

Designing of Assessment System using Multiple Devices based on NCS Professional Basic

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Abstract

In this paper, all elements used in integrated infrastructure for job competency assessments of NCS (National Competency Standards) will be merged into assessment system using multiple devices(ASMD). NCS is a systematic approach on required abilities (knowledge, technical expertise, attitude) to process the tasks in the fields by industry. Competiveness of ASMD design is that no limitation of time and space using personal devices like PC, laptop, smartphone, and tablet, while seeing screen, hearing, touching, speaking, and writing. Question type can be limitless to express the situation. To lead technologies and market for domestic and oversea assessment system, supporting on multiple devices with connectivity that will eliminate limitation of time and space is the key feature for design competitiveness. Design of integrated assessment system proposed in this paper can be applied to NCS, fundamental competency evaluation, online test, job aptitude test, and foreign language test which involve listening, reading, writing, and speaking. Compared with existing evaluation method, reduction of investment and operating cost will be greater. Along with development of ICT technologies, the next generation of integrated assessment system will be quickly changed to ASMD, which already involves connected service between internet and smart devices.

Keywords: *Assessment System, Multiple Devices, NCS, Professional Basic, Fundamental Competencies*

1. Introduction

Recently interdisciplinary approaches receive greater attention in all fields. A future global IT leader is required to have integrated technology and marketing power in a two-tiered IT business market[1]. Not only research but also applications like internet of things (IoT) can be the one of exemplary case that involves mutual communications between human and objects, and between objects. Network framework that is the basis of previously described technologies is also reinvented to 5G intelligent network, which connects

human and IoT seamlessly[2]. In this paper, all elements used in integrated infrastructure for job competency assessments of NCS (National Competency Standards) will be merged into assessment system using multiple devices (ASMD). Ministry of Education and Ministry of Hiring and Labor published ‘scheme for building competency based society’ to achieve fair judgment and evaluation according to performance not by academic clique nor name value of previous companies worked on, and it will be the core element of NCS. NCS is a systematic approach on required abilities (knowledge, technical expertise, attitude) to process the tasks in the fields by industry and work level according to 2nd clause of Framework Act on Qualifications. According to the survey by Youth Community Union, average cost to build up own qualification for university graduates is 42.7 million won, and it takes 5.6 years in average to build the corresponding qualification excluding minimum expenditure for newly hired college graduates (based on survey by PayOpen).

NCS is created by the immediate demand to reduce extra cost in company by removing re-education on newly hired employee and eliminate the unnecessary expenditures for job applicants who can focus on the abilities required by companies. Also, NSC can solve the discrepancy between industrial fields, education, and qualification system.

2. Case study for Job Competency Assessment in Oversea Countries

NCS can classify job competency that has different requirements for each occupational category and “fundamental competency” that is required by all industries. That is, job competencies mean “professional knowledge, technical expertise, attitude, and experiences required for performing assigned task successfully or for special job category. Fundamental competencies are basic aptitudes, which are commonly required skills for the most of jobs. It includes communication skill, mathematical skill, problem solving, self-improvement, resource management, interpersonal relationship, IT knowledge, technical competency, organizational understanding, job ethics, etc[3].

2.1 Fundamental competencies in oversea countries

Table 1 shows the comparison between major countries on fundamental competencies of four countries for four items[3].

Table 1. Comparison between major countries on fundamental competencies

Section	UK	USA	Australia	Japan
System and project name	Key Skills Project	Ability-based Curriculum	Graduate Skills Assessment	Yes Program
Leading party and support background	<ul style="list-style-type: none"> • Government • Lifetime support job competency improvement 	<ul style="list-style-type: none"> • University • Improve hiring potential 	<ul style="list-style-type: none"> • Government • Improve service provided by university 	<ul style="list-style-type: none"> • Government • Resolve youngman unemployment

Section	UK	USA	Australia	Japan
Operation mode	Integrated into course curriculum with fundamental competencies	Integrated into course curriculum with fundamental competencies	Qualification test on freshmen and graduates	Qualification on fundamental competencies
Area and elements of fundamental competencies	<ul style="list-style-type: none"> • Communication skill • Mathematical thinking • IT knowledge and utilization • Learning methodology 	<ul style="list-style-type: none"> • Communication skill • Analysis • International understanding • Problem solving • Civic mindedness • Decision making • Esthetic appreciation • Social interaction 	<ul style="list-style-type: none"> • Communication skill • Teamwork • Problem solving • Entrepreneurship • Planning and organizational skill • Self-management • Learning • Technical expertise • Critical thinking • Problem solving and interpersonal relationship 	<ul style="list-style-type: none"> • Independence • Persuasion • Execution • Problem finding • Planning • Creativity • Dispatching • Hearing • Flexibility • Circumstantial understanding • Discipline • Stress resolving

3. Designing of ASMD for NCS fundamental competencies

3.1 Design Goals

NCS is a standardized system for competencies required in actual fields according to industries. For more objective assessment, by improving paper level evaluation, listening and watching video and audio, which is closer to actual tasks, is used to develop an environment that can run relative analysis and statistical processing while larger mass can participate regardless of location or time for access through internet, computer, and smart devices. Also, not only multiple selections of answers, but also replying by speaking or texting can be done.

3.2 Design Scope

For large scale concurrent assessment using multiple devices like PC, laptop, smartphones, tablet, development language needs to be thoroughly investigated according to each OS, and common framework, ASMD union framework, will be developed. During the evaluation, questions will be downloaded from internet, and screen will be automatically controlled by superintendent to prevent capture or cheating. Answers will be encrypted and sent to inspector's PC. After exam is finished, questions and answers will be deleted automatically. For gathered data, statistical processing according to independent and dependent items by nationwide or by countries should be included.

3.2.1 Feature Design

ASMD needs to be optimally designed for fair assessment of fundamental competencies among NCS, and

various features are required to be included for future upgrade and development. ASMD downloads questions from inspector’s PC via internet, and distributes encrypted questions to multiple devices of connected applicants. Start and end of test can be controlled as well. By seeing and hearing of video image that shows actual issue of field, applicant can answer by speaking and writing own words. It also provides objective assessment of answers, and meanwhile, switching to other smart devices can be effortlessly available. This means where it ends in previous device can be available right away in the next device. Questions that are closely related with works should be used, and for foreign language test of listening, reading, writing, and speaking need to be available. In addition, optimized design of infrastructure that can save operating cost and investment by utilizing existing IBT(internet based test) and CBT(computer based test) assets should be considered.

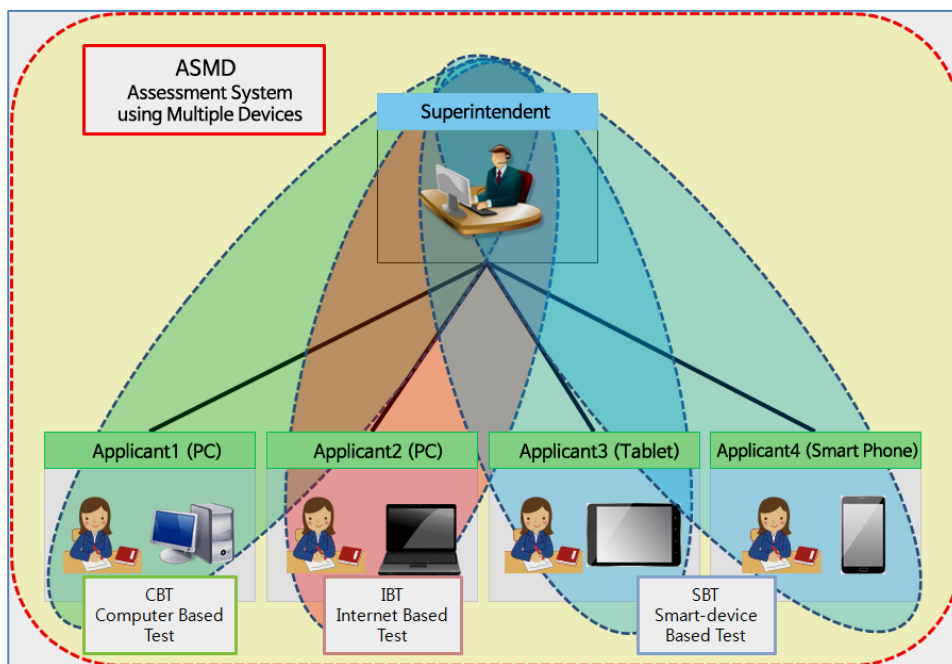


Figure 1. ASMD Outline Diagram

3.2.2 Additional Design

Additional design conditions will be presented as ‘what can be done’ rather than ‘what needs to be done’ as final results of competency test, because this assessment needs to evaluate actual competency of applicant that is required to execute task in corresponding job.

Table2. Additional Competencies and Their Descriptions

Section	Descriptions
Task competency	Ability to execute specific task
Task management	Ability to handle and organize different tasks
Countermeasure for unpredicted situation	Ability to countermeasure unpredicted situation or daily task is pending
Future oriented	Ability to adapt technical and environment change by prediction

Each feature and additional design elements should be designed as module. All elements of fundamental competencies present the ability to execute task as performance unit, and NCS is comprised of these performance units according to each special areas.

3.2.3 Competitiveness Design

Paper based test (PBT) has the limitation for expressing problems other than character or image. CBT and IBT can present the most of problem types, but these tests are limited to space with desktop or laptop computer. Because of lacked accessibility and multiple accesses at the same time, new assessment system that can overcome the limitation of time and space while presenting the question in multimedia format is needed. Competiveness of design is that no limitation of time and space using personal devices like PC, laptop, smartphones, and tablet, while seeing screen, hearing, touching, speaking, and writing. Question type can be limitless to express the situation. To lead technologies and market for domestic and oversea assessment system, supporting on multiple devices with connectivity that will eliminate limitation of time and space is the key feature for design competitiveness.

3.2.4 Design of integrated assessment system

Integrated assessment system needs to be designed for interoperability with existing CBT, IBT, SBT (smart device based test), and major features and advantages from those systems will be added. Therefore, if there is network connection is available, large scale testing without limitation of time and space can be possible. Benefits of CBT like multimedia based questions, advantages of IBT system as question control via downloading from central server when test is needed, and features of smart devices, such as ease of access will be integrated in ASMD, which will allow compatibility with different devices via integrated assessment system.

3.2.4.1 Core items for integrated assessment system

- For the communication between PC and smart devices including usage of different multiple devices, development language for Windows and Android will be analyzed to establish exclusive framework for ASMD.
- As Step 1, API Framework will extract common API classes from different development languages for Windows and Android using basic algorithm. Based on Step 1's results, API Framework for Step 2 and Step 3 will be sequentially developed.
- Using Step 3 API framework based on common API classes, Windows program will be developed in C/C++ language, which will be ported to Java for Android.
- Developed solution from ported code will share common AP protocols, and open/multiple accesses from multiple devices like desktop PC, smartphones, and tablet can be realized to ASMD.

4. Conclusion

After reviewing common issue in fundamental competency assessment in domestic and oversea cases, the most of advanced countries are focused on communication skills among the various elements. Especially communication within organization and team is very important. If communication within team/organization is poor, it will lead poor performance and interrupted information sharing. Information sharing is the most critical competency in knowledge based society. Among the assessment of communication skill, document composition, listening, articulation of speech, etc. are difficult to be evaluated in PBT. For proper evaluation, suggested design feature and evaluation method like ASMD is needed, which involves question listening,

recording and describing the answer properly in either voice or written format. Design of integrated assessment system proposed in this paper can be applied to NCS, fundamental competency evaluation, online test, job aptitude test, and foreign language test which involve listening, reading, writing, and speaking. Compared with existing evaluation method, reduction of investment and operating cost will be greater. Along with development of ICT technologies, the next generation of integrated assessment system will be quickly changed to ASMD, which already involves connected service between internet and smart devices.

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