



University Curriculum Development and Management Based on Korean National Competency Standards: A Case Study

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Abstract: reflecting industry needs. Among them, the National Competency Standards (NCS) that sought to systematize the knowledge, skills, and attitudes required to perform jobs at different levels were developed. To date, NCS is leading to a shift in the curriculum of high schools, colleges, and public and private vocational training institutions. The K University was the first university to develop and manage an NCS based curriculum. This study analyses the cases of NCS based curriculum development and management of K university in Korea through cases study method. As a result of this study, K university developed NCS based curriculum at nine levels and managed systematically by introducing plan, do & check, Act. This means that K university has increased its efforts to better reflect the needs of the industry in the curriculum. By benchmarking the case of The K University's NCS based curriculum development and management process, this study explores the possibility of applying NCS to college education, providing guidance and implications for overseas universities hoping to develop and introduce NCS based curriculum.

Keywords: National Competency Standards, Republic of Korea, NCS based curriculum, College curriculum

1. Introduction

In Korea, as well as in many other countries, the education of university graduates is often incompatible with job availability. Especially in Korea, job applicants complain about the cost and time spent accumulating the purported qualifications for employment, while companies complain about the resources required to train new graduates. In December 2007, the Korean government enacted legislative measures to promote industry based education and cooperation between industries, academia, and research to resolve the mismatch college education reflecting industry needs. More specifically, in 2012, the Ministry of Education (2017) conducted the Leaders in Industry-University Cooperation (LINC) project, which aims to foster industry based university education and to cultivate individual talents. Since 2008, the Korean University Accreditation Institute has been conducting an industry-based university evaluation by academic field

The National Competency Standards (NCS) reflect a Ministry of Labor-created policy that since 2013 has sought to systematize the knowledge, skills, and attitudes required to perform jobs at different levels in various industries. In other words, the competencies required for specific jobs have been systematically classified and standardized. Many countries have developed and operated similar state-centered job performance standards such as Australia's Training Package, New Zealand's Unit Standard, and the United Kingdom and Canada's National Occupational Standards (NOS). To date, a total of 897 NCS have been developed in Korea, leading to a shift in the curriculum of high schools, junior colleges, polytechnic institutions, and public and private vocational training institutions.

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However, it remains hard to find a case in which NCS has been applied to four-year college education. The goal of the junior college is to train professionals such as engineers, making it especially suitable for an NCS based curriculum. On the other hand, four-year colleges in Korea are more academically oriented. Despite criticism that these four-year colleges are not suitable preparation for industry jobs, there has been little interest in NCS and few efforts to apply it to the colleges' curriculum. Indeed, the K University was the first university to develop an NCS based curriculum for all seven of its departments and 18 majors. This NCS based curriculum has been gradually expanded, with plans to offer it in all majors beginning in 2017.

This study aimed to provide implications for educational institutions based on case study on the development and management of NCS based curriculum of the K University. For this purpose, this study analysed the development and management of NCS within a four-year college curriculum by considering the case of the K University in Korea. The research questions are as follows: First, how was the NCS based curriculum developed in the four-year college? Second, how was the NCS based curriculum managed in the four-year college? In order to answer these research questions, we first conducted a literature review. We then analysed the NCS curriculum development report and the NCS instruction management guidelines of the K University. By looking at the case of the K University's NCS based curriculum development and management process, we are able to explore the possibility of applying NCS to college education, providing guidance and implications for overseas universities hoping to develop and introduce NCS.

2. National Competency Standards of Korea

NCS systematizes the essential knowledge, skills, and attitudes required to perform jobs at various levels and across different industries. Created under a Korean national government initiative that encouraged "a competence-based society, not by educational background," the project was expanded in 2013 and the development of the 897 NCS (subdivided according to classification) was completed in 2017. Due to the mismatch of labour supply and demand, companies have incurred excessive costs in recruiting and re-educating their labour forces; meanwhile, the competition stemming from increased job qualifications has become too fierce, resulting in a costly and time-consuming process for job applicants. By introducing NCS at the national level, the government sought to minimize the gap between education and training and Korea's industries (Ministry of Employment and Labour & Human Resources Development Service of Korea, 2017; Yoon, 2016).

NCS systematically classifies and standardizes the competencies required to perform a job based on the job performance model. The competencies defined by NCS can be divided into key competencies and job performance competencies. Key competencies are fundamental to performing all the tasks of one's job. Job performance competencies, on the other hand, refer to the knowledge, skills, and attitudes required to perform a specific job, and they adhere to the system of big class (major group)-medium class (minor group) -small class (broad group)-subdivided class (detailed occupation), and subdivided class can be understood to be the same size as the job. The subdivision consists of several competencies according to level. Level 1 is the level at which an individual performs tasks under specific instructions and supervision, whereas Level 8 the level at which authority and responsibilities are assigned to the organization and the business as a whole (Gu & Kim, 2011).

Various Korean organizations and public institutions have been recruiting employees based on NCS. As of 2017, all public institutions (a total of 321) have adopted competency-oriented recruiting in Korea. Based on this, the government has begun to promote policies to reform the domestic qualifications system and has been operating 61 course-based qualifications. Along with these changes in industry and required qualifications, education and training institutions have sought to rebrand themselves as places in which an NCS based curriculum can be found. In the specialized high schools, colleges, and vocational training institutes in Korea, the curriculum has been reorganized based on NCS, and learning modules based on NCS have been adopted instead of textbooks. Three specialized high schools have completed pilot trials with positive results such as an increase in the average employment rate from 33.17% to 63.37%. Given this success, starting in 2018, an NCS based curriculum will be used beginning from the first year of specialized high school. Starting with 79 schools in 2015, the NCS based education and training curriculum has expanded to 100 colleges as of 2017. In addition, the NCS based curriculum has been fully integrated into public and non-public vocational training institutes since 2015 and 2016, respectively. The institutes abolished the curriculum that did not suit industry jobs and reconstructed the curriculum and its contents based on NCS and job ability (Human Resources Development Institute, Korea University of Technology and Education, 2017).

Until recently, however, there have been very few cases in which the NCS based curriculum has been applied to a four-year college. Some colleges have managed educational programs to enhance students' understanding of NCS and job competencies, thereby preparing students for NCS based recruitment, but the colleges have not organized and implemented curriculum based on NCS. There is growing interest in an NCS based curriculum that promotes a four-year bachelor's introduction and management of the college (Lee, 2016). A NCS based curriculum for the four-year K University is currently being managed.

3. Curriculum Development and Management

3.1 Curriculum Development

Tyler's rational curriculum development model and Dick and Carey's systematic instructional design model are theories representative of general curriculum development and design that have affected the development of the NCS based curriculum. Tyler's (1949) curriculum development model consists of several steps: defining educational objectives, selecting learning experiences, and organizing and evaluating learning experiences. This model can be categorized as a goal- and evaluation-oriented model because the learning experiences are selected, organized, and evaluated in regards to educational goals (Lee, 2016). Dick and Carey's systematic instructional design model is called the ADDIE model and has five steps including analysis, design, development, implementation, and evaluation. The analysis stage consists of confirming the teaching goal, analysing the teaching, and analysing the learners and context. During the design stage, the performance goals, content, teaching strategies and methods, and academic evaluation strategies are developed. The development stage consists of the development of teaching materials, manuals, audio-visual media and evaluation tools, and implementation targets for each unit. During the implementation stage, the learning process occurs. Finally, during the evaluation stage, learning content is evaluated and preparations for program improvement are undertaken.

Curriculum development and design theory, which has directly influenced the development of the NCS curriculum derives from Campbell's development model based on job analysis. It involves five steps: analysis, design, development, implementation, and control. This is similar to Dick and Carey's ADDIE model. In the analysis stage, the tasks to be included in the course are selected and plan for measures of achievement level is considered through analysis related to the job. The design, development, and implementation stages are similar to the ADDIE model. In the last stage, control, an external evaluation of the effects of and improvements made possible through the curriculum is carried out to improve the system.

3.2 Curriculum Management

Curriculum management is a process in which a developed curriculum is practiced. Even that good quality courses are developed, it is useless if not properly implemented in the classroom scene (Kim, 1996). Curriculum management can be discussed at various levels, including national, university, and class. At the national level, curriculum management refers to all activities that ensure that appropriate courses are developed and settled at each university, based on national guidelines. For example, it means developing and distributing NCS learning modules, supporting the training of teacher and the quality of the curriculum implementation process. Curriculum management at the university level means all activities to enable the development of educational activities in each of subjects. In other words, it refers to activities to implement educational activities and at the same time to maintain and support the conditions and environment that accompany educational activities. Curriculum management at the individual class level means all activities to be realized through the course and activities of college education by professors. That is, the professor who is applying the new curriculum is interested in the characteristics of related subjects and modifying and interpreting them in consideration of classroom context.

Factors affecting the educational process management are very diverse. Also, influencing factors and influences can vary depending on the school situation. In general, the factors affecting the curriculum management can be divided into the curriculum itself, external factors of the school, and internal factors of the school (Korean Society for Curriculum Studies, 2017). First, the factors of the curriculum itself are the curriculum that reflects the needs of humans and society, curriculum with clear contents and systems, curriculum with which content and systems are acceptable, and curriculum that are developed and presented with related information. Second, the external factors of the school are the education policy of the Ministry of Education, the human and physical support system, and the evaluation system. Third, the factors inside the school are human resources and material resources in the university. As human factors, the quality of curriculum management depends on the understanding level of university administrators including the president. Also, the level of interest and participation of the instructor, and the support for the instructor influence the quality of the curriculum management. In addition, diverse backgrounds of students and parents' understanding and participation in school education also affect the curriculum management. Meanwhile, material factors include time, space, and finance that are deeply related to the successful management of the curriculum. Accordingly, in order to guarantee the quality of the curriculum, it is necessary to establish education environment including facilities and equipment, to train teachers and to develop and purchase teaching and learning materials, and to provide financial support for compensating teachers.

4. Method

4.1 Method and Procedure

In this study, the case study method was adapted to resolve research questions. The case study focuses on a specific subject, collects information or data related to the subject, and collectively diagnoses and describes the characteristics or problems of the subject based on the collected data (Lee, 2016). The case study emphasizes the context of problems came

from concrete data rather than abstract and formal knowledge, and enable new generalization through interpretation based on the reader's experience (Park, 1997). The purpose of this study is to describe the case of the development and management of NCS curriculum by selecting the case of the K University in the Republic of Korea, which developed and operated the curriculum by applying NCS to the university in Korea for the first time, to identify the educational achievements and problems based on the case study.

The procedure of the study is as followed. First, we collected various data on the development and management of NCS curriculum at the K University, which is the development report of the NCS curriculum by 11 majors and administrative document of NCS curriculum administration department for two years (2016-2017). Second, based on these collected data, the characteristics of the development and management of the NCS curriculum of the K University were specifically analysed. Third, the results and limitations of the NCS curriculum development and management were analysed and described.

4.2 Case Study Object

The K University is a private university located in Cheonan, Chungcheong province, Republic of Korea. The K University is a small university with less than 5,000 students enrolled and is an engineering-oriented university. The undergraduate programs consist of school of mechanical engineering, school of mechatronics engineering, school of electrical, electronics and communication engineering, school of computer science and engineering, school of industrial design & architectural engineering, school of energy, materials & chemical engineering, school of industrial management, school of liberal arts, department of HRD, work-to-school. Educational characteristics of K University are composed of lab oriented curriculum and practical education oriented on industrial field. Since 2015, the K University has developed and managed NCS curriculum as a core subject for improving job skills among undergraduate majors since 2016.

5. Results

5.1 Curriculum Development Based on NCS

5.2.1 Curriculum Development Procedure Based on NCS

Typical industry-academy cooperative education is conducted by selecting educational content in consultation with local industries and then asking the instructor to autonomously organize the content for the relevant subject. A curriculum based on NCS is created similarly, but it differs in that it applies the NCS system to the curriculum. The purpose of a curriculum based on NCS is to train suitable talent for industry and to start the selection of the job competencies appropriate to the type of training and educational objectives. These job competencies are selected from the core competencies that are classified as job duties according to the Korean Employment Classification of Occupation (KECO) in the NCS classification system. A competency unit belonging to the selected sub-category is composed of a subject, and a competency unit element belonging to the sub-category is composed of a lesson unit. The performance criteria for each competency unit element are instructional objectives, and the content of the lessons consists of knowledge, skills, and attitudes.

The development of a curriculum based on NCS is done by considering the requirements of the particular industrial site and analysing these requirements in detail. The requirements of each industry are presented one by one, making the system clear. When organizing a curriculum based on NCS, it is necessary to distinguish between how the NCS competency unit is actually applied in the industry and what it is intended to be. To do so, it is necessary to use environmental analysis, considering the related industrial classification, industrial market, and manpower demands and searching for the direction of industry change. After analysing the career development path of the academic majors that develop curriculum through this process, the content validity of the subject matter experts (SMEs) must be secured.

The criteria for developing a curriculum based on NCS are derived from NCS's applied training standard utilization training course manual (Ministry of Employment and Labour Reserved, Human Resources Development Service of Korea, 2016) and the Curriculum Guidelines Based on NCS (Ministry of Education, National Research Foundation of Korea, 2015). The K University developed a curriculum based on NCS as shown in Table 1, in accordance with college environment by forming a consultation body with professors under the leadership of the NCS Certification Center.

Table 1 - Curriculum Development Procedure Based on NCS

Step	Procedure
1	Establishing Foundation for Curriculum Development
2	Environmental Analysis and Needs Analysis
3	Right People setting by Majors and establishment of objectives of education
4	Job Definition and NCS Classification System Description
5	Establishment and Verification of Job Model by NCS System
6	Deriving a subject
7	Make a Subject Profile
8	Describe the Connection between NCS and Subject
9	Create a Roadmap for Curriculum by Job

5.2.2 Details by Procedure

The K University takes practical engineering and HRD specialist training as the objectives of its curriculum. It aims to cultivate talented individuals who have knowledge of the professional theories and application methods necessary for the development of industrial technologies, the creative resolution of problems in industry, and self-directed learning. Since NCS represents a systematic sequence of job competencies required in industry, the introduction of NCS into the curriculum is consistent with The K University's educational objectives.

For this reason, the K University has tried to come to a consensus regarding whether to adopt a NCS based curriculum. The biggest difficulty in introducing a NCS based curriculum is the resistance of college to NCS in and of itself. College has its own academic goals, and it may reject NCS because there is a gap between deciding upon and developing the curriculum by applying the NCS. The K University has experienced such a phenomenon. In order to overcome this problem, NCS Certification Center has presented the members of the university with repeated briefing sessions, helping them to understand the background and concepts of NCS. In particular, I have emphasized that NCS represents a more systematic curriculum than the curriculum currently in place. This guidance has led some members to become more interested and positive about NCS, which ultimately resulted in the participation of four majors in an NCS based curriculum beginning in 2015.

The environmental analysis was both external and internal. The external environment analysis focused on industry trends, manpower trends, regional trends, similar domestic and overseas curriculum, and employment based on NCS. The internal environment analysis centred on the present status of the departments, student status, and teacher status.

To analyse the content and methods of the external environmental analysis in detail, an occupational and industrial analysis related to each major was conducted based on various classification systems (KECO, KSCO, KSIC, NCS). Because of the wide range of industries involved in each major, there was a possibility that the industrial sectors would overlap when using these classification criteria. For this reason, the graduate entry field that is related to each undergraduate major was derived first, and based on these results, industrial classification related to each major was carried out.

The prospect of supply and demand in the industries related to the majors was analysed based on statistics related to the jobs announced by various government offices. And we analysed similar major curriculum at domestic and foreign colleges and determined the aspects that could be benchmarked. Using the NCS based job announcements promoted by industry, the NCS classifications and job definitions required by industry were analysed.

Next, the analysis of the internal environment centred on the subjects of the present educational situation, the educational objectives, talent development type, curriculum, and careers after graduation. For the student status section, three-year data on the recruitment rate and employment rate of students were analysed. The curriculum based on NCS was analysed in relation to the field of specialization of the major, people who want to cultivate in colleges and majors so that the NCS could be organized in accordance with the job competency to be taught in the major. In order to fulfil the purpose of a curriculum based on NCS, we secured basic data regarding laboratories and equipment status.

Needs analysis is the process of examining and analysing the qualifications and licenses required by industries, as well as the vocational competencies and major competencies needed to carry out particular jobs. Needs analysis was conducted for students, graduates, and industry professionals. Students conduct research in four categories: employment (cognition, requirement, expected occupation, certificate), curriculum (satisfaction, expectation contents), job competence (importance and urgency of vocational competency and competency unit), and general questions sex, grade, major). Graduates conduct research in four categories: recruitment requirement, certificate), curriculum satisfaction, expectation contents), job competence importance and urgency of vocational competency and competency unit), and

general questions graduation year, name-type-location-scale of industry, number of employees per year, sex, age, position, employment period). NCS is a systematic organization of the competencies required to perform tasks in industry settings. Therefore, a needs analysis of industry experts must consider the types of talent selected by a major, the educational objectives, and the most urgent job competencies.

When the environmental analysis and needs analysis were completed, occupational clusters in the field of personnel training were selected based on the results. The occupational cluster matches one of the NCS classification systems. The occupational cluster is selected based on a 7-point scale that considers job importance, job prospects, job performance, department vision, and educational effectiveness. The type of manpower stems from the occupational cluster and the subordinate job level, and the main job description focuses on the abilities required to perform the job. Because a curriculum based on NCS focuses on learning job competencies, it is necessary to clearly align the educational objectives with the type of manpower training provided in the major. The educational objectives must also be described in detail.

Once the type of manpower and the educational objectives have been established by major, the occupational cluster can be selected and the vocational competencies can be derived. When defining jobs by occupational cluster, one should refer to the content of the NCS classification system. Definitions of jobs by occupational cluster focus on providing specific main competencies that the learner has to learn within the relevant curriculum. At this time, a job definition is based on the NCS classification system, and the NCS classification system may be selected based on the defined job.

Step 5 is Establishment and Verification of Job Model by NCS System. When setting up a job model, it is important to describe all competency units and competency unit elements presented in the job definition and NCS classification system. A competency unit is selected for use in the curriculum based on a 7-point scale that takes into account the degree of education needed, job importance, and the certification of the competency unit derived from the job model. It is recommended that all of competency unit elements included in the selected competency unit be utilized, but they can be selectively used in consideration of numerical values such as educational needs and job importance. Competency unit elements were selected based on performance criteria, knowledge, skills, and attitudes. Performance criteria were also selected.

Once the competency unit, competency unit element, and performance criteria have been selected, the subject-based NCS can be derived for each major. The subject-based NCS is determined according to the content of the competency unit and a 1:1 match of competency unit and subject, but matching 1:N, N:1 etc. is also possible depending on the situation. The subject name reflects the content of the competency unit or an aspect of the job, and the number of hours is determined based on the NCS amount of training selected in accordance with college credit system. Because a competency unit may be too small or large to teach its content as a subject, the professor responsible for the subject must carefully determine the parameters of the subject.

Once a subject suitable for the type of manpower development is determined, the competency unit, competency unit element, performance criteria, knowledge, skills, and attitudes selected from the subject combine to create a subject profile. The subject profile includes the subject name, job title, competency unit, competency unit element, performance criteria, educational objectives, educational content, lesson time number, instructional methods, academic evaluation methods, equipment, and tools.

The subject profile is based on the content provided by the NCS, but it can be modified according to major and subject-specific characteristics. In the subject profile, one can list job definitions and competency units from the job model verification process. The educational objectives should be written in terms of observable and measurable knowledge, skills, and attitudes to be taught using the selected NCS competency unit definitions and performance criteria. The educational content is based on the selected NCS competency unit, and the instructional method is selected considering the educational content to be taught. The evaluation method is selected by referring to the evaluation guidelines given to students for NCS performance criteria. The details of the evaluation method are described in the evaluation plan for each subject. The list of equipment and tools is based on the content presented in the NCS competency unit and educational content and methods.

Step 8 is Describe the Connection between NCS and Subject & Create a Roadmap for Curriculum by Job. The resulting NCS subject is classified into grade and semester units and its connection with the NCS competency unit is clearly indicated. The curriculum roadmap for each job is a step-by-step connection of the NCS subject based on job and manpower types. The curriculum roadmap is the basis for students to design their career paths according to the type of workplace they hope to join.

5.2 Curriculum Management Based on NCS

5.2.1 Characteristics of NCS Education at the K University

The K University created the NCS education by verifying that the introduction of a curriculum based on NCS would be consistent with the objectives of the university and setting educational objectives according to particular targets. The reason for classifying the subjects is that the direction of each educational subject is different and the subdivision can organize and implement the curriculum more closely. The K University students are usually undergraduates and workers

participating in the College of Work and Study in Parallel. Accordingly, characteristics of NCS education at the K University has been developed as shown in Table 2 with an eye to various educational targets.

Table 2 – The K University NCS Education Characteristics

Target	Classification	Characteristics
Undergraduates	A track	Strengthen job competence
	B track	Industry professional practice
Learning workers	C track	Work-to-school

5.2.2 Case of curriculum Management Based on NCS

The K University curriculum management based on NCS consists of three phases such as [Figure 1]. The Plan phase is to plan and construct the university's infrastructure for educational management by improving educational conditions and improving the operating system of the university. The do and check phase is a series of management processes including reading syllabi for lectures, applying NCS teaching materials, applying teaching-learning methods, and evaluating job competence. The check phase also includes conducting satisfaction surveys about curriculum management and the quality of lectures. Finally, the act phase is the stage during which to analyse the results of the management of the curriculum and to prepare to improve the next course.

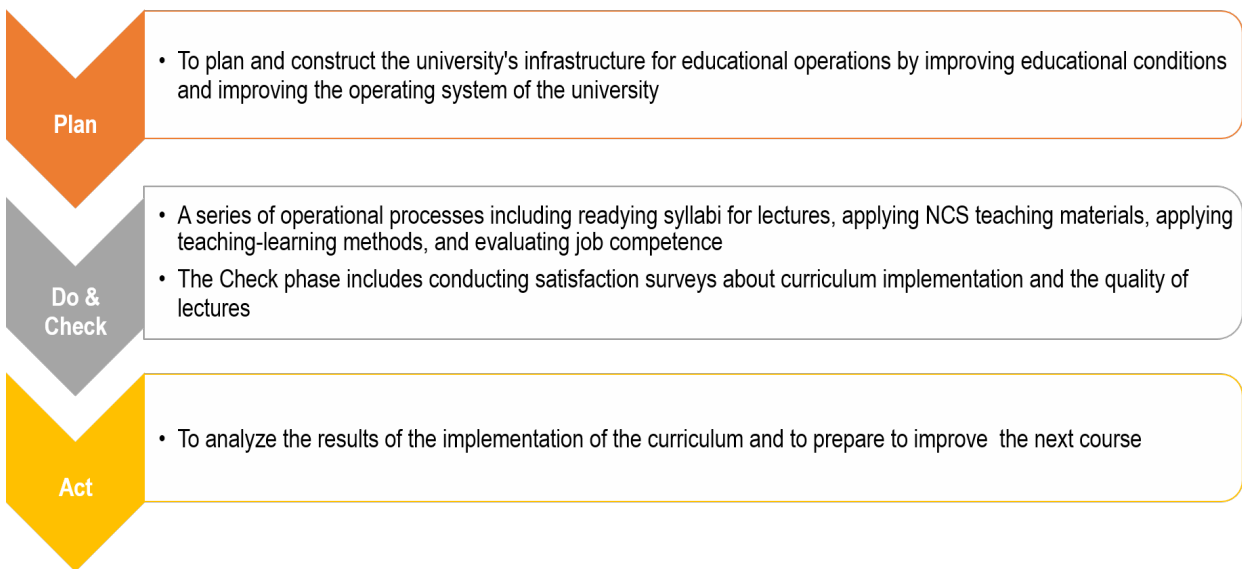


Figure 1 - Curriculum management procedure based on NCS

Plan: Build Management Infrastructure

Three things have been done to build management infrastructure. The first is to form a dedicated organization. In order to introduce a curriculum based on NCS, it is necessary to form an organization that can provide professional support to the university. The K University established the NCS Certification Center, a dedicated support organization for the introduction and management of a curriculum based on NCS. The NCS Certification Center supports in various stages of planning, organizing, and implementing the NCS curriculum. The introduction of a new curriculum requires multidisciplinary decision-making and support within the university. The dean of academic affairs was appointed as the head of the center, and a dedicated workforce was assigned to it. In addition, the NCS steering committee was set up to discuss important issues related to NCS policy and the managements of the university, and a NSC affairs committee was formed to consult on issues arising from the management of NCS.

The second is a reorganization of university educational systems. When introducing a new curriculum into college, regulations related to the management of the curriculum, such as credit, credit requirements, evaluation methods, and grading policies, should be designed in accordance with the existing academic regulations of college (Ministry of Education, 2016). Prior to creating a curriculum based on NCS, The K University reviewed and revised the existing academic regulations by forming a TFT with the office of student affairs, the office of information and communication technology, and the NCS Certification Center.

Since the administrative procedures related to the curriculum of college are mostly carried out electronically, the NCS affairs management system was established in the portal system of college, allowing for the effective execution of academic affairs. We developed a task flow diagram by dividing the subjects into employees, professors, and students, and developed each menu of the system based on this. The NCS affairs management system includes NCS Basic DB Management, NCS management (six forms including Enhanced and Advanced Education Management, among others), NCS Education Quality Management (CQI), and NCS Statistical Management.

The third is to establish an operating environment. Since a curriculum based on NCS places an emphasis on practical training, it is necessary to secure course facilities and equipment that meet the standards of NCS. The K University arranged for facility construction and equipment acquisition in cooperation with the professors who had helped develop a curriculum based on NCS. In order to provide effective support, the office of facilities, the office of student affairs, and the NCS Certification Center actively participated in the project.

Do & Check

In the do and check stage, instructional design, NCS teaching material should be developed, and the class should be operated and evaluated. A subject with its curriculum based on NCS differs from a regular subject’s syllabus for lectures in that the content of the selected NCS and the related evaluation plan are particularly detailed.

The K University must include the NCS competency unit element and performance criteria selected when developing a weekly learning plan. For example, if a faculty member has planned to teach performance criteria 1 to 3 of the competency unit element in the second week of the class, he or she must indicate these performance criteria on the second week of the syllabus for lecture. Students can view the syllabus for lecture to obtain a detailed view of which NCS will be taught in each week's lesson, and this information becomes a guideline for the learner to develop a learning plan and a criterion for the learner in assessing his or her achievement.

A subject based on NCS is assessed at the level of competency unit element based on the performance criteria selected for the subject. At the K University, job competence is evaluated twice or more within a subject. An educational evaluation method is selected by a professor according to the subject's character. However, in addition to paper and pencil tests about the subject based on the NCS, performance evaluation assessment is recommended. After considering how to evaluate the NCS competency unit element, the professor selects an evaluation method and presents the evaluation plan to the students. Through the evaluation plan, students can obtain a detailed picture of the NCS competency unit element and the percentage of each evaluation method that is reflected in the grade.

In order to increase the educational effectiveness of a subject based on NCS, appropriate NCS teaching material should be developed. The NCS teaching materials should clearly show the achievement goals and the content for learning so that the job competencies required by the industry can be utilized in education. The NCS learning module should be developed so that theory, experiment, and practice are possible. In addition, it is necessary to present the direction of teaching-learning according to the performance criteria for the particular subject and to plan the learning strategy by guiding the content of the course.

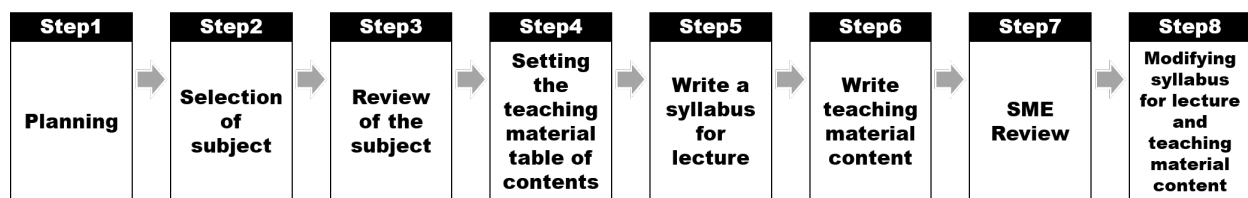


Figure 2 - The K university NCS teaching material development guidelines

NCS teaching materials are made available for subjects based on NCS through step-by-step development such as [Figure 2]. Review of the subject helps determine whether the chosen competency unit can actually be taught in lectures. In the event of a change in the outcome of the review, a new competency unit must be reviewed by at least two industry experts who have more than four years of experience in relation to the content of the subject.

Each NCS course is based on the NCS teaching material developed by the professor. The instructional objectives are based on performance criteria, and the learning content is based on the selected NCS. Because performance criteria are described using explicit verbs, practical training is essential to achieving the performance criteria. If a theoretical lecture is given, practical training related to the theory must also be completed.

The evaluation of job competence is also based on performance criteria. Problem-solving and task completion can be based on performance criteria, and all selected NCS should be evaluated. The results of the evaluation can be expressed in the performance criteria or at the competency unit element level. The level ranges from 1 to 5 depending on the degree of performance. Generally, level 1 means that a person can perform a task only with the help of another person. Level 5 means that a student can perform a task perfectly. The K University recommends that a rubric be created for each competency unit element.

Act

Ho Soon Bae (2004) defined curriculum evaluation as "systematically describing and judging the merits, values, and importance of a particular curriculum." In general, unit schools need to have systems that enable them to continuously evaluate their curriculum. The evaluation of the curriculum must be continuously carried out to confirm that the curriculum is achieving its intended purpose, the kinds of activities that are being used are of high quality, and the staff members should check whether the curriculum is implementing as planned (Korean Society for Educational Evaluation, 2004).

A curriculum based on NCS provides an education that enhances job competence by introducing standards developed through a needs analysis of the industry into the curriculum. In order to confirm and improve upon a curriculum based on NCS, college must develop its own system for managing the quality of education and making improvements that can be fed back into the curriculum management.

The K University consults CQI, satisfaction surveys, and lecture evaluation results in order to measure the effectiveness of a subject based on NCS and validation of the managements. The CQI is written by a faculty member in charge of lectures, and it contains a lecture improvement plan to improve the job competence achievement level of students who take an NCS based subject. Satisfaction surveys and lecture evaluations are completed by students who take a subject based on NCS and measure the satisfaction and effectiveness of the curriculum as determined by students. Based on these results, each subject based on NCS can find a way to improve the overall course management and to maintain excellence.

6. Discussion and Conclusion

This study aimed to provide implications for educational institutions based on case study on the development and management of the NCS based curriculum of the K University. The following conclusions are drawn from the theoretical review of curriculum development and management, the NCS policy in Korea, and the development and operation of the NCS based curriculum at the K University. First, the K University developed NCS based curriculum through the following 9 steps; Establishing a foundation for curriculum development from the consensus of members, environment analysis and needs analysis, setting competency to teach in the department and establishing of objectives of education, job definition and select NCS classification system, establishment and verification of job model by NCS system, deriving a subject, make a subject profile, describe the connection between NCS and subject, create a roadmap for curriculum by job.

Second, the management of the NCS based curriculum at K University operates on three tracks, namely strengthening the job competency of the university courses, qualification-linked university course, and work-to-school for learning workers course. In addition, it manages more specialized curriculum in 3 stage such as 'plan' for infrastructure building, 'Do & check' for instructional design, developed NCS teaching material, class operation and evaluation and 'Act' for curriculum CQI, satisfaction survey and lecture evaluation.

Through the development and management of an NCS based curriculum at the K University, the following performance objectives were achieved. First, there was an increase in university interest not only in NCS but also in the continuous improvement of the overall university curriculum and the quality of the curriculum. Second, because of the environmental analysis and needs analysis of each major, the university increased its efforts to improve the curriculum so that it better reflects the demands of the industry. It also became more natural for professors to deliberate on the content of the curriculum. Third, professors' interest in and efforts towards setting educational goals, selecting educational experiences, and organizing and evaluating students in individual classes increased.

The most important part of developing and managing an NCS based curriculum is to adjust to the context of each university. The four-year university is academic-centered in nature, and this can lead to conflicts and criticism among university stakeholders over the introduction of an NCS based curriculum. The introduction of NCS at a four-year university should be completed gradually rather than all at once, depending on the characteristics of the university. Although the K University is an academically oriented university, it took a period of time to create an atmosphere favourable for the introduction of an NCS based curriculum. Universities in Korea or overseas should consider developing and managing NCS based curriculum based on the characteristics of their particular universities by benchmarking the K University's case. In the future, it will be necessary to study the empirical performance of NCS based university curriculum and to describe the present state of the phenomenon using qualitative research methods.

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