DOI: 10.22616/REEP.2018.035

Didactic Principles in Estonian Craft and their Function in Interdisciplinary Integration

Andry Kikkull PhD
Tallinn University, Estonia
andryk@tlu.ee

Abstract: A new Estonian national curriculum for basic schools, implemented in 2014, supports better connections between theoretical knowledge and practical life skills. The curriculum focuses on integrating the learning content and acquired skills into everyday life. The current article gives an overview of the study, which aimed to identify Estonian craft teachers using teaching methods and didactic principles related to interdisciplinary integration. The author of this article sought answers to the following questions: What kinds of craft methodology are used in Estonian schools, and do these methodologies support interdisciplinary integration in craft lessons? This study was based on a survey conducted with Estonian craft teachers to analyse and generalise both the current experience of teaching craft in Estonia and the teachers' readiness for interdisciplinary integration. The statistical programme SPSS 22 was used to analyse the survey data. As a result, it can be concluded that Estonian craft teachers are relatively conservative in their practice, but their attitude towards integration was generally positive. In regard to methodology, 'old-fashioned' teaching methods are preferred, new methods are not applied quickly and cooperation between craft and other teachers is not common in the schools.

Keywords: school education, craft didactics, craft and science integration, teachers' cooperation.

Introduction

Although much has been said about the need for integration, subjects in basic schools have remained mostly isolated (Akgun et al., 2012). Estonian, as well as foreign, studies (Akgun et al., 2012; Kikkull, 2009; Soylu, Isik, 2008) show that students' subject knowledge remains significantly below the level required to solve domestic and technical problems. While a variety of integration approaches can be found in theory (Mustafa, 2011), and the Estonian national curriculum for basic schools (Government of the Republic, 2014) sets out the requirements for realisation of integration, teachers lack knowledge and experience about functional principles and the directive role of syllabi and textbooks is moderate (Kikkull, 2016).

The Estonian national curriculum for basic schools (Government of the Republic, 2014) has tried to minimise the shortages mentioned above by better integration of theoretical knowledge with practical life skills. This concept begins with learning highlights that help students apply acquired knowledge in new situations, such as solving problems, making choices, discussing the accuracy of claims and arguing their positions, as well as in their studies. Therefore, learning content and acquired skills must be integrated with students' everyday life, including their applicability in students' follow-up studies and future working life.

One of the most important student skills is the ability to transfer knowledge and skills acquired from one subject to lessons of another subject or to real life situations. The term 'transferring knowledge' essentially means to learn something in one context and apply it in another context (Fogarty, 1991). Therefore, the skill of knowledge transfer is the basis of knowledge integration. Unfortunately, students usually consider subjects as detached entireties that are separate from each other and have no direct connections with each other (Perkins, Salomon, 1992). However, in such learning situations, the formation of the students' comprehensive worldview is not supported.

Insufficient use of integrative possibilities in craft lessons may be an important reason why students cannot use learned knowledge outside the subject. At the end of the 19th century, Estonian schooling was already concerned about the chaotic presentation of study material in which links between new and old material were missing (Lind, 2005). Therefore, in craft lessons, it is crucial to assert and reinforce the correctness of knowledge learned in other subjects as well as applying it in domestic and technical situations. To understand the processes that relate to craft in the environment around us, it is best to perform the processes ourselves and thus be convinced of their validity (Borg, 2006). However, these questions remain: how can a teacher put into practice the principle of interdisciplinary integration as expected by the national curriculum, and how-and to what extent-do teachers understand and implement the principles of interdisciplinary integration in craft lessons?

Practice shows that Estonian craft relies largely on teachers' experiential teaching. Also, reproductive activity is still one of the main methods used in craft lessons. However, reproductive learning should be reduced in Estonian craft to make room for creativity and experimentation as well as 'learning by doing' as practised in the Nordic countries (Kikkull, 2012). Practice has also shown that freedom of choice, creativity and experimentation lead students to learning situations where they need the knowledge acquired from other subjects to resolve a task successfully in the craft lesson.

As described above, the learning process in basic school is characterised by conflict between natural integration of craft and other subjects, and its actual realisation. This conflict affects students' ability to use subject knowledge outside that specific subject, i.e. students lack the attitude and readiness to use acquired knowledge to solve life situations, particularly concepts and skills that they have not yet learned directly (Kikkull, 2009, 2016).

Effective integration of craft and other subjects in basic school can help to solve this situation. However, the implementer of integration principles is the teacher. By analysing teachers' perceptions and practical actions and considering current theoretical views, didactic and organisational conditions can be identified that could contribute, with cooperation between craft and other subjects, to students' applied knowledge formation.

The current article gives an overview of the study, which aimed to identify Estonian craft teachers using teaching methods and didactic principles related to interdisciplinary integration.

Methodology

According to this framework, the research questions are as follows: What learning methods do Estonian craft teachers use, how are the learning methods and principles of didactics in craft suited for interdisciplinary integration, and what are Estonian teachers' attitudes towards integration? The method chosen was a survey of Estonian craft teachers to gather responses to the research questions. The questionnaire consisted of 17 questions, which took about 15 minutes to answer. The questions were divided into multiple choice and free response questions. Free response questions expected either specification of a previous multiple-choice response or answering an open-ended question. The questions were divided into four categories. The first category included background questions about the craft teachers' gender, age and length of working experience, and the size of the schools where the teachers worked. The background information provided an opportunity to make different comparative data analyses and to find out whether the teachers' responses had statistically significant differences, for example, between age groups. The second set of questions aimed to identify teachers' main teaching methods and the principles of didactics used in lessons, which allowed analysis and generalisations of the Estonian craft teaching experience, and to learn how these methods function in integration between subjects. The third block of questions focused on understanding the essence of knowledge taught by the craft teacher and explaining it in the context of the learning process. This block thus dealt with integration through identifying the teachers' attitudes towards integration and whether the teachers are ready to put integration into practice. The last block of questions targeted cooperation between teachers of craft and other subjects and its perceived efficiency.

The survey was conducted via e-mail, using the e-Formular environment. To test the questions and suitability of the environment, this questionnaire was piloted with six selected craft teachers. Based on their feedback, corrections were made to the questionnaire, which helped the teachers to understand questions better and answer them with confidence.

For dissemination of the questionnaire, school network data of the Ministry of Education were used; based on this data, 498 questionnaires were mailed to all Estonian basic schools and upper secondary schools where craft was taught. Therefore, it can be said that the population of craft teachers was captured in the survey. 83 questionnaires were returned with responses, of which 90 % were men and 10 % women. While the proportion of men and women corresponds broadly to the general gender ratio of craft teachers, the data collection method used for the survey based on e-Formular raises issues of representation. It can be assumed that, apparently, the more active craft teachers who completed in the survey also belong to study subject associations and actively use computers in their work. However, the teachers who are more passive and do not use computers in their work would not have given positive

input and, therefore, it can be argued that the obtained study results show what is taking place in craft in a more positive light than it warrants.

The survey's quantitative data was analysed with the programme SPSS 22to present different descriptive statistics and perform necessary correlation and mean comparison tests (Analysis of Variance [ANOVA], t-test, $\chi 2$-test, Spearman's ρ). Where possible, Cronbach's alpha was used to measure the questionnaire's internal reliability. The open-ended questions' answers were encoded and assembled into coded content phrases or general ideas.

Results and Discussion

To get a better overview of the structure of the survey questions, the data were divided into the following categories:

- teaching methods and principles of didactic;
- realisation of integration;
- teachers' cooperation.

Teaching methods and principles of didactic

The questionnaire aimed to find craft teachers' main teaching methods and the principles of didactics they used in lessons. It allowed analysis and generalisation of the Estonian craft teaching experience as well as identification of how these methods function regarding integration between subjects.

To this end, the study examined the craft-related aims to which teachers have given greater priority. The responses were given on a Likert scale where 1 was the most insignificant and 5 the most prioritised response. Regarding this question, internal reliability control was performed and measured by Cronbach's alpha. This block of questions had α=0,631, which resulted in the responses being acceptably reliable (Kurpius, Stafford, 2006). The results were summarised in a bar chart (Figure 1) that depicts the averages of responses given by the teachers. The teachers were offered four main targets as response options arising from craft syllabus goals while everyday life skills, unlike others, has not been directly written into the syllabus (Subject field: Technology, 2014). As shown in Figure 1, the teachers consider all these goals to have above-average importance.

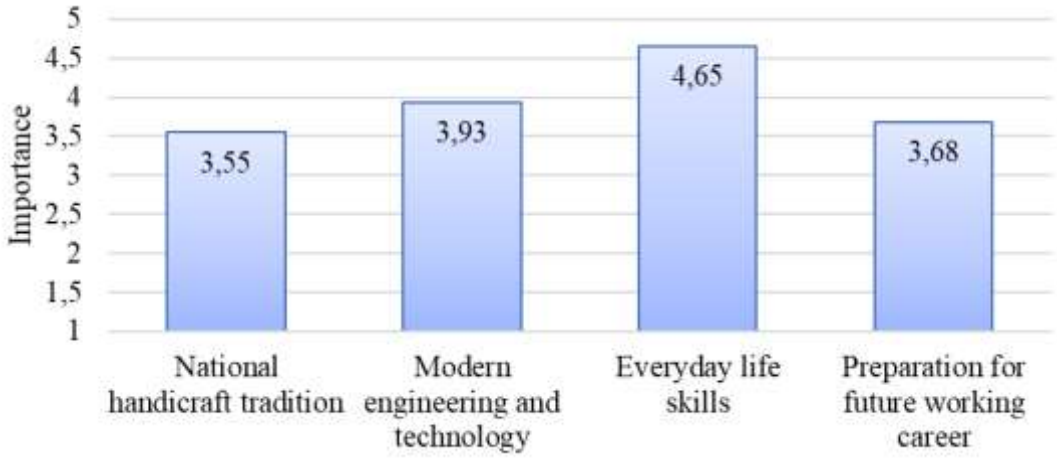

Figure 1. Priority of learning goals.

However, the teachers listed students' preparation for coping with everyday life (M=4,65; SD=0,68) as the most important goal in craft. The statement had a mode of 5, and 72 % teachers responded that teaching coping with everyday life was the craft's top-priority objective. Next was understanding of modern engineering and technology, and preparation for occupation. The teachers consider, however, maintaining and teaching national craft traditions to be the least important (M=3,55; SD=0,97).

This result indicates that teachers try to exceed the average in all of the offered study goals and to make decisions about didactic goals in the light of their own beliefs and the learning environments where everyday life skills are important. This assumption is supported by interviews with Nordic craft teachers conducted by A. Kikkull (2016), in which craft teachers claimed to teach their students mostly the technical

skills necessary in everyday life. An important possibility of integration in applied knowledge formation is hence revealed, for example, in the application of a problem-based integration model (Loepp, 1999).

Since teachers' responses were divided evenly, a comparison between teachers' working experience groups and teaching priorities was carried out to learn whether teachers with different working experiences considered different learning goals to be important. The comparison revealed that teachers' responses did not differ by working experience and that there were no statistically significant differences between age groups.

The teachers were given a free answer option to the question of why, in the teacher's opinion, some acts remain unperformed by students. The answers were encoded using the meaning condensation analysis method (Kvale, 2008). The teachers found that the most frequent cause for students' independent performance remaining undone is lack of motivation, which was mentioned 24 times. Lack of courage and hesitation at the beginning of work ranked second (13 times), which indicates that the student does not have enough prior knowledge or skills, which may also lower motivation.

Students' motivation, however, is an important base in internal integration for the emergence of student-centred and cross-student integrations, because aspiration should be aimed at supporting the creation of connections taking place in the student's head (Fogarty, 1991).

The next focus was the type of task-giving methods teachers use (Figure 2). Based on the answers, it appears that, while introducing the task, teachers use detailed guidance the most (29 %), followed by showing work examples made in previous years (21 %) and repeating these practical works year after year. Teachers also use prepared working instructions and drawings (15 %). Teachers let students design their work in 18 % of cases, and 17 % of teachers conduct collective debates before working. Thus, 65 % of Estonian craft lessons utilise teacher-centred methods. At the same time, it can be said that, in 35 % of the study process, collective debates occur, and students can design their own work.

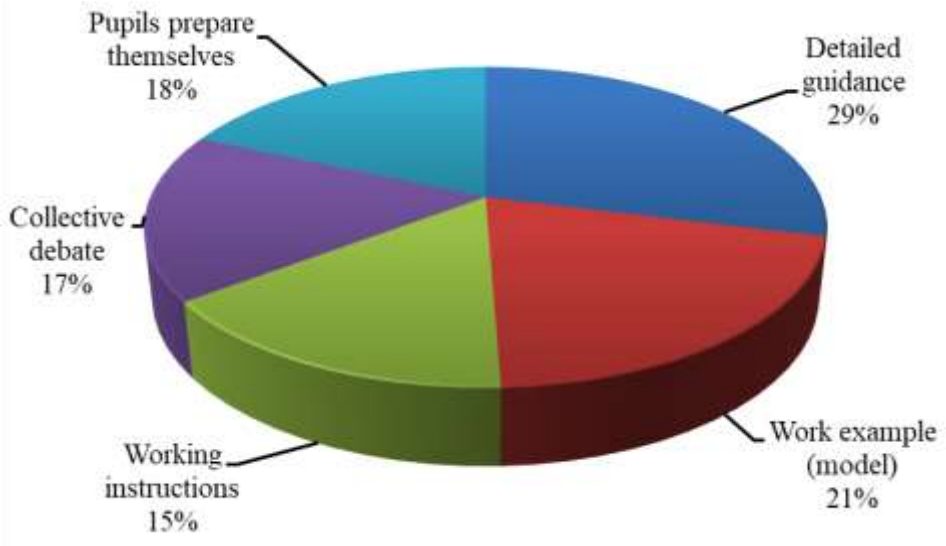

Figure 2. Task-giving methods.

Responses to this question show that the teachers use many tests, tasks and practical works. Most of the teachers follow a relatively strict worksheet, work instruction or example, leaving little time for new experiments and creativity. Unfortunately for students, practical, unique problems rarely arise that students could solve and thus integrate subjects and form integrated knowledge.

Interpretation of the results leads to the idea that respondent teachers need more encouragement and support to implement student-centred work methods, in which a larger role and responsibility in the working process is given to students. Such methods require more collective debate and independent preparation of work by students to support the modern design process principle of craft (Illum, Johansson, 2012).

Since the question of task-giving ways was intriguing, the reply pairs averages of this question were compared and t-test to prove statistical significance was performed to identify connections between different reply options. The highest statistically significant correlation coefficient was in pair 2, where detailed guidance for performing the work and giving opportunity to students to prepare the work

process themselves were compared (r=-0,46 and p2=0) The negative average correlation coefficient shows the use of classical lesson methodology in which the teacher gives clear and comprehensive instructions for work and students have a relatively modest chance to have their say (Table 1).

It is also logical that there is a negative correlation coefficient between detailed guidance for work and using work sheets, which speaks to the fact that these two methods are not used together (pair 1). Comparison between answer pairs again brings out the practice of using a teacher-centred lesson methodology, common in Estonian craft.

Table 1

Paired samples statistics and correlations

Answer pairs		Mean	Std. Deviation	N	t	Sig. (2-tailed)	Correlation	Sig.
Pair 1	Detailed guidance	30,35	15,056	60	5,132	0,000	-0,359	0,005
	Working instructions	15,87	11,341					
Pair 2	Detailed guidance	28,94	12,505	65	3,703	0,000	-0,469	0,000
	Pupils prepare themselves	19,02	12,700					

The last question in this block asked the teachers how they led students to the acquisition of knowledge prescribed by the syllabus. In response, the teachers could select whether they do it mostly by using practical work, theoretical studies or both learning methods relatively evenly. The responses showed that more than half (53 %) of the teachers try to achieve learning goals by doing purely practical tasks and just under half (46 %) of the teachers use a combination of theory and practice in achieving the learning goals prescribed in the syllabus.

The teachers' responses show the prevailing teaching practice in Estonian craft, where students mostly make items in craft lessons and do not deal much with learning theory. In such lessons, theoretical questions are solved during practical work (that is justified in regard to personal problem solving, in the case of advanced students) or theoretical questions are not dealt with at all and students acquire only experiential knowledge in craft lessons. The teachers who combine theory with practice have likely found a balance in practising theoretical knowledge for relatively short intervals, also creating a situation for the formation of applied knowledge.

Realisation of integration

The questions in this study focused on identifying and understanding the essence of knowledge taught by the teacher in the learning process. The objective was to find out the teachers' attitudes towards integration and whether the teachers are ready to put integration into practice in the learning process.

The teachers were asked whether there are possibilities in craft to develop students' readiness for coping with new situations. In general, teachers' attitude towards integration is positive, and 72 % of respondents believe it is possible to develop coping in new situations with the help of craft.

Regarding the responses to this question, the rate of respondents answering: 'hard to say' (25 %) may cause anxiety as it could be concluded that a quarter of the teachers surveyed have no certainty that the knowledge and skills taught in craft are usable and applicable for students later in life.

To continue this theme, the study addressed whether, in teachers' opinions, justification of the veracity and validity of the knowledge given to students is necessary. For this question, almost all teachers who participated in the survey (97 %) responded affirmatively.

Teachers are thus confident that showing and proving the validity of previously discussed phenomena to students, through practical work, is useful to teaching. From this result, it may be concluded that teachers consider interdisciplinary integration to be a useful and necessary element of lessons.

Since the teachers try to justify knowledge, it is important to examine how they do it. The results of this question are shown in Figure 3, which shows that 69 % of teachers try to justify given knowledge based on both other subjects and logic, providing a chance to understand the phenomena in the most

appropriate manner for students. A little over a quarter (26 %) of teachers use logic in explaining teaching, i.e. they rely on overall life experience and common knowledge.

The responses to this question show that relying only on empirical knowledge is usually not enough while justifying the knowledge being taught and that, in different situations, knowledge of other areas is also necessary. A quarter of respondent craft teachers (the teachers that preferred logic) obviously do not feel competent in other areas and hence try to answer students' questions based on logic. This situation clearly indicates need to maintain and strengthen craft teachers' training the several or multi subjects' teachers system.

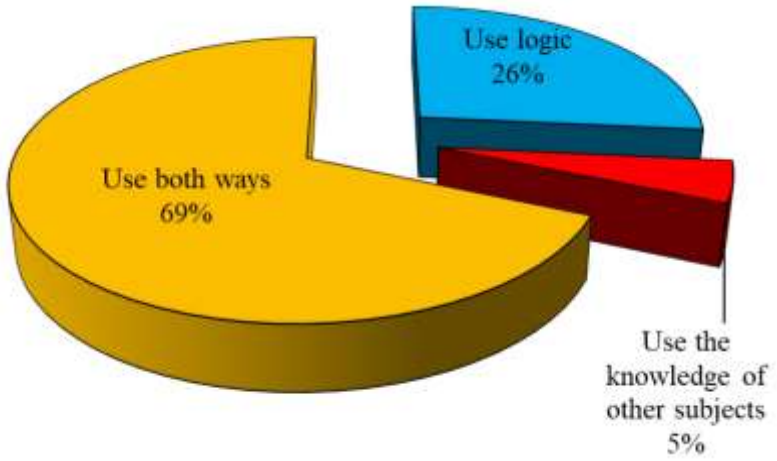

Figure 3. Bases of justification for knowledge given to students.

Finally, the teachers were asked to answer a free-form question: What benefit can justification of knowledge provide 77 % found that justification of knowledge influences students positively. Fifty three percent of the teachers saw an increase in students' independence and conscious activity in completing tasks as a benefit from integration, i.e. the students understand what they are dealing with and what they are doing.

Therefore, justification of knowledge may have a positive impact on students' motivation to do practical work and learn which an important prerequisite for successful integration is.

To identify the connection between the impact of knowledge justification and justification frequency, the correlation coefficient between two variables was found (Table 2). Since these were categorical (qualitative) variables, Spearman's ρ was used to characterise the strength of the correlation coefficient.

Table 2

Spearman's correlation between knowledge justification impact and justification frequency

Spearman's rho		**Knowledge justification impact**	**Justification frequency**
Knowledge justification impact	Correlation Coefficient	1,000	0,315**
	Sig. (2-tailed)	.	0,004
	N	83	83
Justification frequency	Correlation Coefficient	0,315**	1,000
	Sig. (2-tailed)	0,004	.
	N	83	83

**. Correlation is significant at the 0.01 level (2-tailed).

The analysis revealed a moderately severe (ρ=0,315) and statistically insignificant correlation coefficient (p=0,004) between knowledge justification impact and justification frequency. On this basis, it can be argued that teachers who justify knowledge to students more frequently receive better results, and vice versa.

Teachers' cooperation

As teachers' cooperation has a significant role in interdisciplinary integration, the bases upon which craft teachers cooperated with teachers of other subjects, and with whom, were studied. The survey showed that cooperation with other teachers is not a common practice; for example, 31 % of craft teachers have often cooperated and 59 % of craft teachers have rarely cooperated with teachers of other subjects. Craft teachers have worked with math and physics teachers the most (55 %). The answers to the free response questions point out that subjects' separateness, lack of resources and large workload were the main reasons for insufficient cooperation. At the same time, teachers consider cooperation to be useful and beneficial for students (75 %). Teachers who cooperate with teachers of other subjects find that the students know cross-subject relationships in practical situations better and the students are convinced of the validity of another subjects' knowledge (46 %). When asked whether they are cooperative, seventy one percent of craft teachers responded that they are cooperative and open-minded and are ready to perform different forms of cooperation with other teachers. Craft teachers initiate 84 % of cooperation.

The analysis of the study results of the study shows that Estonian teachers feel overloaded; lack resources and subjects are separated in schools. Similar problems are also described by J. Braunger and S. Hart-Landsberg (1994), who note that teachers implementing integrated education need help to overcome the inertness of acting alone. Other researchers have addressed support for interdisciplinary integration, such as H.H. Jacobs (1991) in his recommendations for effective application of integration and S.M. Drake (1993) in discussion of teachers' misconceptions about integration.

Conclusions

Estonian craft teachers recognise the importance of students' coping in domestic and technical fields, but do not connect it enough with students' mental readiness. Such an attitude is demonstrated by the prevailing composition of learning tasks based on exemplary works and work instructions. Knowledge integration, however, requires students to develop a new kind of activity readiness compared to common craft. A large number of Estonian craft teachers believe it is possible to ensure such readiness of students in craft, but discussion of how to achieve integration does not necessarily lead to a successful implementation. This fact highlights the need for improvement of teachers' basic and vocational training in the field of didactics. In doing so, it is worth paying attention to the fact that the goal cannot be integration for integration but is instead a tool for raising a person who is capable of integration. Therefore, operational readiness does not lie in learning to solve a few individual implementation tasks, but in developing the attitude and readiness to cope with different situations that may arise.

While Estonian craft teachers consider the teaching of coping with everyday life situations to students to be important since it is also required by current craft didactics, in doing so, the teachers use many traditional, teacher-centred techniques in which the teacher gives students clear guidance and comprehensive instructions to prepare works based on work instructions or models. Teacher-centred craft, common in Estonia, has also left a negative imprint on students' learning motivation, which may cause difficulties in transferring knowledge, as found in the present study. Current craft has, however, moved from preparing similar works towards a craft design process where all students have an individual relationship with their original work. Through the work personified in this way, it becomes possible to achieve both higher learning motivation and a multi-step self-reflection to evaluate decisions adopted by students. Personalised work and specific situations in the work process that need to be solved are a great opportunity to elicit students' internal integration and to transfer knowledge.

Cooperation between craft and science teachers is not an everyday occurrence. Most cooperation has been done with math and physics teachers, the benefit of which is seen by craft teachers in students' awareness of cross-subject relationships. Craft teachers are generally cooperative and open-minded teachers and they are ready to perform different forms of cooperation with teachers of other subjects for which, however, they need the school's organisational support.

Bibliography

1. Akgun L., Isik C., Tatar E., Isleyen T., Soylu Y. (2012). Transfer of Mathematical Knowledge: Series. *Australian Journal of Teacher Education*, 37(3), 83–89. Retrieved from http://ro.ecu.edu.au/cgi/viewcontent.cgi?article=1670&context=ajte
2. Borg K. (2006). What is sloyd? A question of legitimacy and identity. In K. Borg, P.O. Erixon (Eds.), *Journal of Research in Teacher Education*, 2–3. Umea: Umea University, 34–51. Retrieved from http://www.lh.umu.se/digitalAssets/5/5465_lofu_nr2-3_2006.pdf
3. Braunger J., Hart-Landsberg S. (1994). *Crossing Boundaries: Explorations in Integrative Curriculum*. Portland, Oregon: Northwest Regional Educational Laboratory.
4. Drake S.M. (1993). *Planning Integrated Curriculum: The Call to Adventure*. Alexandria, Virginia: Association for Supervision and Curriculum Development.
5. Fogarty R. (1991). Ten Ways to Integrate Curriculum. *Educational Leadership*, 49(2), 61–65. Retrieved from https://pdfs.semanticscholar.org/fc84/06745befdf07ad521450d7434df379c72c48.pdf
6. Government of the Republic. (2014). *National curriculum for basic schools.* Regulation. Tallinn, Toompea: Justiits ministeerium. Retrieved from https://www.hm.ee/sites/default/files/est_basic_school_nat_cur_2014_general_part_1.pdf
7. Illum B., Johansson M. (2012). Transforming physical materials into artefacts – learning in the school's practice of Sloyd. *Techne Series - Research in Sloyd Education and Craft Science* A, 19(1), 2–16. Retrieved from https://journals.hioa.no/index.php/techneA/article/view/393
8. Jacobs H.H. (1991). Planning for Curriculum Integration. *Educational Leadership*, 49(2), 27–28. Retrieved form http://ascd.com/ASCD/pdf/journals/ed_lead/el_199110_jacobs.pdf
9. Kikkull A. (2009). Craft and technology education for boys in basic school: shaping basic knowledge for vocational education. In M. Miskiniene (Ed.), *Design and technology education at school - the platform of life skills. Relevant issues and solutions of problems*. Vilnius: Vilnius Pedagogical University, 68–74.
10. Kikkull A. (2012). Comparing the Nordic countries' and the Estonian Craft syllabuses. Similarities and differences. In V. Dišlere (Ed.), Proceedings of the International Scientific Conference *Rural Environment. Education. Personality (REEP)*, 5. Jelgava: LLU, TF, 154–160. Retrieved from http://llufb.llu.lv/conference/REEP/2012/REEP-2012-proceedings-E-ISSN-2255-808X.pdf
11. Kikkull A. (2016). *Didaktilised ja organisatoorsed tingimused opilaste teadmiste praktikasse rakendamise tohustamiseks tooopetuse ja reaalainete loimingu kaudu pohikoolis (Didactic and organizational conditions for forming students' applicability of knowledge through integrating craft and sciences in compulsory school)*. Doctoral Thesis. Tallinn:Tallinna Ulikool. (in Estonian)
12. Kurpius S.E.R., Stafford M.E. (2006). *Testing and measurement: A user-friendly guide*. USA: SAGE Publications.
13. Kvale S. (2008). *Doing Interviews*. Trowbridge, Wiltshire: The Cromwell Press.
14. Lind E. (2005). Ajatud tooopetuse opetamisega seonduvad probleemid (Problems with teaching and work-related learning). In E. Lind (Ed.), *Kasitoo- ja kodundusope nuudisajal (Handicraft and home-schooling in modern times)*. Poltsamaa: Vali Press, 94–106. (in Estonian)
15. Loepp F.L. (1999). Models of Curriculum Integration. *The Journal of Technology Studies*, 25(2), 21–25. Retrieved from https://files.eric.ed.gov/fulltext/EJ610852.pdf
16. Mustafa J. (2011). Proposing a model for integration of social issues in school curriculum. *International Journal of Academic Research*, 3(1), 925–932.
17. Perkins D.N., Salomon, G. (1992). Transfer of Learning. *International encyclopaedia of education*, 2. Oxford: Pergamon Press, 6452–6457.
18. Soylu Y., Isik A. (2008). Teaching Linear Algebra: Conceptual and Procedural Learning in Linear Transformation. *Educational Research Journal*, 23(2), 203–429. Retrieved from http://hkier.fed.cuhk.edu.hk/journal/wp-content/uploads/2010/06/erj_v23n2_203-226.pdf
19. *Subject field: Technology.* (2014). Tallinn: Ministry of Education and Research. Retrieved from http://oppekava.innove.ee/subject-field-syllabuses/