Classroom Environment Empirical Evaluation of the Professional English for Chemistry Based on Project-based Learning Model

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Abstract. With the development of the education internationalization, the teaching modes of professional English are becoming more and more diversified, and Project-based learning method is one of the most powerful ones. In order to evaluate the professional English classroom environment, an effective instrument is needed. A sample of 290 students were taken from one university in Dalian, using the methods of exploratory factor analysis, Cronbach’s Alpha, correlation test of SPSS 22.0. The results indicate that most items in the instrument can be categorized into 12 factors which are internally reliable. The reliability coefficients are so high that the items in one factor have certain homogeneity. The formative evaluation and the terminal evaluation are significantly correlated and significantly influenced each other. Thus, in the project-based professional English for Chemistry classroom, the learning behaviors and interpersonal support should be fully focused on, in order to optimize students’ ways and the processes of classroom participation, enhance the learning effects and learning satisfaction.

Keywords: Classroom Environment Evaluation, Professional English for Chemistry, Project-based Learning Model

1. Introduction
In today’s highly informatized and internationalized era, the requirements of professional English teaching are completely different from the traditional teaching and teaching 10 years ago. Student-centered teaching is more diversified, teaching content is richer, and teaching design is more systematic.

In 2015, the College Foreign Language Teaching Steering Committee of the Ministry of Education issued the “University English Teaching Guide”. The guide emphasizes that students are the main body and stimulate the initiative and consciousness of students’ learning. The project-based learning method of professional English can be widely used and applied in many universities. Cooperative learning, independent learning, formative assessment and summative assessment of professional English project learning methods can add an excellent choice to professional English reform[7].
2. Project-based Learning Model
The theoretical basis of project-based learning is “output-driven-input-enabling hypothesis” [3]. This theory is mainly aimed at intermediate and advanced English learners. Its main content is: output is more driving force for language learners than input [1]. The output in this theory is not only the purpose of language learning, but also the driving force of language learning, while the input of language is the means used to achieve the purpose.

Regarding project-based learning (PBL), Buck Institute for Education (Buck Institute for Education) once proposed its definition of standardized project-based learning: “Project-based learning aims to urge students to explore complex and real problems through extensive and in-depth exploration. A systematic teaching method for acquiring knowledge and skills based on well-designed products and tasks” [4]. The PBL of professional English for Chemistry is through the teacher’s design of unit projects, students follow their inherent learning-driven psychology, use relevant professional language knowledge in order to complete the project, start from the real communication purpose, and trigger in-depth on real and important topics, thinking and solving these challenging problems. Through the completion and display of the project, the output application of its language and skills can be realized, thereby enhancing the students’ speech ability and learning satisfaction.

Project-based learning is widely used in professional English teaching practice because of its enlightenment, innovation, forward-looking and strong applicability [2]. In teaching practice, the setting of projects and whether the classroom teaching process is true and effective

3. Classroom Environment Evaluation Scale
Classroom environment evaluation is the evaluation of students’ perception of the physical environment, psychological environment and social environment of teaching. Classroom environment observation and evaluation are of great significance for improving students’ learning anxiety, enhancing classroom teaching effects, and promoting teacher professional development [6]. Therefore, in recent years, domestic and foreign scholars and experts have formulated a variety of classroom environment scales for classroom teaching environment evaluation. Among them, the “Classroom Environment Scale” compiled by Stanford University professor and social environment expert Moos has high validity and reliability. , “University Classroom Environment Scale”, “International Assessment Program of Student Abilities”, etc [2]. However, this type of scale mainly evaluates basic education and general higher education, and does not specifically evaluate professional English classes.

As project-based learning is widely used in English classrooms, we need to combine the characteristics of project teaching and the teaching rules of professional English classrooms to establish Observation points, develop observation scales, make observation records, organize and analyze data, and summarize the results of environmental assessments, thereby improving teaching behavior, improving teachers’ level and students’ learning satisfaction[10].

This research tried to compile the “Professional English Project-based Classroom Environment Assessment Scale” to test its reliability and validity, and then use the scale to evaluate five classes that implement professional English project-based learning, and evaluate their classroom environment.

3.1. Research Methods and Methods
In the selection of research objects, a sample of 290 students and 5 teachers in a professional English course for non-English majors in a college in Dalian was selected. In the sample, boys accounted for 69% and girls accounted for 31%. The class teachers involve three titles of associate professor, lecturer and teaching assistant, and their working years range from 1 to 10 years.

The professional English project-based learning in this university has been implemented for nearly five years, and the teachers are very familiar with the purpose of project-based learning, teaching methods, and classroom evaluation. Take the four units of the course as an example, the course group designs related teaching projects according to the teaching theme of each unit, 4 hours a week, lasting 8 weeks. The study uses two research methods, qualitative analysis and quantitative analysis, to evaluate the research results.
Two research tools are used: questionnaire survey and interview. First, the designed questionnaire “Professional English Project-based learning Classroom Environment Assessment Scale” refers to the typical factors of English learning classroom environment assessment at home and abroad, and adds the characteristic factors of project-based learning. There are 12 factors and 48 items. The evaluation adopts Likert scale. The factors are described as follows:

**Table 1.** Type, dimension, factor, and assessment criteria of Professional English Project-based classroom Environment assessment Scale

| Type          | Dimension        | Factor   | Assessment Criteria                                                                 |
|---------------|------------------|----------|--------------------------------------------------------------------------------------|
| Formative     | Learning         | motivation| The project setting is closely combined with my major study, which can arouse my interest and is of practical significance to me. (+) |
| Assessment    | behavior         | content  | The project topic selection and difficulty setting are reasonable, and the task can be completed on time and with high quality through my efforts. (+) |
|               | depth            |          | In the process of project completion, I can continuously deepen my understanding of my professional English and other major courses. (+) |
|               | mentality        |          | When I was preparing and presenting the project, I felt happy and fulfilled. (+) |
|               | innovation       |          | In the process of project completion, I can think critically or innovatively. (+) |
|               | equality         |          | I felt that my teacher was prejudiced or snubbed me. (-) |
|               | discipline       |          | In the classroom study, I can observe the discipline, take part in class actively. (+) |
|               | interpersonal    | teacher’s| In the project process, the teacher can give me effective guidance and fair evaluation. (+) |
|               | behavior         | support  | The students in my group can cooperate well with me and give me a detailed and fair evaluation. (+) |
| Summative     | learning         | content  | Through project completion and presentation, I can acquire relevant knowledge and skills. (+) |
| assessment    | outcome          |          | Through project presentation, I have mastered the professional language, how to communicate, and the skills of explanation and presentation. (+) |
|               | skill            |          | Through each unit project presentation, I can gain something. (+) |
|               | self-efficacy    |          |                                                                                     |

The above factors cover three evaluation dimensions, and understand the views and attitudes of implementers and learners on project-based learning, language application ability, cooperative learning ability and classroom mental state. Before filling out the questionnaire, students had a comprehensive understanding of the basic concepts, teaching objectives and teaching mode of project-based learning, and completed eight weeks of project-based learning practice to ensure the authenticity and objectivity of the quantitative research data.

Secondly, classroom observation was conducted according to the designed scale, and teachers and students were interviewed. Based on data analysis, 30 students and 5 teachers were interviewed, and 10 classrooms were observed. The above research methods are to gain a more objective and in-depth
understanding of the classroom, to understand the evaluation objects, to understand the implementation of project teaching, to comprehensively monitor the classroom teaching process from practice, to collect evaluation information, select evaluation content, and drive students to participate in the evaluation results.

In this study, questionnaires were set up, and data were distributed and collected. SPSS 22.0 was used to test the reliability and validity of the “Professional English Project-based Classroom Environment Assessment Scale”; statistical analysis of the survey data was conducted to negate the significance of the project.

### 3.2. Research on the Validity and Reliability of the Evaluation Scale

**Table 2.** Factor analysis, reliability analysis and correlation analysis of project-based classroom Environment assessment for professional English teaching

| Type          | Dimension         | Factor      | Number | KM O Test | Eigenvalue | Explained Variance | Cumulative Variance | Alpha Coefficient | Correlation |
|---------------|-------------------|-------------|--------|-----------|------------|---------------------|---------------------|-------------------|-------------|
| Formative Assessment | Learning behavior | motivation | 4      |           | 2.256      | 10.297              | 10.297              | 0.718             | 0.404~0.645 |
|                |                   | content     | 4      |           | 2.143      | 10.356              | 20.653              | 0.810             | 0.412~0.624 |
|                |                   | depth       | 4      |           | 2.174      | 8.167               | 28.82               | 0.817             | 0.432~0.596 |
|                |                   | mentality   | 3      | 0.918     | 2.033      | 7.860               | 36.68               | 0.847             | 0.434~0.648 |
|                |                   | innovation  | 4      |           | 1.818      | 6.243               | 42.923              | 0.812             | 0.404~0.646 |
|                |                   | equality    | 4      |           | 1.983      | 6.568               | 49.491              | 0.859             | 0.412~0.625 |
|                |                   | discipline  | 4      |           | 2.406      | 6.442               | 55.933              | 0.857             | 0.532~0.597 |
| Interpersonal behavior | teacher’s support | 5      | 0.851     | 2.224      | 22.719              | 21.719              | 0.786             | 0.504~0.649 |
|                | peers’ support    | 3         | 1.807    | 25.268    | 46.987              | 0.842               | 0.434~0.647 |
| Summative assessment | Learning outcome | content outcome | 5      | 0.863     | 2.437      | 19.648              | 19.648              | 0.823             | 0.412~0.626 |
|                | skill outcome     | 4         | 2.216    | 18.421    | 38.069              | 0.814               | 0.432~0.598 |
|                | self-efficacy     | 4         | 2.218    | 16.181    | 54.25               | 0.805               | 0.534~0.612 |

For the two observation dimensions of formative evaluation and the learning effect of summative evaluation, the KMO sampling appropriateness test measure is close to 1, indicating that the sample size is suitable for factor analysis. At the same time, Table 2 shows that the cumulative explanatory variances of learning behaviors, interpersonal behaviors, and learning effects are 55.933%, 46.987%, and 54.25%, respectively, indicating that the selected factors can explain the variance of the variable well, and reflect fully and fully. The content of each dimension and each factor of the summative evaluation.

In order to test the reliability of the scale, the internal consistency was tested by using the Cronbach $\alpha$ coefficient test. The results are shown in Table 2. The multi-dimensional reliability coefficients are all
statistically significant (P=0.000<0.001), and The coefficient of the factor is also relatively good, indicating that the internal consistency of the scale and the subscales is good, and the reliability is high. Using the two-tailed detection in SPSS22.0, the correlation analysis of the items was carried out. The correlation between the internal items of the factors in the scale was between 0.404 and 0.649, indicating that the correlation between the items within each factor is significant and can effectively support Factor evaluation.

The data analysis of the above scale shows that the “Professional English Project Teaching Classroom Environment Assessment Scale” has good validity and reliability, and can more comprehensively evaluate the college English project classroom environment. And each dimension has a good correlation with the learning effect, and formative and summative evaluation are closely related. There are several overlapping items in individual factors, which need to be further improved and revised.

4. Research Results and Analysis

After data screening and revision, from the measurement data and interview results of the evaluation scale, professional English project-based learning is highly recognized by implementers and learners, and the effect is good, but there are some weaknesses.

Judging from the data of the evaluation scale, learners generally have an accepting and positive attitude towards the professional English project-based learning classroom [5]. The traditional professional English classroom has been transformed into active preview by students before class[9]. The content of the text assigns tasks, discusses exercises, realizes the internalization of knowledge, and finally students display the project results. Learners use language to organize activities around the project, such as analyzing project information, collecting project data, negotiating project plans, and achieving project output[8]. The project activities are all for the purpose of real communication, highlighting student-centeredness, focusing on the learning process and language output, and enhancing students’ language application ability and learning satisfaction.

The design of the project teaching adheres to the five principles of adaptability, interest, motivation, interactivity and gradualness. In the design and planning of the project, attention is paid to the current level of students and their psychological expectations. According to the data analysis of student psychology, students have a high overall evaluation of the teaching process, which caters to the psychological needs of students.

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