Country Reports

Estonia

1.1 Relevant Policy

Estonia has moved up the PISA international rankings for mathematics education from 17th highest in 2009[1] to 11th highest in 2012.[2] The Estonian Minister of Education, however, is reported to have identified ongoing problems the provision of mathematics education, in particular, substantial differences between the best and worst performing institutions.[3]

The main national education policy initiative is the Estonian Lifelong Learning Strategy 2020, which sets out the goals that will determine national education policy and funding for the years 2014-2020.[4] As part of its overview of the current state of affairs, the Strategy recognises that education and training is often not providing the core skills required by the labour market and that the vocational sector, in particular, is not seen as a provider of high quality education and training.[5] In the vocational sector, key areas identified for improvement include greater access to relevant work experience opportunities and updating the information technology component of vocational curricula to ensure that students have the necessary digital skills for the workplace.[6]

The Strategy also addresses levels of student engagement for all sectors, including vocational education and training. Key priorities across the education sector include adopting a more personalised learning approach to take account of individual needs; introducing a digital focus to increase accessibility, engagement and motivation of young people; and developing an inclusive approach to raise and widen participation.[7] One indicator of progress towards these goals is the target to reduce the percentage of low achievers in basic skills maths from 10.5% in 2012 to 8% in 2018.[8]

1.2 Institutions and Courses

General System

Compulsory education in Estonia begins at seven years of age and continues until student complete nine-years of basic education or until the age of 17.[9] Basic education covers primary school (Grades 1-4) and lower secondary school (Grades 5-9).[10] The language of instruction is typically Estonian; however, there is a small minority of Russian speaking schools (approximately 100 in total).[11] Maths is one of three core subjects examined for the school-leaving certificate at the end of basic education.[12]

Post-compulsory (or upper secondary) general and vocational education is available for learners with a school-leaving certificate; approximately 14% of students leave basic education without obtaining this certificate.[13] The national curriculum for general upper secondary education includes compulsory lessons in mathematics.[14] Learners are examined in a minimum of five subjects at the end of the three-year programme of study; the mathematics examination is optional.[15] Vocational upper secondary education requires learners to follow a three-year programme of study; they may subsequently progress to higher level vocational education and training.[16]

Higher education comprises academic and vocational routes. Academic institutions include universities and specialist professional higher education institutes that allow students to study for a qualification in a particular professional discipline.[17] Learners following a vocational route typically attend a vocational education institute; national policy

[1] http://www.oecd.org/pisa/pisaproducts/48852548.pdf
[2] http://www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf
[3] http://news.err.ee/v/education/ab06c831-b8b0-4e00-8c38-48a9f1a806ba
[4] http://www.hm.ee/sites/default/files/estonian_lifelong_strategy.pdf
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[15] http://www.nuffieldfoundation.org/sites/default/files/files/Country_profiles_outlier_NuffieldFoundation18_04_11.pdf
[16] http://www.baltic-education.eu/pdf/Estonia_esystem.pdf
[17] http://www.hm.ee/en

requires that at least one higher level vocational education institute is established is each regional district.[18] There are also six specialist vocational higher education schools which offer occupational specialisms.[19]

Vocational Courses

At upper secondary level, the curriculum for each vocational specialism is nationally determined in line with the National Qualifications Framework and relevant professional competencies.[20] A third of course content must be devoted to general education; maths comprises 12% of this time.[21] Compulsory mathematics for upper secondary vocational students includes real numbers and rational equations; trigonometry, sector, vectors on a plane, negative angle, perpendicular/collinear vectors; equation of a line, sequences (arithmetic, geometric), functions (even, uneven), investigation of functions; lim, derivatives, stereometry; and the option to study functions II (negative step, exponential function, logarithmic equations).[22] Learners can sit the national mathematics examination as part of their studies, although vocational learners constitute a small minority of the overall number of secondary level students that take the national mathematics examinations (330 out of 4,812 students).[23]

Students may also receive further maths education and training depending on their vocational specialism; this may be examined as part of vocational course assessments.[24] Examples of vocational secondary curricula with a 'specialised' mathematics, physics and/or chemistry component include construction, land-surveying and car experts.[25]

Nationally accredited higher level vocational qualifications (also referred to as specialised vocational training) were only introduced in the academic year 2013/2014.[26] This followed extensive reform of the vocational sector under the 2013 Vocational Education Institutions Act.[27] Prior to this, higher level students were able to follow two-year programmes of vocational education and training but certification was provided directly by institutions of study.[28]

In addition, workplace-based vocational training is available; this route is currently only available to small numbers (500-600 trainees per year) but the Government is currently looking to expand significantly the programme.[29] At least two-thirds of training is offered on the job; participants are either full employees or are paid at an agreed rate by an employer.[30]

1.3 Practice and Pedagogy

There are a significant divergence in attitude to maths learning among Estonian students. While many learners like solving difficult problems[31], there remains a significant number of students who '*do not like to learn mathematics and… do not regard it as a valuable subject in terms of their future plans*'.[32] For learners who struggled with maths skills, private tutoring is becoming increasingly widespread.[33] This is attributed to a number of different factors including unwillingness to access learning support at school for 'image' reasons, lack of ownership over students' own learning, gaps in teacher education and poor communication between home and school.[34] Further professional development and effective use of resources are cited as ways to reduce the number of students in need of external support.[35]

There are case studies of innovative maths teaching within the formal education system, however.[36] One maths teacher, for example, set her students (Grade 8; 14-15 years old) the challenge to design a maths board game or computer game in small groups.[37] The project was informed by computer based approaches but adapted for circumstances with limited IT access.[38] Most student groups made a board game but one group designed a computer game.[39] The activity succeeded in engaging the students who found the exercise to be fun.[40] Students contrasted the approach with the

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[18] http://www.hm.ee/en
[19] http://www.hm.ee/en
[20] http://www.hm.ee/en/vocational-education
[21] http://www.nuffieldfoundation.org/sites/default/files/files/Country_profiles_outlier_NuffieldFoundation18_04_11.pdf
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more traditional method of learning maths: '*usually we take notes in our exercise books and then do exercises in the workbook*'.[41] The teacher won a Ministry of Education Award for Innovative Teacher of the Year.[42]

There are also a number of further initiatives that are reported to promote mathematics skills in Estonia. The Estonian Government, working in conjunction with the University of Tartu, has developed a pilot programme to explore the potential for computer-based maths learning.[43] The pilot focuses on 30 school and two age groups (13-14 years old and 16-17 years old).[44] It comprises a course in statistics and probability that has been developed to address curriculum requirements while using software programmes to carry out the calculations.[45] It requires students to follow four common maths steps: identify the question; express the question mathematically; calculate the answer; and verify the answer.[46] The aim of the initiative is to teach participants to use a computer programme to carry out all the calculations so that they can concentrate on developing their understanding of the other parts of the process.[47] Further pilot schemes currently underway in mathematics education include after-school groups that teach students about robotics, computer programming and creating apps.[48]

The University of Tartu also runs a number of national competitions intended to strengthen and develop mathematics skills in algebra and geometry.[49] Both competition streams promote autonomous learning through the use of software.[50] The 'Notice mathematics around you' algebra stream requires participants (10-19 years of age) to devise a problem written in prose, demonstrate an algebraic solution using the Wiris software programme, and write a commentary.[51] Some submissions use algebra which participants may have typically already known, while others demonstrate the use of more complex algebra.[52] The 'Drawing/Pattern' geometry stream requires participants (10-18 years of age) to complete one of three tasks: to take a photo, use GeoGebra software to identify and draw function graph lines on the photo and write a commentary; to draw three-dimensional figures of mathematical shapes overlaid on natural objects,using GeoGebra software and write a commentary; or to construct patterns using GeoGebra software in order to identify the equations.[53] These competitions have enabled participants to make connections with the real world and other curriculum areas, develop planning and prediction skills, and become more observant of mathematics in the world around them.[54]

1.4 Key Points of Learning

For learners who previously struggled with maths skills, private tutoring is becoming increasingly widespread.

Further professional development and effective use of resources are cited as ways to reduce the number of students in need of external support.

The approach to maths teaching in Estonia appears to have a relatively competitive edge, with national maths competitions. Examples of vocational maths teaching (as opposed to general based school teaching targeting the engagement levels of learners) are, however, limited.

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[41] http://itec.eun.org/c/document_library/get_file?uuid=ada0ac4f-f030-409d-85ee-dabb58929fc3&groupId=10136
[42] http://itec.eun.org/c/document_library/get_file?uuid=ada0ac4f-f030-409d-85ee-dabb58929fc3&groupId=10136
[43] http://www..tes.co.uk/article.aspx?storycode=6323218
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