 DOI: 10.33034/PAIDEIA.2018.6.1.17

Effectiveness of Content Based Instruction for beginner bilingual science teachers

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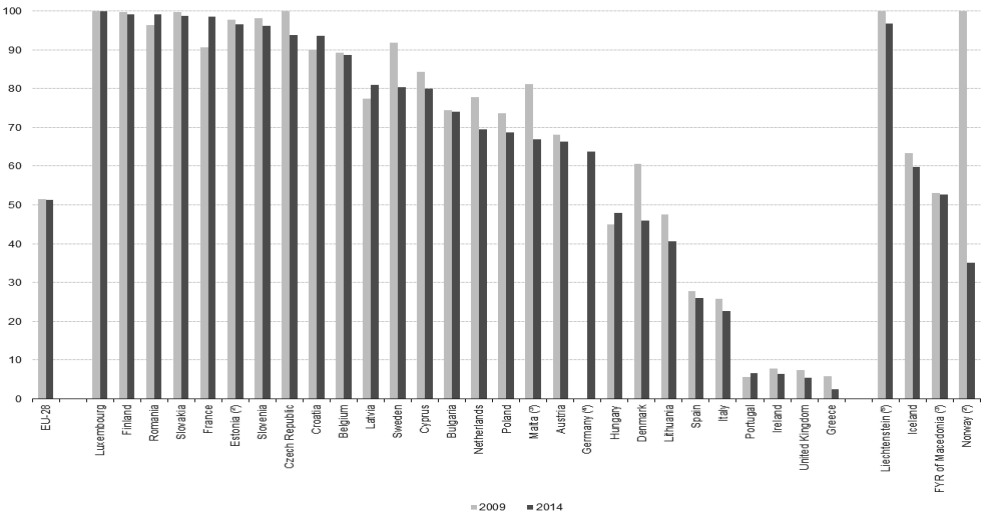
Introduction

Studying languages is considered indispensable especially for Hungary being a member state of the EU. Therefore, the existing teaching methodologies of foreign languages should target vital skills. The quantitative development in language teaching was striking in the late 1980's but the switch was less successful in its qualitative aspects. Having joined to the EU, Hungary made lots of necessary efforts to improve language learning in the educational system. The efficiency of this showed some promising improvements (Figure 1).



(*) Refer to the internet metadata file (http://ec.europa.eu/eurostat/cache/metadata/EN/educ_uoe_enr_esms.htm).
(*) Data for 2008 instead of 2009.
(*) Data for 2010 instead of 2009.
(*) 2009: not available.
(*) Data for 2011 instead of 2009.
Source: Eurostat (online data codes: educ_thfrlan and educ_uoe_lang02), Unesco Institute for Statistics (UIS), OECD

Figure 1. Proportion of students learning two or more languages in upper secondary education (general), 2009 and 2014 (Eurostat, 2016)

As a teacher of Science, I wanted to undertake a challenge. I realised the professional and pedagogical bases and backgrounds of teaching Biology in a bilingual programme at Varga Katalin Grammar School in Szolnok, Hungary in 1988. Many vital and fundamental questions were formulated in my mind at the beginning of this programme. How can we - as professional educators - help

students who are still learning English to understand the language and the concepts of different fundamental subjects such as biology at the same time? What type of an environment can we create that will not only help students learn these teaching materials but also come to understand language and the meaning of these English technical terms and expressions? What possible benefits and drawbacks can be derived from teaching a compulsory subject in a foreign language? How can we preserve the effectiveness of our educational goals, especially to promote the successful acceptance of our students at the most prestigious universities? Knowledge of the language is not the aim but the means of acquiring further knowledge, thus higher standards can be achieved both in the target language and the other subjects. Foreign language teaching exists to support the subjects taught in English and not for its own sake.

Methodology

In my present paper, I am introducing content-based instruction (CBI) as one of the possible ways of teaching a second language. Well delineated academic purposes determine the depth of content-based teaching and language instruction. As a teacher of science, I have been trying to develop a synthesised curriculum for teaching Biology and English as a second language within one academic subject. Beside a wide variety of pedagogical approaches, I would also like to introduce a research study on language pedagogy. As my topic covers the most important advantages of CBI in bilingual classes in science, I presume that the double imprinting of the information on science can be used easier in practice than in studying these teaching matters in Hungarian only. Finally, I want to make a conclusion that classroom management, a well-designed syllabus and the carefully selected methodology, alongside with the students' motivation, can determine the efficiency and the bilingual method can help our students to concentrate on the logical core and sequence of the teaching matter and will make the entire chapter easier and more effective.

Introduction of content-based instruction

Krashen (1982) states that second language acquisition occurs when the learner receives comprehensible input and reasonable well-presented content, not when the learner only memorises vocabulary or works on grammar exercises. Methods, which provide students with more comprehensible input will be more

successful so comprehensible subject-matter teaching becomes language teaching, as in content-based instruction, the focus is on the subject matter and not on the form. *Swain* (1985) believes that the comprehensible input is not only a must for successful instruction, but the educational conditions and environment should ensure the usage of the target second language productively in the classroom as well as in out of class activities. Thus, as the result of this content-based instruction method, learners must produce comprehensible output as well. She states that the students should convey their freshly received information precisely, coherently and with grammatical correctness. The output, the learners' production, aims to produce language which is appropriate from the point of view of both content and language. Obviously, this method can be risky if the entire language acquisition is reduced only to subjects taught in the target foreign language as students cannot master demanding academic language. Therefore, bilingual educational programmes furnish students with profound academic language learning and provide them access to and practice with the cognitively demanding, decontextualized language tasks that academic learning entails. In a content-based approach, the activities of the language class are specific to the subject matter being taught, and are geared to stimulate students to think and learn using the target language. Content-based ESL is a method that integrates English as a second language instruction with subject matter instruction. The technique focuses not only on learning a second language, but using that language as a common medium to learn different academic subjects such as Mathematics, Science, Social studies, World-history, Geography or others. The necessary instruction of certain content is usually given by a language teacher or by a combination of language and content teachers.

Teaching and learning in bilingual classes

In 1988 the staff of Varga Katalin Grammar School assumed that the bilingual method would help our students to reach both English language proficiency and a high standard of academic knowledge in History, Geography, Physics, Mathematics and Biology. At that time, our principal considered the potential volunteers of our staff who wanted to take part in this programme and undertook the preparations for this teaching experience both linguistically and pedagogically. Having examined specialised and technical literature in this field, I assumed that the information and teaching matter of Science in a foreign language can be implemented more effectively for well prepared and motivated students than for those studying these teaching subjects only in Hungarian. To select the well

prepared and motivated students, we introduced the entrance exam in Hungarian literature and grammar in the written form, focusing on grammatical and communicational skills, as well as their knowledge in Mathematics, also in a written form, focusing on the skill of logical deductions and in the English language both in written and oral forms. We chose these subject-based tests because we assumed that if a child receives a good education in the mother tongue, we would able to give him knowledge that makes English input more comprehensible. A child who understands Science or History, thanks to thorough science and history instruction in the first language in their primary education, he will have a better chance to study these subjects taught in English in a secondary bilingual programme than a child without this background knowledge. The best test results would indicate the students most able to successfully take part in this programme. For those students who could not achieve the required level of these tests, another educational program was offered with higher level instruction in Maths and English.

The objectives of the National Curriculum to teach Biology for secondary school students

The teaching of Biology in secondary schools furnishes students with a knowledge that enables them to apply the laws of nature, to orientate themselves among problems of nature and health and to recognise the similarities and differences between biology and other components of life. The major objective of teaching Biology in secondary schools is to acquaint students with the diversity of nature and help them understand its basic laws. The major goals of teaching Biology are to discuss the structure and function of living beings, the formation of the world of these living organisms, as well as the development of man through the theory of evolution. Teaching Biology should also involve instruction on the most general biological laws as well as information required for up-to-date knowledge. Through Science, we can help our students understand the unity of the living world, the relationship between the animate and inanimate environment. The comparatively detailed discussion of human organisms is to provide scientific fundaments of the healthy way of life. The phenomena and laws of the living world are to be taught in such a way that students come to accept and claim the environmental protection. The development of science requires that students not only receive factual knowledge but are shown how to acquire knowledge independently after completing their studies. Therefore, we need to teach them a wide variety of scientific research methods. This independent acquisition of scientific knowledge and of research methods also help students their ability to recognise and solve problems.

Benefits and drawbacks

What possible benefits and drawbacks can be derived from teaching a compulsory subject in a foreign language? How can we preserve the effectiveness of our educational goals in bilingual education? What advantages and disadvantages do bilingual students have during their bilingual studies? Finding answers to these questions I put through a questionnaire for 19 bilingual and 35 monolingual students of three parallel classes (19 students in English-Hungarian bilingual program, 18 students in advanced Math-English program, 17 students in a talent support program) at Varga Katalin Grammar School. In this questionnaire, there were 3 main groups of questions. The first set of questions asked all these students to evaluate their educational program based on its benefits. In the second part the students evaluated some positive statements related to their studies. Finally, I wanted to know whether they would choose their present educational program or not if they had a chance to do so. Figure 2 shows the results of the answers of the first set of questions.

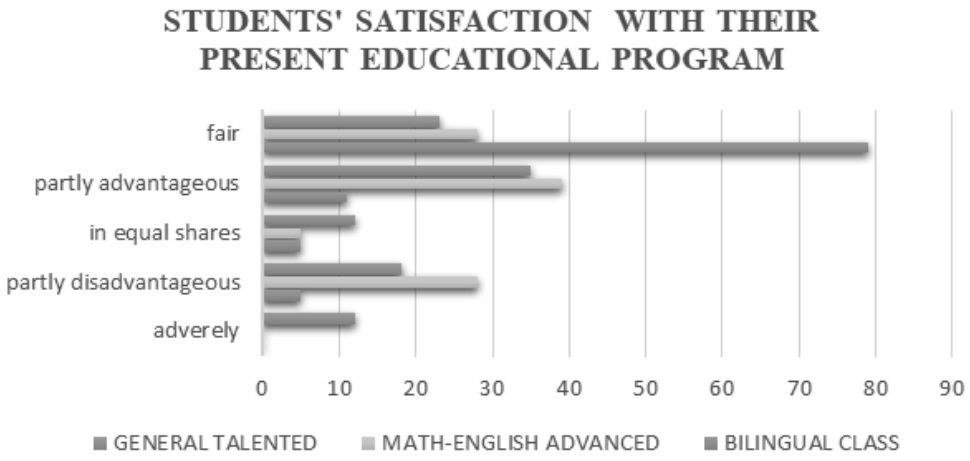


Figure 2. Answers to the question on How advantageous do you feel being in your present educational program?

The most advantageous satisfaction can be measured in the bilingual class where 79% of the entire class feels fairly satisfied with their present educational program for their further studies. In the other two classes this value reached only 28% and 24 %. Table 3 presents the students' evaluation of several concrete beneficial statements in these three classes. There are 12 sentences that can be evaluated between 1 and 11. The statements are in order: 1. I study easily. 2. I can participate in exchange programs. 3. I have lots of books helping me

in studying. 4. I have lots of opportunities to use ICT equipment. 5. I study in good public surroundings. 6. I do not have to swat. 7. I can use my knowledge out of school. 8. I prepare for entering higher education successfully. 9. I have outstanding knowledge of English. 10. Teachers use different methods in class. 11. There are lots of out of classroom activities. 12. I have outstanding knowledge in my second language.

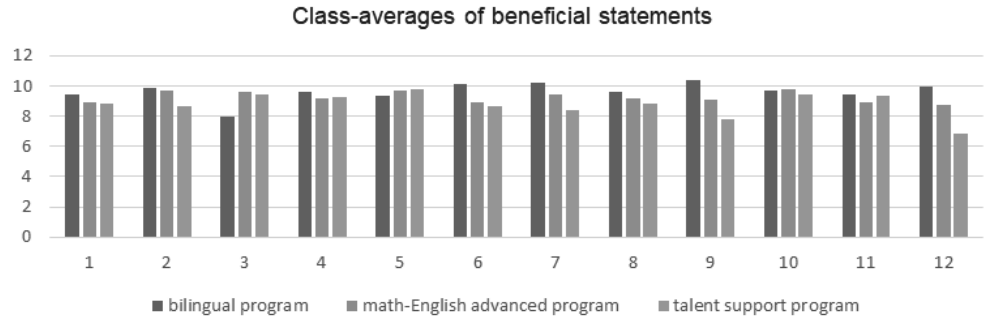


Figure 3. Students' evaluation of beneficial statements

As the diagram (Figure 3) above shows, the highest standard in English is found in the bilingual class as well as in the second language. The evaluation of the usage of ICT equipment, the condition of the classroom-environment and the wide variety of teachers' methods used in class present an equipartition. In bilingual classes the printed learning aids, especially course books are still missing. Finally, these students were asked whether they would choose their present program again if they had a chance. The following table (Figure 4) presents the distribution of the answers. Four choices were offered for the question in each class on how likely the students would choose their present educational program again. These four possible answers were: 1. yes, 2. most likely 3. likely not 4. no.

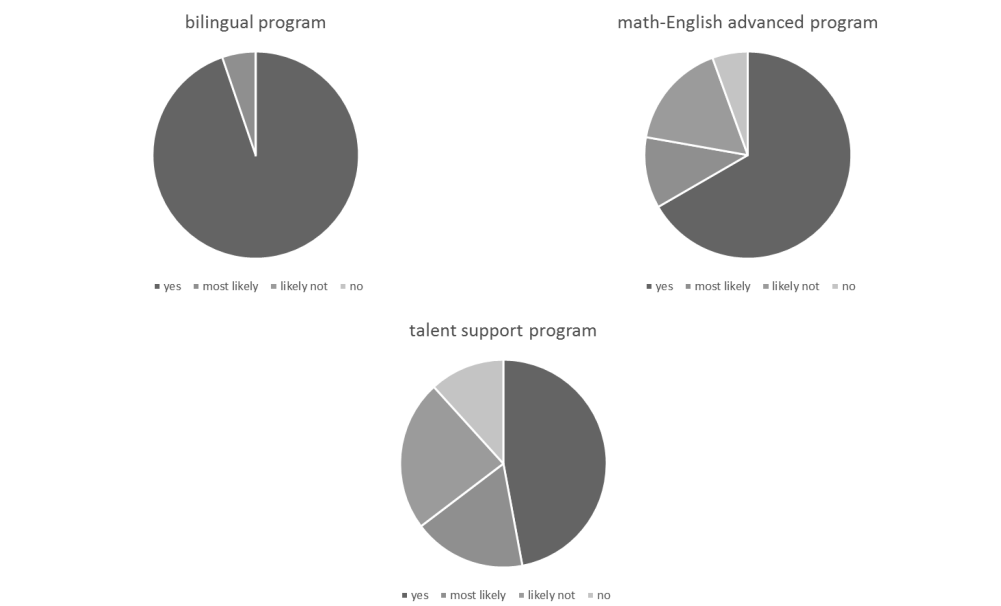


Figure 4. Presentation of students' preferences

If there was a chance again to choose an educational program for secondary studies these students would choose the same program but there are some slight differences. The most stable preference is still measurable in the bilingual program. Because of the wide ranges of different interests in the talent-support program shows the highest distribution of the choices. The students of the bilingual class feel more comfortable in their educational program as they can achieve more successful academic performance. Their overall average grade is also higher than the other students' one in the other classes. Their success in studying also amplifies their dedication to study different subjects in English.

Successful academic performance with meaningful communication

In discussion of CBI many authors refer to successful programme outcomes as evidence of its benefits. They either describe a program that they proclaim successful, or they discuss teacher's and students' interests, programme enrolments and successful student adjustments to later academic work and careers as support for content-based instruction. As students master the target language, they can learn more content, and therefore improve their language skills when they solve problems and communicate on certain topics in the second language. This contrasts with "general literacy" or "general language" instruction which uses

topics or subject matter simply as a vehicle for teaching the four main skills, or the grammar or other "mechanics" of English language, as general processes (Brinton, Snow and Wesche, 1989). Content-based instruction has been used in a variety of language learning contexts for the last twenty-five years. Although this approach has been used for many years in adult, professional, and university education programmes for foreign students, content-based ESL programmes at the elementary and secondary school levels have been emerging worldwide as well as in Hungary nowadays. One of the reasons for the increasing interest among educators in developing content-based language instruction is the theory that language acquisition is based on the input that is meaningful and understandable for the learner (Krashen, 1982). Parallels drawn between first and second language acquisition suggest that the kinds of input that children get from their parents should serve as a model for teachers in the input they provide to second language learners, regardless of age. Input must be comprehensible. If it is and the student feels low anxiety, then acquisition takes place. Although CBI is not new, there has been an increased interest in it over the past fifteen years in Hungary. In content-based ESL the learning of English is well integrated into the instruction of the regular school curriculum. Language is a medium for learning grade-appropriate concepts and content selected from the curriculum. Natural language acquisition occurs in context and requires the continuous and gradual development of four tightly connected skills. For example, it employs authentic reading materials which require students not only to understand information but to interpret and evaluate it as well. It also puts to use several graphs, diagrams, figures that fulfil the role of topic-based conversations, discussions, as well as evaluations. It provides a forum in which students can respond orally to reading and lecture materials. It also recognizes the need to synthesise facts and ideas from multiple sources as preparation for writing an assignment or just simply understanding the logical links between the pieces of newly received information. In this approach, students are exposed to study skills and learn a variety of language skills which prepare them for the range of academic tasks they will encounter (Brinton, Snow and Wesche, 1989). Natural language that can be taught and studied can never be learned detached from meaning. Content-based instruction is a successful teaching method to supply students with subject based learning material that paves the way to discover important segments of knowledge. The content of a recent topic or discussion of any field of the subject itself provides context for meaningful communication in written and/or oral form as well. Content-based language instruction increases the effectiveness of second language learning acquisition because students learn languages best with indispensable motiva-

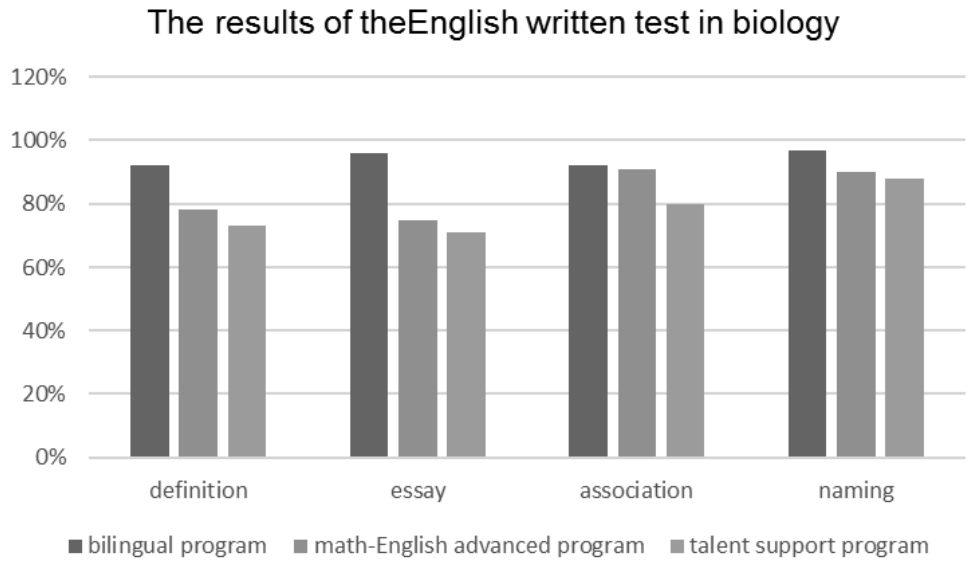
tion when there is an emphasis on relevant content rather than on the language itself. People do not learn languages and then use them, but learn languages by using them (Krashen, 1982). Content based instruction emphasizes a connection to real life skills which are needed to express their thoughts, feelings, opinions and their views. In content-based classes students always should activate their prior knowledge on the given teaching matter, on previously treated information. This action leads to increased learning of the language and content material at the same time. Students in an ESL classroom can successfully master complicated subject matters while working in a contextualized framework that provides support for understanding language and information. An effective ESL classroom engages students in academic language necessary for success in a school environment. Problem-solving and higher-level thinking are natural outcomes of a learning environment that provides a rich language component embedded in a quest for knowledge. Content-based instruction (CBI) shifts the instructional focus from linguistic knowledge to developing language competence through communication of content including content based instruction in other subjects. The two main goals of CBI are to lower the barriers between learning a language and other learning activities and to permit simultaneous learning in more than one area of knowledge as the content is quite complex and has lots of side-branches and related information. A student's main purpose at schools is to increase his knowledge by learning content, skills, strategies and acquiring competencies. These factors imply a lot of real communicative, task-based activities. Students can learn content by using a foreign language simply because it is a code through which content is conveyed, in the same way as with their mother tongue. Many content-based ESL programmes have been developed to provide students with an opportunity to learn cognitive academic language proficiency (CALP), as well as to provide a less abrupt transition from the ESL classroom to an all-English-medium academic program (Brinton, Snow and Wesche, 1989). Content-based ESL courses, whether taught by the ESL teacher, the content-area teacher, or some combination, provide direct instruction in the special language of the subject matter while focusing attention as much or more on the subject matter itself and its technical terms. Essentially, we prepare our students to become life-long learners. Nowadays, we all should renew our professional knowledge and to refresh the facts we studied. The new millennium brings the world very close to us by using data carriers and Internet. Indispensable new information must be understood within the shortest time limit possible. There are several reasons why I am a strong advocate of content-based instruction. In content-based instruction, students practice all the language skills in a highly integrated, communicative fashion while learning

content such as world-history, Geography, Economics, Science, Mathematics, and Social studies. Content-based language instruction is valuable at all levels of proficiency, but the nature of the content obviously might differ by proficiency level. For beginners, the content often involves basic social and interpersonal communication skills, but past the beginning level, the content can become increasingly academic and complex. Thus, one can use content-based instruction in different fields and levels of instructions. The only condition of its use is the thorough-going basic knowledge of the instructed subject. If the bases are strong enough, the following content-based teaching materials can be built on them with the method of CBI.

Testing the students' knowledge in content based instruction

In recent years, especially in the last decade, increasing numbers of language teachers have turned to content-based instruction to promote meaningful student engagement with language and content learning. Through content-based instruction, learners develop language skills while simultaneously becoming more knowledgeable experts in a chosen academic field. In this method, professional teachers tend to create vibrant learning environments that require active student involvement, stimulate higher level thinking skills, and give students responsibility for their own learning. When the instructors, such as in Biology present the bases of natural science and form the abilities of their students, the notions of nature are discussed in a foreign language. This method of teaching Science requires a well-planned and constructed explanation. The formation of the given notion in the students' minds depends upon comprehensible vocabulary and many-sided explication and interpretations by using these techniques in a daily routine. Thus we can reach double imprinting – memorising and understanding notions in English and in Hungarian as well - as the technical terms appear in two forms in the learners' lexicon. The newly formed notion creates an image in the mother-tongue while building a logical approach in both languages and links to its definition in any of the languages that can augment memory retention. Education is becoming more international, multilingual, and multicultural. More students are spending time learning through another language: reading a textbook, a newspaper, or a journal in another language, having some or all their curriculum taught in another language, accessing foreign language material on the Internet, communicating in a foreign language with native speakers in other parts of the world, learning about another culture through musical lyrics in a foreign language, acting out some parts of dramas or musicals in their second language, and so on. These essential goals in our new

century can be attained with the method of content based instruction. Three fundamental assumptions support these attainable and desirable achievements. 1. Language is a matter of meaning as well as of form. 2.Discourse does not just express the meaning of the notion but can help to create meaning in the mind. 3. As we acquire new areas of knowledge, we acquire new areas of language and meaning. As the CBI uses a well-defined content and as it is the base of this method of language teaching, all content-instructors should check and evaluate the level of knowledge. The most important factor to decide and determine what exactly should be tested. Language acquisition or content? Obviously, neither the separate parts of language acquisition nor the knowledge of the content-centred subject can play a dominant role in testing. The entire complex competency of problem solving has the priority when the instructors correct and evaluate the academic performance of their students. In this paper, I wanted to highlight the use, the importance and utility of CBI. Therefore, I conducted a parallel written testing of a given chapter of biology in grade 11 at Varga Katalin Grammar School. I wanted to get a justification of these above described positive educational utilities of this method. This written test was used in three parallel classes (bilingual, math-English advanced, talent support program) in two languages in 20 minutes each within one period. In both cases, there were 2-2 different tests on physiology and each short test contained 4 questions (definition, essay, association, naming of anatomic parts) for 30 points. In Figure 5-6 the results of the tests written in English and in Hungarian can be compared.



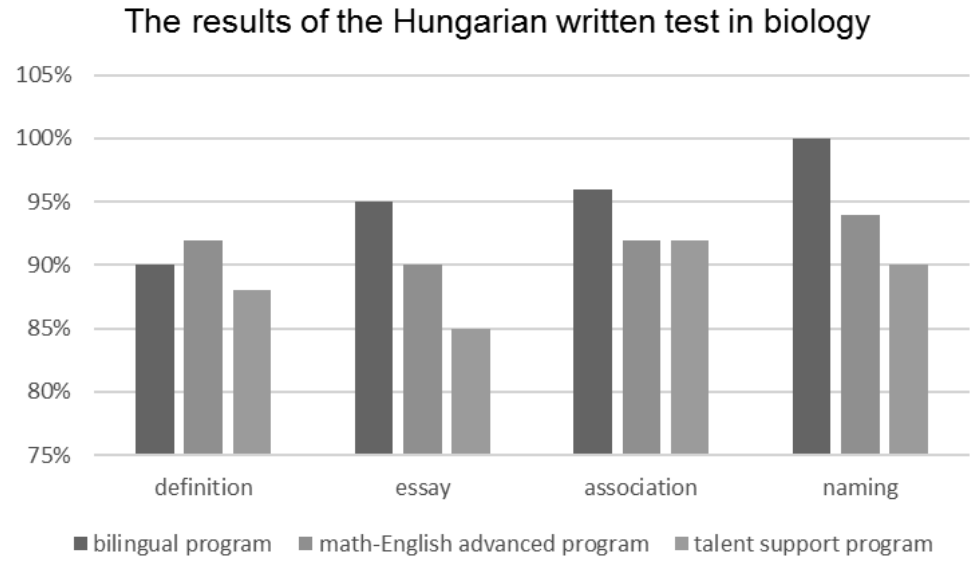


Figure 5-6. Results of the tests written in English and in Hungarian in three classes

Conclusions

The results verify all the positive utilities of CBI. The double imprinting of the content is also justified. Fredericka L. Stoller summarized the essence of this result. "Worth noting here are four findings from research in the field of educational and cognitive psychology that emphasise the benefits of content-based instruction:

1. Thematically organized materials, typical of content-based classrooms, are easier to remember and learn.
2. The presentation of coherent and meaningful information, characteristic of well- organized content-based curricula, leads to deeper processing and better learning.
3. There is a relationship between student motivation and student interest-common outcomes of content-based classes and a student's ability to process challenging materials, recall information, and elaborate.

4. Expertise in a topic develops when learners reinvest their knowledge in a sequence of progressively more complex tasks, feasible in content-based classrooms and usually absent from more traditional language classrooms because of the narrow focus on language rules or limited time on superficially developed and disparate topics (e.g., a curriculum based on a short reading passage on the skyscrapers of New York, followed by a passage on the history of bubble gum, later followed by an essay on the volcanoes of the American Northwest) (Stoller, 2002).

Based on these benefits the educational method of CBI should be improved in the upcoming decades for teaching more successful communication to help and understand each other more effectively.

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