Analysis of the Results of the Implementation of the Design and Drawing Teacher Program in Secondary Schools

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Abstract. The countries of the world are focusing their education policies on the direction of shaping knowledgeable, creative, responsible, and lifelong learning skilled citizens who will participate in solving the common problems of humanity in the new century. Mongolia follows the same demands and aims to introduce advanced methods and technologies by enriching all levels of educational programs with modern content. Since 2012, Mongolia has gradually updated the curriculum of general education to bring it in line with current international standards. In this, the course of Engineering Drawing had changed to Design Technology in grades 6–9 and Design/Drawing and Technology in high school, and some foundations of modern design had been included in the content. To prepare teachers to implement this program, a teacher training program was started in 2015 with two areas: Design and Technology and Design and Drawing teacher. There is a need to compare and evaluate the results of these reformed programs.

This study analyzes the implementation of the Design and Drawing Teacher Program reforms. The teacher training program is closely related to the on-the-job teaching curriculum. Therefore, it was intended to conduct research based on three interrelated concepts of implementation. It includes:

- Knowledge, skills, and attitudes of graduates of the Design and Drawing Teacher Training Program
- Knowledge and skills of the content and the outcomes of the program implemented by the teacher,
- Indicator of the results achieved by the students in the program.

By comparing them, it is considered possible to clarify the shortcomings and achievements of the program reform results and determine what needs to be paid attention to in the future.

The research used the documents of the design and drawing teacher program, and two indicators were quantified: Program learning outcomes (PLO) and Course Learning Outcome (CLO).

It was intended to analyze the results of the implementation of the reform of the content of the elementary school program in 2021 by a total of 8095 students of the 7th–12th grade, and in the evaluation of 24329 students in 2022, who took

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13 questions based on the content of the Design and Drawing, and Technology course.

Keywords: Quality of education · Training plan · Teacher quality · Learning outcomes

1 Introduction

1.1 Teacher Training and Secondary School Curriculum Reform

Human development plays an important role in the development of the country. Educating each student and supporting them to become capable citizens who can creatively use knowledge and skills by making the learning process go from general to detail [1].

Professional competence has a direct impact on the teaching process and teaching methods, both for beginners and teachers with many years of experience. Therefore, it is important to focus on professional skills development in teacher training programs.

Students need to become more competent in their professional disciplines while studying. Some studies show that students' interests and basic skills also influence professional development. A well-qualified teacher with high professional skills can develop a high level of course content and choose the appropriate methodology. However, if the teacher has poor professional skills, even if he knows many teaching methods, the content and planning of the course will be poor.

Education quality is constantly evolving, but progress and results are not immediately apparent. "… It takes a lot of time and effort, at least every twenty years, to change an abstract thing with a spiritual cause, such as culture, tradition, or method" [2]. The seeds that are instilled in people's minds through education are part of a person's lifetime. Therefore, the curriculum and content are continuously improved by researching the educational policy and its implementation.

The planning of learning objectives (knowledge and skills) of the program, which is the latest education reform in Mongolia, has been considered with quantitative indicators. This included the number of learning objectives planned for the updated program in 2019.

The results of several studies conducted in recent years on the implementation of secondary school curricula and the quality and results of the training were discussed. These studies showed that the quality and results of secondary education are not so good. For example, academic achievement at all levels of general education was less than 60%, and academic performance was lower at the primary and upper secondary levels [3].

One of the factors influencing the quality of education is the quality of teachers. There was a positive correlation between teacher quality and Students' learning outcomes commonly related to teachers' quality [4].

The results of a study examining the quality and outcomes of general education about teacher quality and teacher training programs are also significant.

For example, a study by the Asian Development Bank's Technical Assistance Project stated that "… Teachers have a common understanding of the importance of process evaluation, but its essentiality cannot be used in teaching, and focus on teacher capacity strengthening…" [5].

In the 2019 Mongolian Primary Education Sector Research Report, "Secondary school teacher professional standard based on teacher professional design concept, theory and methodological solution in 2009" (MS 5352-95 for higher education and secondary school teachers) was approved and has been implemented in higher education since 2010 [6]. The purpose of this standard is to validate the basic requirements for the content, assessment, duration, and environment of the undergraduate program in secondary school teaching. Since 2014, as part of the higher education reform, teacher training schools have been updating and improving their curricula.

The Design and Drawing Teacher training program was updated in 2015 due the curriculum of the middle and high school curriculums was updated and the contents of the two courses - Drawing and Technology - were combined and named Design Technology. These changes make it difficult in implementing the program. There was not a teacher trained to teach content that integrates the two subjects.

When updating the content and methodology of the teacher training program, it is necessary to consider the percentage of changes in the content, the name of the program, and the consistency of the changes in the high school and elementary school programs.

Changing the names of secondary school programs and courses or updating and unifying the content without research, may confuse the graduates of teacher training programs and reduce the quality of the program. For example, the teacher training program called Design and Drawing has the appropriate content, but if the content of the subject called Design and Technology in secondary school is not clear, the program for teaching it becomes contradictory. To overcome this:

- Clarify the content and name of the Design and Technology course in general education
- Conduct training for teachers on new content and programs
- It is necessary to update the nomenclature, content, and methodology of the teacher training university program in a way that ensures mutual coherence.

Objectives of the study

To study the results, compatibility, and implementation of knowledge and skills acquired by the graduates of the Design and Drawing teacher program and the knowledge and skills acquired by the students in the general education program.

2 Materials and Methods

The curriculum of the senior class Design and Drawing selected in the study was updated in 2015 and a unified curriculum was created, including Design, Technology (Production), and Drawing, and was renamed "Design and Technology" in primary education, "Design and Drawing, and Technology" in high school. Since then, it has been necessary to train or retrain teachers to implement this program. To implement these programs, the teacher training program was updated in 2015. In 2018, there graduated from the Design and Drawing Teacher Program for the first time, and there is currently a shortage of teachers in this profession.

The Design and Drawing Teacher Program is designed to provide a foundation of knowledge and skills in engineering education combined with design solutions at the international level. In 2015, when updating the middle and high school curriculum,

Table 1. Question asked in the survey 2018

	Design knowledge is better	Drawing knowledge and skills are better	Technological knowledge and skills are better	None of these is better
What knowledge and skills do students acquire more through the integration of Design, Drawing, and Technology content?	16	10	44	20

the contents of the two courses - Drawing and Technology - were combined and named Design Technology. These changes make it difficult in implementing the program. There is not a teacher trained to teach content that integrates the two subjects. Therefore, in practice, it was considered that the graduates are taught drawing or technology, depending on the major, and they are not imparting the appropriate knowledge in school.

The Ministry of Education, Science, and Culture (MECS) has conducted nationwide assessments and diagnoses to address the backlog of basic and upper secondary education [7, 8]. From this, it is possible to see the general level of implementation of the curriculum content. A total of 8095 students in grades 7–12 were involved in the pilot study. Of students in grades 7–12, who participated in the survey, 47 percent were male, and 53 percent were female.

The survey was conducted on a sample of 90 teachers from 6 districts of the capital city and local teachers using Google forms. The professional share of teachers surveyed was 32% Fine Arts Teachers, 20% Drawing Teachers, and 48% Technology Teachers. To clarify the advantage of the integrated course, in 2018, participants were asked by following questions.

What knowledge and skills do students acquire more through the integration of Design, Drawing, and Technology content? (Table 1).

2.1 Analysis of Design and Drawing Teacher Training Program Documents

The Mongolian University of Education, a major leader in teacher training, is implementing a results-based curriculum. This includes researching and improving the combination of program learning outcomes (PLO) and course learning outcomes (CLO) that are relevant to the goals and objectives of the program and the needs of consumers and employers. Quantitative results of knowledge and skills in the design and drawing teacher program show that the foundation of teacher education is designed to be large enough to compete with professional knowledge and skills. This appears to be preparing teachers with good teaching skills, but there is a lack of professional skills. Considering the way defined the knowledge and skills of the students that studied with design and drawing curriculum will acquire:

Table 2. Number of knowledge, skills, and attitudes planned by the program

№	Comprehensive curriculum competencies	PLO	CLO
1	Personal basic knowledge, skills, and attitudes	11	220
2	Teacher education knowledge, skills, and attitudes	28	263
3	Professional subjects: B. Design and Drawing	15	261
	Total	54	744

Table 3. Number of knowledge, skills, and attitudes studied by the student's own choice

№	Comprehensive curriculum competencies	PLO	CLO
1	Personal basic knowledge, skills, and attitudes	11	102
2	Teacher education knowledge, skills, and attitudes	28	73
3	Professional subjects: B. Design and Drawing	15	261
	Total	54	436

The program document says that the graduates of the design and drawing program must have a design mindset, knowledge of drawing, the ability to develop basic design projects in engineering and design, and the ability to develop students creatively [9]. The concept of the program has three main pillars: graphic design-drawing-computer graphics [10]. The Mongolian National University of Education has introduced a credit system and teacher selection system that allows students to choose the knowledge and skills planned in the program. (Tables 2 and 3).

This is noticed that students are more likely to choose the knowledge and skills they need in the workplace. (Table 2, Fig. 4). The teacher's professional competence is the most important factor in making the subject clear to others based on the content of their field of specialization and training methodology.

There is a lot of research being done on teacher training and teacher quality improvement. A tetrahedral model has been developed for research on teacher competency measurement. If the teacher's competence is analyzed by a tetrahedral model, the teacher's content, methodology, and communication skills are more related to his professional competence than to his instincts and abilities [11].

When studying the implementation of the reform of the curriculum after a certain period, it is necessary to look at the specialism and knowledge of the teachers who are implementing it, and the knowledge and skills acquired by the students as a result of the reformed program.

Therefore, the following documents and results were studied. It includes (Fig. 1):

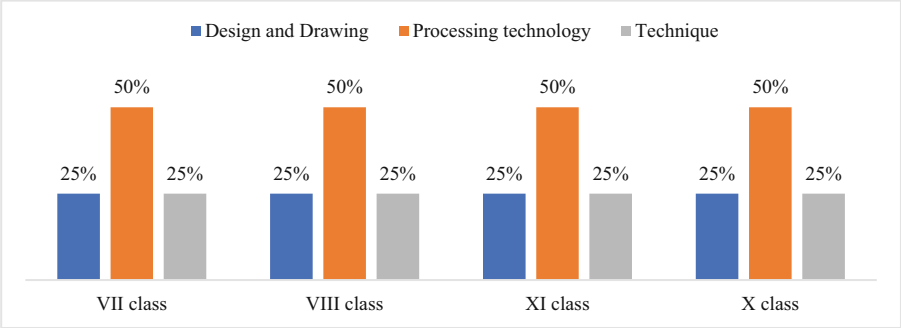

Fig. 1. Content of test tasks for grades 7–10

– When studying the documents of the design and drawing teacher program, two indicators were quantified: Program learning outcomes (PLO) and Course Learning Outcome (CLO).
– It was intended to analyze the results of the implementation of the reform of the content of the elementary school program in 2021 by a total of 8095 students of the 7th-12th grade, and in the evaluation of 24329 students in 2022, who took 13 questions based on the content of the Design and Drawing, and Technology course.
– Most of the teachers implementing curriculum reforms are teachers who taught when there were two separate subjects. Therefore, the query method was used among teachers to research their acquired content.

These studies have shown that implementation of the content is insufficient.

3 Results

3.1 Results of Evaluations Taken at the End of the 2021 Academic Year

The findings of this study provide a basis for diagnosing how students have studied the content of the integrated program and how to supplement the content in the future. To determine whether there are any delays due to program integration, we selected the implementation of Design and Drawing content as a research framework (Fig. 2).

The content of the test task taken from the students was developed one grade back to reveal the knowledge and skills of the content that should be mastered in the previous grade. From the content of the combined two courses, 25% of the 7–10th grade test tasks and 60% of the 11–12th grade test tasks are design and drawing content.

In developing the task data, consideration should be given to the proportion of design and drawing content in each class program.

The test assignments were taken from the 7th grade according to the content of the 6^{th}-grade of primary education curriculum, from the 8th grade according to the 7th-grade content, from the 9th grade according to the 8th-grade content, and from the 10th-grade students according to the 9th-grade content.

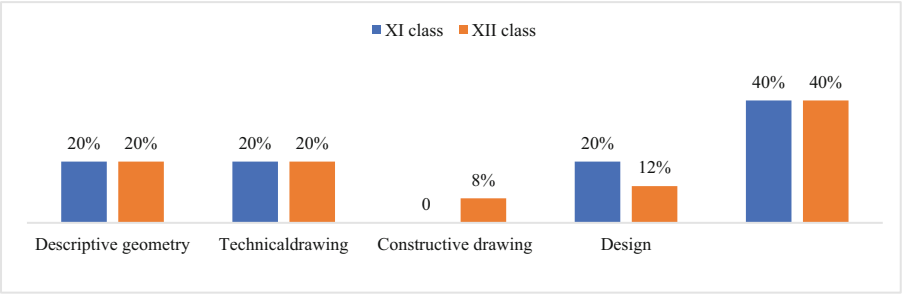

Fig. 2. Content of test tasks for grades 11–12

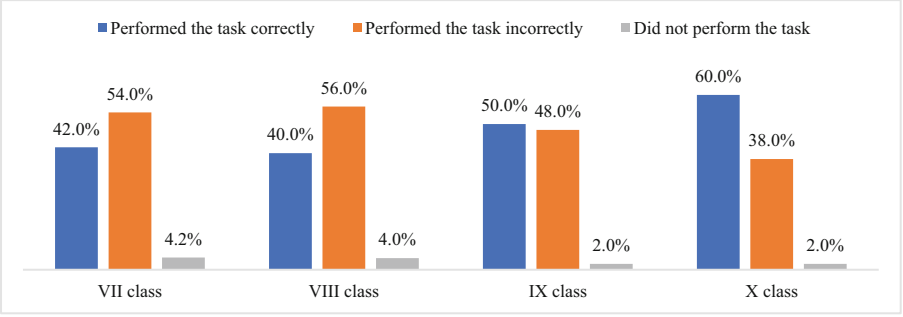

Fig. 3. Performance of students in grades 7–10

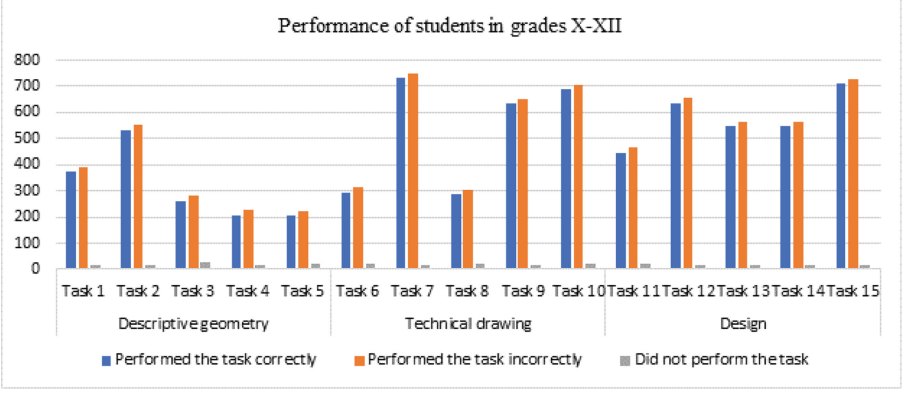

Fig. 4. Results of the evaluation of the three groups of topics in the Design/Drawing, and Technology course of the high school

The performance of a total of 1702 7th-grade students was shown in Fig. 3. Tasks 1 and 2 are designed with drawing content and 3–5 with design content (Table 4).

Table 4. Results of the assessment 2022

Tasks	1	2	3	4	5	6	7	8	9	10	11	12	13
Students who completed the task correctly (%)	63.8	59.7	58.1	55.7	56	50.9	45.2	74.5	46.7	63.3	58.9	95.4	78
Students who did not do the task at all (%)	41.5	43.3	52	54.7	47	48.1	54.8	35.5	53.3	36.7	41.1	4.6	22
Total number of students	24329												

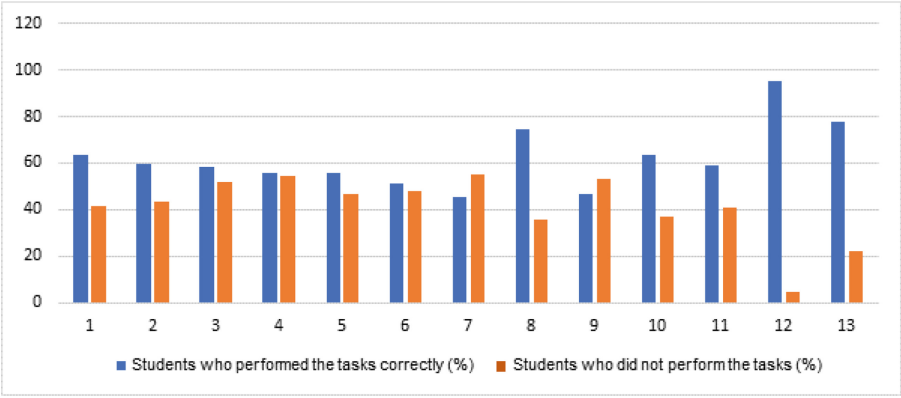

Fig. 5. Student performance for grades 11–12

Design and Drawing theme groups cover 50% of the design and drawing and technology curriculum content in high school. Task performance is considered in this context.

According to the survey, 50%–60% of students in grades VI–X did not complete the task (Fig. 3), and 50% of students in grades XI–XII did the task incorrectly (Fig. 4.). There can be many reasons for this. The results of this analysis should be reviewed and clarified. We need to focus on what lies ahead and identify opportunities to improve results.

3.2 Results of Evaluations Taken at 2022

In April 2022, the results of the assessment obtained from the 8th-grade students were analyzed. Because according to the planning of grades 6–12, the quantitative indicators of knowledge and abilities of grade 8 were planned with more quantity, and the results were updated using a sample survey method (Fig. 5).

An analysis was made of the evaluations obtained from a total of 24,329 students through 13 questions and tasks developed in the context of design, cartography, and technology courses.

According to the assessment, the learning outcomes in 2021 were:

- 40% complete assignments
- There were 60% who performed the task incorrectly or did not do it at all.

According to the results for 2022, the average completion of tasks increased to 62%. This indicates that learning activities have become normal and the results have increased. However, it is considered that the difference in the percentage of completion is 42% for some tasks and 95% for others is related to the processing of tasks.

According to the analysis of the results of the training, there is an improvement from the previous year, but the results are not high. Considering each task, the completion rate of drawing course content is low overall (42%–58%).

4 Conclusion

In recent years, several strategic national programs have been implemented in stages, and these documents set specific goals for teacher training, curriculum, learning environment, teacher development, and student enrollment, reflecting the policy focus on the teacher training system.

In the analysis of the teacher training program document, the students can see more of the knowledge and skills required in the workplace by selecting the knowledge and skills planned by the program learning outcomes (PLO). According to a survey of Design and Drawing alumni, 100% of the professional knowledge and skills were selected according to the plan, while 35% on an educational basis and 85% on an individual basis were studied. This is because more knowledge and skills to be provided based on education are planned, and students selected in the credits frame have influenced the indicators.

Many factors influence the evaluation of design and drawing content implementation, but only a few are mentioned in this study. These include:

– Due to the less number of graduates in the design and drawing teacher program, there are few staff in secondary schools who can provide quality teaching of the subject.
– In addition, since 2015, two separate courses of basic education have been combined into one course, and the drawing section has been omitted, which affects the program implementation.

In the future, there is a need to introduce a variety of assessment methods to assess the students' and teachers' knowledge and skills and to correctly determine the relationship between teaching quality and results.

After the current assessment, relevant organizations, teachers, and schools should pay attention to correct and improvement activities.

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