre: Supporting teachers and students in science, mathematics and technology for life-long learning. *Lifelong Learning in Europe*. 13 (1), 70-72.
- Aksela, M. (2010). Evidence-based teacher education: becoming a lifelong research-oriented chemistry teacher? *Chemistry Education Research and Practice*, 11, 84-91.
- Bianchini, J. A. & Brenner, M. E. (2009). The role of induction in learning to teach toward equity: A study of beginning science and mathematics teachers. *Science education*, 93, 164-195.
- Davis, E. A., Petish, D. & Smithey, J. (2006). Challenges new science teacher face. *Review of Educational Research*, 76 (4), 607-651.
- Euroopan komissio (2010). Developing coherent and system-wide induction programmes for beginning teachers: a handbook for policymakers. *European Commission Staff Working Document SEC (2010) 538 final*. Retrieved from: http://ec.europa.eu/education/policy/school/doc/handbook0410_en.pdf
- Gavish, B. & Friedman, I. A. (2010). Novice teachers' experience of teaching: a dynamic aspect of burnout. *Social Psychology of Education*, 13, 141-167
- Grossman, P. L. (1990). *The making of a teacher: teacher knowledge and teacher education*. New York, Teachers College Press.
- Handolin-Kiilo, H. (2015). *Kemian noviisiopettajien osaaminen ja sen tukeminen työelämän ensimmäisinä vuosina* (Chemistry novice teachers' professional knowledge, know-how and

the support need in professional development during their first years in working life).
Licentiate thesis.

- Handolin, H. & Aksela, M. (2011). Kemian noviisiopettajien käsityksiä opettajan työstä ensimmäisinä työvuosina (Chemistry novice teachers' perceptions of school work during first years of teaching). In M. Aksela, J. Pernaa, & M. Happonen (Ed.). *Kansainvälinen kemian vuosi: Kemia osaksi hyvää elämää*. (s. 72-83). Helsinki, Unigrafia Oy.
- Heikkinen, H., Markkanen, I., Pennanen, M. & Tynjälä, P. (2014). In (Ed.). *Opettajankoulutuksen tilannekatsaus: Muistiot 2014:4 (Teacher training reports: Memos 2014:4)*. (s. 45-54). Helsinki, Opetushallitus.
- Innola, M. & Mikkola, A. (2014). In Kumpulainen, T. (Ed.), *Opettajat Suomessa 2013 (Teachers in Finland 2013)*. Koulutuksen seurantaraportti 2014:8. (s.13-21). Retrieved from: http://www.oph.fi/download/156282_opettajat_suomessa_2013.pdf
- Kyriacou, C. & Kunc, R. (2007). Beginning teachers' expectations of teaching. *Teaching and Teacher Education*, 23, 1246-1257.
- Lin, H-S. & Chiu, H-L. (2000). Using computers to support a beginning teacher's professional development. *Journal of Science Education and Technology*, 9 (4), 367-373.
- Nielsen, B. L. (2010). Need for Danish science teachers' continual professional development after pre-service training (s. 739-750). In *XIV IOSTE Symposium, Bled, Slovenia, Socio cultural and Human Values in Science and Technology Education*. Slovenia, Institute for Innovation and development of University of Ljubljana.
- Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57 (1), 1-21
- Taimisto, S. (2013). *Noviisiopettajan ensimmäiset kuukaudet työelämässä (Novice teachers' first months in working life)*. Master thesis. Jyväskylän Yliopisto. Retrieved from: <http://urn.fi/URN:NBN:fi:ju-201306252039>
- Ulvik, M. Smith, K. & Helleve, I. (2009). Novice in secondary school – the coin has two sides. *Teaching and teacher education*, 25, 835–842.
- Välisaari, J. (2009). Jyväskylän yliopiston kemian opettajankoulutuksen arviointi opiskelijapalautteen pohjalta. (Teacher training program of University of Jyväskylä and its assessment based on student feedback). In: *Kemian Opetuksen Päivät 2009: Arkipäivän kemia, kokeellisuus ja työturvallisuus kemian opetuksessa perusopetuksesta korkeakouluihin*. 264-271. Helsinki, Yliopistopaino Oy.