

TEACHING REFORM AND STRATEGY IN SPECIALIZED ENGLISH OF OPTOELECTRONIC TECHNOLOGY

Zhaopeng Xu, Dong Wen, Huichao Huangfu

School of Information Science and Engineering, The Key Laboratory for Special Fiber and Fiber Sensor of Hebei Province, Yanshan University, Qinhuangdao 066004, P R China

Haiyan Wang

School of Environment and Chemical Engineering, Yanshan University, Qinhuangdao 066004, P R China

ABSTRACT

With the rapid development of science and technology and the high demand for high-tech products, optoelectronic technology and its products have been spotted everywhere in people's daily life and work. As the successor and disseminator of optoelectronic technology, the Chinese undergraduates and graduates majored in optoelectronic technology need to master the international frontier technology and the current development trends. It is extremely critical for them to be engaged in the Specialized English of optoelectronic technology. Based on the CDIO engineering education idea, the paper explores the reform road map and strategy for Specialized English of optoelectronic technology, and then summarizes the concrete reform measures on constructing curriculum framework and evaluating project-based teaching modes. The paper analyzes the reform effect based on the feedback from students graduating in recent three years. It provides the experience for the reform of Specialized English Teaching in the colleges and universities, and lays the foundation for training the better talents under the new situation.

KEYWORDS

CDIO, optoelectronic technology, Specialized English, teaching reform, Standards: 2, 3, 7, 8

1. INTRODUCTION

The rapid development of science and technology along with the continuously advance of the global economic integration has accelerated and is accelerating the internationalization process of China (Zhang, 2013). A large number of scientific and technical information and advanced equipments imported from abroad increase the chance of international cooperation. So it is necessary to cultivate a large number of well-trained international talents who are equipped with broad global perspective and strong interpersonal skills. A good knowledge of Specialized English (sometimes called English for Specific Purpose, ESP) could not only meet the needs of scientific research and academic exchanges, but also offer graduates more access to foreign companies or to work with foreign companies.

This form of international integration posed challenge to the teaching of Specialized English in universities, namely how to improve the students' comprehensive ability, to help the students grasp the latest technology development quickly, to cultivate innovation and creativity within our students, to nurture the students into well-trained professionals with comprehensive language skills and broad knowledge in this fast-developing era.

Today, optoelectronic and photonic technologies have become the most compelling core technology in communication and network fields (Teruo, 2000). In order to track the world's advanced level and understand the frontier research in this field, the students related to optoelectronics should be able to read more professional English papers and documents proficiently as well as to master the basic theory and process of technology. Only in this way can they shine in the near future at the world stage.

Specialized English of optoelectronic technology is a compulsory professional basic course in optoelectronic technology and its related majors. The course is the transition from general English to Specialized English, the conversion from the reading comprehension to the communicative expression, and the development from the language learning to the information exchanging. The course is neither a simple language course nor a simple professional course, but a curriculum in which language applications and expertise are closely integrated.

The purpose of this curriculum is not just to bear a certain amount of specialized vocabulary in mind. It ultimately aims at guiding the students to a scientific way of thinking through Specialized English, which helps the students to improve not only in English, but also in the level of optoelectronic technology. To keep up with the development speed of the subject, or even catch up and bring forth new ideas, we need to learn international first-hand information as much as possible; otherwise it will seriously affect the grasp of the latest science and technology in this field.

CDIO is an international and innovative engineering education mode, following four links of the product life cycle: Conceive, Design, Implement and Operate (Bankel et al., 2003). They also represent four links of education and practical training respectively. By introducing the product lifecycle, i.e. from the development to the operation of the product, CDIO enables the students to learn engineering courses in a way which is active, practical and full of synergistic relationship among courses. CDIO teaching philosophy focuses on engineering practice, which is closely combined with professional and broad knowledge, self-learning ability, capabilities to search for information, interpersonal communication skills, team spirits and practical ability (Berggren et al., 2003).

Based on the study of various existing English teaching modes and analysis of students' learning needs, this article integrates the CDIO teaching ideas into practical teaching and builds a professional English teaching mode which is suitable for the course optoelectronic and photonic technology. This teaching mode will break down the narrow structure of knowledge in the original training mode, enable the students to grasp the forefront technology trends in time, cultivate their academic ability and meet the society's demands for compound talents. Meanwhile, this training method of listening-speaking-reading-writing will also expand the students' career development and enhance the competitiveness of the students both in the job-markets and the academic research.

2. THE TEACHING SITUATION ANALYSIS ON SPECIALIZED ENGLISH OF OPTOELECTRONIC TECHNOLOGY IN YANSHAN UNIVERSITY BEFORE REFORM

From the year 2007, the author began to teach Specialized English of Optoelectronic Technology in Yanshan University. This curriculum has 32 lessons in total. According to the students' feedback and the observation and analysis of some previous teachers and the author himself, the Specialized English teaching of Optoelectronic Technology mainly contains three problems in the following aspects.

2.1 "The teacher translates, and the students remember the words"

Traditional teaching usually treats the quantity and speed of the textbook knowledge as the only criterion of teaching, which results in dull and mechanical classroom atmosphere. As a consequence, it seriously affects the enthusiasm of teachers and students and the interaction among them.

2.2 Fixed teaching method

In general, traditional teaching features with writing the teaching content on the blackboard. The students are likely to use up their patience during the process. Compared with General English, however, Specialized English fails to attract much attention for its shortage of interesting stories or attracting plots. Worse still, the text books are relatively fixed.

2.3 Flattened evaluation mode

Where there is teaching, there is testing. The original English tests normally contain only the usual results (including assignment, attendance etc.) and final test results, but fail to make a comprehensive assessment for the students in listening, speaking, reading and writing.

3. TEACHING REFORM IN SPECIALIZED ENGLISH OF OPTOELECTRONIC TECHNOLOGY IN YANSHAN UNIVERSITY

To make up the deficiency of traditional teaching method, referencing CDIO syllabus, we introduced the project-based teaching method to the Specialized English Teaching. When strengthening the basis of professional knowledge, we hope to broaden the students' horizons, improve their English application ability, develop the students' sense of teamwork and so forth. At the same time, we concentrate on the demand of the student, treat "serving for the students" as our teaching purpose, and regard the "making study serve for practical purpose" as the ultimate goal. We try to make full use of multimedia technology, enhance the students' practical language skills, inspire the students' motivation and active participation and get them from passively accepting knowledge to actively participate in Specialized English teaching activities, independently acquire knowledge. Culture the students' communicative ability in certain working environments in English, which makes Specialized English teaching in our university more scientific, more responsible to the current needs of social development and the requirements of the society. The Specialized English teaching reform program of optoelectronic technology based on CDIO concept is shown in Figure 1.

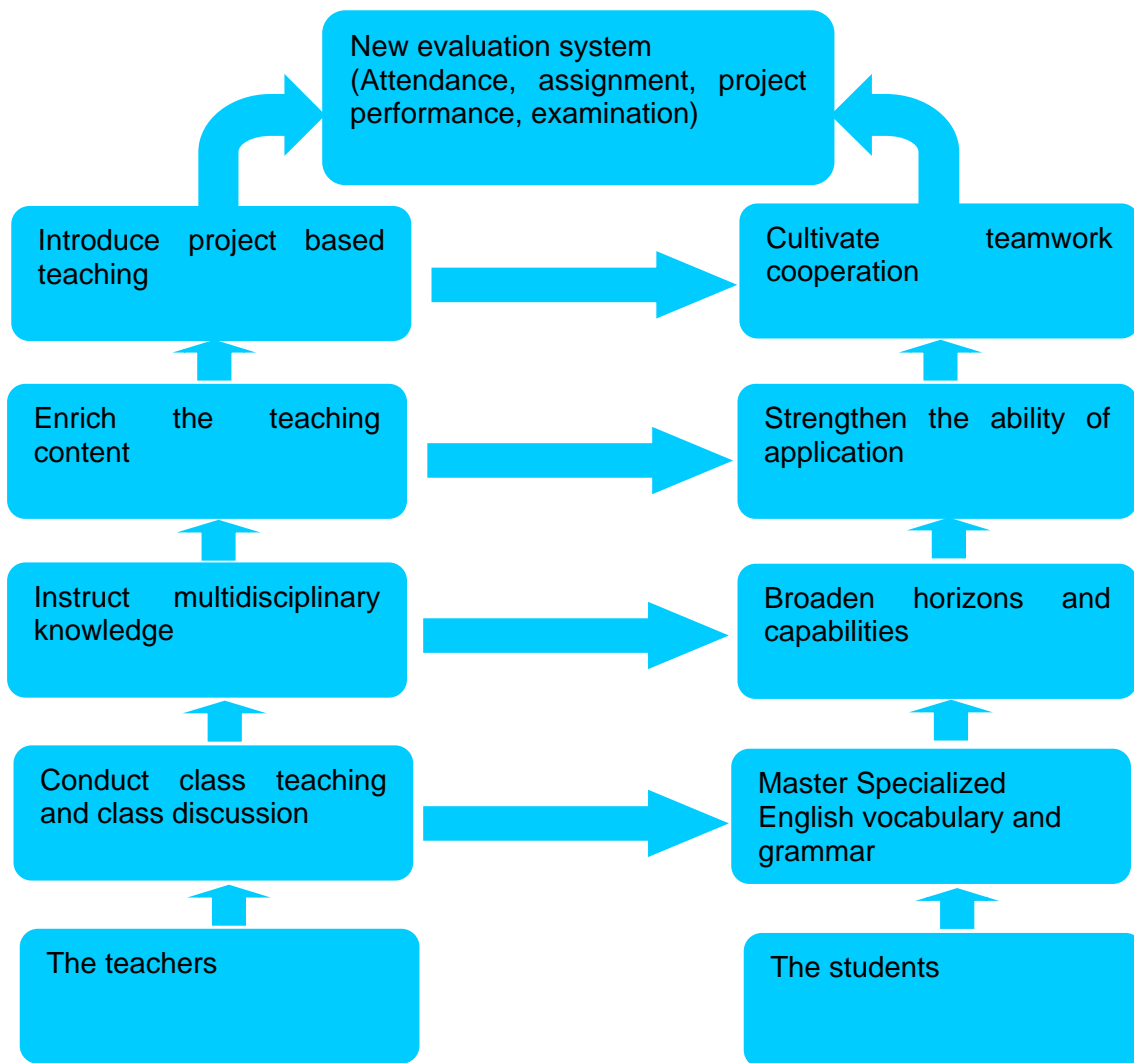


Figure 1. Teaching reform process of Specialized English of Optoelectronic Technology

3.1 New teaching objectives

According to Figure 1, the followings are the new teaching objectives:

- (1) Enable the students to understand the current situation, frontier and development trends of optoelectronics and photonics;
- (2) Enable the students to understand the stylistic features, word formation and grammatical features of the Specialized English;
- (3) Help the students to master the basic methods of document retrieval, data inquiry, research and to use the modern information technology to obtain information;
- (4) Help the students to master the oral expression of mathematical formulas, and to be able to use English to carry out the project report statements;
- (5) Enable the students to master the specialized vocabulary of electronics, and initially to get the ability to read the professional electronic literature;
- (6) Enable the students to master the specialized vocabulary of optics, and initially to get the ability to read the professional optical literature;
- (7) Help the students to get a sense of responsibility and professional ethics;

(8) Help the students to get organization and management skills, strong interpersonal skills and the ability to communicate, cooperate, and compete in a team.

3.2 New teaching mode

The course consists of two parts, namely class teaching, three-level project. Class teaching focuses on the basic teaching content of this course, taking the three-level project as traction, using the integrated teaching method that contains heuristics, discussing and researching methods, and is assisted by a large number of cases and on-site photos, videos and other materials for teaching.

Three-level project sets practical Specialized English as the goal of teaching, the English frontier scientific knowledge of optoelectronics as learning object, and asks the students to complete the chosen topic , literature searching, data collecting, papers writing, PPT making and defense in groups.

We used the following methods to strengthen the practical ability of the students and the relations among course knowledge:

(1) Take team learning mode. Students are grouped and share learning materials and exchange ideas within the group. But they compete among each group, by which students can develop a keen interest in learning, meanwhile the students' sense of cooperation and competition can be greatly strengthened.

(2) Adopt the teaching mode that contains "student-oriented, teacher-guide, student-teacher interaction and feedback". Meanwhile the form of International Conference is introduced into the class. A good atmosphere for students is created to interact and communicate outside and inside class, the level of the students' acceptance and feedback to the teaching of this course are collected. At the same time, the response to the students' feedbacks should be timely and the appropriate adjustments should be made.

(3) Explain further the important teaching content and enrich Specialized English teaching. Optoelectronic technology and electronic technology involve a lot of math expressions which we frequently encounter with. So it is necessary for the students to grasp how to express these mathematical terms exactly in English.

4. TEACHING FORM OF SPECIALIZED ENGLISH OF OPTOELECTRONIC TECHNOLOGY IN YANSHAN UNIVERSITY

According to the general plan of the course reform, the new form of teaching organization includes six aspects as follows:

4.1 Highlight the key points during the class

As a traditional form of teaching organization, class teaching is suitable for the systematic teaching for some forefront knowledge, professional vocabularies, structures and translations. The key point of Specialized English is vocabulary, so it is necessary for the students to master the vocabulary and some specific expressions. Scientific articles contain a large number of professional vocabularies, which means we need to master the formation method of the words. In scientific articles, some of the vocabulary is new for students, but most of the vocabulary is composed of a number of Latin and Greek roots and affixes. Once the students

master the meaning of these common prefixes and suffixes, it is not difficult to understand these new words and their meanings. Whether it is to read scientific articles or to participate in College English Test (CET) or the National Entrance Examination for Postgraduate (NEEP), it will greatly enlarge the students' vocabulary.

4.2 Discussion in Class

Class discussion allows the students to actively participate in the teaching process, making up the shortage of the traditional teaching form that is teacher-centered, and form a benign interaction. Therefore it can make the class atmosphere more active. The teaching form of class discussion is mainly started by a question selected by the teacher, and the students in groups begin to discuss the question, propose some potential solutions, and solve the problem. This form of teaching is designed to allow students to experience the "Ask a question - analyze the problem - solve the problem" process, to give full freedom to the initiative of the students, to stimulate the students' enthusiasm, to strengthen students' spirit of exploration, and to improve the students' communication skills to some extent.

4.3 Multimedia instruction

Multimedia instruction can well make up the insufficiency of the traditional teaching form. At the time we get involved in the frontier knowledge and technology, we can present the teaching content to the students very vividly in the form of text, web, video etc. to strengthen and deepen the students' impression and understanding of the new knowledge. In teaching practice, teachers can use multimedia teaching equipments to create an open learning environment to provide the students with nonlinear, dynamic knowledge, to combine the vitality of the external form with the scientificity of the internal structure of teaching content together closely.

We should try our best to optimize the environment for learning English, make full use of the class and modern teaching methods, and integrate trainings on reading, listening, speaking, writing and translation. For example, we divide the students into groups, let the students search papers to focus on a research hotspot, analyze the literature, and then find the problems, write English papers and make a presentation in the form of an international conference. We try to make a good atmosphere both inside and outside the class to practice English, promote the level and quality of English teaching. Through the teachers' introduction of some professional sites, such as Science, Nature, NASA, OSA and other frontier ones, the students can make up the defect of textbooks' slow update. The discipline of optoelectronics is also one of the subjects closely combined with English. This field contains a lot of data and information presented in the form of English. For example, there are many optoelectronic instruction manuals written in English. Thus in the teaching process, this section can be learned extensively. With knowledge expanding, the students can understand the importance of learning English, as a result they can actively engage in the English learning.

We have developed a multimedia Random Roll-call System. Using this system, we select out the students' photos randomly, and then ask the students to answer questions or give assignment after school. That can make class atmosphere more active, enhance the students' motivation and participation, light up the students' interest in this course and get them from passive recipients to active participants in the English teaching.

4.4 Using task-based reading

The teaching method of Specialized English is much different from college English. In the practical teaching process, the author has tried a variety of teaching methods to mobilize the enthusiasm and the participation in the class activities, hoping to change the traditional approach in which the teacher plays the “one-man show”. Thematic mandates and instruction content are given to the students one week in advance, so they can manage to preview, search for new words, explain the main meaning, and tell the key points and difficult points. By thinking independently, students can improve their analytical and problem-solving skills. In class, we will propose some enlightening questions to stimulate students to think and discuss more, and meanwhile we will randomly ask some students to analyze a paragraph or a sentence. The teacher will explain the key points and difficulties the students have in common in detail, so that the students can overcome the difficulties and master the key points. For the questions that the students could not answer immediately, the teacher will give inspirations and guidance to enable the students to find a solution after their own independent thinking.

Scientific articles are usually relatively long, and the content involved is the most updated technology in various fields, so it will be difficult for those who are not the majors to understand. If students can't be well guided, weariness mood will come into being. Knowing that, the author usually asks the students to go to the library or search online to get to know the background knowledge before explaining a new article, then ask them to introduce the knowledge during the class. It not only allows the students to understand the relevant knowledge, but also improves the students' enthusiasm and the understanding of the text. For example, when explaining the integrated circuit, we will first show the history of the research on the integrated circuit, then make English introductions of relevant scientists about his individual background and research direction, and highlight how their innovative thinking was hatched. All these preparations will stimulate the students' thirst for knowledge, which can mobilize their motivation to learn.

4.5 Introduce Project-Based Teaching

Besides class teaching and assignment, there is no other course content in the traditional Specialized English of Optoelectronics. That makes it difficult for the students to experience the whole process “conceive - design - implement - operate”, so it does not meet the requirements of the CDIO syllabus. For this reason we divide the course into two parts: the first is the learning of the basic knowledge and the training of ability, the second is the part of the defense which plays a vital role in the whole process of learning Specialized English of Optoelectronic Technology and the grade of the defense is one of the key points at the final assessment. The process is as follows: Firstly, divide the students into groups (5 persons /group), designate team leaders, and then arrange the content of defense, which can be selected according to the content given or their self-interested proposition, such as introducing new technology about optoelectronics or the development and promotion of new optoelectronic products. Secondly, each group search and analyze the literature. Thirdly, write a technical report or paper about their topic. Finally, finish relevant PPT, make a presentation in the form of an international conference and do some discussions with the students.

The whole process is based on the CDIO mode. Project evaluation depends on the group's mutual evaluation (accounting for 40%), teacher's evaluation (50%) and self-evaluation (10%) jointly. The whole process from conception to defense is divided into the following stages:

- (1) Conceive stage: Each team must determine their topic for defense.
- (2) Design stage: The students in groups begin to design the content and determine what needed for the research, in which it is necessary to take into account of the connection and the related degree and so on between the content into account.
- (3) Implement stage: The members of each group are assigned with certain work and responsible for their own clear roles and responsibilities, and search for relevant information. The team leader coordinates the group members together to complete this project and the respondent drafts.
- (4) Defense stage: We will randomly select one member from each group to defense and other members of the group jointly participate in the defense.

By setting the content of defense, the students can fully experience the whole process of “Conceive - design - implement - operate”, which helps to combine the theory with practice effectively and enhances the students’ ability of systemic thinking and independent problem-solving, meanwhile provides the students with a platform of teamwork and develops their sense of teamwork.

4.6 Change in assessment methods

We learn from the British BTEC (Business and Technology Education Council) assessment mode about its assessment stage (Cashian, 1995). That is, the new assessment method is led by the task-type assessment. Among the assessment, the course assessment includes four parts, namely: attendance, assignments, projects and exams. Specific requirements and scoring method are shown in Table1.

Table 1 Content and Requirements of Node Evaluation

Serial number	Evaluation items	Evaluation standard
1	Attendance (5 points)	5 points for perfect attendance, 1 point deduction for each absence; The course grade will be cancelled for more than 5 unexcused absences.
2	Assignment performance (15 points)	This course has two curricular assignments and a piece of homework. Students are required to complete independently and submit the work within the stipulated time. Job performance accounts for 15% of the total score .Failures to submit or similar assignments, the performance score will be 0. It requires to use B5 paper to write or print.
3	Project result (30 points)	This course has a three-stage project. Students are required to search for information in groups according to the topic of the three-stage project, and finish the research report and PPT. Project assessment is in the form of defense. Project result accounts for 30% of the total score.
4	Examination (50 points)	The score is based on the exam papers.

5. EFFECTIVENESS ABOUT THE REFORM IN SPECIALIZED ENGLISH OF OPTOELECTRONIC MAJOR IN YANSHAN UNIVERSITY

A survey was conducted among the graduates of recent three years. 174 pieces of valid questionnaires were received from 266 graduates finally (Table 2).

Table 2 Feedback from the graduates

Order	Questions	5	4	3	2	1
1	I have a basic understanding of the current situation, frontier and development trends of optoelectronics and photonics through the course.	66	87	10	6	5
2	The word formation, stylistic and grammatical features of the Specialized English help me a lot in reading professional literature.	62	84	20	5	3
3	I could easily use the modern information retrieval technology learned in the class to get the needed information.	60	89	17	4	4
4	It's easy for me to carry out project report statements, especially the oral expression of some mathematical formulas.	48	67	43	10	6
5	My vocabulary of Specialized English of optoelectronics is relatively large, and I have the ability to read the professional literature.	67	80	13	10	4
6	I develop a strong sense of responsibility and professional ethics during the course.	68	86	12	3	5
7	The interpersonal skills learned in the class put me in a better place to communicate, cooperate, and compete in my team.	64	82	19	3	6
8	I think the new curriculum framework and evaluation system add enjoyment to the course.	67	87	15	2	3

Table 3 Benchmark

Absolutely agree	Agree	Neutral	Object	Absolutely Object
5	4	3	2	1

Table 2 clearly demonstrates the feedback of 174 students, while Table 3 gives the benchmark of score value. We can see that students find learning is more interesting and they improve their interpersonal skills as well as their understanding of optoelectronic and photonic technologies after the implement of CDIO for Specialized English. We can come to a conclusion that most distribution of feedback is positive to the teaching reform. Nevertheless, there is much room to improve in that the project-based method may be a little bit overloaded and stressful for some students. In short, we found that using the reform form mentioned above, the students can not only improve their English translation capability, but also promote the deep understanding for the knowledge in the field, improve their interests in the professional field, develop, practice and strengthen their awareness of independent learning and teamwork ability.

6. CONCLUSIONS

In summary, under the guidance of the CDIO engineering concept, the reform of Specialized English of Optoelectronic Technology in our school has achieved the desired effect. It not only develops the students' comprehensive ability of listening, speaking, reading and writing, but also enhances the students' deep understanding of project-based teaching and team spirit. What's more, it has a certain significant and promotional value for the reform of the relevant majors in other universities in our country.

REFERENCES

- Bankel, J., Berggren, K., Blom, K., Crawley, F. E., Wiklund, I., & Östlund, S. (2003). The CDIO Syllabus: A comparative study of expected student proficiency. *European Journal of Engineering Education*, 28(3), 297-315.
- Berggren, K., Brodeur, D., Crawley, F. E., Ingemarsson, I., Litant, T. G. W., Malmqvist, J., & Östlund, S. (2003). An international initiative for reforming engineering education. *World Transactions on Engineering and Technology Education*, 2(1), 49-52.
- Cashian, P. (1995). The assessment of BTEC common skills in HE – A review of one course team's experience. *Journal of Further and Higher Education*, 19(1), 19-29.
- Teruo, H. (2000). Photonic technologies in the 21st century: Creation of new industries. *Optical Storage and Optical Information Processing, Taipei*, 2-6.
- Zhang, W. X., Fan, L. H., & Zhao, Y. D. (2013). Review and outlook of science and technology policies that promote the development of our society since the reform and opening policy. *Soft Science*, 27(4), 27-31.

BIOGRAPHICAL INFORMATION

Zhaopeng Xu is a professor in Optical Engineering and Vice Dean of Optoelectronic Engineering at Yanshan University, Qinhuangdao, China. He works on improving the curriculum design and teaching & assessment about Specialized English of Optoelectronic Technology. His research focuses on the optical materials, nonlinear optics, et al.

Dong Wen, Ph.D. is a researcher of cognitive science and learning science in School of Information science and engineering at Yanshan University, Qinhuangdao, China. His current research focuses on reform in instruction and cognitive impairment with neuroimaging.

Haiyan Wang is a professor in Applied Chemistry at Yanshan University, Qinhuangdao, China. Her current research focuses on curriculum design and the improvement of teaching and assessment about college courses.

Huichao Huangfu is a graduate student in School of Information Science and Engineering at Yanshan University, Qinhuangdao, China. Her research focuses on the application of metamaterials on the solar cell.

Corresponding author

Professor Zhaopeng Xu
Yanshan University
438 Hebei Street
Qinhuangdao, Hebei Province, China
066004
86-335-805-7078
xuzhaopeng1@163.com



This work is licensed under a [Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Unported License](https://creativecommons.org/licenses/by-nc-nd/3.0/).