

DIFFERENCES IN THE TEACHING OF MATHEMATICS IN KAZAKHSTAN AND THE UK

A Review of the Current Situation in Haileybury Almaty with Recommendations for the Future

INTRODUCTION

1. **Background to the Report.** A perception exists amongst many Kazakh parents that the UK mathematics curriculum is easier and less advanced than the Kazakh one. In addition to the anecdotal evidence, including the quality of Mathematics being used as a reason for leaving the school, there is the evidence of a parental survey.
 2. **Global Rankings.** In PISA rankings neither country achieves highly but the UK consistently out-performs Kazakhstan (UK: 28, 26 & 27; Kazakhstan: 53, 52 & 42). In International Mathematics Olympiads there is little difference as both countries regularly finish in the top 30/100+ and sometimes in the top 10.
 3. **Methodology.** The report compares the UK curriculum with the National Mathematics Curriculum (**NMC**) for non-specialist schools, the curriculum of the selective Nazarbayev Intellectual Schools (**NIS**) and that of the very selective Republican Physics and Mathematics School (**Fizmat**) for exceptional mathematicians.
 4. **The School Response.** The school response to dealing with the perception is set out in the report and centres on accelerating the learning of gifted mathematicians and developing the skills needed for success in Olympiads.
- Comment.** The report does not address is the need to have a PR/marketing programme to ensure that the developments taking place, and the successes associated with them, are well known in the local community

COMPARISON OF THE CURRICULA

4. **Differences in Curriculum Time Allocation.** Significantly more time is allocated to Mathematics in the Kazakh curricula with the exception of the **NMC** in Year 12 and 13 where HAL allocates **16%** more time per year.
 - **Y7 & 8.** NMC allocates **18%** more curriculum time to Mathematics each year.
 - **Y9, 10 & 11.** NMC allocates **15%** more curriculum time per year and NIS **26%** more time per year.
 - **Y12 & 13.** HAL allocates **32%** more time than NMC but **15%** less than NIS and **34%** less than Fizmat.
5. **Differences in the Curriculum.** The main overall difference in the curriculum is that there is a much greater emphasis on pure mathematics in Kazakhstan whereas the UK curriculum is broader with a significant emphasis on applied mathematics and problem solving. This is reflected in almost every year group.
 - **Years 7, 8.** The Kazakh syllabus has a huge bias towards Number and Algebra with **77%** allocated to the former in Year 7 and **48%** to each in Year 8 compared to **32%** and **16%** at HAL whose curriculum is broader.
 - **Year 9, 10 and 11.** The main curriculum difference is the continued focus on Algebra in Kazakhstan. For example in Year 9 NMC allocates **39%** of curriculum time and **NIS 47%** compared to the **21%** allocated at HAL.
 - **Year 12 and 13.** Whereas the UK allocates almost **33%** of curriculum time to Applied Mathematics the Kazakh curricula only include some Statistics and then with only **6%** to **15%** of curriculum time.

SOME PRELIMINARY CONCLUSIONS

6. Kazakh schools have a clear curriculum time advantage. Their school week is longer, they do not have the language demands of HAL and they do not follow such a wide-ranging and balanced overall curriculum.
7. HAL students follow a broader syllabus than their Kazakh peers and are better at Applied Mathematics but will not have studied Algebra or Trigonometry to the same depth unless they study Mathematics in the 6th Form.
8. In terms of advanced pure mathematics HAL A level students cover the same level as the NMC, Further Mathematicians cover more than NIS schools and only specialised Fizmat covers some aspects in more detail.
9. The specialist Kazakh schools cater very well for talented mathematicians - hence their regular success in Olympiads - but their curriculum is not so well suited to a cohort with a broader range of mathematical ability.
10. The great majority of HAL students can access the more applied focus of the curriculum. This may help explain why, despite top-level success, Kazakhstan is well below both the UK and the global average in the PISA rankings.

11. It is of note that universities worldwide understand and accept particular levels of performance in A Levels as entry requirements, whereas very few top universities outside Kazakhstan accept Kazakh national qualifications.

12. Despite significant successes by HAL mathematicians at A level and university entrance and some limited acceleration for gifted mathematicians Kazakh perceptions of HAL mathematics remain largely unchanged as yet.

THE WAY AHEAD - ACCELERATION THROUGH THE CURRICULUM

13. **First Steps.** HAL has become increasingly aware of the dangers of the Kazakh perception of the quality of UK mathematics to the reputation of the School and since academic year 2012-13 has been starting to identify gifted mathematicians early and accelerate their way through the curriculum. This has taken the form of getting selected pupils to take their IGCSE in Year 10 and then study the Further Pure Mathematics IGCSE in Year 11.

Note. Further Pure Mathematics IGCSE covers the same ground as the A level Core and at the same standard

14. **The Next Stage.** With the experience of the last few years HAL now believes that the programme should become more formalised, involve more pupils and be accelerated still further with IGCSE Mathematics being taken at the end of Year 9, AS Mathematics in Year 10, A level Mathematics in Year 11 and Further Mathematics in Year 12/13.

Comments.

- SLT and the Mathematics Department are considering 4 different models (see Appendix 1). The current position is that SLT prefer offering both Options 1 and 4; the Mathematics Department prefer only Option 4.
- Any option chosen must allow pupils to achieve their potential in Mathematics and maximise their chances of studying their subjects of choice at their universities of choice.
- The advantages of having a formal accelerated programme are that it has a hugely positive effect on pupils' motivation and will also do much to help change Kazakh perceptions of mathematics at HAL.
- The main requirement of the accelerated programme is the need to find more time for Mathematics in Year 10 and 11. One possibility is that those taking the accelerated programme do one less IGCSE.

THE OLYMPIAD PROGRAMME

15. **Background.** The introduction of an Olympiad programme is complementary to the accelerated curriculum in addressing the Kazakh perception of UK mathematics especially given the place competitive mathematics has in the Kazakhstan culture. Local schools train pupils to for Olympiads as a vital part of their mathematical education.

16. **Developments at HAL.** Up until two years ago HAL involvement in competitive Mathematics was minimal and the school was regularly asked why it did not take part in more Olympiads. As a result the school has employed 3 local teachers experienced with this style of Mathematics to introduce a programme. Key elements are as follows:

- Starting the programme in Key Stage 3 as success in Olympiads is not something that will come quickly as pupils will need to be exposed to this style of Mathematics for some years if they are to succeed in the future.
- Running two ECAs per week for those in Year 7 to 9. These have proved e very popular and pupils that attend have made excellent progress and have seen their class grades improve as well.
- An option is being introduced in Year 10 which will involve studying Olympiad Mathematics to a higher level for four hours a week instead of studying an IGCSE.

Comment. Year 7 – 11 pupils wishing to study this style of Mathematics will be able to do so 4 hours a week without impinging on other subjects. Consideration is being given to introducing a programme in the 6th Form. The main focus has been on younger pupils so that when they are older, they will be able to compete against the best mathematicians from around the world.

17. **Results in Olympiads.** Appendix 2 sets out the successes achieved so far in Olympiads.