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Application of Universal Design for Learning Strategies for Effective Implementation of Inclusive Education*

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《 Abstract 》

In the changed educational scene, the diversity-based approach such as the plurality of general students, students with disabilities, and students from multi-cultural families should be considered, not the general approach for the average student. When the necessity of applying UDL, which is based on generality and is an approach considering specificity, is emphasized, integrated education can reach the stage of social inclusion beyond the stage of teaching inclusion. Therefore, this study first examines why classroom classes should be universal through the current status of inclusion education in Korea, and then focuses on the status of UDL and reading education improvement research for guaranteeing the right of all students to learn It included the contents of inclusion education and UDL through related statistics and literature review. We discussed the possibility of applying the reality through introducing the 'K-PAL' model and the 'Reading Guidance Program Big Data System' construction model under development. The contents presented through such a series of processes were reaffirmed that it is a very important process for establishing the identity of Korean special education.

Key Words: inclusion education, Fourth Industrial Revolution, UDL, K-PAL, reading instruction program big data system

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Ⅰ. Introduction

The era of the Fourth Industrial Revolution, is a different revolutionary world from the past, where the convergence of science and humanities and the boundaries between reality and imagination has become blended. Unlike the first, second, and third industrial revolutions, which have changed over a period of a century, the Fourth Industrial Revolution is a new change that has come approximately less than a half century since the Third Industrial Revolution. The Fourth Industrial Revolution, represented by core technologies such as artificial intelligence, big data, and the internet of things, is expected to have much more impact comparable to that of previous industrial revolutions throughout society. Schwab, the chairman of the World Economic Forum, mentioned the new revolution at the preface in his book, 'The Fourth Industrial Revolution' published in 2016, that today we are at the door of a revolution that fundamentally changes the way we live and work, in addition, the size, scope and complexity of the Fourth Industrial Revolution are different from those in the past.

With such differences in velocity, breadth and depth, the Fourth Industrial Revolution is characterized by systems impact (Schwab, 2016). The changes occur not only in a specific country or a specific industry, but also in the inter-country, inter-industry, inter-business and whole social system. For this reason, all the sectors that make up the nation, such as politics, economy, society, culture, and education, etc., are forecasting the future and presenting various measures to cope with this in advance. On the basis of 4th Industrial Revolution, Korean government has decided to prepare a key national strategy for 5-years plan of administration and to establish policies to cope with it (Yonhap News, 19 July 2017).

The educational sectors are also significantly related to the fourth industrial revolution. It is anticipated that the changes will be made in education sectors for educational betterment such as providing optimal personalized education service through artificial intelligence, constructing an interactive learning environment between objects and learners using the internet of things, providing instant feedback, and providing customized and adaptive learning with big data (Ahn, 2017). Therefore, the Fourth

Industrial Revolution has a direct influence on present education due to its importance. In other words, software education, smart education, and learner-centered education would be reflected on the revised curriculum that changes to the educational contents and thus teaching methods would be also reflected from the new paradigm of the fourth industrial revolution. With regard to this paradigm shift, in December 2016, the Ministry of Education established the core educational direction for flexibility, autonomy, individualization, specialization, and humanization through the "Direction and Strategy of Mid- and Long-term Education Policy in response to Intelligent Information Society" and how to respond to school education, such as presenting a key promotion strategy.

In accordance with the development of science and technology and the social paradigm changes, special education should offer a new alternative to highlight the universality of special education and at the same time, give more emphasize on the specificity of special education. In particular, the characteristic phenomenon of the educational field comparing with the past showed the importance of preparing such approach in special education as follows.

Firstly, according to the Special Education Annual Report (Ministry of Education, 2017), 63,154 (70.7%) students (of the total of 89,353 special education students) were inclusive in general schools due to quantitative expansion of inclusive education. Among these, 54,848 students were from the elementary, middle, and high school which are equivalent to about 1% of all elementary, middle, and high school students in general schools. Considering that the problem of inclusive education is not depend on 'where' but 'how' to do the education (Park, 2010), inclusive education should be realized on basis of appropriateness and individuality of the learners, not based on the educational institute in the physical sense.

As we have seen thus far, the specialty is not put to the fore, but when the special education is implemented by the universal approach with specialty, the inclusive education can reach the level of social integration beyond the stage of the physical integration. In the present study, I first consider why classroom instruction should be universal with some specificity through reviewing and analyzing the current state of inclusive education in Korea. Then, I review current status of research on UDL for

guaranteeing all students' right to learn and the enrichment of reading education. Finally, to use UDL effectively at inclusive settings, I introduce, first PAL (Planning for All Learner) that considers the instructional design applicable to all students of various backgrounds in the classroom situation, second, reading program with big data system which accumulates and utilizes effective UDL data.

Ⅱ. Status of Inclusive Education in Korea

1. Special Education Status

Legally, special education in Korea is based on 'the Special Education Law for the Persons with Disabilities (2007)'. According to this Law, special education means education that is provided through the provision of special education services and special education related services in order to meet the educational needs of special education students. In addition, it specifies that students who are evaluated as those who need special education among 10 specific types of disability except disabilities defined by Presidential Decree should be selected as SEN students.

The number of SEN students is steadily increasing, from 79,711 in 2010 to 87,950 in 2016, and 89,353 in 2017, and the educational opportunities and support services for SEN students have been strengthened. In terms of disability areas, the most frequent areas were intellectual disabilities (48,084 persons, 53.8%), physical disabilities (10,777, 12.1%) and autism spectrum disorder (11,422, 12.8%) (see Table 1).

<Table 1> General Status of Special Education

By placement		Special School	General school		Special Education Support Center	Total (%)
			Special Class	general class (full-time inclusive class)		
Number of students		25,798	47,564	15,590	401	89,353
Type of Disability	Visually Impaired	1,307	267	439	13	2,026(2.3)
	Hearing Impairment	819	691	1,828	20	3,358(3.8)
	Intellectual Disability	14,379	29,490	4,166	49	48,084(53.8)
	Physical Disability	3,858	3,895	2,916	108	10,777(12.1)
	Emotional Behavior Disorder	229	1,361	679	-	2,269(2.5)
	Autism Spectrum Disorder	4,747	5,925	749	1	11,422(12.8)
	Communication Disorder	88	1,126	824	-	2,038(2.3)
	Learning Disability	15	1,374	651	-	2,040(2.3)
	Health Impairment	33	128	1,465	-	1,626(1.8)
	Developmental Delay	323	3,307	1,873	210	5,713(6.4)
	Total	28,798	47,564	15,590	401	89,353(100)
Number of Schools and Centers		173	7,799	7,622	199	11,306
			10,934			
Number of Classes		4,615	10,325	14,650	74	29,664

Source: Ministry of Education (2017). 2017 Special Education Annual Report. Sejong: Department of Special Education Policy, Ministry of Education. Revision of p.21.

2. Inclusive Education Status

Korea's inclusive education, which began in 1971, has been developed since 1994 when it was backed up by the revision of the 'Special Education Promotion Act' in 1976 (Jung & Kim, 2014). The conceptual orientation of inclusive education in the direction of special education legislation and national special education policy in Korea is as follows. First, it is strengthened by the expansion of special education through the expansion

of special classes, and the guarantee of access rights by expansion of convenience facilities (Kim et al., 2015). Thus, the number of special classes increased from 1 in 1971 to 3,802 in 2000 and 7,792 in 2010 to 10,325 in 2017 (see Table 2). In 2007, the total number of students who were placed in general schools and received the inclusive education was 65.2% in 2007, 70% in 2010 and 70.7% in 2017 (17.4% in general classes and 53.2% in special classes) due to the rapid increase of special classes.

<Table 2> Number of special classes and students by year

Year	1971	2000	2010	2016	2017
Number of special class (Unit: class)	1	3,802	7,792	10,065	10,325
Number of special class students (Unit: person)	30	26,627	42,021	46,645	47,564

Source: Ministry of Education (2017). 2017 Special Education Annual Report. Sejong: Department of Special Education Policy, Ministry of Education. Quote after revision in p. 36 and p. 41

In addition, by the Special Education Law for Disabled Persons in 2007, the general schools that implement inclusive education should provide to students with special education needs facilities (see Table 3) and textbooks as designated by the Presidential Decree. As a result of such legal enforcements, the average installation rate of facilities for the disabled was 95.2% as of September 2016 in elementary, middle, and high schools (Ministry of Education, 2017).

<Table 3> Establishment of special facilities for disabled people in Elementary, Middle and High Schools (2016) (Unit: school,%)

No. general schools with special classes	Intermediate facility			Internal Facilities			Sanitation facility		Information facilities			Average install ratio
	Main access road	Disabled parking area	Main Entrance Height	Doorway (door)	Hallway	Stairs or elevator	Toilet	Toilet urinal	braille block	Guidance equipment	Alarm and evacuation equipment	
7,039	98.5 %	99.1	99.3	99.1	97.2	95.8	99.0	93.1	91.9	81.7	92.1	95.2

Source: Ministry of Education (2017). 2017 Special Education Annual Report. Sejong: Department of Special Education Policy, Ministry of Education. Quoting p.93

From the statistics, it can be said that the mainstream of special education in Korea is the inclusion. Nevertheless, we cannot help but admit that we are still in the phase of physical integration rather than complete integration. In this way, an educational neglect to SEN students may occur (Ryu & Park 2016) when inclusive education is considered only as a homogeneous group. Teachers are also faced with difficulties, such as feeling unfamiliar or lacking in self-confidence, in classes with special education students (Hwang, Kim, & Lee, 2013). Therefore, it is necessary to present a plan for the integration of instruction for meaningful education and successful integration for both special education students and teachers. We will approach this through the universal learning design and the improvement of reading education based on big data.

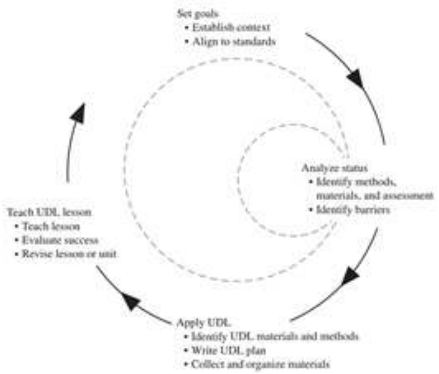
III. Development of Korean Universal Design for Learning model

1. Concept of Universal Design for Learning

The UDL is a "Theoretical framework that helps students design and develops a flexible curriculum with educational methods and materials that can be used by all learners" (Hall et al., 2003). "Handling or correcting one-size-fits-all curriculum that causes major disruptions that prevent all learners from becoming expert learning, that is, unintentional disruptions to learning Approach" (CAST, 2008). Finally, the UDL can be said to be a way for learners with heterogeneity to promote access, involvement, and progress in general education (Rose & Meyer, 2002: Recited from Son, 2008, 2012). Such UDLs are intended to stimulate and effectively engage a full range of learners with or without disability, students below average or above, as well as normal learners (Roh, 2012; Yoon et al, 2002; Han, 2005; Rose & Gravel, 2010).

2. PAL and K-PAL

The method of practically applying UDL can be divided into the process of UDL execution in the classroom situation and the process of UDL execution in the organizational level. Up to now, many discussions have been focused on the process of UDL execution in the classroom situation. The UDL implementation process applied to the classroom situation implies that teachers acquire basic knowledge about UDL and design their classes for ensuring accessibility to all students (Hall et al, 2003). Hall et al. (2003), in connection with three main principles and concepts of UDL based on three major brain networks, a proven professional development strategy, and emotional teaching practice, suggested the four steps including set goals, analyze status, apply UDL, and teach the UDL lessons (see Figure 1). The above steps are expressed in the PAL (Planning for All Learner) because they consider the instructional design applicable to all students of various backgrounds in the classroom situation (CAST, 2004; Hong, 2015; Meo, 2008; Rose et al., 2010).

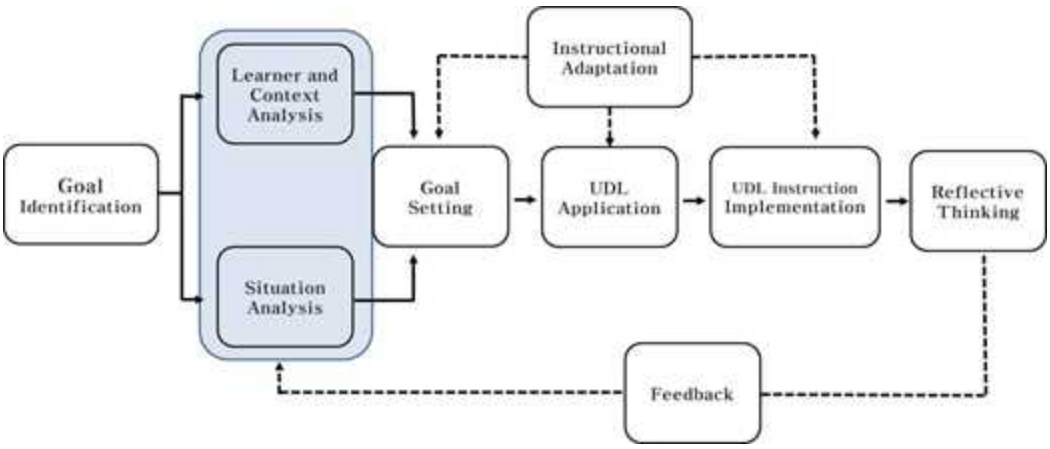


[Figure 1] Instruction design process based on UDL principle (PAL procedure)
Source: Meo, G. (2008). p. 24

However, the contents of each stage of PAL are difficult to apply to Korean educational situation by the following reasons. First, in the goal setting phase, Korea is based on national level curriculum. Therefore, the revision of the educational goals should be done within the framework of national curriculum, and autonomous decision making is relatively difficult. In addition, it is difficult to set goals in the school education because the evaluation contents

are selected rather than the content-oriented evaluation. Second, in the context analysis phase, PAL is analyzing the diversity of students participating in the class. The number of students per class in Korea is 23.6 in elementary school and 31.6 in middle school as of 2014, which is higher than OECD average (21.1 elementary school and 23.1 middle school) (Ministry of Education, 2016). With this class size, implementing individualized education for all students cannot be possible, considering that the number of students per class serves as a factor of work burden (Jung, 2012). Third, UDL application is a step of integrating UDL elements into goal setting and situation analysis results. The biggest practical problems faced at this stage are lacks of instruction plan, difficulty in acquiring adequate media and securing assistive technology equipment to support students with disabilities although the situation analysis is done through the second stage. Finally, the UDL instructional level is the stage of practicing and evaluating the class. The evaluation of diversified learners in the Korean classroom situation is the biggest obstacle. It is well known that there is no great difficulty in universally developing the evaluation items, but considering the fairness of evaluation and the selection function of education, realistic applicable evaluation requires significant restructuring.

As it has been seen, there are many obstacles to apply PAL to the educational situation in Korea. Therefore, PAL is being refined as 'Kim, Nam-Jin & Kim, Yong-Wook's Planning for All Learners' (K-PAL; Developed by the authors) as the following figure.



[Figure 2] Kim Nam-Jin & Kim Yong-Wook' s Planning for All Learners(Plan)

The K-PAL by the authors is divided into 6 steps: goal identification - learner and context analysis / situation analysis - goal setting - UDL application - UDL instruction implementation - reflective thinking. In the stage of goal setting, UDL application, and UDL teaching instruction, we modified and supplemented the previously planned UDL through instruction modification and adaptation. In addition, at the final stage, the teacher has a recursive function to check the degree of UDL implementation against the plan through the self - report evaluation tool, and to reflect the results in the learner and context analysis / situation analysis stage.

K-PAL has ability to reflect on the achievement standards and achievement levels presented at the national level in the goal identification and goal setting phase. In the situation analysis stage, a manual is prepared in accordance with the UDL Guideline 2.0 to solve the obstacles of learners. In addition, 'UDL-based Instruction Analysis Checklist for Self-Report' was developed by the authors. That helps teachers to focus on learner and context analysis prior to provide UDL instruction. In this way, providing such convenience to the teachers is to prevent the application of UDL as another factor that increases the workload of the teachers, so that they do not have a hard time to apply.

The biggest obstacles to be solved or solved in practically applying the K-PAL proposed by the researchers to the field are related to the evaluation. Assessment has the function of reviewing and improving the overall process of education as well as the function of selection and classification. Evaluation in the field of education tends to be faithful to the ability to classify according to the learner's ability or achievement rather than the latter, which corresponds to the recursive function of evaluation. Therefore, equity is the most important in the evaluation, and most of the evaluation depends on the reference evaluation. Therefore, it is not realistic to evaluate the learner according to the level goals and to give the learner the sequence accordingly.

However, it may be feasible by using the free semester system, which is introduced in 2013 and implemented in all middle schools in 2016 (The Chosunilbo, 2017). The free semester system is designed to improve students' class by participating students such as discussion and practice so that students can find dreams during the semester of the middle school

course (Free semester homepage, www.ggoomggi.go.kr). The core of the free semester system is the improvement of classroom instruction for fulfilling the goals of all students participating in the class with appropriate roles (Daegu Metropolitan City Office of Education, 2017). In addition, the evaluation method is to be carried out with process-centered, student centered, no-written test, and curriculum-based evaluation relating to student achievement not ranked (indicated as 'P' only). In September 2017, the Ministry of Education has taken 'Free Semester Expansion and Development Plan', which will be executed from the year of 2018. The "Enforcement Decree of the Elementary and Secondary Education Act" (Ministry of Education, 2017) was legislated in order that the free education system can be steadily implemented by the local district of education. Therefore, the implementation of UDL-based instruction can be applicable at schools for a limited period without any problems. In accordance with this change of educational environment, it is necessary to implement the UDL-based instruction and course-based evaluation during one semester or one academic year in which the liberal semester (grade) system is suitable. In very near future, the teacher training program on UDL and instruction on it should be developed and implemented for general teachers in order to settle the UDL-based instruction.

Ⅳ. Reading Guidance Program Big Data System

1. Big Data and Education

Digital data has exploded over the past decade when the internet has become more commonplace. Since 2007, the amount of worldwide generated digital information has exceeded the available storage space. Since 2011, the amount of digital information generated globally has entered the "Zeta Bite" era, reaching 1.8ZB, and by 2020 it is expected to increase 50 times of the current level. With the exponential increase in the amount of digital information, a large data explosion occurred, resulting in the term "big

data" (Song, 2014). Big data, represented by data floods and explosions, has recently emerged as a topic that is not limited to specific fields, and recognizes big data processing and analysis capabilities as future competitiveness (Kim, 2014).

Educational sectors are not exceptional, learning analytics and educational data mining are being developed to utilize the big data in the field of online education to enhance the students' educational performance and to promote the effectiveness of the elementary and secondary education system. Analytics using technologies such as computer science, mathematics, and statistics is to extract useful information from large amounts of data. Teachers and schools are aimed at predicting students' learning and teaching them according to their ability and level of education (Song, 2014). In the eighth UNESCO Netexplo Award in 2015, the United States' 'Education Problems through Big Data' (Digital Times, 2016) was selected by the top 10 technologies, which is a learning analyst technique that increases the learning efficiency of students by providing customized education. In other words, by establishing a database based on success and failure cases which were recorded and analyzed online in the past, the cognitive science through the individual approach as well as correcting the actual obstacles to the students' goals is improved through experience.

Education in the Big Data era should be able to collect and analyze data related to education and can create necessary information and knowledge (Lee & Cho, 2016). That is, educators should be able to provide effective education and user-customized services by using big data in near future. However, the use of Big Data in Korean educational field is still only the beginning stage of suggesting initial data sampling or analysis measures (Ko, Choi, & Park, 2014). The reason for insignificant utilizing big data or providing poor concrete examples is that the design of what data is necessary in education and how to utilize it are not clear. Currently, studies on learning evaluation and class analysis have progressed to some level of application, but this field is not yet able to implement data collection and retrieval, analysis and visualization technology as a big data base in Korea.

2. Artificial Intelligence and Education

The first concept of artificial intelligence was emerged in 1956 at the Dartmouth Conference, where about ten mathematicians and scientists gathered. At that time, the concept of artificial intelligence was close to the concept of a computer with operations that attempted to solve the logic to a machine in order to solve a given problem. In the 1960s, research on artificial intelligence techniques started, but in 1970, as technical limitations hit, questions about the feasibility of artificial intelligence began to be raised. However, in the 1980s, as the development of database systems to manage data add, artificial intelligence commenced to surface again. Based on the database, artificial intelligence is getting attention again with the attention given to the solution provided by the machine (Kim, Rue, & Kim, 2016). And as the 'Deep Learning' technology developed in 2006, the field of artificial intelligence goes a step further. Deep running is a technology that machines can perceive, deduce, and judge on their own. This allowed us to cluster or classify the big data that could be a background for artificial intelligence in the early hours (Park, 2016).

The emergence of artificial intelligence brings forth various social changes and predictions. In the manufacturing and service industries, there are concerns such as optimistic views such as improvement of productivity and quality, change of job due to automation, improvement of quality of life through providing intelligent services, and serious social and ethical problems. In extreme cases, pessimistic views coexist, such as social and ethical problems and the end of the world (Kim & Yu, 2016). Artificial intelligence and artificial intelligence systems in the field of education provide students with a one-to-one approach to personalize learning that commits to analyze and apply the contents of education through feedback as well as 'tutoring'. On the other hand, as a lot of information related to students is accumulated in the artificial intelligence, security problems such as information leakage and privacy invasion can be raised. In addition to this, there is a concern that the teacher's job may disappear due to the leakage of the teaching method.

3. Prepare foundation for artificial intelligence using read big data

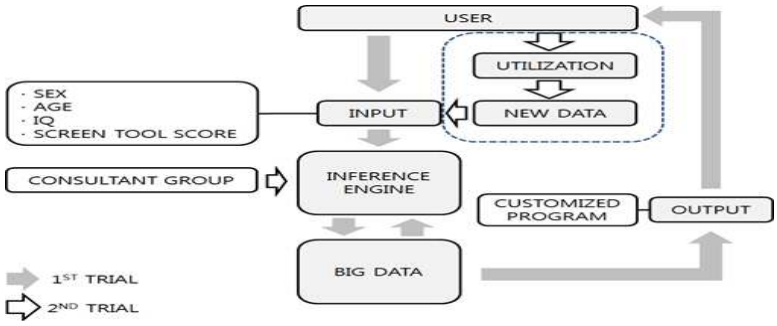
The future of society, predicted by the development of big data and artificial intelligence, is bound to have both sides. Although changes in education may also admit that negative aspects may arise, it is the role of those in charge of education to coordinate their functioning. Therefore, various data produced from big data and artificial intelligence should be used as a means to perform the best education.

Thus, reading among various means or conditions for maximizing the educational effect plays a very important role in human learning and development. Reading is the most basic skill in all learning, and if students have difficulty reading, they may have difficulty in most of the subjects they are learning at school (Kim et al, 2016). Therefore, reading is not a simple means to improve academic achievement of a specific subject to special students only, but a universal tool for adaptation and cognitive development for all students. Hence it should be approached to every student from the all dimensions.

However, it is not enough to suggest a way to utilize accumulated data related to reading nationwide. There is not only a lack of effort to collect and manage diagnostic (screening) tools and various results, but also the use of screening (diagnostic) tools is satisfying the level of diagnostic reading by measuring reading ability of individual students. It is also difficult to find new cases based on accumulated test results from the number of diagnostic tools. Therefore, it is necessary to generate big data in order to collectively manage the reading ability results of individual students and to procreate a new reading guidance program.

Based on the importance of reading and educational reality and its solutions, Research Institute of Korea Special Education (RIKSE) is attempting to build a big data system for reading guidance (Figure 3). The reading instruction program, Big Data System which is promoted by RIKSE, is supplemented by the addition of an expert system element to weak artificial intelligence because strong artificial intelligence is not applicable realistically at present. Expert system has the ability to store the experience, knowledge, and expert decision-making processes required to solve problems that require expertise in a particular field of interest on a

computer, and to provide expert opinion by using it. Further, the expert system realizes the problem-solving ability of the so-called experts, which can solve the problems of the specific field that may not be solved by the ordinary person, as a computer program. The program technician represents the expert and builds the knowledge base from the knowledge obtained from them. It can be defined as an expert system that has an inference engine that uses knowledge to infer problem solving (Koo & Park, 1998).



[Figure 3] Big Data System Construction Model for Reading Instruction Program (Plan)

If the selection and provision of the reading guidance program is dependent on the big data and (weak) artificial intelligence, it is possible to solve the problem at the general level, but it is difficult to solve the specific problem considering the user's multi dimensionality. Therefore, it is possible to provide a customized program based on the information input by the users of the reading guidance program by engaging the reading experts as a consultant group. Considering the present level of science, technology and economy, the intervention of the expert group on the program is applied to the form of directly feedback by the expert on the information of the user. User information and expert consultation results are accumulated as data and information is provided to the user. Based on the provided information, the user selects and utilizes the reading guidance program. The user will re-enter the new data, such as strong and weak points, which he / she has learned in the process of using the selected reading guidance program. The expert group of the advisory group accumulates the data after it is supplemented. The accumulated data from this series of processes is used as a basic data for a new user to select a reading

instruction program in the future.

The accumulation of data through such a series of processes is worth more than providing customized reading guidance programs through big data and artificial intelligence. In other words, the delivery of services through accumulation of data is not only suitable for the specialty of special education, which is the characteristic of individualization, but also serves as an opportunity to expand the area of universality coexisting with specificity. In addition, rehabilitation, medical care, social welfare, etc. have the advantage of providing vast amount of materials that can be accessed and used academically.

V. Conclusion

From the evolutionary history, the development of science academic studies has been constantly upgrading on the process of self-reflection and modification. The study of identity in the academic field is the most fundamental issue in almost all disciplines, and it has been constantly raised, as the discipline that ignores such a series of processes necessarily faces the fate of stagnation and culling (Choi, 2010). Since the start of western modern special education in 1894, Korean special education has made great efforts to establish identity. RIKSE in Daegu University also hosted the 1st Chang Pha International Conference in 2008 with the theme of 'Controversy of identity of Korean special education (academia)' to discuss the identity of Korean special education in academic and practical aspects in depth (Kim, 2015).

The development of the Korean universal learning design model and the construction of the big data system for the reading guidance program are the tasks to be undertaken in a series of consecutive lines to establish the identity of Korean special education in the educational context of Korea. The more inclusive and individualized support through the UDL and the cutting-edge technology of the future society will serve as an alternative to promote self-realization and social integration of SEN students.

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효과적인 통합교육 실행을 위한 보편적 학습설계의 적용

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< 요 약 >

변화된 교육장면에서는 평균의 학생만을 위한 일반적 접근이 아닌 일반학생의 다원성, 장애학생, 다문화가정 출신 학생 등 다양성에 기반한 접근이 고려되어져야 한다. 보편성에 토대하여 특수성을 고려한 접근 방법이라고 할 수 있는 보편적 학습설계의 적용 필요성이 더욱 강조될 때, 통합교육은 교수적 통합의 단계를 넘어 사회적 통합의 단계에 도달할 수 있을 것이다. 이에 이 연구는 현재 한국의 통합교육 현황을 통해 교실에서의 수업이 왜 보편적이어야 하는지를 우선적으로 고찰한 후, 통합교육의 안정적 정착을 위한 방안으로서 모든 학생들의 학습권 보장을 위한 UDL 그리고 읽기교육 내실화 관련 연구 현황을 한국을 중심으로 살펴보았다. 관련 통계 및 문헌 고찰을 통해 통합교육, 보편적 학습설계의 내용을 포함하였으며, 아직은 개발 중에 있는 한국형 보편적 학습설계 모형(K-PAL)과 읽기 지도프로그램 빅데이터 시스템 구축 모형 소개를 통해 현실 적용 가능성을 논의하였다. 이와 같은 일련의 과정을 통해 연구자는 제시된 내용이 한국 특수교육학의 정체성 확립을 위해 매우 중요한 과정임을 재확인하며 마무리하였다.

주제어: 통합교육, 4차 산업혁명, 보편적 학습설계, K-PAL, 읽기 지도프로그램 빅데이터 시스템

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