https://doi.org/10.53656/str2025-2-5-qua

Education for Sustainable Development
Образование за устойчиво развитие

QUALITY OF HIGHER EDUCATION IN BULGARIA: COMMUNICATION AND COMPUTER TECHNOLOGY TRAINING

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Abstract. In the European Higher Education Area (EHEA), quality assurance is seen as a process involving HEIs and registered agencies based on internal and external quality assurance systems. This paper presents a general analysis of the quality of teaching and research activities in Communication and Computer Technology (CCT) in HEIs under ESG standards and guidelines - Part I. It discusses the compliance of training in CCT with the requirements of ENQA standards and guidelines by a total of 17 HEIs in Bulgaria. According to the ESG standards, it summarized the outlined strengths of CCT training and pointed out characteristic weaknesses of this HE segment.

Keywords: communication and computer technology; programme accreditation; evaluation; higher education institutions; strengths; weaknesses

1. Introduction

Due to the global growth of the higher education (HE) sector, higher education institutions (HEIs) face significant challenges in undertaking initiatives to deliver quality education services and globally recognised education (Uiso & Magali, 2017; Mastoi et al., 2019) and ensuring sustainability in research and development (Menon and Suresh, 2020; Omazik & Zunk, 2021). A recognised approach to quality assurance of HE is to use a complementary system of internal and external monitoring and evaluation forms carried out according to standardised rules, methodologies and procedures. In EHEA, quality assurance of HE is seen as a process involving HEIs and registered agencies[1] based on internal and external quality assurance systems. These systems define criteria and performance indicators that are the starting point in the quality assessment process at a given time, resulting in decisions or recommendations for improving the quality of educational activities (Gaftandzhieva et al. 2023). To provide a common framework for quality assurance systems in HE at European, national and institutional levels, the European

Association for Quality Assurance in HE (ENQA) has published the "Standards and Guidelines for Quality Assurance in the European Higher Education Area - ESG" (ESG, 2015). This framework ensures that quality assurance agencies in the EHEA adhere to the same set of principles and that processes and procedures meet the objectives and requirements of their context.

The National Evaluation and Accreditation Agency – NEAA[2] is a specialized state body for evaluation, accreditation and quality control of the educational, scientific, artistic and other activities of HEIs in Bulgaria. One of the main functions of the NEAA is to conduct external evaluation of HEIs under procedures for programme accreditation of professional fields[3] (PF). Such a procedure includes the evaluation of all bachelor, master and doctoral degree programmes of the respective PF offered by the specific HEI. It assesses the compliance of the training provided with the criteria for programme accreditation of the NEAA, which are fully in line with the 10 ESG Part I standards.

At present, of particular interest is the quality of HE in the field of Communication and Computer Technology (CCT), which when compared to the UNESCO International Standard Classification of Education (ISCED-F 2013), generally covers degree programmes belonging to the fields "Information and Communication Technologies" and "Electronics and automation". On the one hand, the interest in CCT is caused by the steady trend towards increasing demand for specialists with qualifications in this field on the labour market nationally and internationally, and on the other hand, by the influence of demographic, economic and social factors that lead to the low interest of prospective students in the engineering and technical degree programmes offered. This paper presents a general analysis of the quality of teaching and research activities in CCT of Bulgarian HEIs under ESG standards and guidelines – Part I. This analysis is based on the results of the 2023 assessment of the CCT PF carried out by the NEAA for the last accreditation period (covering 2017 – 2023 in total, but different for HEIs) for the Republic of Bulgaria and contains only information that is made public by the NEAA.

The following sections of the paper discuss the compliance of the training in the CCT PN offered by a total of 17 HEIs in Bulgaria with the requirements of ENQA standards and quality assurance guidelines. Under the 10 ESG standards – Part I, the emerging strengths of CCT training are summarized, which are the result of the efforts of the accredited HEIs to develop the necessary conditions for quality training in the offered study programmes. Together with this, characteristic weaknesses of this HE segment are pointed out.

2. Summarised results from standards assessment

According to the data from the 17 HEIs offering training in the field of CCT, the average annual number of students fills 47.64% of the total defined educational capacity for the field – 18210 students. Noteworthy is the fact that in the attestation

conducted for the field in the period 2015 – 2021 (NEAA 2023), out of all 17 HEIs, 14 received grades above 9.00, and 1 was positively assessed for the opening of a CCT PF, which indicates that the training offered by them is at a comparable level and generally meets the criteria for programme accreditation to a high degree.

STANDARD 1. Policy for quality assurance

All 17 HEIs have a developed, publicly disclosed and functioning quality assurance policy aligned with the HEI mission, goals and objectives, and this policy is an integral part of their long-term governance processes. HEIs strive to reflect regional priorities and specificities in their strategies for developing CCT training without neglecting the requirements of institutional quality systems. They implement policies to maintain the interrelationship between research and teaching and stimulate the implementation of such an interrelationship by directing research activities towards the creation of new scientific knowledge and scientifically applied products, conditions for the conduct of scientific activities of teachers and opportunities for career development, upgrading of material and technical facilities, etc. The implemented quality management procedures are based on national normative documents and internal regulations. The established quality committees in which trained auditors, students, PhD students and business representatives participate, conduct audits and surveys, prepare annual reports and analyses, etc. All HEIs organise quality management activities at a good level, with some shortcomings in terms of periodic discussion and publicity of the results of these activities or monitoring of the implementation of recommendations made. Notably, HEIs do not consider the workload of the teaching staff in their quality management. On this indicator, according to HEIs, the average workload of teachers on basic contracts with a CCT qualification providing training in CCT varies between 111% and 364%, with an average for all HEIs of over 160%. This fact highlights the need for quality management activities to cover this indicator to prevent a decline in the quality of training.

All HEIs have systems to ensure and monitor compliance with academic freedoms and non-discrimination, as well as procedures to prevent and sanction examination cheating and plagiarism.

STANDARD 2. Design and approval of programmes

HEIs offer different degree programmes in the field of CCT – 5 for the professional bachelor's degree, 43 for the bachelor's degree, 59 for the master's degree and 24 for the doctor's degree. The educational product complies with the principle of sustainability by offering the typical classical programmes (such as Computer Systems and Technologies, Telecommunications, Communication and Security Engineering), as well as with the principle of adaptability by developing new programmes (such as Cyber Security, Artificial Intelligence and Virtual Reality, Telemedicine), according to the latest achievements of knowledge and technology in this field, the requirements of the labour market and economic development.

At the same time, the large number of curricula (388 in total) on which training is offered may lead to dispersion and a decrease in quality.

The Bachelor's degree programmes in all HEIs provide broad professional theoretical and practical training, while the Master's degree programmes provide in-depth scientific-theoretical and specialized training in specific areas of PF and additional broad and interdisciplinary training for students with a Bachelor's degree in another PF. All HEIs have their own specificity and orientation of training, determined by the crucial importance of the field of study for the development of all areas of economic, social and community life, the region in which they are or the state or industrial sector to which they are oriented. The curricula and programmes are compatible with each other and with those of other HEIs (in and outside the European Union), allowing mobility of students to other countries. The existing differences are acceptable and reflect the specificities of the HEIs concerned.

The HEI has regulated and operational procedures for developing, approving, monitoring and updating teaching documentation for all forms of training, following national regulatory documents. These HEIs have a complete set of qualification characteristics, curricula, syllabuses of the subjects studied, an annual semester schedule of the study process, a timetable of classes for each semester and a calendar plan for each subject. Issues for assessing student's knowledge and skills are regulated by national regulatory documents and internal rules.

The curricula of the study programmes contain hours for practical training, the ratio of which varies around 50% ± 10% in the different HEIs and is well balanced. This ratio is between 13% and 29% in only 4 HEIs, and they need to take measures for its increase to ensure good professional preparation of students. There are good practices for concluding contracts with companies partnering with the business community and employers to conduct students' industrial practice. When developing and periodically analysing curricula, HEIs strive to consider the opinions of students and employers, the interest of prospective students in CCT study programmes, labour market trends, recommendations of the Association for Computer Machinery and the IEEE Computer Society, etc. To this end, HEIs have an evaluation system and implement procedures to assess and track stakeholder opinion through periodic surveys, meetings and other feedback forms.

The trend of opening new study programmes or renaming old ones to make them more attractive to prospective students continues, with 112 new curricula developed between 2015 and 2023.

The comparative analysis of the HEI teaching documentation on the relevance to the qualification obtained shows that the relative share of specialised subjects providing profiling technical training for the Professional Bachelor's degree is just over 60%, for the Bachelor's degree is in the range 54 – 65%, and for the Master's degree is between 71% and 93%, and only in rare cases is it below 50%. The ratio between compulsory, elective and optional courses for the CCT degree pro-

grammes is also broadly appropriate. In private HEIs, due to the specific organisation of teaching activities, there is either a higher degree of selectivity of subjects when the required number of credits is obtained by students or a lack of selectivity.

Despite the established procedures for developing and approving the training programmes offered by the HEIs, there are still gaps in the training documentation of the CCT courses. Therefore, recommendations have been made to HEIs to align the curricula with the European Credit Accumulation and Transfer System (ECTS); maintain comprehensive curriculum documentation for the study programmes in each form of study, developed according to the established regulatory requirements and standards; refine the names of the courses and disciplines in the curricula (including content) to match the qualification obtained and include courses fundamental to the CCT; update and keep up-to-date the curricula.

STANDARD 3. Student-centred learning, teaching and assessment

HEIs conduct training of students considering the current requirements for the bachelor, master and doctoral degree acquisition. The qualification characteristics reflect the position of CCT specialists in the National Qualifications Framework for HE. The curricula include a sufficient count of profiling courses in CCT (with a few exceptions where they are less than 50%). However, there are HEIs where lecturers qualified in other PFs taught a significant number of them, which hinders good professional preparation of students.

Because that professional training and the formation of practical skills in a working environment are crucial for students, some HEIs make efforts to involve prominent professionals from practice as lecturers and to conclude contracts with companies and institutions for cooperation to provide opportunities for training and production practice of students. Such good practices should be more widely disseminated and adopted.

HEIs monitor student opinion on the quality and practical usefulness of training through surveys or meetings with learners, the results of which are analysed and summarised. In some HEIs, this monitoring and periodic analysis does not always involve students, partner organisations, experts and staff users.

HEIs apply clear and publicly disclosed methods for assessing students' knowledge, a system for conducting examination procedures, state examinations and thesis defences, and rules for complaints submission and handling, signals and proposals from students and postgraduate students. There is a practice of inviting users of personnel to the committees for conducting diploma defences.

The main recommendations to HEIs regarding this standard are related to deepening interaction with business and increasing student participation in projects.

STANDARD 4. Student admission, progression, recognition and certification

The activity for the attraction, admission, development, recognition, graduation and adaptation of Bulgarian and foreign students and PhD students is centralised in all HEIs. HEIs use variety of means and media to attract students – publishing information

on their websites, publishing a Student Guide, participating in events to attract prospective students, and conducting meetings with students and parents. However, HEIs are experiencing difficulties attracting students to some CCT study programmes.

HEIs have procedural rules for recognizing a HE degree or period of study abroad (incl. as a result of Erasmus+ mobility) and rules for applying the ECTS to continue education in Bulgaria. Although HEIs have concluded agreements for international activities and mobility of students and postgraduate students, the data on the mobility (total of 982 student mobilities during the accreditation period) show that the mobility opportunities are not fully exploited by all HEIs, even though there are objective obstacles to this.

HEIs involve students and PhD students in research projects under the established national and internal rules. In some HEIs, there are good examples of large numbers of students and PhD students participating in project activities (ranging between 42 and 68). In this direction, there is still more to do to develop opportunities for student participation in international and(or) national projects.

The requirements for the content of the primary education and qualification documents issued by HEIs are subject to the regulations. They maintain databases to record and track the realization of graduates.

STANDARD 5. Teaching staff

HEIs have publicly disclosed specific and transparent procedures for teachers' appointment and appraisal regulated in internal normative documents and meeting legal requirements.

The training shall be carried out in priority by academic staff of the basic contracts with appropriate qualifications and research activity while complying with the requirements of the Law on HE for the coverage of lecture courses (of at least 70%) in compulsory, elective and optional courses by habilitated persons of the basic contracts. The best insight into the provision of CCT training with lecturers on basic contracts gains the examination of the situation for the Bachelor's degree. The highest relative proportion of faculty members qualified in CCT in HEIs is 68.29%, followed by three other HEIs with 55.77%, 53.23% and 52%. In a significant part of HEIs, the profiling courses have to be taught by teachers on basic contracts with qualifications in other PFs, who have research activity corresponding to the courses they teach. The ratio of the number of curricula to CCT-qualified lecturers is between 0.2 – 0.5 curricula per lecturer in two HEIs, and in one HEI, there are more than three curricula per lecturer. In all HEIs, the average percentage of habilitated staff out of the total number of academic staff with a CCT qualification providing CCT training is 58.33%, with values ranging between 39% and 100%. It should be noted that a few lecturers with a qualification in CCT are involved in providing CCT training (1 and 4) in two HEIs. This fact indicates a shortage of lecturers qualified in CCT, which points to the need for HEIs to attract new CCT-qualified lecturers on basic contracts.

There are still 11 HEIs for which not all of the habilitated teachers in CCT are registered in the NACID Register of Habilitated Persons with Scientific Metrics (between 0% and 80% registered). There is a positive trend of striving for continuous renewal of academic staff and preparation of future habilitated persons. The presence of a significant average number of non-habilitated academic staff with a PhD in CCT (138, whose relative share is more than 30% of the academic staff with a CCT qualification) is a good indicator of the capacity of HEIs to develop the academic staff with a CCT qualification in the future period.

HEIs have systems to promote academic mobility within the framework of European programmes and bilateral cooperation agreements. The total number of faculty mobilities is 1353, with some HEIs being passive in this respect.

All HEIs have regulated organization, conditions and a procedure for the involvement of undergraduate and postgraduate students in research activities, which reflects on improving the quality of teaching and learning activities. According to the data presented for the accreditation conducted in 2023, on average, students and PhD students trained in CCT have participated as authors/co-authors in more than 368 publications, of which 127 publications indexed in Web of Science and Scopus, 283 participants in scientific projects; and 147 participations in scientific forums. These facts are excellent examples of good practice for integrating research into the training. At four HEIs, there is a need to increase student participation in research.

Teachers conduct an active research activity in line with the current trends in the development of CCT, with some exceptions noted in one HEI. On average, there are 2.12 publications per lecturer per year, including 1.09 publications in publications refereed and indexed in Web of Science and Scopus and 0.64 participation in scientific projects. Compared to other HEIs, these results demonstrate a good level of qualification of the HEI's academic staff. Some weaknesses are observed in terms of research activity at the international level (2 HEIs), the activity of assistant teaching staff (2 HEIs) and publication in journals with high scientific metrics (4 HEIs). The visibility of the research of the faculty members of the 17 HEIs among the international scientific community is demonstrated by their h-index (Hirsch index) data. The average h-index for academic staff with a CCT qualification from all HEIs considered was 3.36, and the highest average h-index was 6 (in 3 HEIs).

During the accreditation period, the total number of PhD students in CCT supervised by habilitated lecturers in CCT was 259. The number of defended PhD students per 1 habilitated lecturer is respectively 1,10.

STANDARD 6. Learning resources and student support

The training in CCT requires the availability of facilities and infrastructure, equipped classrooms and laboratories with modern equipment for teaching using innovative methods. All HEIs have sufficient classroom and laboratory space for student training, workroom space and specialised research laboratories. As for the necessary technical and technological equipment, due to the high dynamics of de-

velopment of CCT PF, the need for its renewal and development is always relevant. HEIs strive to maintain a modern IT infrastructure, which is also the basis for providing a suitable environment for distance learning. Libraries have sufficient seats and modern equipment and provide opportunities for using scientific information from electronic databases. Many of them are digitised and function as modern scientific information centres whose resources can be used online.

Most HEIs provide additional material incentives to lecturers and organise research sessions for undergraduate and postgraduate students to encourage research activity. Some HEIs conduct scientific conferences and publish journals to support teaching and research activities.

In most HEIs, the profiling subjects are provided with the necessary textbooks, teaching aids and materials, with some shortage of author's teaching aids found in 3 HEIs.

All HEIs regulate academic and administrative services for students and PhD students by internal rules and have functioning software platforms for administrative services. Necessary information for students and PhD students is publicly available in various forms.

STANDARD 7. Information management

All HEIs collect and manage information on training and graduates' career development. They do an annual analysis to develop study programmes, students' success rate, and the weaknesses and strengths of the learning process, taking into account the opinions of students, employers, and teachers. HEIs use feedback to manage the quality of education and the need for change.

It should be noted that some HEIs are facing difficulties in attracting a larger number of students, confirmed by the data on the implementation of the designated capacity for CCT training – some HEIs teach between 25.34% and 31.92% from the maximum number of permitted students. These data indicate a need to seek additional methods to attract and retain students.

HEIs have specialized units that monitor graduates' career development. Most HEIs have set up platforms or databases of graduates. According to the data from the Rating System of Higher Education Institutions in Bulgaria for the period 2018-2023, the conversion rate of graduates in the field of CCT is 63.36%. Of course, the realization rate of graduates in individual HEIs depends on the region and the state of the labour market.

HEIs maintain information on achievements in the CCT PF according to the leading standards in the country and abroad in related study programmes in HEIs at home and abroad. Data are available on trends in the development of the CCT PF, as well as on the latest developments in the field of scientific issues in the field of CCT.

STANDARD 8. Public information

HEIs maintain and develop effective systems for the dissemination of information about educational and research activities in the field of CCT of interest

to prospective, current and graduate students, other stakeholders, and the public. Up-to-date information is made publicly available through the HEI websites and at various events (competitions, Olympiads, scientific seminars, conferences, public lectures, etc.), profiles in scientific and social networks and databases, sharing scientific publications, textbooks and teaching aids, etc. Good practice is the annual organisation of Open Days, meetings with employers, students, etc. The low average performance of the capacity defined by the NEAA shows that there is still more to do to provide information on CCT training to attract the interest of prospective students.

HEIs use various channels and forms to provide publicity and disseminate the results of the scientific and creative work of students, postgraduates, and lecturers. An essential prerequisite for the dissemination of these results is the HEIs' academic events (scientific sessions, round tables, scientific seminars, conferences, publication of journals and proceedings, etc.).

STANDARD 9. Ongoing monitoring and periodic review of programmes

HEIs have functioning systems for managing and monitoring the quality of the educational process, developed standards for assessing and maintaining the quality of training, and established and operating an effective system for reporting and reflecting the students' viewpoint. The internal and external assessment of educational documentation embedded in quality systems is a guarantee of achieving and maintaining a high level of information objectivity. Considering the needs of the business and the student's opinions, HEIs update courses, curricula and programmes where necessary. HEI administration officials track student performance and student status for each student based on examination results, and some HEIs have an electronic system for tracking student information. According to the Ranking System of Higher Education Institutions in Bulgaria, 67.53% of the students in their final year of study in the field of CCT in 2022 have successfully graduated, which is an above-average result compared to other HEIs.

STANDARD 10. Cyclical external quality assurance

HEIs have an effective internal organisation for planned self-evaluation activities and internal auditing of all curricula and activities. There is external auditing regarding the learning documentation update, satisfying the needs of trainees and employers. Some HEIs certify all of their core activities and areas to ISO 9001. External evaluation of the CCT PF is carried out by the NEAA and annually within the framework of the Rating System for Higher Education Institutions in Bulgaria. HEIs analyse the results of these evaluations and take adequate actions to improve them. HEIs have to do an in-depth analysis of the available competitive environment and make the necessary efforts to achieve higher positions, especially in the presence of a downward trend in the number of students enrolled.

3. Analysis of strengths, weaknesses, opportunities and threats

The SWOT analysis highlights common strengths, weaknesses, opportunities and threats to CCT training, based on which we can formulate recommendations for HEIs.

At the institutional level, the following ***strengths of*** CCT training are identified:

1. There is a wide range of study programmes in all educational levels and forms of study, which provides candidates with choices and meets the needs of the labour market.

2. HEIs have an established policy for quality assurance of the educational product offered that is consistent with the educational mission, goals and objectives of the PF and effective procedures for its implementation.

3. The training is aligned with the current trends of CCT development and is based on training documentation developed based on institutional standards.

4. HEIs develop and update the learning documentation with the participation of students, external experts and other stakeholders.

5. HEIs strive to cooperate with companies and institutions and involve prominent professionals from practice as lecturers to improve practical and professional training.

6. There is a well-structured and regulated way to collect, analyse and manage information on learning, student development, student success and student satisfaction with the curriculum.

7. The training is provided with highly qualified academic staff habilitated in CCT (205 associate professors and professors, of whom 160 are registered in the Register of Habilitated Persons with Scientific Metrics of NACID), which is active in research and international activities.

8. The results of the research activities of the teaching staff are recognizable nationally and internationally, and there are opportunities for the involvement of students and PhD students.

9. The material-technical base and information resources for training and research work in the field of CCT are up-to-date.

Weaknesses at the institutional level are:

1. Gaps in quality assurance systems (e.g. lack of specific objectives and mechanisms, incomplete tracking of periodic quality assessment results, failure to report on crucial indicators of teaching quality such as faculty workload).

2. A small number of accredited joint programmes with foreign HEIs that support the attractiveness and funding of the CCT PF and a large number of curricula for CCT study programmes in some HEIs that may decrease the quality of training.

3. Gaps in the curriculum documentation of the study programmes, such as curricula that do not fully comply with the ECTS, incomplete curriculum documentation for each form of training, and gaps in its relevance and adequacy.

4. There is a shortage of lecturers with qualifications in CCT in HEIs offering training in CCT - habilitated and(or) non-habilitated.

5. There is more to be desired about to the expansion of the research activities of the faculty at the international level, the activity of the assistant teaching staff and the publication in publications with high scientific indicators.

6. Full compliance with the current Regulation on State Requirements for the Organization of Distance Learning in HEIs is not ensured for study programmes in distance learning form.

The policies and initiatives in place at the national and European levels (digital transformation and technological innovation, open education and science, opportunities for the creation of interdisciplinary, inter-university specialisations and programmes with national and international funding) and the trends on the labour market (demand for specialists and increasing salaries, emergence of new applied and scientific fields, the realised need for synergy between business and HEIs) highlight ***opportunities*** to enhance the importance and quality of training and research.

Some ***threats*** to the training in CCT at the national level are the demographic crisis, difficulties in attracting and retaining teachers caused by insufficient prestige and low remuneration of university professors and scientists compared to business professionals, the small interest of prospective students in the offered programmes, big competition of HEIs in the country against the background of a declining number of trainees, low level of preliminary preparation of prospective students, almost complete lack of interest on the part of prospective students.

4. Conclusion

CCT training aims to build knowledge, skills and expertise in some of the fastest growing areas of human knowledge and technology globally, such as Computer Science, Computer Engineering, Information and Communication Technology, Internet of Things, Cloud Computing, Big Data, Robotics, Cyber Security, Artificial Intelligence, etc. The results of the evaluation show that the Bulgarian HEI in the field of CCT, despite some limitations and weaknesses, is ready for quality training in this innovative field. Many of the teachers are proven scientists with wide recognition in the international scientific space, high academic standards are achieved in the educational process and research activities, and in general, the graduates in CCT have the necessary knowledge and practicals that meet the qualifications obtained and the current needs of personnel with HE in this PF.

HEIs face several contemporary challenges in their attempts to provide high-quality training in CCT. Although in terms of educational capacity replenishment, the CCT PF is in a relatively good position compared to other PFs in the natural and technical sciences, it is also affected by the unfavourable trends characteristic of all of them – demographic crisis, significant competition from foreign

universities, insufficient educational preparation in secondary school, lowering of admission criteria (the average grade in the secondary school diploma of first-year students studying in CCT is below 5.00), etc., leading to the recruitment of All this affects the quality of the final educational product. There is a shortage of trained teachers in CCT, because of which specialists from related fields are often attracted. In addition, faculty members are subjected to high pressures of various kinds - the need to fully assimilate modern emerging advances in the field and to introduce them into teaching, high expectations of the users of personnel, higher demands in their research work set in the minimum national requirements for scientific activity for the CCT PF, high teaching workload, etc. Therefore, these factors should be taken into account when planning the teaching and workload in HEIs.

All this should be taken into account in institutional and national quality systems and educational policies.

Acknowledgements

This paper is partly supported by the European Union-NextGenerationEU, through the National Recovery and Resilience Plan of the Republic of Bulgaria, project № BG-RRP-2.004-0001-C01.

NOTES

1. The register of quality assurance agencies maintained by EQAR.
2. NEAA, 2023. https://neaa.government.bg/akreditirani-institucii/visshi-uchilischa.
3. Similar to ISCED Fields of Education and Training –https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_Standard_Classification_of_Education_(ISCED).

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